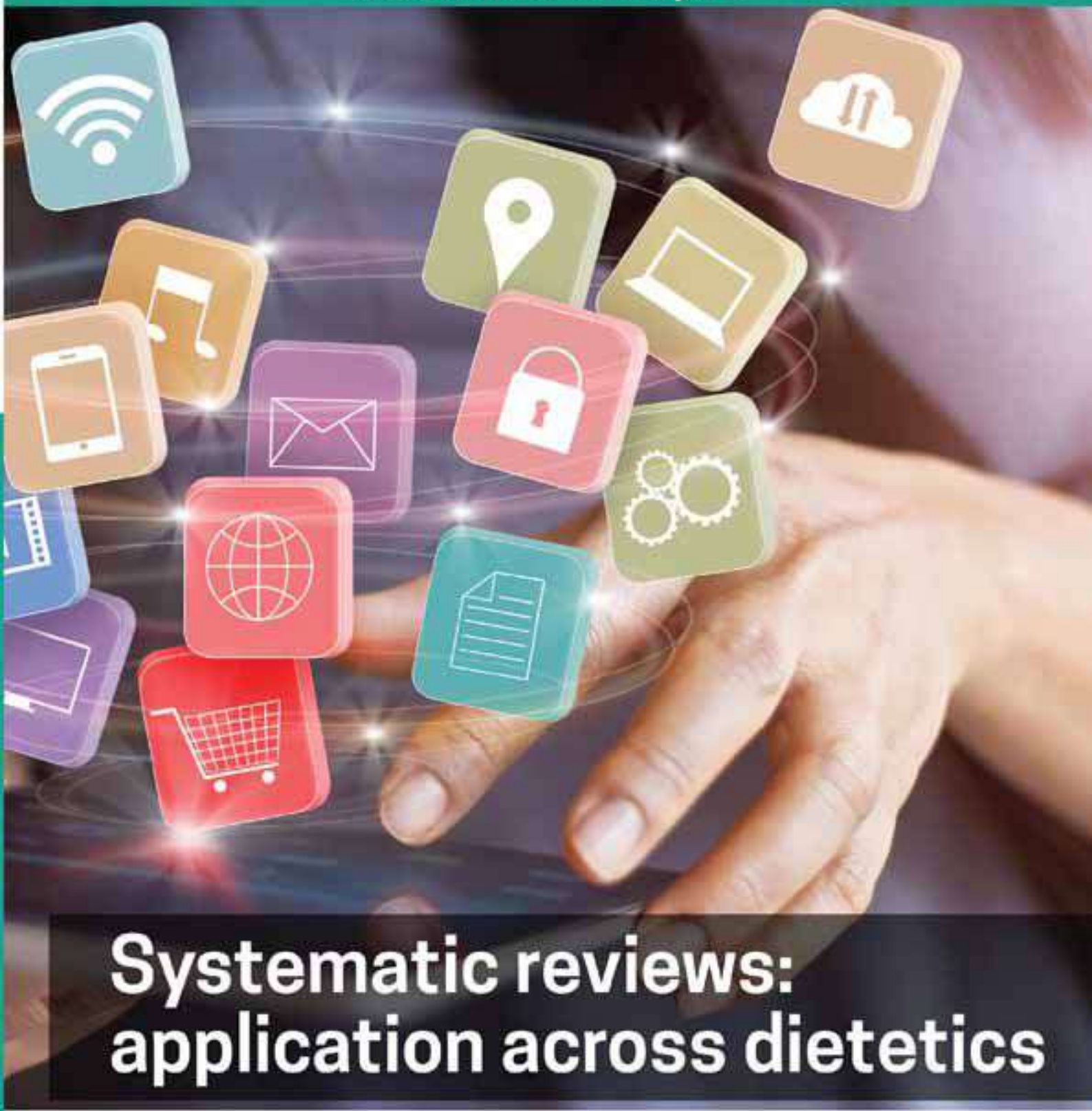
Nutrition & Dietetics
Journal of the Dietitians Association of Australia
Volume 77 Number 1 February 2020



Systematic reviews: application across dietetics

Dietitians Association of Australia
WILEY

Nutrition & Dietetics

Journal of the Dietitians Association of Australia

Cover image courtesy of iStock (ipopba)

Address for Editorial Correspondence:
Editor, *Nutrition & Dietetics*
1/8 Phipps Close
Deakin ACT 2600
Australia
Email: ndi.eo@wiley.com

For submission instructions, subscription and all other information visit http://wileyonlinelibrary.com/journal/ndi

NDI.JEB.Feb20

Nutrition & Dietetics

Journal of the Dietitians Association of Australia

Volume 77 Number 1 February 2020 **ISSN 1446-6368**

Received: 5 January 2020 | Accepted: 5 January 2020

DOI: 10.1111/1747-0080.12607

EDITORIAL

Nutrition & Dietetics Journal of the Dietitians Association of Australia WILEY

A time of change

This New Year heralded the beginning of a new decade and, for me, a new role as Editor in Chief for *Nutrition & Dietetics*. Thank you to the outgoing Editor in Chief, Professor Linda Tapsell, for her longstanding commitment to the journal and support in our recent transition. Thanks also to our Editorial Board and peer reviewers for their dedication in applying the highest editorial standards to all manuscripts submitted for publication.

Change is happening faster than ever before. Within this era of accelerating change one of our greatest challenges lies in delivering excellence. But what does this mean for scientific publishing? And, importantly, what does it mean for the future of *Nutrition & Dietetics*?

In the 580 years since the emergence of the printing press, mass printing and more recently digital technology have led to volumes of information, fast communication speed and 24/7 access. Although there have been numerous innovations that streamline processes in reporting and communication, scientific publishing has largely stalled in delivering a computerised output of a published work ... the pdf. This format is easy to read, but has been described as "antithetical to the spirit of the Web, being static rather than interactive"(p. 87).[1] This leaves us in a paradoxical situation where scientific information is sometimes so abundant that it is difficult to find and, despite its novelty and/or significance, is sometimes uninspiring.

Simultaneously, metrics for translation and impact have become increasingly important compared with the traditional metrics of journal impact factor and citations. Conferences remain an important medium for research dissemination, but authors increasingly promote their outputs to assist readers to discover and connect with their research. This impact may be increased through the use of owned media (eg, websites, blogs, and social media), earned media (where others discuss your research on websites, television, etc.), and paid media (advertising and promotion).[2]

There are expectations that scientific journals and publishers should do more to improve the author/reader interface. Journals must deliver content that is discoverable, and, in a medium that best suits both authors and readers. Keeping pace with digital innovation is not easy. Described as "winning the battle for relevance," businesses (and therefore scientific journals) need to recalibrate, refocus, re-fresh, re-engineer, re-frame and reposition[3] to endure. In practice, this means reconsidering the pdf and reimagining the appearance of a truly contemporary journal. *The New England Journal of Medicine* has embraced such opportunities through the inclusion of interactive cases and images, perspectives and audio summaries within their website to complement their traditional journal format. The journal website of our US colleagues, the *Journal of the Academy of Nutrition and Dietetics*, hosts videos and podcasts by authors, and a research series facilitated by their editorial team.

Can *Nutrition & Dietetics* evolve to deliver research that is modern in its interface while informing dietetic practice? For example, into the future, should a 3 minute thesis style presentation by authors be included to complement their pdf? Would a monthly podcast, downloadable through a digital store support translating expensive research into practice? Even more ambitiously, can research in the spoken form become publishable in scientific journals, including in *Nutrition & Dietetics*? How would peer review be conducted and which reporting frameworks would apply? These are questions in which we are engaged, and seek solutions in order to refocus—sooner rather than later.

Paralleling this era of publishing change are ongoing pressures in the work environment that further compound difficulty in accessing and engaging with scientific evidence. For some practitioners research is not a priority.[4] While dietitians set themselves apart from other nutritional professionals through their ability to deliver evidence based practice, practitioners report that they do not have time for evidence based practice activities.[5] Evidence syntheses, often in the form of systematic reviews, present a potential solution as an efficient means to understand a subject. Although coming under some critique recently due to selection bias and the inclusion of poorly conducted trials,[6] systematic reviews have been described as an elusive search for truth, aiming to address the needs both of decision makers and evidence users.[7]

Published in this issue, we learn that dietitians are confident in their use of systematic reviews, while reporting less confidence in their conduct.[8] This confidence is reassuring since this issue of *Nutrition & Dietetics* comprises a series of recently accepted systematic reviews, including those submitted through our

invitation to authors who presented their research at the 2019 Dietitians Association of Australia conference. In recent years, the presentation of systematic reviews in Australia has increased[9] potentially associated with increasing academic capacity.[10,11] However their publication in *Nutrition & Dietetics* was limited to just four systematic reviews in 2018 to 2019.[12-15] Thank you to the authors of conference abstracts who responded to our invitation to submit their systematic review through expedited peer-review.

This issue contains seven systematic reviews across diverse areas of practice. Yii et al[16] explore population based interventions that address food insecurity in Australia, highlighting that there is a lack of a coordinated and coherent national response to address the many determinants of food insecurity. Rounsefell et al[17] have critiqued the impact of social media engagement/exposure to image-related content on body image and food choices in the population of healthy young adults. Complementing this review, Panão & Carraça[18] have synthesised evidence for exercise motivations on body image and eating habits/behaviour.

In the clinical setting, the review of Fleurke et al[19] examines the role of the dietitian in the management of malnutrition in older adults. McLean et al[20] have synthesised the evidence for nutritional interventions for people admitted to hospital for alcohol withdrawal. The identification and synthesis of the effects of nutritional interventions on markers of sarcopenia in hospitalised patients aged 65 years and above are the focus of the review of Rus et al,[21] while MacKenzie-Shalders et al[22] highlights outcomes that have arisen from implementation of electronic bedside meal ordering systems into hospital foodservice.

Beyond systematic reviews, there are several key reports of professional issues for Australian dietitians published in this issue. These include research undertaken by Broome and Swanepoel[10] who have benchmarked the research track records of dietetic academics in Australia, and the Hidden Jedi: a critical qualitative exploration of the Dietitians Association of Australia Fellow credential and advanced expertise.[23]

We also learn from the geographical system mapping undertaken by a research team at the University of Sydney[24] that there are inequities in the access to dietitians for people with type 2 diabetes in rural, remote and disadvantaged areas. Challenges await us as a profession, and nation, in addressing such health inequalities.

Several other papers present research across diverse areas of practice. In a large cross-sectional study reported by Lavelle et al [25] we learn that diet quality is more strongly related to food skills rather than cooking skills confidence. Original research investigating different aspects of renal function[26] and management[27] are included, as is the SPICE trial protocol.[28]

Although we live in a time of rapid change, a strong evidence base is critical to support our profession. As you read this issue, reflect how you would like to receive journal content into the future ... how can this content be delivered to maximise its translation into practice? What would make research more engaging and easier to access? Opportunities for innovation await.

Judi Porter PhD FDAA, Editor in Chief, Nutrition & Dietetics[1,2]

1. Department of Nutrition, Dietetics & Food, Monash University, Australia
2. Allied Health Clinical Research Office, Eastern Health, Australia.

REFERENCES

1. Shotton D. Semantic publishing: the coming revolution in scientific journal publishing. *Learn Publ*. 2009;22:85-94.
2. Green T. Maximizing dissemination and engaging readers: The other 50% of an author's day: a case study. *Learn Publ*. 2019;32:395-405.
3. McQueen M. *Winning the Battle for Relevance: Why Even the Greatest Become Obsolete... and How to Avoid Their Fate*. New York: Morgan James Publishing; 2016.
4. Taylor N, Harding K, Lynch L, et al. Evaluating the introduction of an allied health clinical research office at a health service on research participation, interest and experience of allied health professionals. *J Allied Health*. 2019;48(1):46-53.
5. Harding K, Porter J, Thompson A, Donley E, Taylor N. Barriers to evidence-based practice for allied health clinicians. *J Contin Educ Heal Prof*. 2014;34(4):224-231.
6. Horton R. Offline: the gravy train of systematic reviews. *Lancet*. 2019;394:1790.
7. Tovey D. Reflection on 10 years as Cochrane's Editor in Chief. Cochrane Database of Systematic Reviews 2019; Issue 5. Art. No.: ED000137. DOI: https://doi.org/10.1002/14651858.ED000137.
8. Gooding B, Probst Y, Houston L, Neale E. Exploring perceptions, barriers and use of systematic reviews amongst nutrition professionals and nutrition students. *Nutr Diet*. 2020;77:151-159.
9. Porter J, Bristow C, Charlton C, Tapsell L, Choi T. Changes in nutrition & dietetic research: a content analysis of the past decade of Dietitians Association of Australia conferences. *Nutr Diet*. 2019;76(5):634-641. https://doi.org/10.1111/1747-0080.12563.
10. Broome K, Swanepoel L. Benchmarking the research track record and level of appointment of Australian dietetic academics. *Nutr Diet*. 2020;77:160-166.
11. Morgan K, Kelly JT, Campbell KL, Hughes R, Reidlinger DP. Dietetics workforce preparation and preparedness in Australia: a systematic mapping review to inform future dietetics education research. *Nutr Diet*. 2019;76:47-56.

12. Lawlis T, Islam W, Upton P. Achieving the four dimensions of food security for resettled refugees in Australia: a systematic review. *Nutr Diet*. 2018;75:182-192.
13. Ross LJ, Barnes KA, Ball LE, et al. Effectiveness of dietetic consultation for lowering blood lipid levels in the management of cardiovascular disease risk: a systematic review and meta-analysis of randomised controlled trials. *Nutr Diet*. 2019;76:199-210.
14. Young KG, Duncanson K, The BT. Influence of grandparents on the dietary intake of their two to twelve-year old grandchildren: a systematic review. *Nutr Diet*. 2018;75:291-306.
15. Wan CS, Nankervis A, Teede H, Aroni R. Dietary intervention strategies for ethnic Chinese women with gestational diabetes mellitus: a systematic review and meta-analysis. *Nutr Diet*. 2019;76:211-232.
16. Yii V, Palermo C, Kleve S. Population-based interventions addressing food insecurity in Australia: a systematic scoping review. *Nutr Diet*. 2020;77:6-18.
17. Rounsefell K, Gibson S, McLean S, et al. Social media, body image and food choices in healthy young adults: a mixed methods systematic review. *Nutr Diet*. 2020;77:19-40.
18. Panão I, Carraça EV. Effects of exercise motivations on body image and eating habits/behaviours: a systematic review. *Nutr Diet*. 2020;77:41-59.
19. Fleurke M, Voskuil DW, Beneken Genaamd Kolmer DM. The role of the dietitian in the management of malnutrition in the elderly: a systematic review of current practices. *Nutr Diet*. 2020;77:60-75.
20. McLean C, Tapsell L, Grafenauer S, McMahon A. A systematic review of nutritional interventions for people admitted to hospital for alcohol withdrawal. *Nutr Diet*. 2020;77:76-89.
21. Rus GE, Porter J, Brunton A, et al. Nutrition interventions implemented in hospital to lower risk of sarcopenia in older adults: a systematic review of randomised controlled trials. *Nutr Diet*. 2020;77:90-102.
22. MacKenzie-Shalders K, Maunder K, So D, Norris R, McCray S. Impact of electronic bedside meal ordering systems on dietary intake, patient satisfaction, plate waste and costs: a systematic literature review. *Nutr Diet*. 2020;77:103-111.
23. Palermo C, Allen L, Dart J, Beck EJ, Daniels L, Ash S. Hidden Jedi: a critical qualitative exploration of the fellow credential and advanced expertise. *Nutr Diet*. 2020;77:167-176.
24. Siopis G, Jones A, Allman-Farinelli M. The dietetic workforce distribution geographic atlas provides insight into the inequitable access for dietetic services for people with type 2 diabetes in Australia. *Nutr Diet*. 2020;77:121-130.
25. Lavelle F, Bucher T, Dean M, Brown HM, Rollo ME, Collins CE. Diet quality is more strongly related to food skills rather than cooking skills confidence: results from a national cross-sectional survey. *Nutr Diet*. 2020;77:112-120.
26. Versele V, Clarys P, Deforche B, et al. Stability of potential renal acid load. *Nutr Diet*. 2020;77:139-143.
27. Roach LA, Russell KG, Lambert K, Holt JL, Meyer BJ. Polyunsaturated fatty acid food frequency questionnaire validation in people with end stage renal disease on dialysis. *Nutr Diet*. 2020;77:131-138.
28. Marx W, McCarthy A, Marshall S, et al. Supplemental prophylactic intervention for chemotherapy-induced nausea and emesis (SPICE) trial: protocol for a multicentre double-blind placebo-controlled randomised trial. *Nutr Diet*. 2020;77:144-150.

Received: 11 March 2019 | Revised: 9 July 2019 | Accepted: 19 July 2019

DOI: 10.1111/1747-0080.12580

REVIEW

Nutrition & Dietetics Journal of the Dietitians Association of Australia WILEY

Population-based interventions addressing food insecurity in Australia: A systematic scoping review

Vivien Yii B Nut (Hons), Graduate | Claire Palermo PhD, AdvAPD, Associate Professor | Sue Kleve PhD, APD, Lecturer

Department of Nutrition, Dietetics and Food, School of Clinical Sciences, Faculty of Medicine, Nursing and Health Sciences, Monash University, Notting Hill, Victoria, Australia

Correspondence
Sue Kleve, Department of Nutrition, Dietetics and Food, Monash University, 264 Ferntree Gully Road, Notting Hill, 3168, VIC, Australia.
Email: suzanne.kleve@monash.edu

Abstract

Aim: Food insecurity (FI) is a critical public health issue in Australia. Population-based interventions aiming to address the socio-ecological determinants of FI are critical for relieving and preventing it. This review aimed to map and summarise the characteristics of population-based interventions addressing household and/or community FI in Australia.

Methods: A systematic scoping review was undertaken. Five databases, selected for range and relevance to FI in Australia ("CINAHL plus", "Ovid MEDLINE", "Sociological Abstracts", "Australian Public Affairs Information Service", and "Rural and Remote Health") were searched in May 2018 using the terms and relevant synonyms "FI" and "interventions". In addition a systematic grey literature search using multiple Google searches was undertaken. Data synthesis included categorisation and counting intervention type. Interventions were defined and charted by influence of at least one dimension of food security and impact on the socioeconomic, cultural and environmental conditions.

Results: A total of 3565 published and grey literature records were identified, with the final 60 records describing 98 interventions. Few national interventions were identified, with approaches predominantly in Victoria, Northern Territory and Tasmania. Determinants related to living and working environments, food availability and food utilisation were most frequently addressed. Interventions addressing the key determinant of FI economic access were limited. A number of interventions did not appear to be associated with rigorous evaluation.

Conclusions: While there is evidence of population responses to FI in Australia, the effectiveness of these remains limited. Importantly there is a lack of coordinated and coherent national responses that address the range of FI determinants.

KEYWORDS

food supply, food security, nutrition, public health, social determinants of health

1 | INTRODUCTION

Food insecurity (FI) is the limited or uncertain availability of individuals', households' and communities physical, social, and economic access to sufficient, safe, nutritious, and culturally relevant food.[1] Increasing evidence suggests that high-income countries such as Australia are facing FI.[2] To date, national monitoring of the prevalence of FI has been limited to a validated, single-item measure within the National Health Survey every 3 years, "In the last 12 months, have you run out of food before you had money to purchase more".[3] While this single-item measure indicates that at least 4% of Australian households do not have sufficient food, it may underestimate the "true burden" of FI and not capture its complexity.[4-9] Importantly, this single-item measure is unable to capture the severity nor temporality of FI experienced by various socio-demographic groups within Australia.[3,5] Studies using more comprehensive, multi-item measures within smaller non-representative Australian populations have typically found the prevalence of FI to be higher, ranging from 10% to above 30%.[4,10-14] FI may contribute to poorer physical, social and psychological health outcomes among children and adults who experience it.[14-16] The specific resources, capacities and conditions which modify resilience to, or risk of, experiencing FI, are referred to as "determinants" of food security and correlate with broader economic and social determinants of health.[17] Present at an individual to global scale, these determinants can be encompassed within four intersecting dimensions fundamental to achieving food security: (1) physical *availability* of food; (2) economic and physical *access* to food; (3) food *utilisation*; and (4) *stability* of the other three dimensions over time.[18,19] Left unaddressed, FI presents as an urgent public health priority, potentially resulting in significant costs to individuals, families and to society as a whole.[14,20]

Recognition of FI, at a household and/or community level, as a critical public health issue has sparked a range of responses from many sectors of government and society.[21] In Australia, consistent with other high income countries, the dominant response to FI has been the provision of emergency food relief[7,22,23] or interventions focused on changing the food knowledge, skills or behaviour of individuals.[24] While these interventions may be able to address some of the immediate consequences of FI at an individual level, they are considered inadequate for shifting the causal or protective determinants of FI which exist on a structural, population level.[20] In contrast, population-based interventions to FI are considered to be critical, effective and necessary to relieve and prevent FI for all Australians.[20,22,25] Population-based interventions are typically referred to as "upstream" interventions that aim to address the socio-ecological determinants of health, which contribute to FI.[26-28] Such determinants are based in the communities in which people live, work and play, and reflect policy decisions about the distribution of resources, money and power within a population or society.[26-28]

Previously, a non-systematic summary of Australian food security interventions and a review protocol investigating the effectiveness food security community-based interventions in developed countries have been published.[17,29] To the authors' knowledge, a recent and systematic review of past and present population-based Australian interventions related to FI does not exist within the literature. This systematic scoping review aimed to summarise interventions designed to shift the specific socio-ecological determinants and outcomes of FI in Australia to date by exploring the question: "What population-based interventions addressing FI have been undertaken in Australia?" Specifically: (a) In which Australian states and/or territories are these interventions undertaken?; (b) Which determinants and dimensions of food security are being addressed by interventions?; (c) How are the interventions attempting to influence population-based drivers of FI?; (d) Who (governments, non-government organisations and/or other sectors) is leading these interventions?; (e) If and how are these interventions evaluated? The review aims to provide a broad overview of existing, explicitly stated population-based interventions to addressing the underlying determinants of FI in Australia to date.

2 | METHODS

Literature on FI interventions is constantly emerging and evolving, heterogeneous in its quality and form, and published through various sources across the academic and grey literature. Thus, a systematic scoping review was conducted instead of a traditional systematic literature review, as it was more appropriate for accommodating varied information sources and answering a question with a broad scope, while still offering a systematic, transparent and replicable process.[30,31] The scoping review protocol was adapted from the Joanna Briggs Institute Reviewer's Manual (2017) and included: defining the research question, identifying relevant studies, selecting studies to include, charting (extracting and synthesising the data), summarising and reporting the results.[32] The review is reported according to the PRISMA guidelines for Scoping Reviews.[33]

Inclusion and exclusion criteria for results obtained from research databases or grey literature searches are summarised in Table 1. Since people living in institutions typically experience limited control in the provision of their own food and meals[34,35] compared to the general non-institutionalised Australian population, only interventions including non-institutionalised human populations living in

TABLE 1 Eligibility criteria for study inclusion and exclusion

	Inclusion criteria	Exclusion criteria
Relevance to Australia	Published by any organisation or individual based in Australia	Published outside of Australia
Duplication	Describes a unique intervention	Document only refers to intervention(s) described in another document
Language	English	Document only available in language other than English
Completeness of document	Most current version	Document was a draft or summary version, or has been replaced with another document
Population	Describes an intervention targeting a non-institutional Australian population	Response relates to an institutional population[a] or other population residing outside of Australia
Interventions of interest	Describes a current/previous intervention in Australia with at least one socioecological, population-based goal, objective or strategy to change at least one determinant of food security	Does not describe a relevant intervention
Information of interest	Describes relevant intervention in sufficient detail in main body of text to answer research questions	Document provides insufficient detail about relevant interventions[b]

[a]The institutional population includes people living in non-private, institutional settings, defined as dwellings other than private houses, units, apartments, flats, or similar, and may include people living in nursing homes; cared accommodation for the retired or aged; hospitals; prisons, corrective or detention institutions for children or adults; child care institutions and dormitories of schools and hospitals; convents and monasteries. Institutional settings typically provide communal or transitory accommodation and are usually dedicated to the care, treatment or custody of individuals on a residential basis.[21,126]

[b]A number of results were summaries or reviews, which referred to multiple responses to FI. Summaries or reviews which did not produce unique information on FI interventions contained within other results, or did not produce information about interventions included in other interventions were excluded. Due to time limitations, the authors were only able to use and extract information presented in the main text of these summaries and did not further investigate responses that were described without details allowing for adequate extraction (eg, responses only mentioned in reference lists, or where only a name and very short description of a program were provided).

Australia were included. Australian population-based interventions addressing FI were defined as interventions which located and attempted to influence at least one determinant of food security (Table 2) by affecting the socioeconomic, cultural and environmental conditions of a group of people.[18,19] To capture a broad range of results, there was no search date limit applied nor were there restrictions according to the types of studies included in this scoping review. Grey literature sources such as reports, articles and websites were also included.

Five databases were searched in April/May 2018: CINAHL plus, Ovid MEDLINE, Sociological Abstracts, Australian Public Affairs Information Service, and Rural and Remote Health, and were selected to cover a range of content and disciplines related to FI in Australia. Search terms were adapted from a previously published review protocol[29] to suit Australian terminology and the different requirements of the chosen database, with additional terms included to capture responses related a wider breadth of food security determinants. See Tables S1 and S2 for search terms.

Screening of abstracts and titles was independently performed by two researchers (VY, SK). Conflicting assessments were resolved via discussion until consensus was achieved. Records deemed eligible progressed to a second screening phase, where full texts were retrieved for further assessment against the inclusion criteria. One researcher (SK) conducted full text screening on a random subset of 30 records, and another researcher (VY) screened the remainder of full texts. Uncertainties about the eligibility of any record at this stage were discussed between researchers until consensus was achieved. Both EndNote X8.2 (Clarivate Analytics, Philadelphia, Pennsylvania) and Covidence (Veritas Health Innovation, Melbourne, Australia) software were used to manage the selection process.

A separate grey literature search strategy was also employed. Search methods were adapted from a previously published systematic grey literature search plan and applied to capture a manageable volume of results.[39] Five unique search queries were applied in Google searches (Google Chrome, Version 66.0.3359.181, Google Inc., Mountain View, California) in May-June 2018 using a filter to only capture results originating from Australian results (Supplementary Table 2). The first 10 pages of each search's hits (equivalent to 100 results) were reviewed for potential relevancy according to the eligibility criteria (Table 1) using the page title, accompanying text snippet and the first screen (webpage or document) of each result. Links assessed as being potentially relevant were "bookmarked" in the Google Chrome web browser in a sub-folder named according the search query used, enabling subsequent extraction into Microsoft Excel

TABLE 2 Descriptions of food security dimensions and determinants[17,36-38]

Food security Dimension/determinant	Description
1. Food availability	The physical presence of sufficient choice and quantity of nutritious foods which are affordable, competitively priced and of appropriate quality to meet dietary needs and preferences.
Food outlet location	Refers to the geographic location of food outlets, including food retail stores (eg, supermarkets, greengrocers) and outlets selling prepared food.
Quality and variety	Indicators of food quality include the freshness, nutritional value, flavour and acceptability of food. Food variety is optimal when there is a wide range of nutritious, fresh and processed foods available.
Availability in food outlets	Refers to the regular availability of nutritious and acceptable foods within local food outlets.
Promotion	Refers to the various ways different foods may be promoted, affecting consumers' food choices and ability to identify and locate food. Promotion methods may include food advertising, pricing discounts or "specials", and the positioning of foods in food outlets or of food outlets themselves.
Price	The affordability and retail price of different foods may significantly impact food purchasing behaviour and consumption, especially for people with low incomes and/or limited disposable income for food.
2. Food access	The ability to acquire food which is safe, affordable, culturally acceptable and nutritious through the use of physical and/or financial resources.
Financial resources	Refers to having enough money to buy nutritious, acceptable and good quality food.
Transport to shops	Refers to the accessibility, availability and adequacy of private or public transport to reach food outlets
Social support	Refers to the ability to use social support networks such as family and friends to assist with food, money and/or transport during periods of FI
Mobility	Good physical mobility is usually required to independently shop for food and prepare meals. Limited physical mobility may restrict these abilities and is often experienced by older people, people with disabilities or those experiencing injuries.
3. Food utilisation	The ability to transform acquired food into safe, nutritionally adequate and culturally acceptable meals to support a nutritious diet where all physiological needs are met.
Knowledge	Refers to an understanding of basic food and nutrition knowledge, including topics such as how to make healthy food choices and ingredient substitutions, label reading and food safety.
Skills	Refers to the set of skills required to obtain and prepare safe, nutritious and culturally acceptable meals, including planning, food preparation, cooking, and budgeting skills.
Preferences	Refers to the desirability, amenability and/or palatability of foods which affects food choice and consumption. Food preferences may be influenced by factors such as nutrition knowledge, eating habits, sociocultural factors, allergies and intolerances, marketing, and time available to prepare food.
Storage and cooking facilities	Refers to the equipment and resources required to adequately and safely store, prepare and cook food to support healthy eating. Storage facilities should be secure and provide adequate storage room, and may include a fridge, freezer and/or pantry. Cooking facilities including knives, chopping boards, stoves, etc.
Time	Shopping for and preparing healthy meals requires adequate time availability. A lack of time may limit access to a healthy diet and increase reliance on processed or take-away foods of poorer nutritional quality than home-prepared meals.
4. Stability	Refers to a sustained ability to access and acquire sufficient quantities of safe, nutritious, affordable food of appropriate quality to meet dietary needs and preferences, at all times.

(Microsoft, Washington) for further screening. Potentially relevant grey literature records were retrieved as offline downloaded documents, or viewed at the original URL. Records were screened by one researcher (VY) according to the inclusion criteria (Table 1) with decisions recorded in an Excel spreadsheet. Where the eligibility of any grey literature record was unclear, this was discussed with a second researcher (SK) until agreement was achieved.

Data extraction included name, intervention location and funder, target population and date of implementation. To

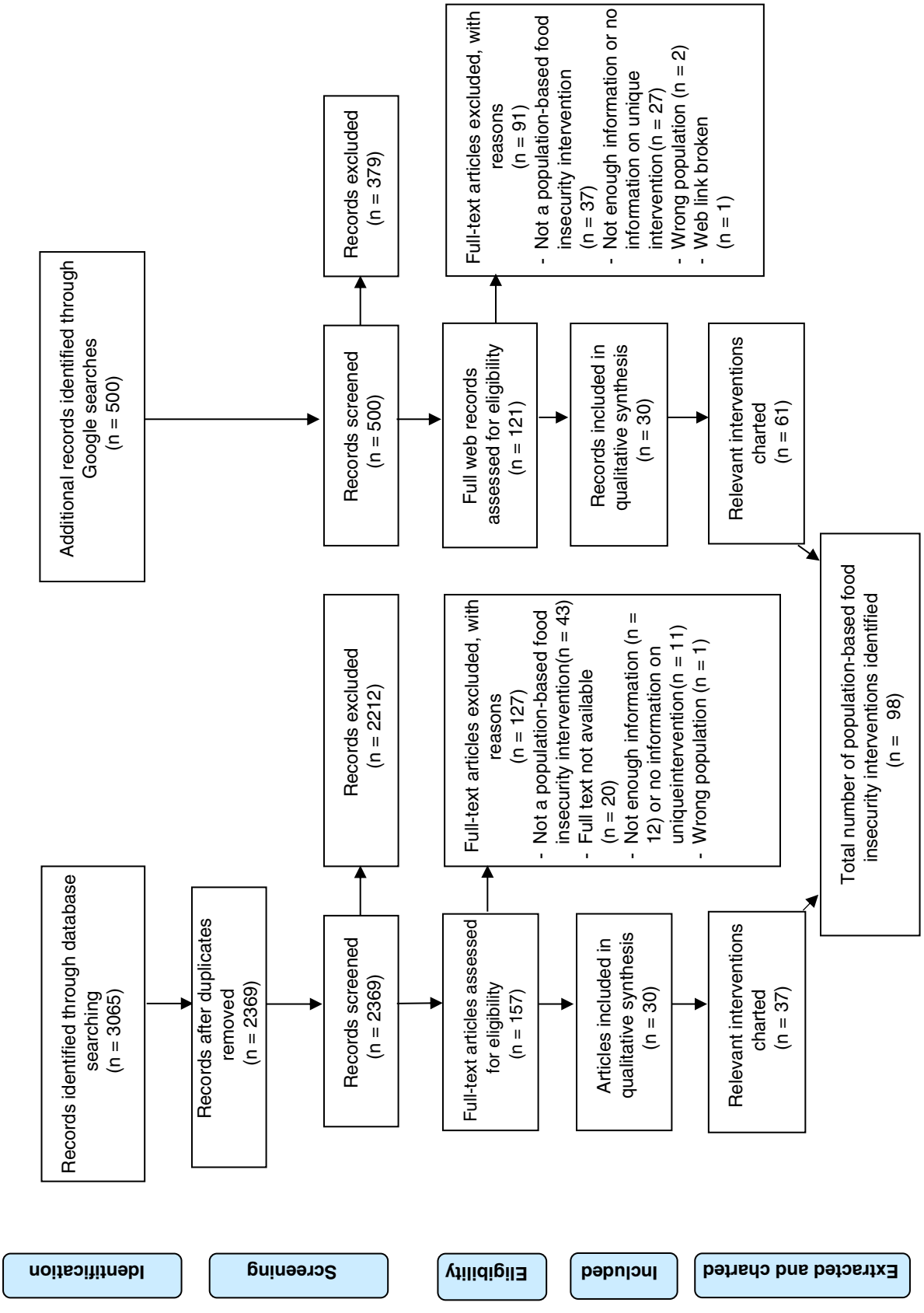


FIGURE 1 Flow diagram describing record inclusion for population-based interventions addressing food insecurity in Australia systematic scoping review

describe how included responses related to the "causes of the causes"[27] of FI and the social determinants of health, three broad and hierarchical categories were used within the data extraction form to provide an indication of where responses were locating and attempting to influence population-based drivers of FI. These categories were adapted from similar analyses of public health responses[40] and based on health equity and social determinants of health literature.[26,28,40-44] They included (1) local, community-based interventions responding more directly to causes of FI, to (2) interventions within living and working environments and settings, to (3) pro-active, sociocultural interventions attempting to shift overarching societal conditions, norms and structures most indirectly causing FI. Ten per cent of the records (n = 10, randomly selected) were independently extracted by another researcher (SK) with minor discrepancies in the volume and level of detailed information identified and resolved via discussion until consensus was achieved, and the final data extraction entries revised for all records based on these discussions. Extracted data were summarised through a data "charting" process for this scoping review, whereby a visual, graphical overview of the extracted data is presented.[30,31] Graphical overviews of the dimensions and determinants of food security, and how responses aimed to influence food security determinants, were produced from this charting process in lieu of a tabular summary of included studies.[30,31] Typical of scoping reviews a formal quality assessment of included records was not undertaken for this review.[45]

3 | RESULTS

The database and grey literature search returned a combined total of 3565 records. After excluding duplicate records, those which did not meet inclusion criteria, and those for which full text articles or web links could not be retrieved; 60 records (30 identified via database search and 30 identified through Google searches) were included, describing 98 unique population-based responses to FI in Australia (Figure 1, Table S3). Table S3 summarises each intervention and relevant associated literature.[11,17,46-112]

Eight population-based interventions to FI were identified as targeting the whole Australian population, with a further two interventions focused on remote Indigenous communities across multiple states. Comparing the non-national interventions across states or territories, Victoria had the highest number (n = 26), followed by the Northern Territory (n = 14), New South Wales (n = 13), Tasmania

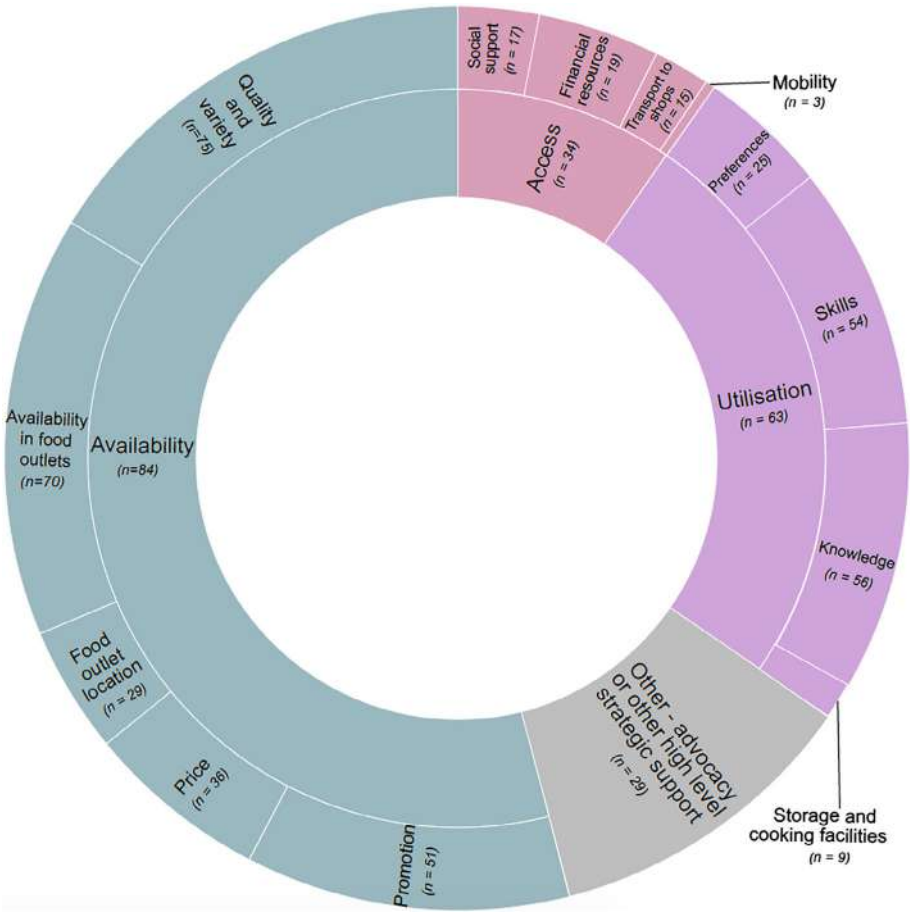


FIGURE 2 Determinants and dimensions of food security addressed by included interventions[(a)]

(n = 11) and South Australia (n = 10). There were fewer included interventions in Western Australia (n = 7), Queensland (n = 3), the Australian Capital Territory (n = 3). One intervention targeted a population located within two council areas which share the Victorian-New South Wales border. The majority of interventions (n = 67) included strategies targeting whole populations defined by their area or institution (eg, people living within a particular local government area, state or territory; school communities or health service management). Twenty-five interventions specifically targeted populations experiencing higher prevalence, or risk, of FI. Some interventions (n = 6) took a whole-of-population approach but also had additional strategies to reach population groups with greater identified risk or prevalence of FI.

The availability of information regarding funding sources and time periods for which interventions were active varied. Most records either did not state any information about the period for which an intervention was active (n = 30), or stated the commencement date of the response (n = 44). The funding sources of responses were not reported as intended due to limited reporting in documents reviewed.

The majority of included interventions addressing FI featured strategies or objectives to address the food availability "dimension" of food security (n = 84) and food utilisation (n = 63), while fewer interventions had strategies focused on food access (n = 34) (Figure 2). Almost a third of interventions also featured a range of other high-level strategies to address one or more food security dimensions (n = 29) through activities such as advocacy, capacity-building, collaboration between relevant stakeholders, and/or investment in programs, projects or services related to FI. Within these identified FI interventions, some determinants were more frequently represented than others, with the exception of time (in consideration of food utilisation), which did not feature in any intervention (Figure 2).

Most interventions (n = 67) aimed to influence the underlying socio-environmental, cultural and/or economic processes, political and cultural systems and norms which contribute to FI through strategies such as advocacy, strategic partnerships, policy, governance and legislation whilst targeting determinants related to living and working conditions. Fewer interventions (n = 10) focused on community strengthening, resilience, and building social support and cohesion.

The organisations, institutions or other groups involved in leading the identified interventions were categorised according to sector types including: government (local, state or federal), non-government or non-profit (including charitable organisations), private businesses, and universities. Though most interventions were led by actors from a single sector (n = 69), many involved actors from multiple sectors (n = 29). Of the included interventions, the majority involved state or territory government entities (n = 60) and with considerable involvement from non-profit, non-government and charitable organisations (n = 27). Fewer interventions were led by governments at a local and federal level (n = 21 and n = 17, respectively). A minority of interventions were described as being led by private sector (n = 13) or university groups (n = 7).

Approximately 40% of the population-based interventions which addressed FI included in this review provided no description of any proposed or completed evaluation efforts (n = 40). Other interventions detailed one or more evaluations. Thirteen interventions proposed future evaluation plans in limited detail, while 10 included statements that an evaluation or formal review had been completed, though limited further details were provided. Fourteen interventions described conducting process evaluations, nine interventions used informal progress reports, and 16 involved impact evaluations. Very few interventions described conducting formative (n = 3) or economic (n = 1) evaluations. Four interventions were subject to federal government inquiries and audits by the Australian National Audit Office, and one intervention was a randomised controlled trial, which measured pre-during-post-intervention outcomes.

4 | DISCUSSION

This scoping review aimed to explore population-based FI interventions undertaken in Australia. There were relatively few national interventions indicating a limited coordinated and coherent national response to FI. Determinants related to living and working environments, food availability and food utilisation were most frequently addressed in the interventions. Additionally a significant proportion of interventions did not appear to be associated with any rigorous evaluation efforts. Of importance these findings highlighted the limited interventions that are focussed and/or consider the key determinant of FI; financial access, for example policy responses to address adequate income.

Previous national nutrition activities such as the Food and Nutrition Policy (1992) and Eat Well Australia (2000-2010) have considered addressing food and nutrition insecurity; however, these policies and programs have historically been regarded as being inadequately resourced.[113,114] Accordingly, the relative abundance of responses at a state government level may in part be compensating for this lack of a national, whole-of-government approach to addressing FI. Notably, five of the eight national interventions to FI identified in this scoping review focused on Aboriginal and Torres Strait Islander populations. Unlike for the non-Indigenous Australian population, there has been a succession of high-level national strategies, plans and inquiries related to addressing FI among Aboriginal and Torres Strait Islander, particularly following

the establishment of the National Aboriginal and Torres Strait Islander Peoples in Australia Nutrition Strategy and Action Plan (NATSINSAP) in 2000.[56,59,115-120]

Compared to other Australian states and territories, there was a disproportionate number of interventions based in Victoria. Ten of the twenty-six Victorian interventions identified in this review involved local government actors. The significant response from this sector in Victoria is consistent with previous national surveys of Australian local government activities conducted by Yeatman[121] in 1995 and 2007. These highlighted local governments to be significantly more active in engaging with food and nutrition issues in Victoria than elsewhere. Since 1995, some Victorian local governments have received financial and resource support to address food and nutrition issues by VicHealth's "Food for All" food security program (2005-2010)[87] and "Food Alliance" food systems partnership (2009).[122] However, there are likely other factors contributing to greater engagement in Victoria as the 1995 survey results indicated disproportionate activity even before these additional supports existed.[121] VicHealth's strategic and funding priorities have since appeared to shift away from supporting local governments to improve community food security, to focusing more on improvements to consumer food and beverage choices and product reformulation.[123]

Interventions identified in this scoping review most frequently aimed to improve determinants of household and/or community food security within the food availability dimension (Table 1 and Figure 2). Some of the determinants associated with food availability, such as food quality and variety, availability in food outlets, promotion, and price, were addressed most often, consistent with the finding that most included interventions attempted to influence living and working conditions where these determinants may manifest and affect food systems. Policies and programs related to improving the supply of healthy food within schools, health services, and/or retail environments have been implemented across Australia (Table S3). However, with few associated impact or outcome evaluations for settings-based responses identified in this review, evidence regarding the actual effect of these healthy food supply responses on community food and nutrition security is unknown. The reason for limited evaluation evidence may be multifactorial and broadly categorised according to three factors: organisational (eg, understanding of the role of evaluation), capacity (eg, evaluation knowledge and skills, financial resources) and translational (eg, difficulties translating evaluation findings to practice).[124] A potential implication of limited evaluation is that responses that have no or negligible impact on addressing or improving food and nutrition security status may continue to be funded and/or implemented. Evaluation of interventions need to be adequately planned, with outcome measures and tools, and resourced; financial and with adequate skill development.

The majority of responses also addressed the determinant of food utilisation, especially food skills and knowledge, which may be somewhat expected given the traditional focus of public health nutrition interventions in these areas.[24] This is despite using eligibility criteria which only included interventions that addressed food-related skills, knowledge and behaviour if they also featured strategies involving broader social or environmental changes. In combination with other social and environmental changes conducive to healthy food consumption, strengthening food skills and knowledge can contribute to resilience and to improving nutrition issues such as low vegetable consumption.[7,125] However, while these interventions are widely perceived to be valuable in addressing FI in Australia and internationally, the ability of food literacy to improve FI in deprived or disadvantaged contexts is limited where food quality or quantity is inadequate.[7,21,126] Previous population surveys conducted in other high-income countries have found no deficit in food skills among food-insecure households compared to food-secure households.[126] Food literacy skills can only protect or buffer the experience of FI to a point. Stronger associations between being on Australian social assistance payments and experiencing FI have been demonstrated within the literature, particularly for people on payments such as the Newstart Allowance (deemed among the most inadequate payments to support healthy living).[127] Accordingly, the perception of food skills programs as an appropriate population-based solution to addressing FI due to inadequate household incomes has been questioned.[21,126]

No interventions considered the potential impact of time poverty on the procurement and preparation of food on food security status in domiciled households. Literature indicates that insufficient time is among the most frequently cited barriers for healthy eating[128] and that a lack of time for household food provisioning in addition with other factors may impact on food security for some households.[129,130] This finding supports sentiments that the way in which time "contours" health and issues such as FI may indeed be neglected in health and social policy and interventions.[128]

The necessity of policies and programs to address the structural drivers of FI in Australia has long been recognised for the potential scale of their preventative impacts.[24,131] However, population-based interventions to FI identified in this scoping review appeared to lack rigorous evaluations and detailed reporting on process and program implementation issues. This could indicate that despite the recognised importance of such interventions, there have been missed opportunities to strengthen the evidence base regarding the factors which may contribute to a more effective population-based FI intervention. This may impede the capacity of FI

workforce to effectively advocate for and justify their inclusion in evidence-informed policy and practice. Given the documented significant health, social, and environmental impacts of FI there is the need for advocacy for leadership by Government to provide strategic direction inclusive of funded policy solutions to address the complex array of determinants. This needs to be supported with evaluations that are adequately resourced such that the findings may be translated to "practice".

This systematic scoping review presented an overview of population-based interventions to address FI undertaken in Australia to date. To the authors knowledge this is the first of such a review in Australia and is crucial to inform the FI workforce, academics, and policy makers. Using a systematic search process to locate and summarise the interventions of interest it highlights the focus of such interventions and their jurisdictions for example; across government tiers and sectors, non-government organisations and not for profits. Importantly it provides evidence of an absence of a coordinated, coherent national response to FI. This could be rectified by the development of a resourced policy for example, a National Food and Nutrition policy that is inclusive of food security and intercepts with other broader policy based responses that address other key drivers.

This review included both peer reviewed and grey literature, however it was dependent on the availability of information. The grey literature search was appropriate in the custom Google search to scope a wide pool of results, yet such searches are powered by complex relevancy rankings, algorithms and potentially influenced by personalisation which may limit the repeatability of results.[28] Further, a synthesis of evaluation findings was not completed as part of this review and the majority of included literature would be regarded as low-level evidence in a traditional evidence hierarchy, though this was appropriate for the research question and reflects the nature of evidence in this area of research.

The review highlighted responses most frequently addressed food availability and utilisation, and often attempted to affect change within living and working environments. While this review identified numerous interventions including strategies aiming to influence the various sociopolitical, environmental and cultural structures and processes which contribute to FI, there was a notable absence of interventions with a lack of evaluation. In order to contribute to the evidence base of the impact and effectiveness of FI interventions it is imperative that they are evaluated in a rigorous manner and document their public health implications.

In order to address this public health issue there needs to be a shift from predominantly individual responsibility food based responses towards "upstream" population interventions that addresses the key FI determinants with a committed and shared action by Government and decision makers and is inclusive of the voices of those experiencing this issue.

AUTHOR CONTRIBUTIONS

V.Y. conducted the literature search, record screening, and data synthesis as part of the requirements for an Honours degree. V.Y. wrote the manuscript reviewed and revised by S.K. and C.P. S.K. and C.P. formulated the original research question, and oversaw the study design and completion of the study. S.K. assisted with screening records. All authors are in agreement with the manuscript and declare that the content has not been published elsewhere.

ORCID

Claire Palermo https://orcid.org/0000-0002-9423-5067
Sue Kleve https://orcid.org/0000-0003-1182-0357

REFERENCES

1. Committee on World Food Security. *Coming to Terms with Terminology*. Rome, Italy: Food and Agriculture Organisation; 2012.
2. Smith MD, Rabbitt MP, Coleman-Jensen A. Who are the World's food insecure? New evidence from the Food and Agriculture Organization's food insecurity experience scale. *World Dev*. 2017;93:402-412.
3. Australian Bureau of Statistics. *4363.0.55.001—Australian Health Survey: Users' Guide, 2011–13—Food Security*. Canberra, Australia: Australian Bureau of Statistics; 2013.
4. Australian Bureau of Statistics. *4364.0.55.009—Australian Health Survey: Nutrition—State and Territory Results, 2011–12*. Canberra, Australia: Australian Bureau of Statistics; 2015.
5. McKechnie R, Turrell G, Giskes K, Gallegos D. Single-item measure of food insecurity used in the National Health Survey may underestimate prevalence in Australia. *Aust N Z J Public Health*. 2018;42:389-395.
6. Kleve S, Gallegos D, Ashby S, Palermo C, McKechnie R. Preliminary validation and piloting of a comprehensive measure of household food security in Australia. *Public Health Nutr*. 2018; 21:526-534.
7. Gallegos D. The nexus between food literacy, food security and disadvantage. In: Vidgen H, ed. *Food Literacy: Key Concepts for Health and Education*. London; New York: Routledge; 2016: 131-144.
8. Temple JB, Russell J. Food insecurity among older aboriginal and Torres Strait islanders. *Int J Environ Res Public Health*. 2018;15:1766.
9. Kleve S, Davidson ZE, Gearon E, Booth S, Palermo C. Are low-to-middle-income households experiencing food insecurity in Victoria, Australia? An examination of the Victorian Population Health Survey, 2006–2009. *Aust J Prim Health*. 2017;23: 249-256.
10. Ramsey R, Giskes K, Turrell G, Gallegos D. Food insecurity among adults residing in disadvantaged urban areas: potential

health and dietary consequences. *Public Health Nutr*. 2012;15:227-237.
11. VicHealth. *Healthy Eating—Food Security Investment Plan, 2005–2010*. Melbourne, Australia: VicHealth; 2005.
12. Nolan M, Rikard-Bell G, Mohsin M, Williams M. Food insecurity in three socially disadvantaged localities in Sydney, Australia. *Health Promot J Austr*. 2006;17:247-253.
13. Temple J. Severe and moderate forms of food insecurity in Australia: are they distinguishable? *Aust J Soc Issues*. 2008;43:649-668.
14. Ramsey R, Giskes K, Turrell G, Gallegos D. Food insecurity among Australian children: potential determinants, health and development consequences. *J Child Health Care*. 2011;15:401-406.
15. Tarasuk V, Mitchell A, McLaren L, McIntyre L. Chronic physical and mental health conditions among adults may increase vulnerability to household food insecurity. *J Nutr*. 2013;143:1785-1793.
16. Cook JT, Black M, Chilton M, et al. Are food insecurity's health impacts underestimated in the U.S. population? Marginal food security also predicts adverse health outcomes in young U.S. children and mothers. *Advances in Nutrition (Bethesda, Md)*. 2013;4:51.
17. Rychetnik L, Webb K, Story L, Katz T. *Food Security Options Paper: A Planning Framework and Menu of Options for Policy and Practice Interventions*. Sydney, Australia: NSW Centre for Public Health Nutrition for NSW Health; 2003.
18. Food and Agriculture Organisation. *Rome Declaration on Food Security, World Food Summit*. Rome, Italy: Food and Agriculture Organisation; 1996.
19. Weingärtner L. The concept of food and nutrition security. In: Klennert K, ed. *Achieving Food and Nutrition Security: Actions to Meet the Global Challenge*. 3rd ed. Feldafing, Germany: Internationale Weiterbildung gGmbH; 2009:21-51.
20. Booth S, Smith A. Food security and poverty in Australia—challenges for dietitians. *Aus J Nutr Diet*. 2001;58:150-156.
21. Loopstra R. Interventions to address household food insecurity in high-income countries. *Proc Nutr Soc*. 2018;77:270-281.
22. Booth S, Whelan J. Hungry for change: the food banking industry in Australia. *Br Food J*. 2014;116:1392-1404.
23. Gallegos D, Booth S, Kleve S, McKechnie R, Lindberg R. Food insecurity in Australian households: from charity to entitlement. *A Sociology of Food and Nutrition: the Social Appetite*. 4th ed. South Melbourne, Victoria: Oxford University Press; 2017:55-74.
24. Caraher M, Coveney J. Public health nutrition and food policy. *Public Health Nutr*. 2004;7:591-598.
25. Pollard C, Begley A, Landrigan T. The rise of food inequality in Australia. In: Caraher M, Coveney J, eds. *Food Poverty and Insecurity: International Food Inequalities*. Switzerland: Springer International Publishing; 2016:89-103.
26. VicHealth. *Fair Foundations: the VicHealth Framework for Health Equity*. Melbourne, Australia: Victorian Health Promotion Foundation; 2015.
27. Rose G, Khaw K, Marmot M. *Rose's Strategy of Preventive Medicine*. Oxford; New York: Oxford University Press; 2008.
28. Friel S, Hattersley L, Ford L. *Evidence Review: Addressing the Social Determinants of Inequities in Healthy Eating*. Melbourne, Australia: Victorian Health Promotion Foundation; 2015.
29. Burns C, Kristjansson B, Harris G, et al. Community level interventions to improve food security in developed countries. *Cochrane Database Syst Rev*. 2010;12:CD008913. https://doi.org/10.1002/14651858.CD008913.
30. Levac D, Colquhoun H, O'Brien K. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5:69.
31. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8:19-32.
32. Peters M, Godfrey C, McInerney P, Baldini Soares C, Khalil H, Parker D. Scoping reviews. In: Aromataris E, Munn Z, eds. *Joanna Briggs Institute Reviewer's Manual*. Adelaide, SA: The Joanna Briggs Institute; 2017.
33. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation the PRISMA-ScR statement. *Ann Intern Med*. 2018;169:467-473.
34. Fine M, Graham S, Matheson G. *The Institutional Population of Australia: 1976–1991, Report of a Feasibility Study*. Sydney, Australia: Social Policy Research Centre, University of New South Wales; 1995.
35. Lim PP, Percival R. *Simulating Australia's Institutionalised Population*. Canberra, Australia: National Centre for Social and Economic Modelling, University of Canberra; 1999:63.
36. Innes-Hughes C, Bowers K, King L, Chapman K, Eden B. *Food Security: The What, How, Why and Where to of Food Security in NSW. Discussion Paper*. Sydney, Australia: Physical Activity and Nutrition Obesity Research Group, Heart Foundation NSW, Cancer Council NSW; 2010.
37. Chenhall C. *Improving Cooking and Food Preparation Skills: A Synthesis of the Evidence to Inform Program and Policy Development*. Canada: Healthy Living Issue Group of the Pan Canadian Public Health Network; 2010.
38. Food and Agriculture Organisation. *Policy Brief: Food Security*. Geneva, Switzerland: Food and Agriculture Organisation; 2006.
39. Godin K, Stapleton J, Kirkpatrick SI, Hanning RM, Leatherdale ST. Applying systematic review search methods to the grey literature: a case study examining guidelines for school-based breakfast programs in Canada. *Syst Rev*. 2015;4:138.
40. Browne G. *How Does Local Government Use Evidence to Inform Strategic Planning for Health and Wellbeing?*. Melbourne, Australia: University of Melbourne; 2017.
41. National Collaborating Centre for Determinants of Health. *Let's Talk…Advocacy for Health Equity*. Antigonish, Canada: National Collaborating Centre for Determinants of Health, St. Francis Xavier University; 2015.
42. Solar O, Irwin A. *A Conceptual Framework for Action on the Social Determinants of Health. Social Determinants of Health Discussion Paper 2 (Policy and Practice)*. Geneva, Switzerland: World Health Organisation; 2010.
43. Gore D, Kothari A. Social determinants of health in Canada: are healthy living initiatives there yet? A policy analysis. *Int J Equity Health*. 2012;11:41.
44. Dahlgren G, Whitehead M. A framework for assessing health systems from the public's perspective: the ALPS approach. *Int J Health Serv*. 2007;37:363-378.
45. Peters M, Godfrey C, Khalil H, McInerney P, Parker D, Soares C. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc*. 2015;13:141-146.

46. Allen L, O'Connor J, Amezdroz E, et al. Impact of the social cafe meals program: a qualitative investigation. *Aust J Prim Health*. 2014;20:79-84.
47. Council to Homeless Persons. *Beyond Emergency Food: Responding to Food Insecurity and Homelessness*. Vol 29*(2)*. Melbourne, Victoria: Council to Homeless Persons; 2016. https://righttofoodcoalition.files.wordpress.com/2016/05/parity_vol29-02.pdf. Accessed May 30, 2018.
48. Ball K, McNaughton SA, Ha NDL, et al. Influence of price discounts and skill-building strategies on purchase and consumption of healthy food and beverages: outcomes of the Supermarket Healthy Eating for Life randomized controlled trial. *Am J Clin Nutr*. 2015;101:1055-1064.
49. Le HN, Gold L, Abbott G, et al. Economic evaluation of price discounts and skill-building strategies on purchase and consumption of healthy food and beverages: the SHELf randomized controlled trial. *Soc Sci Med*. 2016;159:83-91.
50. Lee Olstad D, Ball K, Abbott G, et al. A process evaluation of the Supermarket Healthy Eating for Life (SHELf) randomized controlled trial. *Int J Behav Nutr Phys Act*. 2016;13:1-15.
51. Black AP, Vally H, Morris PS, et al. Health outcomes of a subsidised fruit and vegetable program for Aboriginal children in northern New South Wales. *Med J Aust*. 2013;199:46-50.
52. Brimblecombe J, Ferguson M, Chatfield MD, et al. Effect of a price discount and consumer education strategy on food and beverage purchases in remote indigenous Australia: a stepped-wedge randomised controlled trial. *Lancet Public Health*. 2017;2:e82-e95.
53. Brimblecombe J, van den Boogaard C, Wood B, et al. Development of the good food planning tool: a food system approach to food security in indigenous Australian remote communities. *Health Place*. 2015;34:54-62.
54. Brimblecombe JK, McDonnell J, Barnes A, Dhurrkay JG, Thomas DP, Bailie RS. Impact of income management on store sales in the Northern Territory. *Med J Aust*. 2010;192:549-554.
55. Browne J, Hayes R, Gleeson D. Aboriginal health policy: is nutrition the 'gap' in 'Closing the gap'? *Aust N Z J Public Health*. 2014;38:362-369.
56. Lee A, Ride K. *Review of Nutrition Among Aboriginal and Torres Strait Islander People*. Mount Lawley, WA: Australian Indigenous Health InfoNet; 2018.
57. Davy D. Australia's efforts to improve food security for aboriginal and Torres Strait islander peoples. *Health Hum Rights*. 2016;18:209.
58. Australian National Audit Office. In: Cabinet DotPMa, ed. *Food Security in Remote Indigenous Communities*. Canberra, Australia: Australian National Audit Office; 2014:96.
59. Council of Australian Governments. In: Cabinet DotPMa, ed. *National Strategy for Food Security in Remote Indigenous Communities*. Canberra, Australia: Council of Australian Governments; 2009:9.
60. Butler R, Tapsell L, Lyons-Wall P. Trends in purchasing patterns of sugar-sweetened water-based beverages in a remote aboriginal community store following the implementation of a community-developed store nutrition policy. *Nutr Diet*. 2011;68:115-119.
61. Cooke L, Sangster J, Eccleston P. Improving the food provided and food safety practices in out-of-school-hours services. *Health Promot J Austr*. 2007;18:33-38.
62. Ferguson M, O'Dea K, Holden S, Miles E, Brimblecombe J. Food and beverage price discounts to improve health in remote Aboriginal communities: mixed method evaluation of a natural experiment. *Aust N Z J Public Health*. 2017;41:32-37.
63. Department of Families, Housing, Community Services and Indigenous Affairs. In: Department of Families H, Community Services and Indigenous Affairs, ed. *Stronger Futures in the Northern Territory: Implementation Approach for the Food Security Measure*. Canberra, Australia: Department of Families, Housing, Community Services and Indigenous Affairs; 2013:9.
64. Dick M, Lee A, Bright M, et al. Evaluation of implementation of a healthy food and drink supply strategy throughout the whole school environment in Queensland state schools, Australia. *Eur J Clin Nutr*. 2012;66:1124-1129.
65. Stylianou M, Walker JL. An assessment of Australian school physical activity and nutrition policies. *Aust N Z J Public Health*. 2018;42:16-21.
66. Gardiner B, Blake M, Harris R, et al. Can small stores have a big impact?: a qualitative evaluation of a store fruit and vegetable initiative. *Health Promot J Austr*. 2013;24:192-198.
67. Palermo C, Gardiner B, Gee C, Charaktis S, Blake M. A mixed-methods impact evaluation of the feasibility of an initiative in small rural stores to improve access to fruit and vegetables. *Aust J Prim Health*. 2016;22:545-553.
68. Palermo C, Harris R. *Health Promoting Retail Outlets. A Summary and Analysis of the Retail Fruit and Vegetable Project in Gippsland, Victoria, Australia*. Department of Health: Melbourne, Australia; 2014.
69. Hawe P, Stickney EK. Developing the effectiveness of an intersectoral food policy coalition through formative evaluation. *Health Educ Res*. 1997;12:213-225.
70. Webb K, Hawe P, Noort M. Collaborative intersectoral approaches to nutrition in a community on the urban fringe. *Health Educ Behav*. 2001;28:306-319.
71. Kiss A. *What's Eating South Sydney? Health Promotion in South Sydney Council's Local Food Policy*. Vol 25. Waterloo, NSW: Australian Institute of Environmental Health; 1996:33-37,39.
72. Lee AJ, Hobson V, Katarski L. Review of the nutrition policy of the Arnhem Land Progress Association. *Aust N Z J Public Health*. 1996;20:538-544.
73. MacDonald C, Genat B, Thorpe S, Browne J. Establishing health-promoting workplaces in Aboriginal community organisations: healthy eating policies. *Aust J Prim Health*. 2016;22:239-243.
74. Matwiejczyk L, Mehta K, Scott J. Engaging South Australian local governments in the development of healthy eating policies. *Health Promot J Austr*. 2017;28:148-150.
75. Miller J, Lee A, Obersky N, Edwards R. Implementation of a better choice healthy food and drink supply strategy for staff and visitors in government-owned health facilities in Queensland, Australia. *Public Health Nutr*. 2015;18:1602-1609.
76. Payet J, Gilles M, Howat P. Gascoyne growers market: a sustainable health promotion activity developed in partnership with the community. *Aust J Rural Health*. 2005;13:309-314.
77. Pettigrew S, Pescud M, Donovan RJ. Stakeholder perceptions of a comprehensive school food policy in Western Australia. *Health Policy*. 2012;108:100-104.
78. Pettigrew S, Pescud M, Donovan RJ. Outcomes of the west Australian school healthy food and drink policy. *Nutr Diet*. 2012;69:20-25.
79. Powles J. Victoria's food and nutrition policy. *Health Promot*. 1988;2:239-242.

80. Reilly RE, Cincotta M, Doyle J, et al. A pilot study of aboriginal health promotion from an ecological perspective. *BMC Public Health*. 2011;11:749.
81. Smith A, Coveney J, Carter P, Jolley G, Laris P. The Eat Well SA project: an evaluation-based case study in building capacity for promoting healthy eating. *Health Promot Int*. 2004;19: 327-334.
82. Department of Agriculture, Fisheries and Forestry. In: Department of Agriculture FaF, ed. *National Food Plan: our Food Future*. Canberra, Australia: Department of Agriculture, Fisheries and Forestry; 2013:124.
83. Farmar-Bowers Q, Higgins V, Millar J. *Food Security in Australia: Challenges and Prospects for the Future*. 1st ed. UK: Springer; 2012:473.
84. City of Darebin. *Food Security Policy*. Melbourne, Australia: City of Darebin; 2010.
85. Casey City Council. *Food Security Policy*. Melbourne, Australia: Casey City Council; 2016.
86. VicHealth. *Ten Ways Local Government Can Act on Food Security*. Carlton South, Australia: VicHealth; 2010.
87. VicHealth. *Food for all: how Local Government Is Improving Access to Nutritious Food*. Victoria, Australia: VicHealth; 2008.
88. Montague M. In: Health Do, ed. *Local Government and Food Security, an Evidence Review: What we Know about What Works and What Might Work*. Northcote, Australia: Department of Health; 2011:126.
89. Manningham City Council. *Manningham City Council Food Security Plan 2016–2021*. Victoria, Australia: Manningham City Council; 2016.
90. Central Coast Council. *Central Coast Council Local Food Security Strategy*. Ulverstone, Australia: Central Coast Council; 2016.
91. Ward A, Williams J, Connally S. Food for all Tasmanians: development of a food security strategy. *Population Health, Department of Health and Human Services*. Tasmania, Australia: Department of Health and Human Services; 2013:6.
92. Lee A, Baker P, Stanton R, Friel S, O'Dea K, Weightman A. *Scoping Study to Inform Development of the National Nutrition Policy for Australia*. Canberra, ACT: Queensland University of Technology, Australian Department of Health and Ageing; 2013.
93. Healthy Food Access Tasmania Heart Foundation. Healthy Food Access Tasmania Project. https://www.healthyfoodaccesstasmania.org.au/about-healthy-food-access-project/. Accessed August 20, 2018.
94. City of Melbourne. *Food City: City of Melbourne Food Policy*. Melbourne, Australia: City of Melbourne; 2012.
95. Merri Health. Food security in Moreland. https://www.merrihealth.org.au/get-involved/health-initiatives/food-security-in-moreland/. Updated 2017. Accessed August 15, 2018.
96. Ballarat Community Health. *Ballarat Community Food Security Partnership Project*. Ballarat, Victoria: Ballarat Community Health; 2017. https://bchc.org.au/news/ballarat-community-food-security-partnership-project. Accessed May 30, 2018.
97. Australian Greens. In: Greens A, ed. *Our Food Future: the Greens' Plan for Australia's Food Security*. Canberra, Australia: Australian Greens; 2013:49.
98. Social Inclusion Unit, Department of Premier and Cabinet. Tasmanian Food Security Council. https://stors.tas.gov.au/1127396. Updated 2013. Accessed August 25, 2018.
99. Social Inclusion Unit, Department of Premier and Cabinet. A Social Inclusion Strategy for Tasmania. https://stors.tas.gov.au/1127396. Updated 2013. Accessed August 25, 2018.
100. Social Inclusion Unit, Department of Premier and Cabinet. In: Cabinet DoPa, ed. *A Social Inclusion Strategy for Tasmania: Preliminary Reponse October 2009*. Tasmania, Ausralia: Department of Premier and Cabinet; 2009:40.
101. Social Inclusion Unit, Department of Premier and Cabinet. In: Cabinet DoPa, ed. *Tasmanian Food Security Council: Terms of Reference*. Tasmania, Ausralia: Department of Premier and Cabinet; 2010:5.
102. Department of Health and Human Services. Food Security Factsheets. https://www.dhhs.tas.gov.au/publichealth/publications/food_security_factsheets. Updated 2018. Accessed August 3, 2018.
103. City of Darebin. *Darebin City Council Food Security and Nutrition Action Plan 2016–2020*. Victoria, Australia: City of Darebin; 2016.
104. City of Unley. *Food Security Strategy*. South Australia: City of Unley; 2011.
105. South Australian Government. In: Government SA, ed. *Report of Anangu Pitjantjatjara Yankunyjatjara Lands Food Security Strategy*. South Australia: South Australian Government; 2014:24.
106. VicHealth. *Food for all? Food Insecurity Community Demonstration Projects, Maribyrnong City Council and North Yarra Community Health*. Carlton South, Australia: VicHealth; 2003.
107. Public Health Association of Australia, Dietitians Association of Australia, Australian Red Cross. *Food Security for Aboriginal & Torres Strait Islander Peoples Policy*. Canberra, Ausralia: Public Health Association of Australia; 2013.
108. National Health and Medical Research Council. *Australian Dietary Guidelines: Providing the Scientific Evidence for Healthier Australian Diets*. Canberra, ACT: Canberra National Health and Medical Research Council; 2013:226.
109. Hobsons Bay City Council. In: Council HBC, ed. *Improving Access to Nutritious Food (Food Security) Policy Statement*. Victoria, Ausralia: Hobsons Bay City Council; 2009:5.
110. Heart Foundation. Food Access Networks Mornington. http://www.healthyactivebydesign.com.au/case-studies/food-access-networks-mornington. Updated 2018. Accessed August 4, 2018.
111. Yarra City Council. *Urban Agriculture Strategy 2014–2018*. Victoria, Ausralia: Yarra City Council; 2014.
112. Robertson K. In: Health Do, ed. *A Settings Approach: Healthy@Work—a Model of a Health Promoting Workplace*. Northern Territory, Ausralia: Department of Health; 2015:7.
113. Bastian A. The future of public health nutrition: a critical policy analysis of eat well Australia. *Aust N Z J Public Health*. 2011;35: 111-116.
114. Carey R, Caraher M, Lawrence M, Friel S. Opportunities and challenges in developing a whole-of-government national food and nutrition policy: lessons from Australia's National Food Plan. *Public Health Nutr*. 2016;19:3-14.
115. Public Health Association of Australia, Dietitians Association of Australia, Australian Red Cross. *Policy-at-a-Glance—Food Security for Aboriginal & Torres Strait Islander Peoples Policy*. 2013.
116. Dietitians Association of Australia. *Supporting Document for the Joint Policy Statement on: Food Security for Aboriginal & Torres Strait Islander Peoples*. Canberra, Ausralia: Dietitians Association of Australia; 2016.
117. Australian Government Department of Health. *Nutrition: Informing the Development of Indigenous Community Agreements*.

Canberra, Ausralia: Australian Government Department of Health; 2013.
118. National Public Health Partnership. *National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan 2000–2010 and First Phase Activities 2000–2003*. Canberra, Ausralia: National Public Health Partnership; 2001:55.
119. *Northern Territory National Emergency Response Act 2007 (Cwlth)*. Canberra, ACT: Australian Government, Attorney - General's Department; 2007.
120. *Stronger Futures in the Northern Territory (Consequential and Transitional Provisions) Act 2012*. Canberra, ACT: Australian Government; 2012.
121. Yeatman H. Action or inaction? Food and nutrition in Australian local governments. *Public Health Nutr*. 2009;12:1399-1407.
122. VicHealth. *Healthy Eating Partnerships: Food Alliance*. Victoria, Ausralia: VicHealth; 2015.
123. VicHealth. *VicHealth Healthy Eating Strategy 2017–19*. Carlton South, Ausralia: VicHealth; 2018.
124. Lobo R, Petrich M, Burns SK. Supporting health promotion practitioners to undertake evaluation for program development. *BMC Public Health*. 2014;14:1-8.
125. Meiklejohn SJ, Barbour L, Palermo CE. An impact evaluation of the FoodMate programme: perspectives of homeless young people and staff. *Health Educ J*. 2017;76:829-841.
126. Huisken A, Orr SK, Tarasuk V. Adults' food skills and use of gardens are not associated with household food insecurity in Canada. *Can J Public Health*. 2016;107:e526-e532.
127. Temple J, Booth S, Pollard C. Social assistance payments and food insecurity in Australia: evidence from the household expenditure survey. *Int J Environ Res Public Health*. 2019; 16:455.
128. Strazdins L, Griffin AL, Broom DH, et al. Time scarcity: another health inequality? *Environ Plan A*. 2011;43:545-559.
129. Coleman-Jensen A. *Time Poverty, Work Characteristics and the Transition to Food Insecurity among Low-Income Households*. State College, PA: The Pennsylvania State University; 2009.
130. Kleve S, Booth S, Davidson ZE, Palermo C. Walking the food security tightrope—exploring the experiences of low-to-middle income Melbourne households. *Int J Environ Res Public Health*. 2018;15:1-19.
131. Peeters A, Blake MRC. Socioeconomic inequalities in diet quality: from identifying the problem to implementing solutions. *Curr Nutr Rep*. 2016;5:150-159.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Yii V, Palermo C, Kleve S. Population-based interventions addressing food insecurity in Australia: A systematic scoping review. *Nutrition & Dietetics*. 2020;77:6–18. https://doi.org/10.1111/1747-0080.12580

Received: 28 May 2019 | Revised: 17 July 2019 | Accepted: 11 August 2019

DOI: 10.1111/1747-0080.12581

REVIEW

Nutrition & Dietetics Journal of the Dietitians Association of Australia WILEY

Social media, body image and food choices in healthy young adults: A mixed methods systematic review

Kim Rounsefell APD, PhD Candidate[1] | Simone Gibson PhD, AdvAPD, Senior Lecturer[1] | Siân McLean PhD, Research Fellow[2,3] | Merran Blair APD, Research Assistant[1] | Annika Molenaar BNutSc (Hons), Research Officer[1] | Linda Brennan PhD, Professor of Advertising[4] | Helen Truby PhD, Director of Dietetics[1] | Tracy A. McCaffrey PhD, Senior Lecturer[1]

[1]Department of Nutrition, Dietetics and Food, Monash University, Melbourne, Victoria, Australia

[2]Institute for Health and Sport, Victoria University, Melbourne, Victoria, Australia

[3]School of Psychology and Public Health, La Trobe University, Melbourne, Victoria, Australia

[4]School of Media and Communication, RMIT University, Melbourne, Victoria, Australia

Correspondence
Tracy A. McCaffrey and Helen Truby, Department of Nutrition, Dietetics and Food, Monash University, Level 1 264 Ferntree Gully Road, Melbourne VIC 3168 Australia.
Email: tracy.mccaffrey@monash.edu (T. A. M.) and helen.truby@monash.edu (H. T.)

Funding information
National Health and Medical Research Council, Grant/Award Number: GNT1115496

[Correction added on 14 October 2019, after first online publication: The affiliations of authors Siân McLean and Linda Brennan have been corrected].

The copyright line for this article was changed on 9 May 2020 after original online publication.

Abstract

Aim: Negative body image increases the risk of engaging in unhealthy dieting and disordered eating patterns. This review evaluated the impact of habitual social media engagement or exposure to image-related content on body image and food choices in healthy young adults (18-30 years).

Methods: A systematic search of six databases of observational literature published 2005-2019, was conducted (PROSPERO Registration No. CRD42016036588). Inclusion criteria were: studies reporting social media engagement (posting, liking, commenting) or exposure to image-related content in healthy young adults. Outcomes were: body image (satisfaction or dissatisfaction) and food choices (healthy eating, dieting/restricting, overeating/binging). Two authors independently screened, coded and evaluated studies for methodological quality.

Results: Thirty studies were identified (n = 11 125 participants). Quantitative analysis (n = 26) identified social media engagement or exposure to image-related content was associated with higher body dissatisfaction, dieting/restricting food, overeating, and choosing healthy foods. Qualitative analysis (n = 4) identified five themes: (i) social media encourages comparison between users, (ii) comparisons heighten feelings about the body, (iii) young adults modify their appearance to portray a perceived ideal image, (iv) young adults are aware of social media's impact on body image and food choices, however, (v) external validation via social media

is pursued. Most studies (n = 17) controlled for some confounding variables (age, gender, BMI, ethnicity).

Conclusions: Social media engagement or exposure to image-related content may negatively impact body image and food choice in some healthy young adults. Health professionals designing social media campaigns for young adults should consider image-related content, to not heighten body dissatisfaction.

KEYWORDS

body image, disordered eating, self-objectification, social comparison, social media, social networking sites

1 | INTRODUCTION

Young adulthood (18-30 years) marks the transitional period between adolescence and adulthood.[1] It is an impressionable life stage as young adults develop new skills toward their independence yet remain vulnerable due to a lack of life experience.[2] Young adulthood is a pivotal time to intervene to promote healthy food choices. They are among the largest consumers of sugar-sweetened beverages and fast food, and have low fruit and vegetable intakes.[3-7] These modifiable food choice behaviours carry long term health implications such as increased risk of chronic metabolic diseases (eg, cardiovascular diseases and diabetes mellitus).[8]

Due to the exponential growth in social media (SM) use over the last decade,[9] nutrition and health professionals, government and non-government health organisations (health professionals) try to leverage SM to reinforce healthy food choices and nutrition-related behaviours in young adults.[10-12] However, health campaigns utilising social media and targeting young adults have suffered from poor engagement and high attrition rates.[13-15] In addition, content from health professionals must compete against sophisticated social marketing campaigns of corporate brands and food industries.[16,17] SM content is poorly regulated, and food and beverage organisations are known to exploit young adults' social vulnerabilities using image-based marketing tactics, including peer ambassadors and celebrity endorsements designed to sell an illusion of health, beauty and success from products they are offering.[16] Evidence is now emerging of the negative consequences of such content for body image (BI) concerns, particularly in young women.[18,19]

Body image is experienced on a continuum from positive to negative. People with negative BI (body dissatisfaction) feel dissatisfied with their appearance, and perceive a discrepancy between their current appearance and ideal appearance.[20,21] The more dissatisfied a person feels about their body, the higher their risk of experiencing low self-esteem depression,[22] and poor quality of life.[23,24] Negative BI increases the likelihood of engaging in disordered eating behaviours including dieting, binge eating, fasting, calorie counting, and self-induced vomiting[25] with numerous serious long-term health consequences.[26] Recognition of these negative consequences emphasises the importance of promoting and supporting positive BI in young adults to optimise health and wellbeing.

One forum through which appearance-related content is presented is SM platforms.[12] Approximately 90% of young adults in Australia,[27] and the United States,[9] use SM platforms, the majority on a daily basis,[28] either in a passive or active form (Appendix S4). SM use can also be categorised as positive or negative. For the current review, users that are seeking reassurance or engaging in negative body fat talk (eg, "I look fat") with others online are defined as engaging negatively on SM.[29]

Theoretical perspectives that provide insight into the relationship between SM engagement and exposure to image-related content on BI are social comparison theory and objectification theory. Comparisons made with peers perceived as being more attractive, or thinner (upward comparisons) are an established precursor of body dissatisfaction.[18,30] A predisposition to engage in social comparisons on SM may be an underlying mechanism (herein referred to as mediator) influencing the development of BI dissatisfaction.[18,31] Objectification theory proposes that the sexual portrayal of women in society promotes a culture where women are seen as objects for the viewing pleasure of others.[32] It is suggested that these influences acclimatise women in particular, to engage in self-objectification. Self-objectification refers to the degree that a person internalises a third-person perspective of themselves and becomes preoccupied with how their body looks to peers. This can result in habitual monitoring of their bodies' appearance. Social networking sites provide opportunities for young adults to engage in self-objectification behaviours by uploading photos of themselves that invite comments and reactions from others.[18]

These theories are not just applicable to women, as men also engage in self-objectifying behaviours on SM.[33,34] For example, young adult men reported that showcasing fashion choices on SM was a means of expressing

themselves for which they receive appearance-related evaluations (eg, "looking good man") on images posted.[35] The portrayal of inspirational fitness images (fitspiration), thin bodies (thin-ideal), and evocative food images on SM are also evidence of this phenomena.[36,37] Engaging in self-objectifying behaviours on SM may act as a mediator in the development of body dissatisfaction as long-term manifestations of self-objectification include body shame, body surveillance, appearance anxiety, internalisation of the thin-ideal and increased risk of disordered eating behaviours.[38]

Despite emerging evidence linking SM to BI and the implications of negative BI on health and wellbeing, there is limited evidence to date that explores the relationship between SM, BI and food choice in young adults. A previous systematic review of experimental and observational literature reported that exposure to social networking sites was associated with negative BI and disordered eating behaviours in children, pre-adolescent, adolescent and young adult populations in community, school and college settings.[39] A limitation of using experimental literature to evaluate the effects of SM exposure is that it is difficult to mimic the ever-evolving SM environment to which young adults are exposed.[19] Therefore, this review evaluates the observational literature consisting of both qualitative and quantitative studies. This area of research is evolving rapidly and updated exploration of SM engagement or exposure to image-related content in a young adult population exclusively is in progress.[40]

The aims of the current review were to systematically search the existing literature in order to summarise: the impact of engagement (eg, sharing, commenting, liking) and/or exposure to any image-related content (eg, images, photos and videos) via SM on BI (satisfaction or dissatisfaction) in young adults and explore how exposure influences food choices (eg, dieting, healthy eating or overeating).

2 | METHODS

This was a mixed method systematic review of observational quantitative and qualitative studies. Study design, implementation, analysis, and reporting followed The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol.[41] The systematic review protocol was registered in PROSPERO (Registration No. CRD420 16036588) March 2016.

Inclusion criteria were studies that involved healthy young adults (aged 18-30 years) of any body mass index (BMI kg/m^2), using SM (online blogs, microblogs, content communities, or social networking sites) for engagement (eg, sharing, commenting, liking), or image-related activities (eg, viewing, posting, or engaging with images). Observational studies that explored habitual SM use were included. The outcomes of interest were the impact on BI (satisfaction or dissatisfaction), or a diet-related health behaviour (measures of healthy eating, dieting/restricting, overeating/bingeing). Search criteria were restricted to peer-reviewed papers published in English between 2005 and July 2019. These dates coincide with the increasing popularity of SM.[9] Exclusion criteria were studies that involved young adults with pre-diagnosed chronic illness, psychological disorders, eating disorders, internet addiction or partaking in risky health behaviours (eg, smoking, heavy alcohol, drug use). Studies evaluating exposure to pro-eating disorder sites were also excluded as this content may attract participants with existing BI dissatisfaction.[18] Experimental studies were also excluded as they did not constitute habitual SM use.

A systematic search in CINHAL Plus, Cochrane, OVID Medline, PsychINFO, Scopus, and Sociological Abstracts databases was initally completed in May 2018 and updated on 6th July 2019. Search terms included a keyword combination of population terms AND SM terms AND BI or food choice terms. Food choice was an umbrella term to describe foods and beverages that young adults consumed and their eating habits (eg, snacking, dieting, restricting, and overeating). This term reflects the observational literature examined, as long-term eating behaviours are unable to be determined. An example search term is "young adult" AND "social network" AND "body dissatisfaction or diet". The complete Boolean keyword search strategy used is shown in Table 1. Search terms were altered to suit the individual requirements of each database including MeSH terms. The database search strategy is in Appendix S1, Supporting Information.

Study records were managed using Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia). Search results were imported with duplicate records automatically removed. Two investigators (KR and SS, MB or AM) independently screened citations (title, abstract) against inclusion and exclusion criteria. A third investigator independently screened conflicting citations (TM). Two investigators (KR and SS, AM or MB) independently assessed full-text articles for eligibility against inclusion and exclusion criteria. Excluded papers were coded as either "*not a population of interest*", "*not an intervention of interest*", or "*not an outcome of interest*". Discrepancies were discussed between investigators (KR and SS, MB or AM) and resolved by consensus. Conference proceedings and dissertations were flagged and later excluded from analysis as their level of peer review was unknown.

A data extraction template was created and tested to extract data from quantitative and qualitative studies. One investigator (KR) independently extracted data from all included studies. Secondary independent data extraction was completed in duplicate (TM, SG, KK or MB). Discrepancies were discussed between investigators (KR, TM, SG, KK, MB) and resolved by consensus. Data extracted for analysis included; reference details, study design (type, sample size, setting, recruitment

Population	Exposure	Comparison	Outcome
"young adult*", "young women", "young men", "young people", "young individual*", youth, teen*, undergraduate*, student*, school-aged, adolescen*	"social media", "social network*", "social medium", facebook, Instagram, twitter, tweet*, google*, myspace, Pinterest, Tumblr, LinkedIn, snap chat, youtube, blog*, "web site*", internet, smartphone*, "mobile app*"	n/a	"body image", preoccupation, "body dissatisfaction", "body satisfaction", appearance, thinness, "health behav*", "behav*r change", "ideal weight", "body weight", "weight control*", diet, "eating behav*", "eating disorder", binging, fasting, bulimia, anorexia, orthorexia, overeat*

TABLE 1 PICO search criteria for systematic review of social media exposure for effects on body image and food choices

*Denotes truncation of search term.

method, response rate, SM channel, SM engagement or image-related exposure measure, BI measure, food choice measure), mediators between SM engagement/exposure and BI and eating behaviours (social comparison, objectification), population characteristics (age, gender, ethnicity) and key findings. For qualitative outcomes, two investigators (KR, MB) independently extracted and coded qualitative results data. Investigators then came together (KR, MB and SG) to discuss codes and group into themes associated with factors influencing SM engagement or exposure to image-related content on young adults' BI and food choices.

Two quality assessment tools were used to evaluate the risk of bias and were each conducted independently by two researchers. Discrepancies were discussed between investigators (KR and KK or MB) and resolved by a third independent reviewer (TM). The Agency for Healthcare Research and Quality (ARHQ) Methodology Checklist for Cross-Sectional/Prevalence Study tool [42] was used to evaluate quantitative observational studies. The 11-item tool used a "yes", "no" or "unclear" rating to assess the quality of data collection, analysis and reporting. Quality in Qualitative Evaluation: A Framework for Assessing Research Evidence was used to evaluate qualitative studies.[43] The 18-item tool appraised contribution, design rigour and credibility of conclusions drawn.

Qualitative and quantitative results were synthesised according to study quality, population demographics, study characteristics, and BI and food choice outcomes. Qualitative and quantitative results were then interpreted together in the discussion.

3 | RESULTS

The literature search retrieved 11,956 references, with 30 studies meeting the inclusion criteria (Figure 1). Table 2 provides a summary of the 30 eligible studies (26 quantitative, 4 qualitative).

Quality assessment of cross-sectional studies (Appendix S2)[42] identified that the majority of studies had clearly defined inclusion and exclusion criteria. Reasons for exclusion of participants in analysis and adjustment for confounding variables were also incorporated in many studies. However, many studies did not identify pertinent information including a time-period of data collection, and participant response rates. The assessment of the quality of qualitative studies[43] identified that findings in all studies were supported by the evidence with clearly stated purpose, data collection methods with relevant appraisal and conclusions made. However, studies lacked detail contextualising their data sources and the backgrounds of researchers involved in studies. There was also little information provided of ethical, interview and focus group procedures. One study did not report any study limitations.[44]

Quantitative studies primarily recruited participants from university cohorts (n = 23),[45-67] of which three were psychology cohorts[52,53,61] with the majority based in the USA,[22,23,40-52,66] followed by Australia.[48,49,51-53] Three studies recruited participants in community settings (n = 3).[68-70] Study sample size ranged from 100 to 1104 participants with a mean age of 18.5 to 25.78 years, of which 84% were female. Where ethnicity was reported in studies (n = 23), participants were mostly Caucasian.[46-59,61,62,64,66,68,70] Of the 12 studies that reported BMI,[45,48,49,51-53,57,63-65,67,70] participants had a mean range between 20.26 and 28.24 kg/m^2. A variety of tools to measure BI and eating behaviour were used, with little overlap between the studies (Appendix S3). However, the Eating Disorder Examination Questionnaire (EDEQ),[52,57,58,62,64] Eating Disorder Inventory (EDI), [48,49,51-53,56,59,62,67,70] Objectified Body Consciousness (OBC-Y)[46,48,49,54,55,61,65,67,69,70]

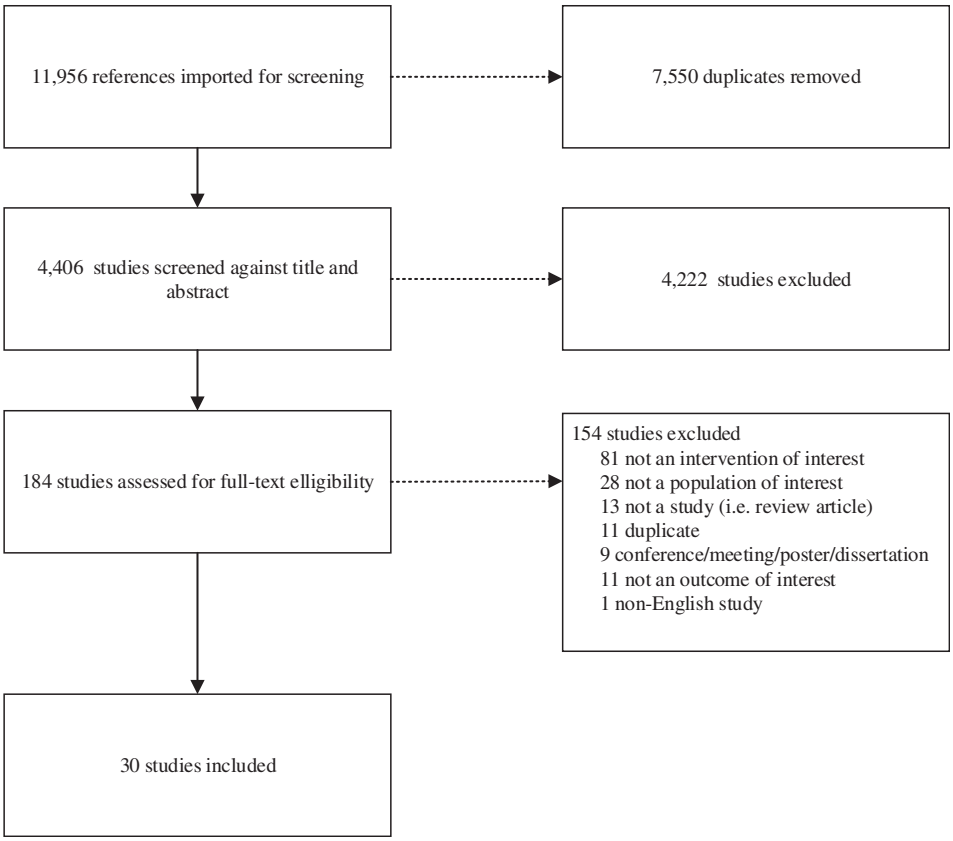


FIGURE 1 PRISMA flow diagram

and Physical Appearance Comparison Scale (PACS)[46-48,53,59,65,66,69,71] were the most frequently utilised measures.

The following sections report findings from included studies. Eight studies reported the impact of SM engagement on BI and food choice (n = 8);[54,55,57-62] 10 studies reported the impact of exposure to image-related content on BI and food choice (n = 10);[45,47,49,51-53,63,65,67,69] and eight studies reported the impact of both SM engagement and exposure to image related content on BI and food choice outcomes (n = 8).[46,48,50,56,64,66,68,70]

Associations between SM engagement and BI and food choice outcomes were examined in 31% of studies [54,55,57-62]; Facebook was the most commonly used social networking site (n = 6),[55,57-59,61,62] followed by Instagram (n = 2).[54,57] Engagement was measured as either neutral engagement (eg, passive or active use[54,55,61]) or negative engagement (eg, maladaptive use,[58,62] and reassurance seeking[57]). Negative SM engagement (reassurance seeking[57] and maladaptive Facebook use[58,62]) was associated with higher body dissatisfaction and disordered food choices[57,58,62] including eating restraint[58] in both female[57,58,62] and male[58] college cohorts. Differences were identified based on ethnicity in two studies (Table 2).[57,60]

Associations between exposure to image-related content and BI[45,47,49,51-53,63,67,69] and food choice (n = 4)[46,49,52,65] outcomes were measured in 42% of studies. Instagram (n = 5),[45,47,51,63,67] followed by Facebook (n = 3)[53,67,69] were the most commonly investigated platforms. Image-related exposures were categorised as non-specific images[52,69] (image type not specified in results) or idyllic images[45,47,49,51,53,63] (celebrities, friends or peers portraying perfect lifestyles,[45,51,53] and selfies[47,49,63,65,67]). Exposure to non-specific images was associated with higher body dissatisfaction on Facebook.[69] While exposure to idyllic images including fitness posts,[51] celebrities[45] and peers,[51,53] portraying perfect lifestyles was associated with higher body dissatisfaction,[51-53] and drive for thinness.[51,53] Selfie exposure (to self-photos) yielded mixed results[47,49,63,65,67] with greater exposure associated with higher body dissatisfaction among Australian female university students,[49] however, there was no association among USA male and female college students.[47,63] Female USA college students taking (but not posting) selfies were associated with higher body dissatisfaction.[63] A greater predisposition to engage in physical comparisons mediated relationships between image-related exposure and body dissatisfaction,[51-53,69] drive for thinness,[51,53] increased dieting.[52] This finding was consistent across all SM platforms, cohorts, genders and locations.[51,53,69,71] Comparisons made with female celebrities, had higher associations to body dissatisfaction followed by comparisons with close friends and distant peers.[53]

Associations between both SM engagement and exposure to image-related content and BI[46,48,50,56,66,68,70] and food

TABLE 2 Study characteristics and results of social media engagement and exposure to image-related content on body image and food choice outcomes in healthy young adults

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
Howard et al[57]	USA	CS, S	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	922(100) College 21 ± 2.8 Caucasian 25 ± 5.8, African American 28.24 ± 6.1 Caucasian (51) African American (48)	Facebook Instagram Twitter	Frequency of SNS use Reassurance Seeking Scale (a)	Body Shape Questionnaire (BSQ-16) Eating Disorder Examination Questionnaire (EDE-Q)	African American women used Facebook less but had the same Twitter and Instagram use compared to white women. African American women experienced lower body dissatisfaction and disordered eating than white women. Frequency of Facebook use associated with body dissatisfaction but not Twitter or Instagram (no differences between ethnicity). Engaging in higher reassurance seeking increased body dissatisfaction and disordered eating (no differences between ethnicity).
Hummel et al[58]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	185 (78) College Students 18.73 ± 1.2 NR Caucasian (73.2)	Facebook	Maladaptive Facebook Questionnaire Status updates and comments coded for positive and negative emotions.	**Body Image** Eating Disorder Examination Questionnaire (EDEQ-4) **Food choices** Eating Disorder Examination Questionnaire (EDEQ-4) Subscales Restraint, and Eating Concern.	Participants who wrote revealing status updates with negative comments had greater shape and eating concerns. Participants with a feedback seeking style and high number of comments were more likely to report eating restraint. Receiving negative comments from personal status updates predicted eating concerns.
Smith et al[62]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	232(100) College Students 18.72 ± 1.6 NR Caucasian (76.3)	Facebook	Maladaptive Facebook Usage Scale	**Body Image** Body Dissatisfaction Subscale (EDI) Shape Concern Subscale (EDEQ-4).	Maladaptive Facebook use predicted increased body dissatisfaction and shape concern.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
							Reassurance Seeking Subscale (DIRI-RS) **Food choice** Bulimia Subscale (EDI) Eating Disorder Examination Questionnaire (EDEQ-4).	Body dissatisfaction partially mediated the relationship between maladaptive Facebook use and increased bulimic symptoms. Maladaptive Facebook usage predicted increased bulimic symptoms and over-eating episodes.
Feltman et al[54]	USA	CS, S	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	492(100) College 18.5 ± 0.85 NR Caucasian (84)	Instagram	Passive Use Active Use	Body Surveillance Subscale (OBCS) Internalisation Subscale (SATAQ-3) Upward and Downward Appearance Comparison Scale Appearance-Related Commentary (RD) Social Networking Appearance-Related Commentary Scale (SNARCS) (RD) Self-Objectification Questionnaire (SOQ)	Active and passive Instagram use positively correlated with self-objectification, body surveillance, upward and downward appearance comparisons and positive appearance commentary. The internalisation of cultural beauty standards and engaging in upward appearance comparisons mediated the association between Instagram use with body surveillance and self-objectification. Positive and negative commentary and downward appearance comparisons did not mediate the association between Instagram, use, self-objectification and body surveillance.
Hanna et al[55]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	1104 (62.5) College students F19.11, M19.43 NR Caucasian (>70)	Facebook	Time spent using Facebook minutes-hours Passive Facebook Use Active Facebook Use	State Self-Esteem Scale (SSES) Iowa Netherlands Comparison Orientation Measure Body Surveillance subscale (OBC-Y)	Time spent on Facebook was inversely associated with self-esteem, and positively associated with social comparison, depression, anxiety and body shame.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
							Enjoyment of Sexualisation Scale (ESS) Sexual Appeal Self-Worth Scale	Social comparison and self-objectification mediated relationship between Facebook use and body shame.
Kim et al[59]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	186 (64) College students 19.75 ± 2.06 NR Caucasian (74.1)	Facebook	Utz and Beukeboom's SNS use for Grooming Scale[a] Time spent on Facebook/day	Drive for Thinness (EDI) Drive for Muscularity (DMS) Physical Appearance Comparison Scale (PACS)	Men reported greater drive for muscularity than women. Women reported greater drive for thinness, Women are more likely to engage in appearance comparisons. Social grooming behaviours positively associated with the drive for thinness and appearance comparisons. Appearance comparisons mediated Facebook use with social grooming and drive for thinness. Time spent on Facebook not associated with appearance comparison, drive for thinness or drive for muscularity.
Lee et al[60]	USA/Korea	CS, S	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	USA 502(60.1) Korea 518(62.6) College USA 21.13 ± 4.5 Korea 22.35 ± 2.15 NR USA—Asian (48) Korea—all Korean	Social Media	Social media use for information (eg, fashion, exercise.) Social media use for status seeking Social media use for socialising (posting, comments)	Body-Esteem Scale for Adolescents and Adults Rosenberg's Self-esteem Scale Ryff's (1989) psychological wellbeing scale	Social media information seeking negatively affected body image in both US and Korean participants, but was not significant in the Korean cohort. Social media use for status seeking and socialising did not change body image in US participants. Social media use for status seeking positively affected body image in Korean participants with socialising having no effect.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
Manago et al[61]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	815 (n = 467) Psychology students 19.07 ± 0.82 NR Caucasian (74.3)	Facebook	Facebook Involvement: Time spent/day Facebook Intensity Scale Passive Use (viewing stories, liking) Active Use (posting, status updates)	**Objectified Body Consciousness:** Gordon and Ward Self-Worth Measure Body Shame Subscale (OBC-Y) Body Surveillance Subscale (OBC-Y) Enjoyment of Sexualisation Scale	Women reported higher levels of Facebook involvement, body shame and appearance self-worth than men. Women and men with high Facebook involvement (passive/active use) reported greater objectified body consciousness. Objectified body consciousness predicted greater body shame in women and men.
Fardouly et al[52]	AUS	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	146 (100) Psychology Students 19.24 ± 2.24 21.74 ± 3.71 Caucasian (39.6)	Social Media	Participants periodically asked by text message if they made appearance comparisons, and their context (eg, Social Media).	**Body Image** Body Dissatisfaction Subscale (EDI) Appearance Subscale (SSES) Appearance Comparisons: Frequency/Nature/Direction[b] **Food choices** 2 adapted questions from (EDEQ) on restraint and diet behaviour.	10% appearance comparisons made through social media. Participants reported more upward social media comparisons than lateral or downward comparisons. Engaging in upward social media comparisons associated with less appearance satisfaction. Social media comparisons associated with more dieting thoughts and diet-related behaviours.
Cohen et al[49]	AUS	CS, S	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	259(100) College 22.97 ± 3.25 22.45 ± 3.89 Caucasian (77.5)	SNS	Time spent SNS/day Selfie Activities (taking/sharing) Photo Investment Scale Photo Manipulation Scale	Body Image: Internalisation Subscale (SATAQ-3) Appearance Evaluation Subscale (MBSRQ) Body Surveillance Subscale (OBCS) Drive for Thinness (EDI) Eating Behavior Bulimia Subscales (EDI)	64% use SNS 2 hours/day. 48.7% take selfies at least once /fortnight. 62.2% edit photos. 80.7% do not edit photos. Selfie posting negatively correlated with body satisfaction. Photo investment positively correlated with thin-ideal internalisation, drive for

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
								thinness and bulimia symptoms. Photo investment negatively correlated with body satisfaction. Selfie behaviours did not predict drive for thinness. Self-objectification mediated photo investment and bulimia symptoms.
Ahadzadeh et al[45]	Malaysia	CS, OS	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	273 (62.3) College 20.09 ± 1.12 21.05 (3.53) Chinese (83.9)	Instagram	Time (minute, hour) Following celebrities (yes/no) Number/type of pictures posted	Body Areas Satisfaction Scale (BASS) Body Image Ideals Questionnaire (BIQ) Appearance Schemas Inventory (ASI-R) Rosenberg Self-Esteem Scale (RSES)	Instagram use was inversely associated with body satisfaction.
Barry et al[47]	USA	CS, S, SMO	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	100(80) College 19.93 ± 1.35 NR Caucasian (77)	Instagram	30-day Content Analyses (posts, followers, following) Coding included (selfie, non-selfie, photo of participant [posie], no participant)	Rosenberg Self-Esteem Scale (RSES) Physical Appearance Comparison Scale (PACS) Sociocultural Attitudes Toward Appearance (SATAQ3).	Greater selfies and posies not significantly associated with preoccupation with physical appearance standards. Physical appearance selfies not significantly associated with physical appearance concerns or self-esteem.
Fardouly et al[51]	AUS/USA	CS, S	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	276(100) College 22.83 ± 3.57 24.37 ± 6.52 Caucasian (USA 71.5, AUS 54.8)	Instagram	Instagram checked/day Time Spent/day How often fitspiration images viewed Frequency comparisons to female groups (family, friends, acquaintances, strangers, celebrities, themselves)	Internalisation Subscale (SATAQ-3) Upward and Downward Appearance Comparison Scale Body Dissatisfaction Subscale (EDI) Drive for Thinness subscale (EDI) Self-Objectification Questionnaire (SOQ)	Instagram checked 1× daily—every few hours. Approx. 30 minutes spent on Instagram. Comparisons made mostly to friends and celebrities. Instagram use positively correlated with self-objectification and internalization of beauty ideal (not body dissatisfaction, drive for thinness or appearance comparison).

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
								Viewing fitspiration images positively correlated to comparison tendencies, body dissatisfaction and drive for thinness (not self-objectification). Appearance comparison mediated frequency of viewing fitspiration images with body dissatisfaction and drive for thinness. Frequency of comparison to fitspiration images mediated frequency of viewing fitspiration images and body dissatisfaction.
Fardouly et al[53]	AUS	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	227 (100) Psychology students 19.13 ± 2.21 21.41 ± 3.93 Caucasian (46.3)	Facebook	Times spent checking Facebook Physical Appearance Comparison Scale (PACS)[a] Comparison direction for family members, close friends, Facebook friends, friends of friends, celebrities.	Body Dissatisfaction Subscale (EDI) Drive for Thinness Subscale (EDI) Physical Appearance Comparison Scale (PACS)[a]	Greater frequency of checking and Facebook use positively associated with body dissatisfaction and drive for thinness. Appearance comparisons mediated these relationships. Body rated most negatively after comparing to female celebrities followed by close friends and distant peers.
Niu et al[65]	China	CS	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	886(100) College 20.14 ± 1.09 20.26 ± 2.57 Chinese	WeChat	Selfie posting frequency Verbal Commentary on Physical Appearance Scale (VCOPAS)	**Body objectification** Objectified Body Consciousness Scale (OBCS) **Food choice** Restrained Eating subscale from the Dutch Eating Behaviour Questionnaire (DEBQ)	Selfie posting frequency positively correlated with commentary on appearance and self objectification. Selfie posting was positively correlated with restrained eating. Commentary on appearance and self objectification both mediated the relationship between selfie posting frequency and restrained eating.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
Veldhuis et al[67]	Netherlands	CS	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	179(100) College 21.54 ± 2.05 21.95 ± 2.73 NR	Facebook Instagram Twitter Pinterest Tumblr	The photo subscale from Facebook photo-activity scale[a] Photo Selection Scale Editing of selfies[a] Deliberate selfie posting[b]	Body Dissatisfaction Subscale (EDI)[a] Body Appreciation Scale-2 Objectified Body Consciousness Scale (OBCS) Rosenberg Self-Esteem Scale (RSES)	Facebook most popular SNS. Average 1-2 selfies posted per week. Selfie selection was non-significantly associated with increased body appreciation.
Wagner et al[63]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	130(100) College Students 19.9 ± 1.62 21.59 ± 3.17 NR	Instagram	Number of solo selfies taken and posted in a month.	Body Dimensions (BIAS-BD)	Average of 17 selfies taken and 0.34 selfies were posted during a month. Participant's actual body size positively related to level of body dissatisfaction. Actual body size and body dissatisfaction predicted the number of selfies taken. Low BMI or greater body dissatisfaction predicted more selfies taken. Actual body size and body dissatisfaction not related to number of selfies uploaded.
Xiaojing[69]	China	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	384 (52.9) Community 25.78 ± 3.09 NR NR	Facebook	Facebook photo-activity scale Online appearance interactions Online appearance presentation	Internalisation Subscale (SATAQ-3) Body Surveillance Subscale (OBCS) Physical Appearance Comparison Scale (PACS) Female Weight Satisfaction Subscale (BES) Muscularity and Body Fat subscales of (male body attitudes scale)	Social media appearance interaction positively associated with both men's and women's body dissatisfaction. Social comparison mediated the relationship between men's online appearance interaction and body dissatisfaction.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
Arroyo et al[46]	USA	CS, OS	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	488 (66.2) College students 20.51 ± 1.43 NR Caucasian (73.6)	SNS—Facebook, Instagram, Twitter Pinterest	Frequency of SNS exposure Viewing friends fitness posts (eg, food, before/after photos) Negative Body Talk Scale (NBT)[a]	**Body Image** Body-Esteem Scale for Adolescents and Adults (BESAA) Physical Appearance Comparison Scale (PACS) Body Surveillance Subscale (OBC-Y) **Food choice** Exercise and Diet Subscale (HPS)[a]	Friends' fitness posts negatively associated with body satisfaction. Friends' fitness posts positively associated with healthy eating and negative body talk. Social comparison moderates friends' fitness posts and negative body talk. Women engage in healthy eating behaviours and negative body talk more than men.
Butkowski et al[70]	International sample Researchers from USA	CS	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	177(100) Online 18–30 25.09 ± 6.32 Caucasian (59.9) African American (11.86)	Instagram	Selfie feedback investment[a] Frequency of Instagram use Frequency of selfie posting	**Body Image** Body Dissatisfaction Subscale (EDI) Drive for Thinness Subscale (EDI) Body Surveillance Subscale (OBCS) **Food choice** Bulimia Subscale (EDI)	Selfie feedback investment positively correlated with drive for thinness, body surveilance and selfie posting frequency. Selfie posting frequency negatively correlated with body dissatisfaction. Bulimia action tendencies positively correlated with body surveilance. Neither selfie feedback investment nor selfie posting frequency was correlated with bulimia action tendencies.
Eckler et al[50]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	881 (100) College students 23.83 ± 7.26 NR Caucasian (87.4)	Facebook	Time spent checking, reading, posting, looking at photos. Frequency topics relating to weight, body image, diet topics are posted and commented on. Frequency of weight and body comparisons with friends	**Body Image:** Body Shape Questionnaire (BSQ) Researcher Question: "How often has looking at someone else's photos on Facebook made you feel negatively about your body in the last month?" **Food choices:** Food choice Test (EAT-26)	20% time spent looking at photos. 8.51% posts on body, weight, diet, exercise. More time on Facebook related to feeling negatively after viewing photos. More time viewing/posting photos led to more attention to physical appearance of others and negative body attitudes.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
						Frequency attention is given to dress, body in others pictures		Increased Facebook exposure and weight loss desire increased disordered food choice.
Cohen et al[48]	AUS	CS, S	n (%F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	259(100) College 22.97 ± 3.25 22.45 ± 3.89 Caucasian (77.5)	Facebook Instagram	Times accessed/day Time spent on Social Media The Facebook Questionnaire (FBQ) Instagram accounts followed (health, fitness, diet, celebrities, travel)	Internalisation Subscale (SATAQ-3) Physical Appearance Comparison Scale (PACS) Appearance Evaluation Subscale (MBSRQ) Body Surveillance Subscale (OBCS) Drive for Thinness Subscale (EDI)	99.2% of participants had Facebook. 90.3% checked Facebook 3-5 times daily 81.5% had an Instagram account. 57.5% checked Instagram 3-5 times/day. Total time not associated with body image outcomes. Facebook appearance exposure positively correlated with thin-ideal internalisation, and body surveillance. On Instagram: Following health and fitness accounts positively correlated with thin-ideal internalisation and drive for thinness. Following celebrity accounts associated with thin-ideal internalisation and body surveillance. Users reported greater body surveillance than non-users.
Hayes et al[68]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	241 (n57) Population 18-29 years NR Caucasian (73.2)	Facebook	Time spent and accessed/day Facebook apps used over last 30 days (eg, pictures, posting, commenting)	3 Body image questions adapted from Centre for Eating Disorders survey.	29.5% of young adults reported looking at own photos more than twice per week. Young adults scored higher on negative Facebook body image scale than members of older cohorts.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
								Age independently inversely associated with higher body image dissatisfaction.
Hendrickse et al[56]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	185 (100) College students 21.04 ± 3.55 NR Caucasian (66.3)	Instagram	Instagram Photoactivity Index[a] Passive exposure Physical Appearance Comparison Scale (PACS)[a]	Body Dissatisfaction Subscale (EDI) Drive for Thinness Subscale (EDI)	Greater appearance comparisons associated with greater body dissatisfaction and drive for thinness. Appearance comparisons mediated Instagram photo activity with drive for thinness, and body dissatisfaction.
Strubel et al[66]	USA	CS	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	796(100) College 20.71 ± 3.25 NR Caucasian (51.5) Hispanic (23.6)	Facebook	General Social Media Usage subscale from Media & Technology Usage and Attitudes Scale[a]	Internalisation Subscale (SATAQ-3)[a] Physical Appearance Comparison Scale (PACS) Body Parts Satisfaction Scale for Females (BPSS-F) Rosenberg Self-Esteem Scale (RSES)	No significant correlations between Facebook use and body image outcomes
Walker et al[64]	USA	CS, S	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity (%)	128(100) Undergrad students 18-23 years 23.2 ± 4.48 Caucasian (81.3)	Facebook	Facebook Intensity Scale: Total number of friends Time spent on Facebook/day Physical appearance comparison scale (PACS) Online Fat Talk Scale	Eating Disorder Examination Questionnaire (EDEQ-Q4) Multidimensional Perfectionism Scale (MPS) Beck Depression Inventory State-Trait Anxiety Inventory General Self Efficacy Scale	Appearance comparison and online fat talk positively associated with disordered eating behaviors. Facebook intensity positively associated with appearance comparisons. Appearance comparison mediated the relationship between Facebook intensity and disordered eating. Online Fat Talk did not significantly mediate the relationship between

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
								Facebook Intensity and disordered eating. Time only (in the absence of appearance comparisons) was not associated with disordered appearance comparisons.
Baker et al[72]	USA	Qual, FG	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	27(100) College 20.00 ± 1.2 NR Caucasian (63)	Instagram	**Research question 1:** How do female college students use Instagram and what features (eg, posting, liking and commenting) are most important?	**Research question 2:** Does Instagram use impact female college students body image and in what ways?	**Research question 1: Uses and features**; (i) effortful posting, (ii) promotion of self, (iii) seeking engagement **Research question 2: Body image;** (i) responding to beauty ideals, (ii) comparing self with others, (iii) display of self
Barry et al[44]	USA	Qual, I	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	20(0) Urban 19-29 years NR Caucasian (>60%)	Social Media	In-depth Interviews	Explored cultural factors impacting body dissatisfaction. Participants were asked how dress and social media practices affect their body image.	Social media provides a platform for self-objectification, body surveillance and to receive immediate appearance assessments. Social media exposure provokes men to analyze their self-image and engage in comparison and competition among peers. Social media amplifies focus on visual self and critical analysis of clothing and bodies.
Grover et al[71]	USA	Qual, FG	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	73(100) College	Social Media	—	Open conversations exploring internalized thin-ideal values. Origins of the thin-ideal and understanding themes factors that	Students focus on image of themselves portrayed online. Social media images of peers affect young women's self-perceptions.

(Continues)

TABLE 2 (Continued)

References	Country	Design	Participant characteristics		Channel	Exposure measure	Outcome measure	Key findings
							promote being ultra-thin.	The collective effect of thin-ideal images may take precedence over individual body image attitudes.
Vateralus et al[73]	USA	Qual, FG, I	n (% F) Setting Age (M ± SD) BMI (kg/m^2) Ethnicity	34(79) College 20.4 years 26% OW/OB Caucasian (82.4)	Social Media	Social media use and daily life	Explored the influences of social media on participants eating habits.	Participants felt some peers posts intend viewers to feel shame about their bodies. Viewing pictures of peers losing weight was a form of motivation and inspiration Social media increases food choices. Viewing pictures of food too frequently is irritating. Viewing food posts could lead to feeling hungry, eating more or restraint. Social media can distract during meal times and lead to poor food choices.

Abbreviations: BMI, body mass index; CS, cross-sectional; Qual, qualitative; S, survey; FG, Focus Groups, I, interview; SMO, social media observation; NR, not reported; RD, researcher developed, SNS, social networking site.

[a]Adapted.

[b]Researcher developed.

choice[46,50,64,70] outcomes were explored in 31% of studies. Facebook[46,48,50,64,66,68] and Instagram[48,56,70] studies measured either neutral[48,56,66,68] or negative engagement,[46,50,64] and exposure to non-specific,[50,56,64,68,71] idyllic images,[46,48] or selfies.[70] Studies measured either both BI and food choice outcomes (n = 3),[46,50,70] BI outcomes only (n = 3),[48,56,68] or food choice outcomes only (n = 1).[64] Negative engagement, such as maladaptive use or reassurance seeking, was associated with higher disordered food choices,[64] and viewing non-specific images[50] was associated with higher body dissatisfaction among USA college cohorts. Exposure to idyllic images was associated with greater negative body talk,[46] drive for thinness,[48] or healthy eating.[46] Investment in receiving feedback on selfies posted was associated with greater drive for thinness.[70] Predisposition to engage in appearance comparisons mediated the relationships between intensity of Facebook use and disordered eating,[64] and between Instagram photo use and both body dissatisfaction and drive for thinness.[56] The community study found that young adults had higher negative BI scores as a result of Facebook exposure compared to older cohorts.[68]

Qualitative studies were USA based, using a semi-structured interview,[44] focus group,[72,73] or both approaches,[74] in mostly college cohorts.[72,74] Theoretical approaches used by the research teams included grounded theory[72] and phenomenology.[74] Study sample size ranged from 20 to 73 participants, with an age range of 19 to 29 years.[44,74] Participants were mostly female (82%) and Caucasian (>60%).[44,73,74] Studies explored SM effects on young men's dress practices and BI,[44] young women's self-image and thin ideals,[72] and eating habits of young men and women.[74]

Qualitative thematic analysis revealed five themes contributing to SM's influence on BI and food choices: (i) SM spurs comparison and competition, (ii) comparing on SM heightens feelings about the body, (iii) young adults self-evaluate and modify appearances to portray an ideal online image, (iv) young adults are aware of SM's impact on BI and food choices, however, (v) external validation via SM is pursued.

All qualitative studies (n = 4) identified that SM promoted a culture of personal appearance[44,72-74] and food-related[74] comparison and competition among peers. Participants reflected on the feeling of being constantly compared to others as well as engaging in self-comparisons regularly.[44,72-74] Images of selfies, body physiques, fashion, exercise and weight-loss were reported to be popular posts, and while some posts were considered inspirational, many posts were seen as showboating[44,72,74] which were perceived as intending to make peers feel bad about themselves.

Exposure to body and food-related posts heightened feelings of self-judgement and body dissatisfaction because participants compared peers physical and lifestyle attributes to their own perceived strengths and inadequacies and often felt that they did not measure up to these online ideals.[44,72-74] Online appearances were considered important with participants using photo editing filters,[44,72,73] and fashion choices,[44] and promotion of their physique [44] and fitness achievements[74] to accomplish this. Selfies were usually taken from multiple angles[44] with only the best images or those detailing significant accomplishments posted.[74] Young adults reported using SM as a platform for body and food-related feedback and overanalysed images for quality and the number of follows and likes they received.[44,73] This indicates that participants objectified themselves online to obtain an observers viewpoint about their bodies.[32] Food-related images assisted with meal preparation ideas.[74] However, exposure to these images also increased young adults food preoccupations. Food-related posts amplified feelings of hunger, with participants reporting wanting to eat regardless of satiety cues. In some situations, participants reported they felt a need to implement dietary restraint when exposed to food images considered "unhealthy". Engaging in social media during mealtimes was reported to distract young adults and predisposed them to make poorer food choices. However, participants appear aware of the negative impact SM can have on their BI and food choices and yet continued to engage on these platforms.[44,72-74]

4 | DISCUSSION

This mixed methods systematic review aimed to understand how SM engagement and exposure to image-related content influences BI and food choice in healthy young adults. Quantitative analysis (n = 26) identified that SM engagement or exposure to image-related content was associated with higher body dissatisfaction, dieting/restricting food or overeating, or healthy food choices. Although the research has been dominated by quantitative studies, the qualitative research shed further light on the influence of SM on young adults in relation to feelings of comparison, competition and their pursuit of external validation. Considered together, findings suggest both SM engagement and exposure to image-related content were associated with higher negative body image and some unhealthy food choices, however, these relationships are complex. Young adults engaging in negative SM activities (negative body talk, seeking reassurance, engaging in appearance-related comparisons or self-objectification), or being exposed to idyllic images (celebrities, peers, fitness) may be more susceptible to negative BI and food choice outcomes.

The findings from this review of observational literature are consistent with experimental studies exploring image-related content. For example, young adult women exposed to

idyllic images of celebrities, peers and fitness ("fitspiration") on Instagram reported greater body dissatisfaction,[36,75] and weight loss behaviours when exposed to "fitspiration" on Pinterest.[30] *Fitspiration* images aim to inspire healthy eating and exercise behaviours.[36] However, content analyses of fitspiration on SM platforms have found that many images and their messages praise thinness and high fitness levels as ideals.[76,77] The internalisation of thin and fitness ideals have been established as factors that increase body dissatisfaction in women[36,78] suggesting that when the focus is on attaining physical body ideals, there is a potential for negative BI.[46] SM exposure to idyllic content may be more pronounced compared to mass media due to the pervasive and personalised nature of these platforms.[52]

Studies in this review identified that a predisposition to engage in appearance-related comparisons online mediated the relationship between SM engagement and exposure to image-related content and BI,[44,51-53,55,56,69,72,74] and food choice outcomes.[52,64] Social comparison theory suggests that people are inclined to compare themselves to others as a means of self-evaluation and this predisposition to compare is stronger when the comparator is considered similar to oneself.[79] These findings highlight that by facilitating connection and engagement with peers and close or distant networks, SM platforms present an opportune vehicle for appearance-related comparisons.[18] Qualitative findings in this review highlight that young adults appear pressured to present an ideal image of themselves online.[44,72-74] This can lead to young adults vetting and altering photos, in order to post and share optimised images of themselves and their lives, thus further perpetuating an online environment of competition and comparison among peers.[44,63,72,74] The extent that young adults engage in appearance comparisons will depend on how they internalise these ideals.[80] When there is a strong desire to conform to societal ideals combined with a discrepancy in one's self-evaluation,[79] there is a higher risk of developing body dissatisfaction or engaging in unhealthy eating behaviours.[80] Supporting this contention, in this review, appearance comparisons made with peers were found to "amplify" effects on dieting,[52] and body dissatisfaction[53] in young adult women.

SM remains a challenging platform for health professionals to engage and educate young adults about healthy behaviours.[14] Young adults seem drawn to the health messages of influencers and celebrities in preference to health professionals.[80] Many of these SM accounts have large fan bases for which they endorse products, praise idyllic lifestyles and share their perception of health and BI messages often misaligned with health promotion messages. They also provide a compelling source of entertainment and examples of the lived experience that young adults can aspire to. Health professionals have strived to emulate these qualities using social marketing strategies reported to improve engagement. These include using striking images and video, celebrity and peer spokespeople, and encouraging user-generated content and collaboration.[10,81] However, this systematic review indicates these exposures, or merely engaging on SM platforms may negate the original intent of health messages if not considered and moderated carefully.

There is a risk of health professionals unintentionally perpetuating poor BI and disordered food choices in healthy young adults while trying to implement engaging SM health-related behaviour change campaigns. A re-examination of core message philosophies, sensitivities towards BI dissatisfaction and disordered food choices to understand these nuances is needed to ensure SM interventions both engage young adults while mitigating the risks posed to body dissatisfaction and abnormal eating behaviours. Findings from this review suggest that SM health messages refrain from focussing on weight or physicality as measures of health. Alternatively, SM health messages that may support body satisfaction include: celebrating body functionality as opposed to body aesthetics,[82] promoting greater self-compassion with positive quotes and illustrations online,[83] and representing body diversity by celebrating a variety of body shapes, sizes, ethnicities and gender identities online.[84]

These findings must be considered in light of the following limitations; this review evaluated habitual SM exposure using only observational literature. Therefore, causation and longer-term eating behaviours cannot be determined. However, there are some insights that health professionals can consider in future SM health communications to mitigate risks associated with promoting negative BI and undesirable eating behaviours. Caution should be exercised when interpreting these results which had a focus on university cohorts from industrialised nations.

It is recommended future research explores the effects of exposures in broader young adult population groups and community settings. The SM environment is rapidly evolving making timely and relevant recommendations an ongoing challenge. Heterogeneity of tools used to evaluate outcome measures meant narrative synthesis was used to interpret results with qualitative analyses used to contextualise findings. In practice, health professionals need to consider discussing the influence of SM on BI with their young adult clients, including when engaging in health promotion campaigns.

In conclusion, SM is considered an essential platform for health professionals to reach and engage with young adults to encourage healthy behaviours. This review indicates that SM engagement and exposure to image-related content may have a negative impact on BI and food choice in healthy young adult population groups who are vulnerable to SM influence. Viewing idyllic images of celebrities, peers, food, fitness and

fashion, engaging in negative behaviours (body fat talk, reassurance seeking), or appearance comparisons online are specific exposures that may increase these risks. The pressure young adults feel to present an ideal image of themselves provided additional insight with significant investment given to photo taking and editing, fashion and promoting physical and fitness achievements on SM identified. SM campaigns must be cognisant of image-related content to not unintentionally create or promote further body dissatisfaction among young adults.

AUTHOR CONTRIBUTIONS

K.R. and T.M.C. conceptualised the review. K.R. completed literature searches. K.R., A.M., M.B., S.S. screened references. K.R., T.M.C., S.G., M.B. extracted data and completed quality assessment. K.R. and T.M.C. analysed and interpreted the data. L.B. and H.T. contributed to the final paper and the conceptualisation of the research questions. S.M. contributed to the final paper. All authors have read and approved the final version submitted for publication. We wish to acknowledge the contribution of Associate Professor Catherine Lombard (dec) for the planning and conceptualisation of this review. We would like to acknowledge Dr Karen Klassen and Shistata Shrestha for their assistance. This work is an essential adjunct to the Communicating Health project funded by the National Health and Medical Research Council (NHMRC) (grant number: GNT1115496). Communicating Health brings together academics from social marketing, consumer psychology, and nutrition to create best practice guidelines for nutrition professions to help them communicate with young adults. K.R. is a self-funded PhD Candidate. H.T., T.M.C. and L.B. are co-investigators on Communicating Health. A.M. and M.B. salaries are funded by Communicating Health (NHMRC grant number: GNT1115496). S.M. holds an ongoing salaried position at Victoria University.

CONFLICT OF INTEREST

Authors have no conflicts of interest to declare for this review.

ORCID

Kim Rounsefell https://orcid.org/0000-0001-8784-9004
Simone Gibson https://orcid.org/0000-0002-0008-9020
Siân McLean https://orcid.org/0000-0002-4273-2037
Merran Blair https://orcid.org/0000-0001-9804-1633
Annika Molenaar https://orcid.org/0000-0001-6037-4133
Linda Brennan https://orcid.org/0000-0002-1964-1487
Helen Truby https://orcid.org/0000-0002-1992-1649
Tracy A. McCaffrey https://orcid.org/0000-0001-9699-3083

REFERENCES

1. Arnett J. Emerging adulthood: what is it, and what is it good for? *Child Dev Perspect*. 2007;1:68-73.
2. Wood D, Crapnell T, Lau L, et al. Emerging adulthood as a critical stage in the life course. In: Halfon N, Forrest C, Lerner R, Faustman E, eds. *Handbook of Life Course Health Development*. Cham, Switzerland: Springer, 2018:123-143.
3. Australian Bureau of Statistics. Consumption of sweetened beverages. Updated 2015. http://www.abs.gov.au/ausstats/abs@.nsf/lookup/4364.0.55.007main+features7102011-12. Accessed January 7, 2019.
4. Nour M, Sui Z, Grech A, Rangan A. The fruit and vegetable intake of young Australian adults: a population perspective. *Public Health Nutr*. 2017;20:2499-2512.
5. National Health Service Digital. Fruit and vegetables. Updated 2017. http://healthsurvey.hscic.gov.uk/data-visualisation/data-visualisation/explore-the-trends/fruit-vegetables.aspx. Accessed July 10, 2019.
6. Bleich SN, Vercammen KA, Koma JW, Li Z. Trends in beverage consumption among children and adults, 2003-2014. *Obesity*. 2018;26:432-441.
7. Fryar CD, Hughes JP, Herrick KA, Ahluwalia N. *Fast Food Consumption Among Adults in the United States, 2013–2016*. Hyattsville, MD: National Center for Health Statistics Data Brief; 2018:1-9.
8. Gakidou E, Afshin A, Abajobir AA, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390:1345-1422.
9. Perrin A. Social media usage: 2005–2015. Updated 2015. http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/. Accessed May 1, 2017.
10. Kite J, Foley BC, Grunseit AC, Freeman B. Please like me: Facebook and public health communication. *PLoS One*. 2016;11:1-16.
11. Capurro D, Cole K, Echavarría MI, Joe J, Neogi T, Turner AM. The use of social networking sites for public health practice and research: a systematic review. *J Med Internet Res*. 2014;16:E79.
12. Klassen KM, Douglass CH, Brennan L, Truby H, Lim MSC. Social media use for nutrition outcomes in young adults: a mixed-methods systematic review. *Int J Behav Nutr Phys Act*. 2018;15:70.
13. Thackeray R, Neiger BL, Hanson CL, McKenzie JF. Enhancing promotional strategies within social marketing programs: use of web 2.0 social media. *Health Promot Pract*. 2008;9:338-343.
14. Waters RD, Burnett E, Lamm A, Lucas J. Engaging stakeholders through social networking: how nonprofit organizations are using Facebook. *Public Relat Rev*. 2009;35:102-106.
15. Maher CA, Lewis LK, Ferrar K, Marshall S, Bourdeaudhuij DI, Vandelanotte C. Are health behavior change interventions that use online social networks effective? A systematic review. *J Med Internet Res*. 2014;16:E40.
16. Freeman B, Kelly B, Vandevijvere S. Young adults: beloved by food and drink marketers and forgotten by public health? *Health Prom Int*. 2015;31:954-961.
17. Mangold WG, Faulds DJ. Social media: the new hybrid element of the promotion mix. *Bus Horiz*. 2009;52:357-365.

18. Perloff RM. Social media effects on young women's body image concerns: theoretical perspectives and an agenda for research. *Sex Roles*. 2014;71:363-377.
19. Fardouly J, Vartanian LR. Social media and body image concerns: current research and future directions. *Curr Opin Psychol*. 2016;9: 1-5.
20. Grogan S. Body image and health: contemporary perspectives. *J Health Psychol*. 2006;11:523-530.
21. Bucchianeri M, Neumark-Sztainer D. Body dissatisfaction: an overlooked public health concern. *J Public Ment Health*. 2014;13: 64-69.
22. Paxton SJ, Neumark-Sztainer D, Hannan PJ, Eisenberg ME. Body dissatisfaction prospectively predicts depressive mood and low self-esteem in adolescent girls and boys. *J Clin Child Adolesc Psychol*. 2006;35:539-549.
23. National Eating Disorders Collaboration. What is body image? https://www.nedc.com.au/assets/Fact-Sheets/NEDC-Fact-Sheet-Body-Image.pdf. Accessed 8 January 2019.
24. Wynne C, Comiskey C, McGilloway S. The role of body mass index, weight change desires and depressive symptoms in the health-related quality of life of children living in urban disadvantage: testing mediation models. *Psychol Health*. 2016;31: 147-165.
25. Neumark-Sztainer D, Paxton SJ, Hannan PJ, Haines J, Story M. Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. *J Adolesc Health*. 2006;39:244-251.
26. The National Eating Disorders Collaboration. Eating disorders prevention, treatment & management: An upadated evidence review. Updated 2017. https://www.nedc.com.au/assets/NEDC-Publications/Evidence-Reviewelectronic-complete-FINAL-compressed.pdf. Accessed January 8, 2019.
27. Australian Bureau of Statistics. 8146.0—Household use of information technology, Australia, 2016–17. Updated 2018. http://www.abs.gov.au/ausstats/abs@.nsf/mf/8146.0. Accessed January 8, 2019.
28. Sensis. Sensis social media report. *Chapter 1 - Australians and Social Media*. Melbourne, Austalia: Sensis; 2017.
29. Arroyo A, Harwood J. Exploring the causes and consequences of engaging in fat talk. *J Appl Commun Res*. 2012;40:167-187.
30. Lewallen J, Behm-Morawitz E. Pinterest or thinterest?: social comparison and body image on social media. *Soc Media Soc*. 2016;2: 1-9.
31. Rodgers RF. The relationship between body image concerns, eating disorders and internet use, part II: an integrated theoretical model. *Adolesc Res Rev*. 2016;1:121-137.
32. Fredrickson BL, Roberts TA. Objectification theory. *Psychol Women Q*. 1997;21:173-206.
33. Morry M, Staska S. Magazine exposure: internalization, self-objectification, eating attitudes, and body satisfaction in male and female university students. *Can J Behav Sci*. 2001;33:269-279.
34. Daniel S, Bridges SK. The drive for muscularity in men: media influences and objectification theory. *Body Image*. 2010;7:32-38.
35. Ben B, Martin D. Dapper dudes: Young men's fashion consumption and expressions of masculinity. *Critl Stud Men Fashion*. 2015;2:5-21.
36. Tiggemann M, Zaccardo M. "Exercise to be fit, not skinny": the effect of fitspiration imagery on women's body image. *Body Image*. 2015;15:61-67.
37. Dejmanee T. "Food porn" as postfeminist play: digital femininity and the female body on food blogs. *Tel New Media*. 2016;17: 429-448.
38. Calogero RM. Objectification theory, self-objectification, and body image. *Encyclopedia of Body Image and Human Appearance. Academic Press: San Diego*; 2012:574-580.
39. Holland G, Tiggemann M. A systematic review of the impact of the use of social networking sites on body image and disordered eating outcomes. *Body Image*. 2016;17:100-110.
40. Lombard C, Brennan L, Reid M, et al. Communicating health—Optimising young adults' engagement with health messages using social media: study protocol. *Nutr Diet*. 2018;75:509-519.
41. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264-269.
42. National Center for Biotechnology Information. Appendix D: Quality Assessment Forms. Updated 2004. https://www.ncbi.nlm.nih.gov/books/NBK35156/. Accessed April 4, 2017.
43. Spencer L, Ritchie J, Lewis J, Dillon L. Quality in qualitative evaluation: a framework for assessing research evidence. Updated 2003. https://www.heacademy.ac.uk/system/files/166_policy_hub_a_quality_framework.pdf. Accessed April 7, 2017.
44. Barry B, Martin D. Fashionably fit: Young Men's dress decisions and appearance anxieties. *Textile*. 2016;14:326-347.
45. Ahadzadeh AS, Sharif SP, Ong FS. Self-schema and self-discrepancy mediate the influence of Instagram usage on body image satisfaction among youth. *Comput Human Behav*. 2017;68 (8–16):8-16.
46. Arroyo A, Brunner SR. Negative body talk as an outcome of friends' fitness posts on social networking sites: body surveillance and social comparison as potential moderators. *Appl Commun Res*. 2016;44:216-235.
47. Barry CT, Reiter SR, Anderson AC, Schoessler ML, Sidoti CL. "Let me take another selfie": Further examination of the relation between narcissism, self-perception, and Instagram posts. *Psychol Pop Media Cult*. 2017;6(1):48-60.
48. Cohen R, Newton-John T, Slater A. The relationship between Facebook and Instagram appearance-focused activities and body image concerns in young women. *Body Image*. 2017;23:183-187.
49. Cohen R, Newton-John T, Slater A. 'Selfie'-objectification: the role of selfies in self-objectification and disordered eating in young women. *Comput Human Behav*. 2018;70:68-74.
50. Eckler P, Kalyango Y, Paasch E. Facebook use and negative body image among US college women. *Women Health*. 2017;57: 249-267.
51. Fardouly J, Willburger B, Vartanian LR. Instagram use and young women's body image concerns and self-objectification: testing mediational pathways. *New Media Soc*. 2018;20:1380-1395.
52. Fardouly J, Pinkus RT, Vartanian LR. The impact of appearance comparisons made through social media, traditional media, and in person in women's everyday lives. *Body Image*. 2017;20: 31-39.
53. Fardouly J, Vartanian LR. Negative comparisons about one's appearance mediate the relationship between Facebook usage and body image concerns. *Body Image*. 2015;12:82-88.
54. Feltman CE, Szymanski DM. Instagram use and self-objectification: the roles of internalization, comparison, appearance commentary, and feminism. *Sex Roles*. 2018;78:311-324.

55. Hanna E, Ward LM, Seabrook RC, et al. Contributions of social comparison and self-objectification in mediating associations between facebook use and emergent adults' psychological well-being. *Cyberpsychol Behav Soc Netw*. 2017;20:172-179.
56. Hendrickse J, Arpan LM, Clayton RB, Ridgway JL. Instagram and college women's body image: investigating the roles of appearance-related comparisons and intrasexual competition. *Comput Human Behav*. 2017;74:92-100.
57. Howard LM, Heron KE, MacIntyre RI, Myers TA, Everhart RS. Is use of social networking sites associated with young women's body dissatisfaction and disordered eating? A look at black–white racial differences. *Body Image*. 2017;23:109-113.
58. Hummel AC, Smith AR. Ask and you shall receive: desire and receipt of feedback via Facebook predicts disordered eating concerns. *Int J Eat Disord*. 2015;48:436-442.
59. Kim JW, Chock TM. Body image 2.0: associations between social grooming on Facebook and body image concerns. *Comput Human Behav*. 2015;48:331-339.
60. Lee H-R, Lee H, Choi J, Kim J, Han H. Social media use, body image, and psychological well-being: a cross-cultural comparison of Korea and the United States. *J Health Commun*. 2014;19:1343-1358.
61. Manago AM, Ward LM, Lemm KM, Reed L, Seabrook R. Facebook involvement, objectified body consciousness, body shame, and sexual assertiveness in college women and men. *Sex Roles*. 2015;72:1-14.
62. Smith AR, Hames JL, Joiner TE. Status update: maladaptive Facebook usage predicts increases in body dissatisfaction and bulimic symptoms. *J Affect Disord*. 2013;149:235-240.
63. Wagner C, Aguirre E, Sumner EM. The relationship between Instagram selfies and body image in young adult women. *First Monday*. 2016;21(9). https.//doi.org/10.5210/fm.v21i9.6390
64. Walker M, Thornton L, De Choudhury M, et al. Facebook use and disordered eating in college-aged women. *J Adolesc Health*. 2015;57:157-163.
65. Niu G, Sun L, Liu Q, Chai H, Sun X, Zhou Z. Selfie-posting and young adult women's restrained eating: the role of commentary on appearance and self-objectification. *Sex Roles*. 2019;80(2):1-7.
66. Strubel J, Petrie TA, Pookulangara S. "Like" me: shopping, self-display, body image, and social networking sites. *Psychol Pop Media Cult*. 2018;7:328-344.
67. Veldhuis J, Alleva JM, Bij de Vaate AJD, Keijer M, Konijn EA. Me, my selfie, and I: the relations between selfie behaviors, body image, self-objectification, and self-esteem in young women. *Psychol Pop Media Cult*. 2018;1-17. https://doi.org/10.1037/ppm0000206
68. Hayes M, van Stolk-Cooke K, Muench F. Understanding Facebook use and the psychological affects of use across generations. *Comput Human Behav*. 2015;49:507-511.
69. Xiaojing A. Social networking site uses, internalization, body surveillance, social comparison and body dissatisfaction of males and females in mainland China. *Asian J Commun*. 2017;27:616-630.
70. Butkowski CP, Dixon TL, Weeks K. Body surveillance on Instagram: examining the role of selfie feedback investment in young adult women's body image concerns. *Sex Roles*. 2019;81:385-397.
71. Grover A, Grover A, Foreman J, Foreman J, Burckes-Miller M, Burckes-Miller M. "Infecting" those we care about: social network effects on body image. *Int J Pharm Healthc Mark*. 2016;10:323-338.
72. Baker N, Ferszt G, Breines JG. A qualitative study exploring female college students' Instagram use and body image. *Cyberpsychol Behav Soc Netw*. 2019;22:277-282.
73. Vaterlaus JM, Patten EV, Roche C, Young JA. Gettinghealthy: the perceived influence of social media on young adult health behaviors. *Comput Human Behav*. 2015;45:151-157.
74. Brown Z, Tiggemann M. Attractive celebrity and peer images on Instagram: effect on women's mood and body image. *Body Image*. 2016;19:37-43.
75. Simpson CC, Mazzeo SE. Skinny is not enough: a content analysis of fitspiration on Pinterest. *Health Commun*. 2017;32:560-567.
76. Carrotte ER, Prichard I, Lim MSC. "Fitspiration" on social media: a content analysis of gendered images. *J Med Internet Res*. 2017;19(3):e95.
77. Harper B, Tiggemann M. The effect of thin ideal media images on women's self-objectification, mood, and body image. *Sex Roles*. 2008;58:649-657.
78. Festinger L. A theory of social comparison processes. *Hum Relat*. 1954;7:117-140.
79. Myers TA, Crowther JH. Social comparison as a predictor of body dissatisfaction: a meta-analytic review. *J Abnorm Psychol*. 2009;118:683-698.
80. Hoffman SJ, Tan C. Following celebrities' medical advice: meta-narrative analysis. *BMJ*. 2013;347:F7 151.
81. Royne LM. Marketing for public health: we need an app for that. *J Consumer Aff*. 2011;45:1-6.
82. Wood-Barcalow NL, Tylka TL, Augustus-Horvath CL. "But I like my body": positive body image characteristics and a holistic model for young-adult women. *Body Image*. 2010;7:106-116.
83. Slater A, Varsani N, Diedrichs PC. #fitspo or #loveyourself? The impact of fitspiration and self-compassion Instagram images on women's body image, self-compassion, and mood. *Body Image*. 2017;22:87-96.
84. Slater A, Cole N, Fardouly J. The effect of exposure to parodies of thin-ideal images on young women's body image and mood. *Body Image*. 2019;29:82-89.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Rounsefell K, Gibson S, McLean S, et al. Social media, body image and food choices in healthy young adults: A mixed methods systematic review. *Nutrition & Dietetics*. 2020;77:19–40. https://doi.org/10.1111/1747-0080.12581

Received: 3 May 2019 | Revised: 29 June 2019 | Accepted: 3 July 2019

DOI: 10.1111/1747-0080.12575

REVIEW

Nutrition & Dietetics Journal of the Dietitians Association of Australia WILEY

Effects of exercise motivations on body image and eating habits/behaviours: A systematic review

Inês Panão MSc, Accredited Nutritionist[1] | Eliana V. Carraça PhD, Auxiliary Professor/Researcher[1,2]

[1]Faculdade de Educação Física e Desporto, Universidade Lusófona de Humanidades e Tecnologias, Lisbon, Portugal

[2]Interdisciplinary Centre for the Study of Human Performance (CIPER), Faculdade de Motricidade Humana, Universidade de Lisboa, Lisbon, Portugal

Correspondence
Eliana V. Carraça, Faculdade de Educação Física e Desporto, Universidade Lusófona de Humanidades e Tecnologias, Campo Grande 376, 1749-024 Lisbon, Portugal.
Email: p4890@ulusofona.pt, ecarraca@fmh.ulisboa.pt

Abstract

Aim: The quality of exercise motivations may undermine body image and eating habits/behaviours. This systematic review summarizes the state of the scientific evidence on the effects of exercise motivations on body image and eating habits/behaviours.

Methods: This review was registered on PROSPERO (CRD42019129904). Three electronic databases (PubMed, PsycINFO, SportDiscus) were searched using combinations of terms concerning: (a) the population of interest (adults, exercisers), (b) the independent variables (eg, exercise autonomous motivations) and (c) the outcomes of interest (eg, body image, eating habits). No study design restrictions were implemented. To be included, empirical studies had to be published up to June 2019, in English, in peer-reviewed journals/theses and analyse associations between exercise motivations and body image or eating habits/behaviours. Study quality was assessed using the EPHPP Quality Assessment Tool for Quantitative Studies. Two authors performed all steps. Outcome data were combined narratively.

Results: Of 168 records, 26 were included in this review: 22 analysing links between exercise motivations and body image and 11 exploring links between exercise motivations and eating habits/behaviours. Autonomous motivations (eg, for pleasure, health, wellbeing) and health-focused exercise were associated with positive body image and healthy eating habits/behaviours, whereas exercising for appearance-related and other controlled reasons was inversely related to both outcomes.

Conclusions: Better-quality exercise motivations (ie, autonomous) seem to result in healthier body image and eating outcomes. Further research is still recommended to explore these associations in more depth. Nevertheless, these findings suggest that future interventions should promote individuals' autonomy, competence and relatedness to foster autonomous motivations.

KEYWORDS

body image, dietary intake, motivations, physical activity

1 | INTRODUCTION

Physical and psychological benefits of regular engagement in exercise and physical activity are well documented, but rates of exercise adherence and maintenance do not reach the recommended dosages.[1,2] According to prior research,[3] 40% of European adults do not achieve the physical activity guidelines for engaging in moderate to vigorous physical activity at least 30 minutes on five or more days of the week. Exercise motivations could be one of the primary reasons for the poor adherence rates, in part because they might undermine the positive effects of physical activity.

Self-Determination Theory (SDT) addresses the motivational dynamics underlying human behaviours, proposing that behaviours can be regulated by different types of motivation (differing in quality), organised on a continuum of an increasing level of self-determination or autonomy (Figure 1).[4] When the behaviour is performed in order to receive rewards, avoid punishments, to get others approval or avoid feelings of guilt/shame, the motivation is considered more controlled or non-self-determined. On the other hand, when the behaviour is performed for the inherent pleasure, for the retrieved benefits or value congruence, the motivation is more autonomous or self-determined.[4]

SDT has been studied in exercise contexts, showing that positive and lasting behavioural and psychological outcomes emerge when autonomous exercise motivations prevail, when basic psychological needs are satisfied or when exercise goals are of an intrinsic nature. In contrast, controlled motivations are typically associated with less favourable results, not contributing to sustained behaviour adherence or positive psychological outcomes in the long term.[4,5]

Poor body image and unhealthy eating behaviours are highly prevalent in Western societies, mostly derived from the socially sanctioned body ideals, which are all-pervading but nearly impossible to achieve without adopting extreme behaviours,[6,7] and from the "opportunistic food environment" we currently live in, rich easily accessible, highly processed foods.[8] According to SDT, these social ideals could be experienced as controlling, thwarting the satisfaction of basic psychological needs, thus resulting in the pursuit of extrinsic goals (eg, an attractive appearance), more controlled motivations to regulate exercise/eating behaviours and less flexible functioning patterns, which are typically linked to higher frustration levels.[9] This has important consequences on one's physical and mental wellbeing, leading to drastic strategies to lose weight, eating disorders and ultimately overweight/obesity.[10,11] As a result, investigation on protective factors that are able to improve body image and eating self-regulation, and thus increase people's wellbeing, has been called for.[12] Physical activity/exercise could be such a protective factor, provided that it has been shown to enhance body image[13-15] and contribute to healthier eating behaviours and dietary habits,[16-18] which are crucial to prevent unhealthy metabolic profiles and comorbidities typically related with overweight/obesity.[19]

Still, the reasons underlying one's engagement in physical activity/exercise might attenuate, or even eliminate, the positive physical activity effects on body image and eating self-regulation. For example, exercising to lose weight or improve appearance has been found to be related to lower body appreciation, lower intuitive eating and higher controlled motivations to regulate eating,[20,21] whereas exercising for autonomous motivations and intrinsic goals has been associated with higher body appreciation, increased eating

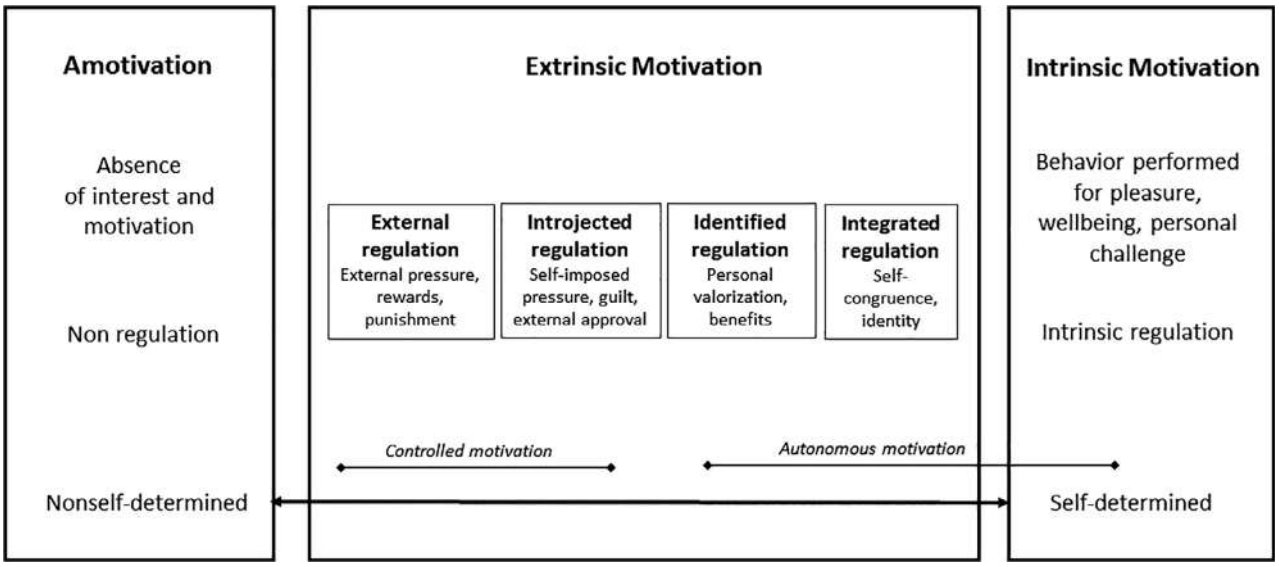


FIGURE 1 Self-determination theory motivational continuum

self-efficacy and lower food disinhibition.[21,22] These findings seem to suggest that certain types of exercise motivations and goals should not be encouraged by exercise professionals, not only for the sake of individuals' long-term adherence to physical activity but also to avoid unfavourable psychological and behavioural outcomes. It is thus important to have an evidence-based review exploring the most favourable and unfavourable forms of motivation so that professionals can most effectively promote those that lead to better body image and eating outcomes. Yet, no previous systematic review has explored this issue up to now.

Therefore, this systematic review aims to summarise all the available scientific evidence, without restrictions on study design, exploring the effects or associations between exercise motivations and (a) body image or (b) eating habits/behaviours in adult exercisers. Findings from the current review are expected to improve our understanding of exercise motivations' effects at the psychological and behavioural levels and potentially lead to recommendations for professionals' practice.

2 | METHODS

The current systematic review was registered on the PROSPERO international prospective register of systematic reviews (registration number CRD42019129904) and was reported according to *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*.[23]

To be included, empirical studies had to fulfil the following eligibility criteria: be published in English in peer-reviewed journals or dissertations, include adults (older than or equal to 18 years), include exercisers (ie, people doing exercise or some other form of physical activity of moderate or vigorous intensity, at least occasionally), analyse the effects or associations between exercise motivations proposed by SDT (or associated motivational variables) and assess (a) body image measures or (b) indicators of eating habits/behaviours. There were no restrictions on study design.

A comprehensive search of peer-reviewed articles and theses published until June 2019 (including online ahead of print publication) was conducted in three electronic databases (PubMed, PsycINFO and SportDiscus). Searches included various combinations of three sets of terms following PICO: (a) terms concerning the population of interest (eg, adults, exercisers), (b) terms concerning our independent variables (eg, exercise autonomous motivations, exercise controlled motivations) and (c) terms concerning the outcomes of interest (eg, body image, body appreciation, eating habits). A full search example can be seen in Figure 2.

Other sources included manual cross-referencing of bibliographies cited in prior reviews[14,17,24,25] and included studies and hand searches of the content of key scientific journals.

Titles, abstracts and references of relevant articles were screened by the two authors to identify studies that fulfilled the eligibility criteria. Duplicates were manually eliminated. The full text of potentially relevant articles was then retrieved for a full read by the two authors, and decisions to include or exclude studies in the review were made by consensus. The authors found discrepancies in eight studies, of which five were excluded by consensus.

A data extraction form was developed, informed by the PRISMA statement for reporting systematic reviews.[23] Data extraction was performed by the two authors and included information about study details (authors, year and country of publication), participant characteristics, study design and setting, independent variables and respective measurement instruments, outcomes of interest and respective measurement instruments, intervention length and characteristics (if present).

Study quality was assessed using the Quality Assessment Tool for Quantitative Studies, developed by the Effective

#1 (Exercisers OR "fitness clients" OR active) AND adults

#2 (Exercise OR physical activity) AND (goals OR motives OR motivations OR expectations OR "outcome expectations" OR reasons)

#3 O: "body image" OR "body image appreciation" OR "body appreciation" OR "body satisfaction" OR "body image satisfaction" OR "body image discrepancy" OR "body image investment" OR "body shape concerns" OR "physical self-perception"

#4 eating AND (behaviors OR behaviours OR habits) OR "dietary habits" OR "food habits" OR "food consumption" OR "food intake")

#5 1 AND 2 AND 3

#6 1 AND 2 AND 4

FIGURE 2 Full search example

TABLE 1 Characteristics and outcomes of studies testing the association between exercise motivations and body image (n = 22)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
Brunet and Sabiston (2009)[27]	Cross-sectional study	220 women, 161 men; age = 18.69 ± 1.15 years; BMI women = 21.84 ± 3.60, BMI men = 23.58 ± 3.71 kg/m^2	—	Exercise motivation - relative autonomy index (Behavioural Regulation in Exercise Questionnaire 2)	Social physique anxiety (Social Physique Anxiety Scale)	Social physique anxiety indirectly and negatively influenced exercise motivation (relative autonomy index)	Weak
De Young and Anderson (2010)[28]	Cross-sectional study	119 women; 107 men; age = 19.3 ± 2.6 years	—	Affect-related exercise motivation ("Do you ever exercise because you are feeling bad?")	Shape and weight concerns (Eating Disorder Examination Questionnaire)	Negative affect motivated exercise was associated with greater shape and weight concerns	Weak
Frederick and Morrison (1996)[29]	Cross-sectional study	127 men, 199 women; mean age = 20.6 years	—	Exercise motivations (Motivation for Physical Activity Measure)	Social physique anxiety (Social Physique Anxiety Scale)	Individuals who had higher social physique anxiety were more likely to endorse extrinsic motives for exercise (appearance, fitness and social interaction) than individuals showing low social physique anxiety. Individuals with higher physique anxiety placed high external pressure on themselves to engage in exercise, showing an emotional profile similar to addicted exercisers	Weak
Frederick and Richard (1993)[30]	Cross-sectional study	241 women, 134 men; mean age = 39 years	—	Exercise motivations (Motivation for Physical Activities Measure)	Body appearance self-esteem and body-functioning self-esteem (Multidimensional Self-Esteem Inventory)	Body-related motivation was associated with lower body appearance self-esteem in individual sport participants, while	Weak

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
						competence motivation was positively associated with body functioning self-esteem in fitness group activities	
Gonçalves and Gomes (2012)[31]	Cross-sectional study	161 men, 140 women; age = 25.8 ± 8.89 years	—	Weight-focused exercise motivation ("Are you exercising in order to maintain, lose or increase weight?")	Shape and weight concerns (Eating Disorder Examination Questionnaire); Self-esteem related to appearance (The Weight Influenced Self-Esteem Questionnaire)	Individuals exercising for weight/shape reasons reported greater body image concerns than those motivated by health reasons	Weak
Homan and Tylka (2014)[32]	Cross-sectional study	321 women; age = 19.88 ± 3.73 years	—	Appearance-focused exercise motivations ("To what extent do you exercise in order to influence your weight, shape, or body tone?")	Body appreciation (Body Appreciation Scale); Internal body orientation (Body Surveillance—Objectified Body Consciousness Scale); Functional body satisfaction (Functional Satisfaction—Embodied Image Scale)	High levels of appearance-based exercise motivation were associated with lower levels of body appreciation and internal body orientation (focus on how the body functions and not on how it appears to others)	Weak
Hubbard et al (1998)[33]	Cross-sectional study	49 women; age = 19.6 years; BMI = 22.2 ± 2.4, IMC = 21.8 ± 2.2 kg/m^2	—	Exercise motivations ("Do you ever exercise because you feel like you've eaten too much food and you have to work it off?")	Body dissatisfaction (Eating Disorder Inventory 2); body image (Multidimensional Body-Self Relations Questionnaire)	The "food related" exercisers exhibited greater body dissatisfaction, appearance orientation and weight preoccupation than the "non-food related" exercisers	Moderate

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
Luu (2014)[34]	Cross-sectional study	120 men, 169 women; age = 18.87 ± 1.75 years; BMI = 23.59 ± 4.09 kg/m^2	—	Exercise motivations (Reasons for Exercise Inventory and the Exercise Motivations Inventory 2)	Body appreciation (Body Appreciation Scale)	Health motives for exercise were related to positive body image in both genders. Women with appearance exercise motives had lower levels of body appreciation	Moderate
Markland (2009)[35]	Cross-sectional study	112 women; age = 26.19 ± 11.41 years	—	Exercise motivations (Behavioural Regulation in Exercise Questionnaire 2)	Self-ideal body size discrepancies (Figure Rating Scale)	Body size discrepancies were negatively associated with autonomous motivations and not associated with controlled motivations. Thus, body size discrepancies appear to decrease feelings that exercise is a valued and enjoyable activity rather than leading people to feel more externally or internally controlled in their behaviour	Weak
McDonald and Thompson (1992)[36]	Cross-sectional study	100 men, age = 23 years; 91 women, age = 22 years	—	Exercise motivations (Reasons for Exercise Inventory)	Body dissatisfaction (Eating Disorder Inventory 2)	In women, exercising for weight, tone and attractiveness reasons was associated with greater body dissatisfaction. In men, exercising for tone was linked to greater body dissatisfaction	Weak
			—				Weak

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
Thøgersen-Ntoumani and Ntoumanis (2006)[37]	Cross-sectional study	121 men, 246 women, 8 without gender identification; age = 38.7 ± 10 years		Exercise motivation (Behavioural Regulation in Exercise Questionnaire)	Physical self-worth (Physical Self-Worth—Physical Self-Perception Profile); Social physique anxiety (Social Physique Anxiety Scale)	Autonomous motivations (ie, intrinsic motivation and identified regulation) were associated with higher physical self-worth and lower social physique anxiety, while external regulation and amotivation were negatively associated. Introjected regulation was only related to higher social physique anxiety	
Thøgersen-Ntoumani and Ntoumanis (2007)[38]	Cross-sectional study	119 women, 26 men, 4 without gender identification; age = 33.94 ± 9.76 years; BMI = 22.78 ± 2.84 kg/m^2	—	Exercise motivations (Behavioural Regulation in Exercise Questionnaire)	Body dissatisfaction and drive for thinness (Eating Disorder Inventory 2); Social physique anxiety (Social Physique Anxiety Scale); Physical self-worth (Physical Self-Worth—Physical Self-Perception Profile)	Introjected motivation was positively associated with social physique anxiety, drive for thinness and body dissatisfaction and negatively with physical self-worth. Intrinsic motivation was positively associated with physical self-worth	Weak
Tiggemann and Williamson (2000)[39]	Cross-sectional study	143 women, 109 men; age = 16-60 years	—	Exercise motivation (Reasons for Exercise Inventory)	Body satisfaction (Body Cathexis Scale)	Exercising for weight control or tone reasons was associated with lower body satisfaction, while exercising for health and fitness reasons was not	Weak

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
Tylka and Homan (2015)[21]	Cross-sectional study	258 women; BMI = 22.59 ± 3.36 kg/m^2; 148 men; BMI = 23.79 ± 3.40 kg/m^2; age = 19.62 ± 2.87 years	—	Exercise motivations (Function of Exercise Scale)	Body acceptance by others (Body Acceptance by Others Scale), Internal body orientation (Body Surveillance—Objectified Body Consciousness Scale); Body appreciation (Body Appreciation Scale)	Body acceptance by others directly contributed to higher functional exercise motives and indirectly contributed to lower appearance exercise motives through higher internal body orientation. Functional exercise motives positively, and appearance exercise motives inversely, contributed to body appreciation	Moderate
Vartanian et al (2012)[40]	Cross-sectional study	205 women; age = 22.65 ± 7.84 years; BMI = 23.49 ± 5.03 kg/m^2	—	Exercise motivations (Reasons for Exercise Inventory)	Body dissatisfaction and drive for thinness (Eating Disorder Inventory 2)	Appearance-based motives for exercising were positively associated with body image concerns, whereas health-related reasons for exercise were negatively associated with body image concerns	Weak
Castonguay et al (2015)[41]	Longitudinal study	152 men; age = 23.72 ± 10.92 years; IMC = 23.98 ± 3.81 kg/m^2	—	Exercise motivations (Behavioural Regulation in Exercise Questionnaire)	Shame and guilt (Weight- and Body-Related Shame and Guilt Scales); authentic and hubristic body-related pride (Body-Related Pride Scale)	Body-related shame was positively associated with external and introjected regulations and negatively correlated with intrinsic motivation. Guilt was positively linked to external, introjected and identified regulations. Authentic pride was	Moderate

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
						negatively related to external regulation and positively correlated with both identified and intrinsic regulations. Hubristic pride was positively associated with intrinsic motivation	
Fuller-Tyszkiewicz et al (2018)[42]	Longitudinal study	178 women; age = 22.15 ± 5.14 years; BMI = 22.92 ± 4.58 kg/m^2	Assessments at six time points daily for 10 days	Motives for exercise (options: physical appearance, fitness/health, fun, goal, stress/mood or social reasons from the Reasons for Exercise Inventory)	Trait body dissatisfaction (Body Image Satisfaction—Body Image and Body Change Inventory); Appearance awareness ("Since the last survey, how much have you been thinking about how you look to other people?"); State body satisfaction ("How satisfied are you with your appearance right now?")	Trait body-dissatisfied individuals were more likely to exercise for appearance-related reasons and experienced less of an increase in state body satisfaction post-exercise. Appearance-motivated exercise also increased appearance awareness	Moderate
Lepage and Crowther (2010)[43]	Longitudinal study	61 women; age = 19.1 ± 2.88 years; BMI = 23.23 ± 3.65 kg/m^2	Questionnaires were completed at different times of the day, including after work out, for 10 days	Exercise motivations (Reasons for Exercise Inventory)	Body dissatisfaction (State Self-Esteem Scale); also used to asses trait body dissatisfaction	Appearance and weight motivations were related to higher state body dissatisfaction for all individuals. Fitness and health motivations were related to higher state body dissatisfaction for high trait body dissatisfied individuals and lower state body	Moderate

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
						dissatisfaction for low trait body dissatisfied individuals	
Martín-Albo et al (2012)[44]	Longitudinal study	148 men; 145 women; age = 34.1 ± 13.1 years	Questionnaires were completed at three time points: baseline, after 1 month and 3 months	Exercise motivations (Intrinsic Motivation—Perceived Locus of Causality Scale; Intrinsic Motivation Inventory)	Physical self-concept (Physical Self-concept—Physical Self-Concept Questionnaire)	Intrinsic motivation was directly and positively associated with physical self-concept	Weak
O'Hara et al (2014)[45]	Randomized comparative trial	48 women; age = 20.54 ± 1.30 years; BMI = 22.72 ± 3.98 kg/m^2	Women randomly divided into two groups: appearance-focused exercise class (n = 26) vs health-focused class (n = 22). In the first group, the instructor emphasised exercise to alter appearance; in group 2, emphasis was on exercise health benefits. Exercise class for 30 minutes	Exercise motivations (Reasons for Exercise Inventory)	Trait self-objectification (Self-Objectification Questionnaire); State self-objectification (Body Surveillance—Objectified Body Consciousness Scale); State social physique anxiety (Social Physique Anxiety Scale—state version)	Participants with lower health reasons for exercise reported greater state self-objectification in the appearance-focused class compared with those with higher health reasons for exercise. In the health class, there was no relationship between health reasons for exercise and state self-objectification. Appearance reasons for exercise were a positive predictor and health reasons a negative predictor of state social physique anxiety	Moderate
Pearson and Hall (2013)[46]	Experimental study	80 women; age = 33.4 ± 7.6 years; BMI = 29.02 ± 4.71 kg/m^2	Cardiovascular exercise program for 18 weeks: personalised moderate- to high-intensity exercise	Exercise motivations (Behavioural Regulations in Exercise Questionnaire 2)	Body image (Multidimensional Body-Self Relations Questionnaire)	Significant relationships were observed between body areas satisfaction and the more self-determined	Moderate

(Continues)

TABLE 1 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
			program, three times per week, for 30-45 minutes, progressive			forms of exercise motivation	
Wilson and Rodgers (2002)[47]	Experimental study	114 women; age = 25.98 ± 11.17 years; BMI = 22.71 ± 2.89 kg/m^2	Participants were enrolled in a 15-week exercise class to improve cardiovascular fitness (eg, aerobic dance, cycling, walking), twice per week for ~50 minutes	Exercise motivations (Behavioural Regulation in Exercise Questionnaire)	Physical self-esteem (Physical Self-Description Questionnaire)	Only intrinsic and identified regulations were associated with higher physical self-esteem	Weak

Public Health Practice Project.[26] This tool evaluates six key methodological domains: study design, blinding, representativeness (selection bias), representativeness (withdrawals/dropouts), confounders and data collection. Each domain is classified as having Strong, Moderate and Weak methodological quality based on specific criteria. A global rating is determined based on the scores of each component. Two researchers independently rated each of the six domains and overall quality. Discrepancies were resolved by consensus (n = 14). Inter-rater agreement was acceptable (Cohen's kappa = 0.68).

Extracted data were qualitatively synthesised and presented in tabular form. Results were organised and analysed separately for each outcome of interest, body image (Table 1) and eating habits/behaviours (Table 2). In addition, studies were organised by study design, in alphabetical order, in both tables.

3 | RESULTS

A total of 207 records were retrieved from database searches and an additional 29 from reference lists and contents of key journals. Of 198 records (after duplicates removed), 66 were considered potentially relevant, and full-text articles were retrieved. Twenty-six papers met all inclusion criteria and were therefore included in the present review (Figure 3).

Characteristics of the included studies are presented in Tables 1 and 2. Briefly, most studies had a cross-sectional design (n = 17); four were longitudinal, and five were intervention/experimental studies. Samples were mostly female (n = 12) or mixed gender (n = 11). The mean sample age ranged between 19 and 39 years. In most studies reporting body mass index (BMI, n = 11), the average value was in the healthy weight range (between 18.5 and 24.9 kg/m^2), and six included overweight/obese samples.

Of the 26 studies included, 22 assessed the associations between motivation for exercise and body image, 11 assessed the associations between exercise motivations and eating habits/behaviours, and seven assessed both associations.

Motivations for exercise practice were predominantly evaluated using the Behavioural Regulation in Exercise Questionnaire (n = 10) and the Reasons for Exercise Inventory (n = 7). Other instruments used included the Motivations for Physical Activity Measure (n = 2) and the Intrinsic Motivation Inventory (n = 2), among others. Four studies evaluated appearance/weight-focused motivations for exercise using single questions.

Body image and its constructs were mainly analysed using the Social Physique Anxiety Scale (n = 4), the Eating Disorder Inventory 2 (n = 4) and the Body Appreciation Scale (n = 3). Eating habits/behaviours were mostly evaluated by the Eating Disorder Inventory 2 (n = 3), the Intuitive

TABLE 2 Characteristics and outcomes of studies testing the association between exercise motivations and eating habits/behaviours (n = 11)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
De Young and Anderson (2010)[28]	Cross-sectional study	119 women; 107 men; age = 19.3 ± 2.6 years	—	Affect-related exercise motivation ("Do you ever exercise because you are feeling bad?")	Restraint and eating concerns (Eating Disorder Examination Questionnaire)	Negative affect-motivated exercise was associated with greater eating concerns and eating restraint	Weak
Gast et al (2015)[48]	Cross-sectional study	181 men; age = 21.4 ± 3.66 years; BMI = 24.40 ± 4.17 kg/m^2	—	Exercise motivation (Behavioural Regulation in Exercise Questionnaire)	Intuitive eating (Intuitive Eating Scale)	Men who were classified as intuitive eaters showed lower external and introjected regulations	Moderate
Gast et al (2012)[49]	Cross-sectional study	200 women; age = 19.58 ± 2.42 years; BMI = 23.23 ± 4.95 kg/m^2	—	Exercise motivation (Behavioural Regulation in Exercise Questionnaire)	Intuitive eating (Intuitive Eating Scale)	Women who reported greater intuitive eating levels were significantly more likely to engage in exercise for pleasure and to view exercise as part of their self-concept. Introjected regulation was negatively associated with intuitive eating	Moderate
Gonçalves and Gomes (2012)[31]	Cross-sectional study	161 men, 140 women; age = 25.8 ± 8.89 years	—	Weight-focused exercise motivation ("Are you exercising in order to maintain, lose or increase weight?")	Restraint and eating concerns (Eating Disorder Examination Questionnaire)	Individuals exercising for weight/shape reasons reported greater restraint and eating concerns than those motivated by health reasons	Weak
Hubbard et al (1998)[33]	Cross-sectional study	49 women; age = 19.6 years; BMI = 22.2 ± 2.4, IMC = 21.8 ± 2.2 kg/m^2	—	Exercise motivations ("Do you ever exercise because you feel like you have eaten too much food	Eating disorder (Eating Disorder Inventory 2)	The "food-related" exercisers exhibited greater eating disorder symptoms (eg, bulimia drive) than the	Moderate

(Continues)

TABLE 2 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
				and you have to work it off?")		"non-food-related" exercisers	
McDonald and Thompson (1992)[36]	Cross-sectional study	100 men, age = 23 years; 91 women, age = 22 years	—	Exercise motivations (Reasons for Exercise Inventory)	Bulimia (Eating Disorder Inventory 2)	Only in men, exercising for weight reasons was linked to greater bulimia scores, while fitness reasons were linked to lower scores	Weak
Thøgersen-Ntoumani and Ntoumanis (2007)[38]	Cross-sectional study	119 women, 26 men, 4 without gender identification; age = 33.94 ± 9.76 years; BMI = 22.78 ± 2.84 kg/m^2	—	Exercise motivations (The Behavioural Regulation in Exercise Questionnaire)	Dichotomous variable: at risk vs not at risk of developing eating disorders; based on the Eating Disorder Inventory 2 subscales	Introjected motivation was higher in individuals at risk of developing an eating disorder	Weak
Tylka and Homan (2015)[21]	Cross-sectional study	258 women; BMI = 22.59 ± 3.36; 148 men; BMI = 23.79 ± 3.40 kg/m^2; age = 19.62 ± 2.87 years	—	Exercise motivations (The Function of Exercise Scale)	Intuitive eating (Intuitive Eating Scale)	Appearance exercise motives inversely contributed to intuitive eating. Functional exercise motives were positively associated with intuitive eating	Moderate
Vartanian et al (2012)[40]	Cross-sectional study	205 women; age = 22.65 ± 7.84 years; BMI = 23.49 ± 5.03 kg/m^2	—	Exercise motivations (The Reason for Exercise Inventory)	Eating restraint (Restraint Scale)	Appearance-based motives for exercising were associated with greater eating restraint, whereas health motives were not	Weak
Fenzl et al (2014)[50]	Randomized comparative trial	45 women and 51 men; age = 26.1 ± 9.4 years	20-minute cycle ergometer, low to moderate intensity (55-65% VO_2max). Two conditions: "fat-burning exercise" label or "endurance	Exercise motivations—composite score (Behavioural Regulation in Exercise Questionnaire 2)	The amount of food eaten was measured using a balance (pre vs post), subtracting any leftovers. Perception of calories burned during	Participants who exercised in the fat-burning condition reported burning more fat and less carbohydrates than participants in the	Moderate

(Continues)

TABLE 2 (Continued)

Authors	Study design	Samples	Intervention	Independent variables	Outcomes	Results	Study quality
			exercise" label exhibited in a wall post and in the bike monitor. After workout, participants ate ad libitum while completing a survey		exercise (single question)	endurance condition. Participants with low behavioural regulation scores (self-imposed exercisers) consumed more food after the exercise bout if it was labelled fat burning than in the endurance exercise condition. The reverse was true for participants with high behavioural regulation scores (ie, they ate less)	
Mata et al (2009)[22]	Randomized controlled trial	239 women; age = 38 ± 6.8 years; BMI = 31.3 ± 4.1 kg/m^2	Lifestyle weight management program for 1 year vs a control group, receiving a health education program	Exercise motivation (Self-Regulation Questionnaire for Exercise; Intrinsic Motivation Inventory)	Eating restraint, disinhibition and perceived hunger (Three-Factor Eating Questionnaire); External eating and emotional eating (Dutch Eating Behaviour Questionnaire); Eating self-efficacy (Weight Management Efficacy Questionnaire)	Exercise autonomous motivations (especially intrinsic) were positively associated with eating self-efficacy and negatively associated with emotional eating. Positive correlations were also found with eating restraint and negative associations with eating disinhibition, hunger and external eating	Moderate

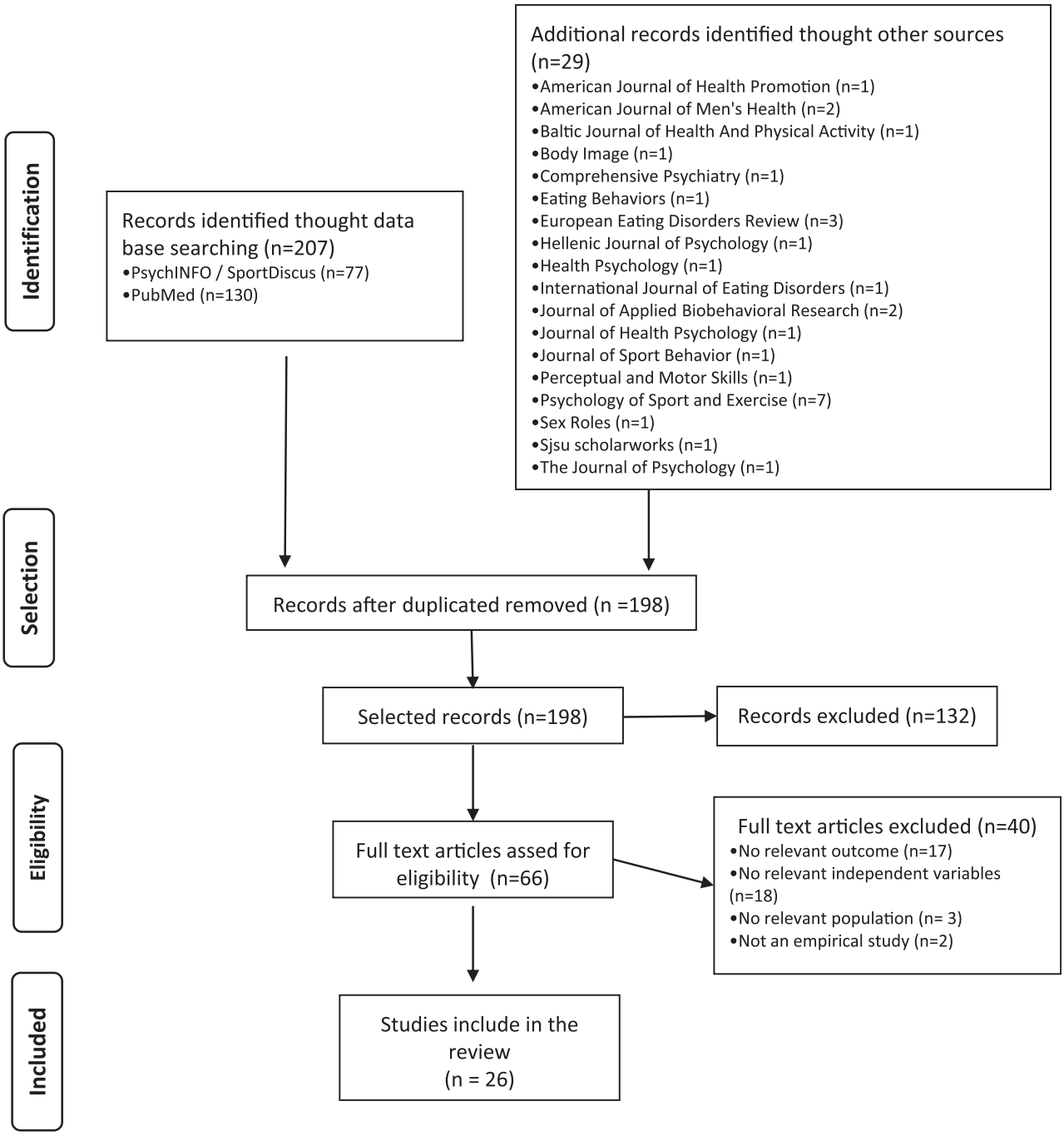


FIGURE 3 Flow diagram of study selection

Eating Scale (n = 3) and the Eating Disorder Examination Questionnaire (n = 2).

Methodological study quality is presented in Tables 1 and 2 (for more details, Supporting Information Table 1). Eleven studies were evaluated as moderate and 14 as weak. All studies included a sample of volunteers, and most of them did not report sample size calculations, being rated as weak on representativeness/selection bias (n = 21). The 17 cross-sectional studies received a weak rating on study design, which, combined with the weak rate on selection bias, automatically resulted in a global weak rating for 13 of these studies (for more information, see Supplementary file).

Exercise motivations and body image: All eight studies exploring the association between exercise motivations and body image measures within this systematic review showed positive associations between autonomous motivations for exercise and several markers of positive body image (eg, physical self-worth, body-related pride, lower social physical anxiety, lower body shame and lower body size discrepancies).[27,35,37,38,41,42,46,47] In contrast, three studies found

positive associations between controlled motivations for exercise and several indicators of negative body image, including higher body-related shame and guilt, social physique anxiety, drive for thinness and body dissatisfaction.[37,38,41] One study did not find any associations between controlled motivations and body size discrepancies.[35]

The other 14 studies evaluated the role of exercise motives/goals instead of focusing on behavioural regulations. In general, these studies showed that exercising for appearance/weight-focused reasons is rather detrimental for body image, whereas exercising for health/enjoyment reasons appears to be associated with a positive body image. Specifically, appearance/weight-focused exercise (typically of extrinsic nature) was positively associated with negative body image indicators (n = 8),[29,31,33,36,40,42,43,45] such as social physique anxiety, body dissatisfaction, body shape concerns and appearance awareness, and negatively associated with positive body image indicators (n = 5),[21,30,32,34,39] including body appreciation, body-related esteem and internal body orientation. On the other hand, health/enjoyment reasons for exercise (typically of intrinsic nature) were positively associated with increased body appreciation, body esteem and perceived body acceptance by others (n = 3)[21,30,34] and negatively associated with body image concerns, social physique anxiety and boy dissatisfaction (n = 4).[31,32,39,45] Health/fitness reasons were related to lower state body dissatisfaction but only for low-trait body-dissatisfied individuals (n = 1)[43] or not at all associated (n = 2).[36,39] In addition, exercising to compensate/deal with negative affects has also been related to greater shape and weight concerns in one study.[28]

Exercise motivations and eating habits: Studies analysing the associations between exercise motivations and eating habits/behaviours are scarcer but tend to show significant relations. Gast et al[48] found that women who reported greater intuitive eating levels were significantly more likely to engage in exercise for pleasure and to view exercise as part of their self-concept, that is, to be autonomously motivated to exercise. In addition, Mata et al[22] observed that self-determined motivations for exercise were related to a more balanced eating self-regulation, characterised by lower disinhibition and emotional eating and higher eating self-efficacy. On the other hand, controlled (ie, non-self-determined) motivations for exercise were associated with lower intuitive eating levels and a higher risk of developing an eating disorder in two studies.[38,49] An experimental priming study reported similar results, showing that self-imposed exercisers (ie, with low self-determined motivation) consumed more food after exercising in a fat burning-labelled condition than in an endurance-labelled condition, while those who exercised for pleasure and the intrinsic value of the activity (ie, high self-determined motivation) ate less in the fat-burning condition.[50] The present study suggests that high self-determination may protect individuals against food overcompensation after practicing exercises perceived as fat burning.

Performing exercise to achieve extrinsic or intrinsic goals also appears to lead to contrasting outcomes. Appearance/weight-focused exercise (typically of extrinsic nature) has been related to less favourable eating outcomes, namely, to greater eating concerns, restraint, bulimia symptoms and lower intuitive eating (n = 4).[21,31,34,40] Two other studies also showed that exercising for food-related reasons or to compensate negative affect results in greater eating concerns and restraint,[28] as well as higher levels of eating disorder symptomatology.[33] On the other hand, health/fitness reasons for exercise were associated with greater intuitive eating, lower eating restraint and concerns about food and lower bulimia symptoms in men (n = 3)[21,31,36] or showed no association (n = 1).[40]

4 | DISCUSSION

This systematic review aimed to summarise the evidence on the associations between exercise motivations and body image and between exercise motivations and eating habits/behaviours. Most included studies analysed the associations between exercise motivations and body image, showing that self-determined (ie, autonomous) motivations were associated with several positive body image markers, mainly including lower social physical anxiety and greater physical self-worth and body appreciation. Studies analysing the associations between exercise motivations and eating habits/behaviours were very limited but generally showed positive relations between self-determined motivations and healthier eating habits and behaviours. In contrast, studies generally indicated that, when exercise is performed to control weight, change body composition or improve appearance (ie, for controlled reasons and to achieve extrinsic goals), greater concerns with food, weight and shape, poorer body image and unhealthier eating habits and behaviours are observed. Appearance and weight-focused exercise participation was also found to be more frequently associated with eating disturbances. Thus, the studies included in the present systematic review support the contention that different quality exercise motivations are related to exercise-related behaviours, cognitions and physical self-assessments in different ways.

These findings are consistent with SDT,[4] which emphasises the importance of motivation quality (ie, autonomous vs controlled motivations) and proposes that the presence of a higher level of motivation will not necessarily generate the best outcomes, especially if the quality of motivation is poor (ie, controlled). This type of motivation likely echoes

feelings of pressure or coercion to perform physical activity, inability to successfully complete the exercises and lack of support—all constituting basic psychological need-thwarting experiences from the perspective of SDT (ie, lack of autonomy, competence and relatedness, respectively). These are thought to reinforce (or result in) the endorsement of substitute needs (eg, stronger body image concerns) and compensatory behaviours, such as a rigid (vs flexible) eating approach or a less intuitive eating style.[4,9] In contrast, autonomous motivations likely reflect feelings of volition or choice to engage in physical activities that are coherent with one's inner values, competence to successfully perform the activities and non-judgemental support, all constituting basic psychological need satisfaction experiences, and are thus expected to strengthen one's psychological functioning and wellbeing, as well as sustained behaviour adherence.[4,9]

Most studies included in this review provided support for the positive contribution of self-determined (ie, autonomous) exercise motivations to more favourable psychological and behavioural outcomes,[4] namely, to a more positive body image and healthier eating. Performing exercise because one values its benefits (eg, health gains, wellbeing), because it is coherent with one's inner values and interests or because it is simply fun and pleasant seems to be associated with greater body appreciation and acceptance and with an eating style that is more consonant with that feeling, that is, more intuitive and not so deliberately and rigidly controlled (sometimes even obsessed with food).[15,21,48,51] On the other hand, performing exercise by obligation or self-imposed pressure might cause a exercise experience that is less pleasant, more intense and fatiguing and lead to a more negative body image and to unhealthier eating behaviours and food compensation.[21,49,52,53]

The results of this review highlight the importance of developing interventions focused on the promotion of exercise autonomous motivations in order to foster positive body image and healthy eating habits. These interventions need to satisfy the three basic psychological needs proposed by SDT—autonomy, competence and relatedness.[4] To promote autonomy, exercise and health professionals should provide choice; encourage active experimentation; and establish significant links between what is being proposed and what one most values in life, such as the ability to play with one's children or grandchildren.[54,55] To promote competence, established goals should respond to the individual needs and preferences but also challenge him/her; expectations should be clarified right from the start, and feedback should be positive, relevant and informative.[54,55] Relatedness can be promoted by creating a positive interpersonal environment, which is non-judgemental; focused on the process and not on the results; and shows respect, acceptance and enthusiasm.[54,55]

In addition, interventions should not focus on physical appearance and on the acceptance by others. Instead, they should reduce appearance-focused practices, highlighting individuals' conquests and progresses since they started exercising, such as mastering a particular skill, improving fitness or increasing their ability to do activities that are important to them. Educational workshops that help individuals increase awareness and reflect about the salience of appearance in their lives, or about the potential causes of binge/emotional eating, could be additional, enriching propositions.

This is the first systematic review summarising the evidence on the effects/associations between exercise motivations, differing in quality, and body image and eating habits/behaviours. Still, this review has several limitations. Most of the studies analysed the relation between exercise motivations and body image, whereas few studies analysed the relations with eating habits. More studies exploring the later associations are needed to allow solid conclusions to be drawn. In addition, many studies presented a weak methodological quality, mainly because of their cross-sectional design, therefore suggesting that more studies with stronger designs (longitudinal and experimental) should be conducted to allow cause-effect analysis and more robust findings. Most of the samples included young adults, so the conclusions are not generalisable to other adults. In addition, some participants were exercise beginners (exercising once a week or less), whereas others had greater experience, which may have influenced the observed results. Therefore, future investigations should control for age and exercise experience or include different age and experience groups. Variability in assessment instruments also might have influenced results, preventing firmer conclusions. Researchers should select the most appropriate and recognised instruments to assess each variable. It is also important that future investigations include multidimensional measures of body image that tap into its cognitive, affective and behavioural dimensions and assess more diverse eating behaviours (eg, flexible and rigid eating restraint, emotional eating, implicit wanting and liking for food).

In conclusion, better-quality (ie, autonomous) exercise motivations seem to result in healthier body image and eating outcomes. However, more research is still needed to explore these associations in a more comprehensive and diverse way. Body image is more than mere body (dis)satisfaction and social physique anxiety, and several important eating behaviours, such as flexible restraint or implicit wanting for food, have been left out of these studies. The issue of exercise motivations and its relation with body image and eating habits and behaviours is an emergent research topic, which could make an important contribution to the design of future interventions.

CONFLICT OF INTEREST

Authors have no conflicts of interest to declare regarding the contents of the manuscript nor has it been submitted for consideration elsewhere.

AUTHOR CONTRIBUTIONS

I.P. and E.V.C. conceived the study. I.P. and E.V.C. conducted the literature search. I.P. wrote the manuscript and E.V.C. reviewed it and wrote some sections. I.P. and E.V.C. collated, analysed and interpreted the data and wrote the manuscript. Both authors have read and approved the version submitted for publication.

ORCID

Eliana V. Carraça https://orcid.org/0000-0002-5789-811X

REFERENCES

1. Sallis JF, Bull F, Guthold R, et al. Progress in physical activity over the Olympic quadrennium. *Lancet*. 2016;388:1325-1336.
2. Pedersen BK, Saltin B. Exercise as medicine—evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scand J Med Sci Sports*. 2015;25:1-72.
3. Marques A, Sarmento H, Martins J, Saboga Nunes L. Prevalence of physical activity in European adults—compliance with the World Health Organization's physical activity guidelines. *Prev Med*. 2015;81:333-338.
4. Ryan RM, Deci EL. *Self-Determination Theory Basic Psychological Needs in Motivation, Development, and Wellness*. New York, NY: The Guilford Press; 2017.
5. Teixeira PJ, Carraça EV, Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: a systematic review. *Int J Behav Nutr Phys Act*. 2012;9:78.
6. Thompson JK, Heinberg LJ. The media's influence on body image disturbance and eating disorders: we've reviled them, now can we rehabilitate them? *Aust J Soc Issues*. 1999;55:339-353.
7. Rohlinger DA. Eroticizing men: cultural influences on advertising and male objectification. *Sex Roles*. 2002;46:61-74.
8. Wansink B, Sobal J. Mindless eating: the 200 daily food decisions we overlook. *Environ Behav*. 2007;39:106-123.
9. Verstuyf J, Vansteenkiste M, Soenens B. Eating regulation and bulimic symptoms: the differential correlates of health-focused and appearance-focused eating regulation. *Body Image*. 2012;9:108-117.
10. Baker A, Blanchard C. Men's body image: the effects of an unhealthy body image on psychological, behavioral, and cognitive health, weight loss. Ignacio Jáuregui Lobera, IntechOpen. https://www.intechopen.com/books/weight-loss/men-s-body-image-the-effects-of-an-unhealthy-body-image-on-psychological-behavioral-and-cognitive-he. Published November 5, 2018. Accessed June 7, 2019.
11. Martin Ginis KA, McEwan D, Bassett RL. Physical activity and body image. In: Ekkekakis P, ed. *Routledge Handbook of Physical Activity & Mental Health*. New York, NY: Routledge; 2013:236-246.
12. Tylka TL, Kroon Van Diest AM. Protective factors. In: Smolak L, Levine MP, eds. *The Wiley Handbook of Eating Disorders*. West Sussex, UK: John Wiley & Sons, Ltd; 2015:430-444.
13. Campbell A, Hausenblas HA. Effects of exercise interventions on body image: a meta-analysis. *J Health Psychol*. 2009;14:780-793.
14. Hausenblas HA, Fallon EA. Exercise and body image: a meta-analysis. *Psychol Health*. 2006;21:33-47.
15. Bassett-Gunter R, McEwan D, Kamarhie A. Physical activity and body image among men and boys: a meta-analysis. *Body Image*. 2017;22:114-128.
16. Carraça EV, Silva MN, Coutinho SR, et al. The association between physical activity and eating self-regulation in overweight and obese women. *Obes Facts*. 2013;6:496-506.
17. Hobbs M, Pearson N, Foster PJ, Biddle S. Sedentary behaviour and diet across the lifespan: an updated systematic review. *Br J Sports Med*. 2015;49:1179-1188.
18. Blakely F, Dunnagan T, Haynes G, Moore S, Pelican S. Moderate physical activity and its relationship to selected measures of a healthy diet. *J Rural Health*. 2004;20:160-165.
19. Abdurahman AA, Azadbakhat L, Rasouli M, Chamari M, Qorbani M, Dorosty AR. Association of dietary inflammatory index with metabolic profile in metabolically healthy and unhealthy obese people. *Nutr Diet*. 2018;76:192-198.
20. Carraça EV, Leong SL, Horwath CC. Weight-focused physical activity is associated with poorer eating motivation quality and lower intuitive eating in women. *J Acad Nutr Diet*. 2019;19:750-759.
21. Tylka TL, Homan KJ. Exercise motives and positive body image in physically active college women and men: exploring an expanded acceptance model of intuitive eating. *Body Image*. 2015;15:90-97.
22. Mata J, Silva MN, Vieira PN, et al. Motivational 'spill-over' during weight control: increased self-determination and exercise intrinsic motivation predict eating self-regulation. *Health Psychol*. 2009;28:709-716.
23. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med*. 2009;6:e1000100.
24. SantaBarbara NJ, Whitworth JW, Ciccolo JT. A systematic review of the effects of resistance training on body image. *J Strength Cond Res*. 2017;31:1.
25. Sleddens E, Kroeze W, Kohl FM, et al. Determinants of dietary behaviour among youth: an umbrella review. *Int J Behav Nutr Phys Act*. 2015;12:7.
26. Thomas BH, Ciliska D, Dobbins M, Micucci S. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews Evid Based Nurs*. 2004;1:176-184.
27. Brunet J, Sabiston CM. Social physique anxiety and physical activity: a self-determination theory perspective. *Psychol Sport Exerc*. 2009;10:329-335.
28. De Young KP, Anderson DA. The importance of the function of exercise in the relationship between obligatory exercise and eating and body image concerns. *Eat Behav*. 2010;11:62-64.

29. Frederick C, Morrison CS. Social physique anxiety: personality constructs, motivations, exercise attitudes, and behaviors. *Percept Mot Skills*. 1996;82:963-972.
30. Frederick C, Richard MR. Differences in motivation for sport and exercise and their relation with participation and mental health. *J Sport Behav*. 1993;16:124-146.
31. Gonçalves SF, Gomes AR. Exercising for weight and shape reasons vs. health control reasons: the impact on eating disturbance and psychological functioning. *Eat Behav*. 2012;13:127-130.
32. Homan KJ, Tylka TL. Appearance-based exercise motivation moderates the relationship between exercise frequency and positive body image. *Body Image*. 2014;11:101-108.
33. Hubbard ST, Gray JJ, Parker S. Differences among women who exercise for 'food related' and 'non-food related' reasons. *Eur Eat Disord Rev*. 1998;6:255-265.
34. Luu MA. Perspiration and Motivation: An Examination of Body Image and Exercise [ProQuest Dissertation Theses]. San Jose, CA: San Jose State University; 2014, 4474.
35. Markland D. The mediating role of behavioural regulations in the relationship between perceived body size discrepancies and physical activity among adult women. *Hell J Psychol*. 2009;6:169-182.
36. McDonald K, Thompson JK. Eating disturbance, body image dissatisfaction, and reasons for exercising: gender differences and correlational findings. *Int J Eat Disord*. 1992;11:289-292.
37. Thøgersen-Ntoumani C, Ntoumanis N. The role of self-determined motivation in the understanding of exercise-related behaviors, cognitions and physical self-evaluations. *J Sports Sci*. 2006;24:393-404.
38. Thøgersen-Ntoumani C, Ntoumanis N. A self-determination theory approach to the study of body image concerns, self-presentation and self-perceptions in a sample of aerobic instructors. *J Health Psychol*. 2007;12:301-315.
39. Tiggemann M, Williamson S. The effect of exercise on body satisfaction and self-esteem as a function of gender and age. *Sex Roles*. 2000;43:119-127.
40. Vartanian LR, Wharton CM, Green EB. Appearance vs. health motives for exercise and for weight loss. *Psychol Sport Exerc*. 2012;13:251-256.
41. Castonguay AL, Pila E, Wrosch C, Sabiston CM. Body-related self-conscious emotions relate to physical activity motivation and behaviour in men. *Am J Mens Health*. 2015;9:209-221.
42. Fuller-Tyszkiewicz M, Dias S, Krug I, Richardson B, Fassnacht D. Motive- and appearance awareness-based explanations for body (dis)satisfaction following exercise in daily life. *Br J Health Psychol*. 2018;23:982-999.
43. Lepage ML, Crowther JH. The effects of exercise on body satisfaction and affect. *Body Image*. 2010;7:124-130.
44. Martín-Albo J, Núñez JL, Domínguez E, León J, Tomás JM. Relationships between intrinsic motivation, physical self-concept and satisfaction with life: a longitudinal study. *J Sports Sci*. 2012;30:337-347.
45. O'Hara SE, Cox AE, Amorose AJ. Emphasizing appearance versus health outcomes in exercise: the influence of the instructor and participants' reasons for exercise. *Body Image*. 2014;11:109-118.
46. Pearson ES, Hall CR. Examining body image and its relationship to exercise motivation: an 18-week cardiovascular program for female initiates with overweight and obesity. *Balt J Heal Phys Act*. 2013;5:121-131.
47. Wilson PM, Rodgers WM. The relationship between exercise motives and physical self-esteem in female exercise participants: an application of self-determination theory. *J Appl Biobehav Res*. 2002;7:30-43.
48. Gast J, Nielson AC, Hunt A, Leiker JJ. Intuitive eating: associations with physical activity motivation and BMI. *Am J Health Promot*. 2015;29:e91-e99.
49. Gast J, Madanat H, Nielson AC. Are men more intuitive when it comes to eating and physical activity? *Am J Mens Health*. 2012;6:164-171.
50. Fenzl N, Bartsch K, Koenigstorfer J. Labeling exercise fat-burning increases post-exercise food consumption in self-imposed exercisers. *Appetite*. 2014;81:1-7.
51. Salci LE, Martin-Ginis KA. Acute effects of exercise on women with pre-existing body image concerns: a test of potential mediators. *Psychol Sport Exerc*. 2017;31:113-122.
52. McCaig DC, Hawkins LA, Rogers PJ. Licence to eat: information on energy expended during exercise affects subsequent energy intake. *Appetite*. 2016;107:323-329.
53. West J, Guelfi KJ, Dimmock JA, Jackson B. "I deserve a treat": exercise motivation as a predictor of post-exercise dietary licensing beliefs and implicit associations toward unhealthy snacks. *Psychol Sport Exerc*. 2017;32:93-101.
54. Edmunds J, Ntoumanis N, Duda JL. Helping your clients and patients take ownership over their exercise: fostering exercise adoption, adherence, and associated well-being. *ACSMs Health Fit J*. 2009;13:20-25.
55. Silva M, Barata J, Teixeira P. Exercício físico na diabetes: missão impossível ou uma questão de motivação? *Rev Port Cardiol*. 2013;32:35-43.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Panão I, Carraça EV. Effects of exercise motivations on body image and eating habits/behaviours: A systematic review. *Nutrition & Dietetics*. 2020;77:41–59. https://doi.org/10.1111/1747-0080.12575

Received: 24 July 2019 | Revised: 17 October 2019 | Accepted: 23 October 2019

DOI: 10.1111/1747-0080.12593

REVIEW

Nutrition & Dietetics Journal of the Dietitians Association of Australia WILEY

Systematic review of nutritional interventions for people admitted to hospital for alcohol withdrawal

Cameron McLean Msc, APD Clinical Dietitian and PhD Candidate[1,2] |
Linda Tapsell PhD, FDAA, Senior Professor[2] |
Sara Grafenauer PhD, AdvAPD, Honorary Fellow[2] |
Anne-Therese McMahon PhD, APD, Senior Lecturer[3]

[1]Nutrition and Dietetics Department, St George Hospital, Kogarah, New South Wales, Australia

[2]Nutrition and Dietetics, School of Medicine, University of Wollongong, Wollongong, New South Wales, Australia

[3]Public Health Nutrition, School of Health and Society, University of Wollongong, Wollongong, New South Wales, Australia

Correspondence
Cameron McLean, Msc, APD Clinical Dietitian and PhD Candidate, Nutrition and Dietetics Department, St George Hospital, Kogarah, NSW, Australia.
Email: cameron.mclean@health.nsw.gov.au

Abstract

Aim: The aim of this review is to describe the nature of nutritional interventions for people admitted to hospital for alcohol withdrawal reported in the scientific literature and the health outcomes achieved.

Methods: The review protocol was registered with PROSPERO (CRD42 017081884). The following databases were systematically searched following the PRISMA protocol: CINAHL, MEDLINE, PsycARTICLES, PsycINFO, Scopus and Web of Science. Eligible studies were those published in English, in a hospital inpatient setting with the primary reason for admission being alcohol withdrawal. Studies of patient populations with the diagnosis of pancreatitis or liver cirrhosis were excluded. Studies were screened for eligibility, and data were extracted and descriptively analysed. Identified articles were assessed using the Quality Criteria Checklist for Primary Research produced by the Academy of Nutrition and Dietetics.

Results: Fourteen studies met the inclusion criteria. Given the heterogeneity of studies, only a descriptive analysis of interventions could be achieved. Nutrition interventions included supplementation with thiamine, multivitamins, amino acids, antioxidant compounds, probiotics, magnesium or were educational interventions. Outcome measures included memory function, biochemical and anthropometrical indices, withdrawal symptoms, bowel flora levels and nutrition knowledge. However, the overall body of evidence was limited, particularly as there was a wide variation in participant age, study designs and duration of interventions.

Conclusions: A wide range of nutrition interventions were identified, mostly involving nutrient supplements ameliorating inadequacies. Future research might also consider total dietary interventions as well as studies on the perspectives of people undergoing alcohol withdrawal.

KEYWORDS
alcohol related disorders, alcoholism, malnutrition, nutrition therapy, outcome assessment (health care), thiamine

1 | INTRODUCTION

Alcohol consumption is driven by a number of internal and external influences that can be either positive or negative, for reasons such as a behavioural control, emotional coping strategies, socially for pleasure or enjoyment, historically for medicinal purposes, cultural practice, religious rituals, and sometimes for the purpose of intoxication.[1-3] There is ongoing debate within the scientific literature that the moderate consumption of alcohol may provide some health benefits.[4,5] However, this position should be interpreted with caution. A previous meta-analysis has highlighted that there is no benefit of moderate alcohol consumption on mortality outcomes in a healthy population.[6] A systematic analysis of the data from the Global Burden of Disease study has highlighted alcohol consumption as the seventh leading risk factor for premature death and disability internationally in 2016.[7] Although there are guidelines available in at least 37 countries to reduce the health risks from consuming alcohol,[8] this most recent systematic analysis suggests that there may be no safe level of alcohol consumption that minimises the negative effects of alcohol use.[7]

Alcohol use disorder (AUD) is a diagnosis characterised by an increased tolerance to the effects of alcohol consumption, impaired control over the consumption of alcohol, a presence of psychological and physiological harms or withdrawal signs and symptoms.[9] Individuals with a diagnosis of an AUD experience significantly increased rates of mortality across the lifespan.[10-12] Chronic alcohol consumption or intoxication is known to inhibit various neurotransmitter systems.[13] The onset and severity of these signs and symptoms is influenced by a number of factors.[13,14] There are a range of signs and symptoms associated with alcohol withdrawal from less severe such as tremulousness, to more severe such as confusion and auditory or visual hallucinations.[13,14] Some of these symptoms may be associated with a nutritional deficiency. The chronic consumption of alcohol is known to contribute to micronutrient deficiency, in particular thiamine deficiency.[15,16] Wernicke's Encephalopathy (WE) is an acute neurological condition associated with thiamine deficiency, that if left untreated can lead to irreversible brain damage known as Korsakoff Syndrome.[15,16] Thus first line nutrition interventions for AUD often involve thiamine supplementation.

A more comprehensive approach to nutritional intervention in this patient group may emerge from a global assessment of malnutrition.[26-28] Patients undergoing drug and alcohol treatment are frequently identified as being malnourished because of multiple serum micronutrient insufficiencies and altered body composition. These micronutrient insufficiencies have been shown to improve with nutrition interventions.[17-19] It is difficult to compare the rates of malnutrition across studies given the variance in assessment tools used and the difficulty in obtaining an accurate history from these patients who may be cognitively impaired.[20] Consequently, the prevalence of malnutrition is likely to underestimate the number of nutritional risk factors and the severity of micronutrient deficiency in this population.[18] A clinical examination may be more sensitive than biomarkers to determine rates of malnutrition in patients with an AUD.[21] In a cohort of patients admitted to hospital for inpatient withdrawal from alcohol, 53% of patients were identified at medium or high risk of malnutrition despite having a normal body mass index (BMI).[22] Nutrient deficiencies in this patient population result from reduced dietary intake of nutrient dense food compounded by the effects of chronic alcohol consumption impairing nutrient digestion, absorption, metabolism and utilisation.[18,19] Thus nutritional interventions beyond thiamine supplementation are called for.

A hospital admission may be required for severe cases of alcohol withdrawal for medical management and symptom control to prevent the development of severe complications such as seizures or delirium tremens which if left untreated may result in death.[13,14] Those most likely to be admitted to hospital for the management of alcohol withdrawal are patients presenting with severe withdrawal symptoms, a history of severe alcohol withdrawal symptoms, psychiatric or concurrent medical disorders which may complicate management.[23,24] The purpose of alcohol withdrawal management is to interrupt the pattern of heavy and regular alcohol use; alleviate withdrawal symptoms; prevent severe withdrawal complications; facilitate links to ongoing treatment; and provide assistance with other co-occurring conditions (such as access to accommodation, food and speciality medical management including mental health services).[23,24] Interventions relating to these issues could cover a range of problematic areas and include nutritional interventions and lifestyle education programs. The aim of this review is to describe the nature of nutritional interventions for people admitted to hospital for alcohol withdrawal reported in the scientific literature and to report on the health outcomes achieved.

2 | METHODS

This systematic literature review followed the requirements of the Preferred Reporting Items for Systematic

Reviews and Meta-Analysis (PRISMA).[25] This review was registered with the International Prospective Register Of Systematic Reviews (PROSPERO) (Registration number: CRD42017081884).

A systematic search of the databases CINAHL, MEDLINE, PsycARTICLES, PsycINFO, Scopus and Web of Science was conducted in April 2018. Initially, a scoping review was carried out of these databases to identify all relevant key terms for inclusion. As recommended by Rosen and colleagues free text terms were used in combination with Medical Subject Headings (MESH) for MEDLINE and CINAHL databases.[26] The two (2) following search strategies were applied: (a) "alcoholism OR alcohol related disorder OR alcohol depen* OR alcohol* intoxi* OR AUD OR alcohol use disorder OR alcohol disorder" AND "nutri* OR diet* OR vitamin OR mineral OR diet* supplement* OR nutri* supplement* OR nutri* educat* OR diet* educat*"; and (b) MESH headings applied to MEDLINE and CINAHL databases "nutri* OR diet* OR vitamin OR mineral OR diet* supplement* OR nutri* supplement* OR nutri* educat* OR diet* educat*" and MESH Alcoholism OR Alcohol Related Disorders. The reference lists of eligible articles and relevant reviews were also screened for potential publications for inclusion. The search was repeated in November 2018 and no new eligible articles were identified.

To be included in this review studies were required to meet the following inclusion criteria: (a) prospective studies conducted in humans aged 18 years and above; (b) studies available in the English language; (c) hospital inpatient based setting; and (d) primary reason for admission to hospital as alcohol withdrawal. The following exclusion criteria were applied: (a) populations with a diagnosis of liver cirrhosis; (b) populations with a diagnosis of pancreatitis; and (c) case reports or case studies. There was no restriction placed on journal article publication date. There were a large number of different interventions ranging from single nutrient supplementation such as thiamine through to those that were educational based. The outcomes reported on ranged from biochemical based through to symptoms of alcohol withdrawal.

Articles were screened based on title and abstract. In the absence of abstract or sufficient information to draw a conclusion regarding inclusion within the review, the full text was retrieved. Abstract screening was completed by CM under supervision where considerations of uncertainty resolved via consensus with ATM, SG and LT.

The following data were extracted: citation, country, sample size, setting, study design, nutrition intervention and duration, outcome measures, and details of control group (if applicable). A descriptive summary is provided.

The Quality Criteria Checklist for Primary Research produced by the Academy of Nutrition and Dietetics was used to assess the research design.[27] The Quality Criteria Checklist includes four relevance questions around applicability to practice and 10 validity questions that address scientific soundness of the research. The article is designated either a negative (−), neutral (0) or positive rating (+).

3 | RESULTS

Following removal of duplicates a total of 11,922 articles were identified from the systematic search. After applying the exclusion criteria 11,803 articles were removed leaving 119 full text articles. After assessment for eligibility, 14 studies were included in the descriptive synthesis. The process is displayed in the PRISMA diagram (Figure 1).

Most of the 14 studies were conducted in the United States,[28-31] followed by the United Kingdom,[32-34] and then Croatia,[35] Poland,[36] France,[17] Russia,[37] Canada,[38] Australia,[39] and Sweden.[40] Intervention periods ranged from 1 to 40 days. Studies were published between 1968 and 2013 but only 4 (28%) in the last 10 years. Sample sizes ranged from 16 to 236 participants, with an age range of 38 to 50 years. Male participants comprised from 20 to 100% of the various samples. The quality of research design of articles included in this review was largely positive. These characteristics are displayed in Table 1.

All but one of the studies focused on single nutrients—supplementation occurred with various forms of vitamins and minerals or compounds with anti-oxidant activity (which may include vitamins) or probiotics. One study was an educational intervention. There were no studies investigating comprehensive dietary interventions targeting overall amelioration of symptoms and the recovery of supportive eating habits.

There were a number of studies looking at single nutrient supplementation. There were two studies that reviewed the effects of thiamine supplementation, on functional and metabolic outcomes respectively.[39,40] One of these used daily intramuscular thiamine hydrochloride at different dosages (5, 20, 100 or 200 mg) to show a dose related effect on working memory performance measured by a delayed alternation task.[39] The other investigated the effects of oral thiamine (50 mg) compared to a standard hospital diet (containing 0.8-1.5 mg thiamine) on serum thiamine and transketolase activity.[40] The thiamine di-phosphate (TDP) effect reflects the extent of unsaturation of transketolase with TDP.[41] The present study demonstrated that orally delivered thiamine shifted the TDP effect toward normal, whereas the thiamine content of the hospital diet alone was insufficient.[41] There was one study that investigated the effects of

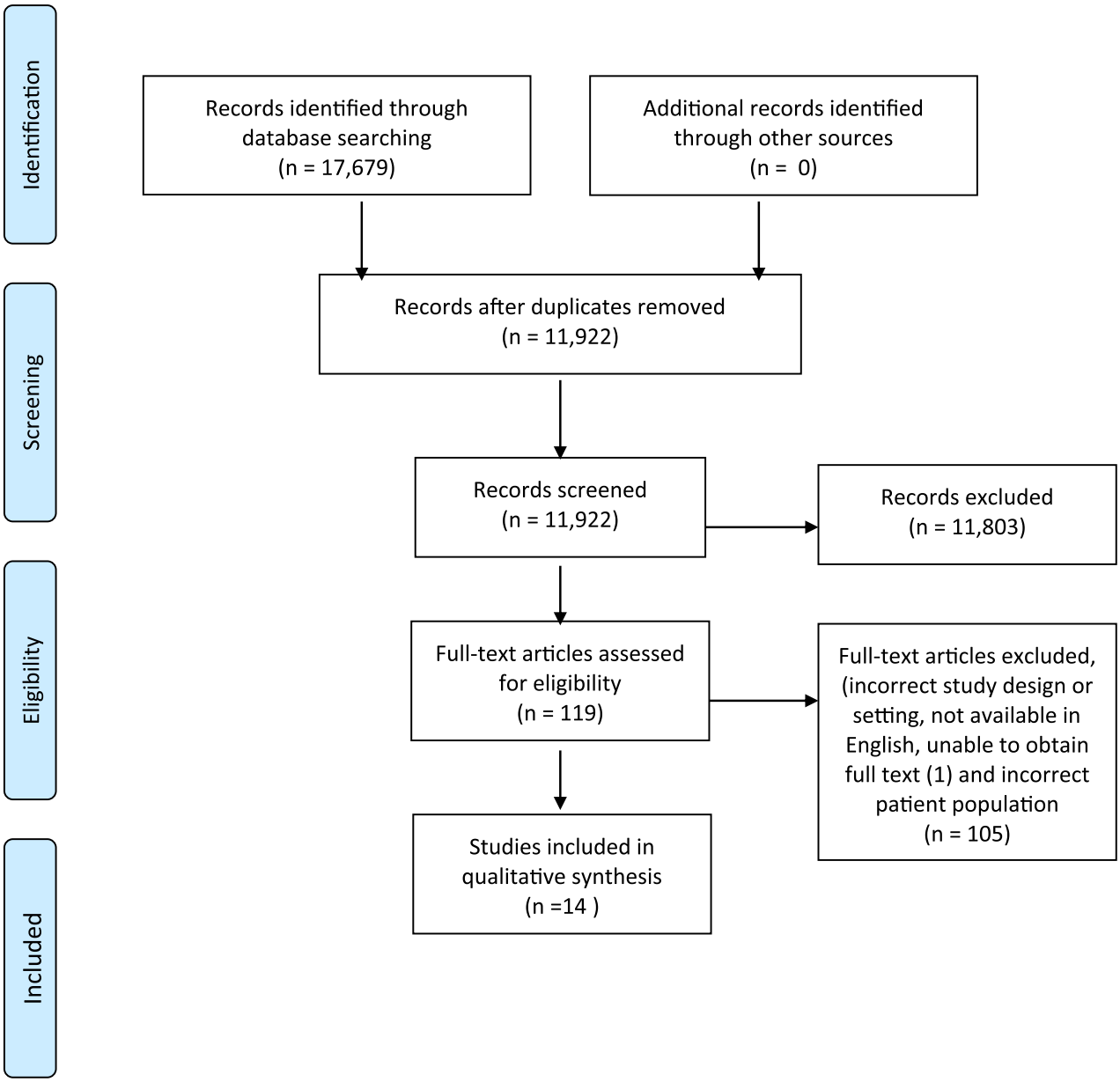


FIGURE 1 Flow chart depicting the inclusion and exclusion of articles for the systematic review

intramuscular magnesium sulphate on severity of alcohol withdrawal symptoms and serum magnesium levels compared to placebo, demonstrating no statistically significant differences between groups.[38]

Two studies investigated the effects of amino-acids delivered through supplements or food sources respectively on different stress parameters.[31,35] The first investigated the effects of an amino acid supplement on restoration of brain neurotransmitter balance in both alcohol dependent and poly-drug users.[31] There was a significant improvement in stress response, physical response to alcohol withdrawal, behavioral and emotional wellbeing by day 7 of withdrawal in those who were alcohol dependent.[31] The second study investigated the effects of a food based supplement on alcohol withdrawal symptoms demonstrating a significant decline in all psychiatric symptoms (except anxiety) compared to day one of admission within the intervention group.[35]

Three studies investigated the effects of various forms of "antioxidant" supplements.[17,32,36] The first demonstrated no significant effect on free radical activity as measured by diene conjugated linoleic acid assay, but in the supplemented group (containing vitamin E, C, selenium and beta-carotene) serum levels of vitamin E and beta-carotene improved.[32] The next showed that compared to placebo, the supplemented group (containing vitamin C, beta-carotene, alpha-tocopherol, zinc and selenium) had increased serum levels of vitamin C, alpha-

TABLE 1 Characteristics of included studies of nutrition interventions and outcomes in patients admitted to hospital for alcohol withdrawal

Citation country	Sample size (N), mean age (years) proportion males (%)	Study design	Intervention	Outcome measures	Quality criteria checklist rating (−, 0, +)[27]	Results
Ambrose 2001 Australia	N = 107, 47 years, not disclosed	A (randomised controlled trial)	Intramuscular thiamine hydrochloride once daily as: 5, 20, 50, 100 or 200 mg Duration: 2 d	Delayed alteration task Note: criterion defined as 12 consecutive correct responses	+	Fewer trials to reach criterion in 200 mg intervention compared between groups ($P = .047$) a and mean of other dosage groups ($P = .031$)[b]
Waldenlind 1981 Sweden	N = 41, 43 years, 75% male	C (non-randomised -controlled trial)	Treatment: 50 mg thiamine daily orally Comparator: standard hospital diet only (0.8–1.5 mg thiamine/day) Duration: 10 d (final measures taken 2 d after last dose)	Serum thiamine Transketolase Thiamine diphosphate (TDP) effect	+	Increase in serum thiamine levels in treatment group ($P < .02$)[b] Increase transketolase activity in treatment group ($P < .10$)[b] TDP effect restored toward normal in treatment group (NS)[b]
Wilson 1984 Canada	N = 100, 45 years, 79% male	A (randomised controlled trial)	Treatment: magnesium sulphate 2 g every 6 h intramuscularly (four injections in a total of 24-h period) Control: 0.9% sodium chloride solution (four injections in a total of 24-h period) Duration: 1 d (24 h)	Serum magnesium Severity of alcohol withdrawal seven point scale (diaphoresis, tremor, vomiting, hallucination, and overall test score) Amount of chlordiazepoxide	+	Effect of treatment on alcohol withdrawal symptoms (NS)[b] Higher serum magnesium levels at 24- and 48-h in treatment group ($P < .05$)[b] Sedative requirement between groups ($P > .10$)[b]
Blum 1989 United States	N = 25, 38 years, 80% male	A (randomised controlled trial)	Treatment: 2 SAAVE capsules containing D-phenylalanine 230 mg, L-phenylalanine 230 mg, L-tryptophan 25 mg, L-glutamine 25 mg, Pyridoxal 5′-phosphate 5 mg three times daily Control: placebo capsules (methyl cellulose) Duration: 21 d (and 7 d follow up)	Skin conductance level (SCL) Behavioural Spiritual and Social (BESS) score Physical Score (PS)	0	Lower SCL at day 7 in the treatment group ($P < .025$)[a], treatment group remains lower at other time points (NS) Lower PS in treatment group at day 7 ($P < .004$)[b] higher levels at day 21 and 28 (NS) Greater improvement in BESS score in treatment group at day 10, 21 and 28 ($P < .001$)[b]

(Continues)

TABLE 1 (Continued)

Citation country	Sample size (N), mean age (years) proportion males (%)	Study design	Intervention	Outcome measures	Quality criteria checklist rating (−, 0, +)[27]	Results
Jukic 2011 Croatia	N = 20, 42 year, 75% male	A (randomised controlled trial)	Treatment: one capsule daily (300 mg d/l-phenylalanine, 150 mg l-glutamine, 5 mg l-5-hidroksitriptofane, 1 mg vitamin B6, 50 mg calcium gluconate, 25 mg magnesium oxide, 0.01 mg folic acid). Control: capsule (1 mg of vitamin B6, 50 mg calcium gluconate, 25 mg magnesium oxide 0.01 mg folic acid). Duration: 40 d	Serum cortisol Psychological testing SCL-90-R Note: SCL-90 R measures of somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, global index of disturbance	+	Decline in serum cortisol at day 40 of admission in both groups ($P < .05$)[b], NS between groups Fewer psychiatric symptoms in treatment group at day 40 of admission ($P < .05$)[b], exception anxiety ($P = .056$)[b]
Butcher 1993 United Kingdom	N = 28, 45 years, 60% male	C (non-randomised controlled trial)	Treatment: Antioxidant mixture containing: vitamin E 400 mg, beta-carotene 40 mg, vitamin C 1000 mg, selenium 10ug Control: Placebo. Duration: 7 d	Diene conjugate of linoleic acid (DCLA) Serum vitamin E Serum Beta-Carotene Serum Aspartate Transaminase (AST)	+	Similar decrease in DCLA between groups ($P = .32$)[c] Decreased AST activity between treatment ($P = .41$)[c] Greater increase in serum beta carotene ($P = .034$)[c] and vitamin E ($P = .006$)[c] in treatment group
Guegen 2013 France	N = 106, 41 years, 51% male	A (randomised controlled trial)	Treatment: Antioxidant capsule (120 mg vitamin C, 6 mg Beta-Carotene [1000 retinol equivalents], 30 mg alpha-Tocopherol, 20 mg Zinc and 100ug Selenium). Control: Placebo capsule (not disclosed) Duration: 21 d	Serum Vitamin C Retinol Alpha-tocopheral Beta-cryptoxanthin Lycopene Alpha-carotene Beta-carotene Zinc Selenium	+	Increase in the treatment group when compared to control levels of: vitamin C ($P < .001$)[b], alpha-tocopherol ($P < .001$)[b], beta-carotene ($P < .001$)[b], zinc ($P < .01$)[b] and selenium ($P < .001$)[b] Greater increase in lycopene in the control group compared to the treatment group ($P < .05$)[b]

(Continues)

TABLE 1 (Continued)

Citation country	Sample size (N), mean age (years) proportion males (%)	Study design	Intervention	Outcome measures	Quality criteria checklist rating (−, 0, +)[27]	Results
Zaniewska 2009 Poland	N = 16, 36 years, 100% male	C (non-randomised controlled trial)	Treatment: borage oil enriched with vitamin E (Neoglandyna [72.5 mg y-linolenic acid, 129.5 mg linoleic acid and 7.4 mg vitamin E]) six capsules daily. Control: no supplementation (no placebo capsule). Duration: 30 d	Alpha-mannosidase (MAN) Alpha-fucosidase (FUC) Beta-glucuronidase (GLUCUR)	+	NS difference in MAN and GLUCUR activity[d] Tendency for FUC activity to decrease in treatment group (NS)[d]
Baines 1988 United Kingdom	N = 25, 39 years, 64% male	A (randomised controlled trial)	Treatment 1: Intramuscular multivitamin containing 250 mg thiamine once daily Treatment 2: Oral multivitamin supplement containing 50 mg thiamine five times daily Control: No supplementation at all Duration: 5 d	Erythrocyte thiamine di-phosphate (ETDP) levels	0	After 5 d similar increase in mean ETDP levels, greater in the intramuscular group ($P < .05$)[b]
Brown 1982 United Kingdom	N = 97, not disclosed, not disclosed	C (non-randomised controlled trial)	Treatment 1: Intravenous Parentrovite HP (Bencard Ltd., Brentford, Middlesex, United Kingdom) 10 mL 250 mg thiamine HCL, 4 mg riboflavin, 4 mg pyridoxine, 160 mg nicotinamide, 500 mg ascorbic acid Treatment 2:1 Orovite tablet (Bencard Ltd., Brentford, Middlesex, United Kingdom) Containing 150 mg thiamine HCL, 15 mg riboflavin, 15 mg pyridoxine, 600 mg nicotinamide, 300 mg ascorbic acid three times daily Control: placebo capsules one capsule three times daily (contents not disclosed) Duration: 5 d	Erythrocyte Transketolase (ETK) Erythrocyte Glutathione Reductase (EGR) Erythrocyte glutamate oxalocetate transaminase (EGOT) Coefficient for enzyme activity also calculated	+	Increase ETK in intravenous and oral groups by day 2 ($P < .05$)[b] and all groups by day 5 ($P < .001$)[b] Improvement not demonstrated until day 5 when using alpha coefficient of ETK ($P < .001$)[b] Improvement in the activation coefficient EGR across all treatment groups demonstrated by day 2 ($P < .05$, $P < .05$ and $P < .001$ respectively)[b]. All groups improvement by day 5 ($P < .001$)[b], however below normal ranges.

(Continues)

TABLE 1 (Continued)

Citation country	Sample size (N), mean age (years) proportion males (%)	Study design	Intervention	Outcome measures	Quality criteria checklist rating (−, 0, +)[27]	Results
			Note: all patients received 100 mg thiamine hydrochloride I.V. on admission (secondary to WE risk), interventions commenced thereafter			Increase in alpha coefficient of EGOT in all groups demonstrated by day 2 ($P < .001$)[b] and day 5 ($P < .001$, $P < .01$ and $P < .001$ respectively)[b]
Corley 1968 United States	N = 236, 45 years, 20% male	C (non-randomised controlled trial)	Treatment: protein supplement (Provimalt, Fleet) twice daily (48 g protein and 300 cal 2.1 mg thiamine, 3.4 mg riboflavin, 9.4 mg niacin, 1500 USP vitamin A, 100 USP vitamin D, 100 mg ascorbic acid, 0.26 mg pyridoxine, 3.4 ug cyanocobalamin, 1.7 mg pantohtenic acid, 11.0 mg iron, 1100 mg calcium, 935 mg phosphorus, 0.85 mg copper, 0.17 mg magnesium, 380 mg sodium, 680 mg potassium and 850 mg chlorine). Control: following admission of patients over a 2 week period received no treatment. Duration: 5 d Note: every patient received one multivitamin capsule daily (Vigran Squibb) daily and 100 mg tablet of ascorbic acid	Weight (increase or decrease) Tremor, Mental Attitude, Need for Sedative Medication (4-point scale)	−	A greater number of weight increases in the intervention group ($P < .01$)[b] Tremor, mental attitude or need for sedation (NS)[b]
Iber 1987 United States	N = 25, not disclosed, not disclosed	A (randomised controlled trial)	Treatment: Oral Alcohol Treatment Supplement (OATS) Custom Laboratories, Inc of Baltimore) (50 g fructose, 0 g glucose, 50 mg sodium, 50 mg potassium, 40 mg magnesium, 40 mg calcium, 10 mg zinc). Four (16 oz) bottles in the first 24 h followed by two on successive days.	Serum potassium Serum zinc Serum magnesium Serum phosphorous Hand tremor Sleep score Ability to draw continuous line between two concentric circles	+	No significant difference between treatment group and control group for all outcome measures[b]

(Continues)

TABLE 1 (Continued)

Citation country	Sample size (N), mean age (years) proportion males (%)	Study design	Intervention	Outcome measures	Quality criteria checklist rating (−, 0, +)[27]	Results
			Control: placebo (50 g glucose) four (16 oz) bottles in the first 24 h followed by two on successive days Duration: 3 d	Amount of sedative required Analogue scale of withdrawal symptoms (mental attitude, social participation, ability to relax, perceived hyperactivity and tremulousness) Analogue scale of representative behaviour (appetite, restlessness, blues, stomach and intestine unrest, sufficiency of medication)		
Kirpich 2008 Russia	N = 66, 42 years, 100% male	A (randomised controlled trial)	Treatment: Probiotic capsule (0.9×10^8 Colony Forming Units (CFU) B. bifidum and 0.9×10^9 CFU Lplantarum 8PA3) Control: Standard therapy (without probiotic supplement) Duration: 5 d Note: all patients scheduled on standard vitamin B1 and vitamin B 6 therapy (dosage not disclosed)	Aminotransferase (ALT) Aspartate aminotransferase (AST) Lactate dehydrogenase (LDH) Gamma glutamyl transpeptidsase (GGT) Bilirubin Microbiological assay of bowel flora bifidobacteria, lactobacilli and enterococci from faecal samples	+	Increased levels of bifidobacteria, enterococci and lactobacilli in the treatment group by day 5 ($P < .05$)[b] Lower ALT and AST in the treatment group by day 5 ($P < .05$)[b]
Timmers 1988 United States	N = 44, 34 years, 88% male	C (non-randomised controlled trial)	Treatment: group education session via a slide show presentation and video materials on knowledge areas of basic	Pre and post-test evaluation via 50 item questionnaire	0	Higher post-test scores in the treatment group in areas of consumerism ($P < .001$)[b],

(Continues)

TABLE 1 (Continued)

Citation country	Sample size (N), mean age (years) proportion males (%)	Study design	Intervention	Outcome measures	Quality criteria checklist rating (–, 0, +)[27]	Results
			nutrition; digestion, absorption and metabolism; consumer practices; alcohol and nutrition. Control: did not receive nutritional instruction alternative assignment based on admission to unit. Duration: 2.5 h over 2 d	measuring knowledge based on key knowledge areas		alcohol and nutrition ($P < .001$)[b] and overall total test score ($P < .001$)[b] No significant improvements seen in areas of basic nutrition or digestion, absorption or metabolism

Note: a ANOVA b T-Test c Wilcoxon Rank Sum d Mann-Whitney U-Test.

tocopherol, beta-carotene, zinc and selenium after 21 days.[17] The third study investigated the effects of capsules of borage oil enriched with vitamin E on lysosomal exoglycosidases. Increased levels of exoglycosidases in serum has been shown as an indication of inflammatory disease and alcoholism.[36] At the completion of the study, there were no significantly differences between groups.[36]

Two studies investigated the effects of multivitamin supplementation.[33,34] The first compared the effects of oral (five tablets daily each containing 50 mg thiamine) and intramuscular multivitamin supplement (one injection daily containing 250 mg thiamine) compared to no supplement on erythrocyte levels of thiamine diphosphate (ETDP).[34] The results demonstrated that the parenteral route more rapidly raised serum levels of ETDP, however oral supplementation was as efficacious in producing mean increases in serum ETDP levels by day 5.[34] The second study investigated the effects of oral and intravenous multivitamin supplementation (containing thiamine, riboflavin, pyridoxine, nicotinamide and ascorbic acid) compared to no supplementation at all.[33] Thiamine, riboflavin and pyridoxine status were assessed by measurement of erythrocyte transketolase (ETK), glutathione reductase (EGR) and glutamate oxaloacetate transaminase (EGOT), respectively.[33] By day 5 of the intervention there were improvements seen in all participants in terms of enzyme activity, regardless of the intervention.[33] Of those who were thiamine deficient at baseline (47/73), most remained deficient regardless of the intervention (31/73).[33] However, depending on the method of assessment used to assess thiamine deficiency, when assessed by the activation coefficient for transketolase fewer participants (10/73) were identified as deficient by day 5.[33]

Two studies investigated the effects of oral liquid nutrition supplementation.[28,30] The first study investigated the effects of a protein supplement (containing 1200 kJ and 48 g protein) on weight change, liver enzyme activity (serum glutamic oxaloacetic transaminase (SGOT), mental attitude and sedation requirement during alcohol withdrawal.[28] Although a causal relationship was not demonstrated with oral nutrition support, there were observed increases in body weight.[28] The second study evaluated the effects of an oral fructose based supplement (containing 50 g fructose) on symptoms of alcohol withdrawal syndrome.[30] The fructose based supplement did not demonstrated a more rapid alleviation of withdrawal symptoms when compared to control.[30]

Only one study investigated the effects of a probiotic supplement (containing *B bifidum* and *L plantarum* bacteria) on bowel flora.[37] In the intervention group there were significant increases in levels of bifidobacteria, enterococci and lactobacilli similar to those seen in healthy controls at day 5.[37] Furthermore, when compared

to the control at the end of treatment the probiotic group had significantly lower liver function tests, reflective of reduced alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels.[37]

Only one study investigated the effects of an educational intervention on knowledge outcomes. There was no significant improvement observed in basic nutrition, digestion, absorption and metabolism knowledge.[29] However, the intervention group scored significantly higher in areas of consumer practices (ie, information around health foods, synthetic and natural vitamin sources and economics factors influencing purchase), alcohol and nutrition and their overall test scores.[29]

4 | DISCUSSION

The current review identified 14 studies investigating the effects of nutritional based interventions on health-related outcomes in patients admitted to hospital for alcohol withdrawal. A broad range of interventions, largely involving single nutrients, were identified ranging from supplementation with thiamine, amino acids, antioxidants, probiotics and magnesium to educational intervention. Current inpatient guidelines for alcohol withdrawal focus on supportive care across the admission, from a nutritional perspective this includes encouraging oral intake, the provision of supplements (including thiamine), ensuring adequate hydration and the monitoring of nutritional status.[23,24] Although not routinely indicated, patients may benefit from baseline pathology assessment such as serum electrolytes, calcium, magnesium, iron and vitamin levels for those who may have poor dietary intake or may be at risk of refeeding syndrome.[42] Electrolyte disturbances are common in patients who chronically consume alcohol,[43] however the incidence of refeeding syndrome is low.[44] A dietitian can assist in determining risk of refeeding syndrome and provide input on appropriate management, whilst providing holistic and targeted advice supporting food based dietary patterns and supplement recommendations that incorporate psychosocial aspects which can lead to long term sustainable health outcomes.

Pre-existing literature and international guidelines on alcohol withdrawal management highlight the importance of thiamine in the treatment and prevention of WE.[2,23,24,45,46] Currently, evidence from randomised controlled trials is insufficient to guide dose, frequency and route of administration against or for the treatment of WE.[46] This current review reported on a number of studies investigating the effects of thiamine alone,[39,40] or included in a multivitamin formulation.[33,34] Although the studies reported here have reported similar improvements in serum thiamine and enzyme activity levels when comparing oral or parenteral thiamine administration,[33,34,40] these studies may be of inadequate duration to demonstrate a central nervous system response.[40] International guidelines recommend parenteral thiamine for people with suspected WE, or those who may show signs of malnourishment over 3 to 5 days.[2,23,24,45,46] In these guidelines, thiamine dosages of up to a minimum of 500 mg are recommended for patients suspected of WE,[23,24,45] and this is considered to be a safe and effective form of treatment.[45] Despite the introduction of mandatory and voluntary fortification with thiamine in staple grain foods such as bread in both developing and developed countries,[47] the studies reported on in this review did not review participant dietary patterns to identify food based thiamine intake prior to supplementation. Oral thiamine supplementation may still remain important for those with alcohol dependence following inpatient alcohol withdrawal,[48] from a nutrient adequacy and utilisation perspective.

Patients with an AUD display a range of neurocognitive deficits and inhibitory control.[20,49] Cognitive impairments are likely to impact on the efficacy of management and compromise treatment outcomes in those with an AUD.[49] Although abstinence is associated with cognitive recovery, some residual deficits may interfere with effective treatment.[20,49] In this review only one study investigated the improvement of knowledge after a nutrition education session.[29] It evaluated the immediate improvement of knowledge post intervention whilst knowledge retention was not evaluated. Previous research surrounding the individualised nutritional care post alcohol withdrawal has reflected improved micronutrient intake and lower alcohol intake at 4 month follow up when compared to control groups.[50] Substance abuse treatment programs offering a holistic treatment approach, including group nutrition education have been associated with positive treatment outcomes, thus supporting nutritional education as an essential component of alcohol treatment programs.[51] Consideration should be made surrounding cognitive function and ability to provide accurate information as well as retain information when providing nutritional counselling to patients with an AUD.

There were no identified studies included in this review that focussed on addressing malnutrition despite the known nutritional risk of this patient population. A recent systematic literature review undertook a review of interventions for the prevention or treatment of malnutrition in homeless problem drinkers.[52] Although participants were not recruited from a hospital inpatient admission for alcohol withdrawal, the outcomes reported in this review are relevant when considering nutritional

intervention on discharge from acute hospital based care. Interventions included education, supplementation (ie, intramuscular, oral tablet or fortified food product based), and provision of food products (ie, hot meals or food rations). Although multicomponent interventions lead to improved nutritional behaviour in some studies, results were not consistent across others.[52] Therefore, holistic and individualised nutritional interventions post admission to hospital should be formulated by a trained nutritional professional, considering psychosocial aspects of care and long term follow up and evaluation. This may include the involvement of other allied health professionals, to ensure treatment effectiveness.

The hospital length of stay is likely to influence the efficacy of treatment and health outcomes. The length of nutrition intervention in the present study ranged from 1 to 40 days. Addiction, in the context of an AUD, should be considered a chronic health condition.[53] Whereby the continual engagement and individualised treatment services on discharge is likely to lead to successful long-term treatment outcomes.[54] However, the hospital admission provides the opportunity to engage with patients and to co-ordinate post discharge care.[23-25] The continuation of nutritional intervention, monitoring and support on discharge from acute care is likely to contribute to improved nutrition related outcomes in this patient population and should be further evaluated.

Holistic management inclusive of malnutrition screening seems to be most appropriate for this group of patients identified at nutritional risk. The literature provides some promising insights into nutritional approaches that address health outcomes, however a more comprehensive approach that addresses the overall amelioration of symptoms and the restoration of supportive eating habits across all stages of an alcohol use disorder is required. Future research would be further supported by considering the perspectives of people undergoing alcohol withdrawal to contribute to more meaningful recommendations for practice.

AUTHOR CONTRIBUTIONS

C.M. wrote the article. C.M., A.T.M., S.G. and L.T. contributed to conception and design of this research. C.M. developed and complete the search strategy, screening and descriptive analysis of results under the direct supervision of A.T.M., S.G. and L.T. All authors agree with the manuscript and declare that the content has not been published elsewhere.

ORCID

Cameron McLean https://orcid.org/0000-0002-6636-737X
Linda Tapsell https://orcid.org/0000-0002-2546-6507
Sara Grafenauer https://orcid.org/0000-0002-4286-8284
Anne-Therese McMahon https://orcid.org/0000-0001-9657-6001

REFERENCES

1. Williams A, Clark D. Alcohol consumption in university students: the role of reasons for drinking, coping strategies, expectancies, and personality traits. *Addict Behav*. 1998;23(3):371-378.
2. National Health and Medical Research Council. *NHMRC Australian Guidelines to Reduce Health Risks from Drinking Alcohol*. Canberra: Commonwealth of Australia: National Health and Medical Research Council; 2009.
3. Kolind T, Thom B, Hunt G. *The SAGE Handbook of Drug & Alcohol Studies: Social Science Approaches*. London: Sage Publications; 2016.
4. Britton A. Moderate alcohol consumption and total mortality risk: do not advocate drinking for 'health benefits. *Nutr Metab Cardiovasc Dis*. 2019;29(10):1009-1010.
5. Costanzo S, de Gaetano G, Di Castelnuovo A, Djoussé L, Poli A, van Velden D. Moderate alcohol consumption and lower total mortality risk: justified doubts or established facts? *Nutr Metab Cardiovasc Dis*. 2019;29(10):1003-1008.
6. Stockwell T, Zhao J, Panwar S, Roemer A, Naimi T, Chikritzhs T. Do "moderate" drinkers have reduced mortality risk? A systematic review and meta-analysis of alcohol consumption and all-cause mortality. *J Stud Alcohol Drugs*. 2016;77(2):185-198.
7. Griswold MG, Fullman N, Hawley C, et al. Alcohol use and burden for 195 countries and territories, 1990–2016: a systematic analysis for the global burden of disease study 2016. *Lancet*. 2018;392(10152):1015-1035.
8. Kalinowski A, Humphreys K. Governmental standard drink definitions and low-risk alcohol consumption. *Addiction*. 2016;111(7):1293-1298.
9. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, DC: American Psychiatric Association Publishing; 2013.
10. Roerecke M, Rehm J. Alcohol use disorders and mortality: a systematic review and meta-analysis. *Addiction*. 2013;108(9):1562-1578.
11. Laramée P, Leonard S, Buchanan-Hughes A, Warnakula S, Daeppen J-B, Rehm J. Risk of all-cause mortality in alcohol-dependent individuals: a systematic literature review and meta-analysis. *EBioMedicine*. 2015;2(10):1394-1404.
12. Kendler KS, Ohlsson H, Sundguist J, Sundguist K. Alcohol use disorder and mortality across the lifespan: a longitudinal cohort and co-relative analysis. *JAMA Psychiat*. 2016;73(6):575-581.
13. Hall W, Zador D. The alcohol withdrawal syndrome. *Lancet*. 1997;349(9069):1897-1900.
14. Jesse S, Brathen G, Ferrara M, et al. Alcohol withdrawal syndrome: mechanisms, manifestations, and management. *Acta Neurol Scand*. 2017;135(1):4-16.
15. Isenberg-Grzeda E, Chabon B, Nicolson S. Prescribing thiamine to inpatients with alcohol use disorders: how well are we doing? *J Addict Med*. 2014;8(1):1-5.
16. Alim U, Bates D, Langevin A, et al. Thiamine prescribing practices for adult patients admitted to an internal medicine service. *Can J Hosp Pharm*. 2017;70(3):179-187.

17. Gueguen S, Pirollet P, Leroy P, et al. Changes in serum retinol, alpha-tocopherol, vitamin C, carotenoids, zinc and selenium after micronutrient supplementation during alcohol rehabilitation. *J Am Coll Nutr*. 2003;22(4):303-310.
18. Ross L, Wilson M, Banks M, Rezannah F, Daglish M. Prevalence of malnutrition and nutritional risk factors in patients undergoing alcohol and drug treatment. *Nutrition*. 2012;28 (7–8):738-743.
19. Wilkens Knudsen A, Jensen J, Nordgaard-Lassen I, Almdal T, Kondrup J, Becker U. Nutritional intake and status in persons with alcohol dependency: data from an outpatient treatment programme. *Eur J Nutr*. 2014;53(7):1483-1492.
20. Bernardin F, Maheut-Bosser A, Paille F. Cognitive impairments in alcohol-dependent subjects. *Front Psych*. 2014;5(78). https://doi.org/10.3389/fpsyt.2014.00078
21. Gautron M, Questel F, Lejoyeux M, Bellivier F, Vorspan F. Nutritional status during inpatient alcohol detoxification. *Alcohol Alcohol*. 2018;53(1):64-70.
22. Teixeira J, Mota T, Fernandes J. Nutritional evaluation of alcoholic inpatients admitted for alcohol detoxification. *Alcohol Alcohol*. 2011;46(5):558-560.
23. National Institute for Health and Care Excellence (NICE). Alcohol-use disorders: diagnosis, assessment and management of harmful drinking and alcohol dependence [Clinical Guideline CG115]. 2011. https://www.nice.org.uk/guidance/cg115. Accessed January, 2019.
24. Haber P, Lintzeris N, Proude E, Lopato O. *Department of Health and Ageing*. Australian Government: Guidelines for the Treatment of Alcohol Problems. Australia; 2009.
25. Moher D, Liberati A, Tetzlaff J, Altman D. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA. *PLoS Med*. 2009;6(7):e1000097.
26. Rosen L, Suhami R. The art and science of study identification: a comparative analysis of two systematic reviews. *BMC Med Res Methodol*. 2016;16(24):24.
27. Academy of Nutrition and Dietetics. *Evidence Analysis Manual: Steps in the Academy Evidence Analysis Process*. Chicago, IL: Academy of Nutrition and Dietetics; 2016.
28. Iber F. Evaluation of an oral solution to accelerate alcoholism detoxification. *Alcohol Clin Exp Res*. 1987;11(3):305-308.
29. Timmers T, Mcintosh E, Girard D, Abrahams L. Nutrition education in the treatment of the alcoholic. *J Alcohol Drug Educ*. 1988;33(2):27-36.
30. Corley KC, Hoff EC. Protein supplementation during the initial hospitalization of alcoholics. *Q J Stud Alcohol*. 1968;29(4): 913-918.
31. Blum K, Trachtenberg M, Elliott C, et al. Enkephalinase inhibition and precursor amino acid loading improves inpatient treatment of alcohol and polydrug abusers: double-blind placebo-controlled study of the nutritional adjunct SAAVE. *Alcohol*. 1988;5(6):481-493.
32. Butcher GP, Rhodes JM, Walker R, Krasner N, Jackson MJ. The effect of antioxidant supplementation on a serum marker of free radical activity and abnormal serum biochemistry in alcoholic patients admitted for detoxification. *J Hepatol*. 1993; 19(1):105-109.
33. Brown L, Rowe A, Rryles P, et al. Efficacy of vitamin supplementation on chronic alcoholics undergoing detoxification. *Alcohol Alcohol*. 1983;18(2):157-166.
34. Baines M, Bligh J, Madden J. Tissue thiamin levels of hospitalised alcoholics before and after oral or parenteral vitamins. *Alcohol Alcohol*. 1988;23(1):49-52.
35. Jukic T, Rojc B, Boben-Bardutzky D, Hafner M, Ihan A. The use of a food supplementation with D-phenylalanine, L-glutamine and L-5-hydroxytriptophan in the alleviation of alcohol withdrawal symptoms. *Coll Antropol*. 2011;35(4): 1225-1230.
36. Zaniewska A, Borzym-Kluczyk M, Szajda S, et al. The activity of lysosomal exoglycosidases in serum of alcohol-dependent men supplemented with borage oil enriched with vitamin E. *J Med Food*. 2009;12(4):914-918.
37. Kirpich I, Solovieva N, Leikhter S, et al. Probiotics restore bowel flora and improve liver enzymes in human alcohol-induced liver injury: a pilot study. *Alcohol*. 2008;42(8):675-682.
38. Wilson A, Vulcano B. A double-blind, placebo-controlled trial of magnesium sulfate in the ethanol withdrawal syndrome. *Alcohol Clin Exp Res*. 1984;8(6):542-545.
39. Ambrose M, Bowden S, Whelan G. Thiamin treatment and working memory function of alcohol-dependent people. *Alcohol Clin Exp Res*. 2001;25(1):112-116.
40. Waldenlind L, Borg S, Vikander B. Effect of peroral thiamine treatment on thiamine contents and transketolase activity of red blood cells in alcoholic patients. *Acta Med Scand*. 1981;209 (3):209-212.
41. Baines M, Davies G. The evaluation of erythrocyte thiamin diphosphate as an indicator of thiamin status in man, and its comparison with erythrocyte transketolase activity measurements. *Ann Clin Biochem*. 1988;25(6):698-705.
42. Manning V, Arunogiri S, Frei M, et al. *Alcohol and Other Drug Withdrawal: Practice Guidelines*. 3rd ed. Richmond, Victoria: Turning Point; 2018.
43. Palmer BF, Clegg DJ. Electrolyte disturbances in patients with chroinc alcohol-use Disoder. *N Engl J Med*. 2017;377(14): 1368-1377.
44. Manning S, Gilmour M, Weatherall M, Robinson GM. Refeeding syndrome is uncommon in alcoholics admitted to a hospital detoxification unit. *Intern Med J*. 2014;44(5):512-514.
45. Nishimoto A, Usery J, Winton JC, Twilla J. High-dose parenteral thiamine in treatment of Wernicke's encephalopathy: case series and review of the literature. *In Vivo*. 2017;31(1):121-124.
46. Day E, Bentham P, Callaghan R, Kuruvilla T, George S. Thiamine for prevention and treatment of Wernicke-Korsakoff syndrome in people who abuse alcohol. *Cochrane Database Syst Rev*. 2013;1(7): CD004033. https://doi.org/10.1002/14651858.CD004033.pub3.
47. Global Fortification Data Exchange. Map: Count of Nutrients in Fortification Standards: 2018. http://www.fortificationdata.org. Accessed December, 2018.
48. Rees E, Gowing L. Supplementary thiamine is still important in alcohol dependence. *Alcohol Alcohol*. 2013;48(1):88-92.
49. Bates M, Bowden S, Barry D. Neurocognitive impairment associated with alcohol use disorders: implications for treatment. *Exp Clin Psychopharmacol*. 2002;10(3):193-212.
50. Biery JR, Williford JH Jr, McMullen EA. Alcohol craving in rehabilitation: assessment of nutrition therapy. *J Am Diet Assoc*. 1991;91(4):463-466.
51. Grant L, Haughton B, Sachan D. Nutrition education is positively associated with substance abuse treatment program outcomes. *J Am Diet Assoc*. 2004;104(4):604-610.

52. Ijaz S, Thorley H, Porter K, et al. Interventions for preventing or treating malnutrition in homeless problem-drinkers: a systematic review. *Int J Equity Health*. 2018;17(8):8.
53. Dennis M, Scott CK. Managing addiction as a chronic condition. *Addict Sci Clin Pract*. 2007;4(1):44-55.
54. Proctor S, L Herschman P. The continuing care model of substance use treatment: what works, and when is "enough," "enough?". *Psychiatry J*. 2014;2014:1-16.

How to cite this article: McLean C, Tapsell L, Grafenauer S, McMahon A-T. Systematic review of nutritional interventions for people admitted to hospital for alcohol withdrawal. *Nutrition & Dietetics*. 2020;77:76–89. https://doi.org/10.1111/1747-0080.12593

Nutrition & Dietetics 2020; **77**: 139–143 DOI: 10.1111/1747-0080.12432

ORIGINAL RESEARCH

Stability of potential renal acid load

Vickà VERSELE,[1] Peter CLARYS,[1] Benedicte DEFORCHE,[1,2] Johan LEFEVRE,[3] Evelien MERTENS,[1] Ruben CHARLIER,[3] Sara KNAEPS[3,4] and Dirk AERENHOUTS[1]

[1]Faculty of Physical Education and Physiotherapy, Department of Movement and Sport Sciences, Vrije Universiteit Brussel, Brussels, [2]Faculty of Medicine and Health Sciences, Department of Public Health, Ghent University, Ghent, [3]Faculty of Kinesiology and Rehabilitation Sciences, Department of Kinesiology, KU Leuven, Leuven and [4]Department of Movement and Sports Sciences, Ghent University, Ghent (BE), Belgium

Abstract

Aim: The potential renal acid load (PRAL) has been described in relation to different health outcomes. Outcomes over time and conclusions made are often based on baseline dietary intake values. However, to study reliable long-term associations, parameters calculated based on dietary intake data, such as PRAL, must be stable over time. Therefore, the aim of the present study was to assess the stability of PRAL and its components over a 10-year time period.

Methods: PRAL values of three-day dietary intake data from 197 women and 373 men on two assessment moments (2002–2004 and 2012–2014) were calculated. Pearson correlation and intra-class correlation coefficients were used for assessing the stability of PRAL and its components. Level of agreement between the two assessment moments was estimated after splitting up subjects in quintiles of PRAL, calculating kappa values and changes of quintiles over time.

Results: No significant differences in mean PRAL over time were found. Stability of PRAL and its components was low. Poor agreement between the first and second assessment was shown by low kappa values and change of most of the subjects to an adjacent and non-adjacent quintile after 10 years.

Conclusions: Based on nutrition assessments carried out using three-day dietary records, stability of PRAL over a 10-year time period could not be confirmed, even though no significant difference between mean PRAL and its components over time was found. Therefore, interpretation of longitudinal outcomes based on PRAL and its component calculated at baseline should be interpreted with caution.

Key words: nutrition assessment, potential renal acid load, stability.

Introduction

The potential renal acid load (PRAL) was first described by Remer *et al*. in order to provide reliable estimates about the influence of foods on acid–base homeostasis.[1] Fruits and vegetables result in negative PRAL values, indicating their excess of alkaline forming potential. Cheese, meat, fish and grain products result in positive PRAL values, indicating their acid-forming potential.[1–3] The calculation of PRAL is based on different components (protein and mineral composition) taking into account the bioavailability of nutrients. PRAL can be used as a predictor of urine pH levels resulting from a certain diet.[2] Therefore, PRAL can be helpful when an adjustment to target pH is needed, for example, in the case of urolithiasis or urinary tract infections.[1,2,4] Beside this, PRAL has also been described in relation to different metabolic effects, such as mineral balance and bone health (e.g. bone density, osteoporosis),[5–7] the development of prosperity diseases[8,9] and mortality.[10] Furthermore, the PRAL of different diets (e.g. vegetarian *vs* non-vegetarian) and the acid–base balance in different populations (athletes, children) has been described.[3,11,12] A study by Alexy *et al*. of children and adolescents with annual dietary intake assessments for four years followed by a single bone mineral density (BMD) analysis using peripheral quantitative computed tomography (pQCT) showed a positive link between long-term high dietary protein intake and diaphyseal bone stability. These authors assumed that bone health might be partly negated by dietary PRAL.[13] In another longitudinal study applying pQCT of Pedone *et al*., no association between baseline PRAL and loss of bone mineral density over six years in an elderly female population was found.[14] Besides a difference in age, duration,

V. Versele, MSc, PhD student
P. Clarys, PhD, Full Professor
B. Deforche, PhD, Full Professor
J. Lefevre, PhD, Full Professor
E. Mertens, PhD, Research Assistant
R. Charlier, PhD, Research Assistant
S. Knaeps, PhD, Research Assistant
D. Aerenhouts, PhD, Professor
Correspondence: V. Versele, Faculty of Physical Education and Physiotherapy, Department of Movement and Sport Sciences, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium.
Tel.: +32 9 629 27 31.
Email: vicka.versele@vub.be

Accepted March 2018

Nutrition & Dietetics

dietary assessments and statistical analysis, a possible explanation is that the study of Alexy *et al*. repeatedly assessed PRAL, whereas the latter only used baseline PRAL values. Several other prospective studies compared a single estimated dietary intake and corresponding PRAL values with outcomes over time.[5,6,15] A link between higher diet-induced acid load with increased risk of cardiovascular diseases,[8] type 2 diabetes[9] and a negative effect between dietary acid load and bone health in elderly men[7] and elderly women[16] has been described. To make reliable long-term conclusions, PRAL generated at baseline must reflect the continuing acid–base balance over time, that is, showing acceptable stability. PRAL is often calculated based on dietary assessment methods such as three-day dietary records or food frequency questionnaires.[2,3,7,13] These methods have also been frequently used for calculating dietary indices;[17,18] however, no stability in dietary indices was found over time.[19] Therefore, we questioned whether PRAL is stable over time and whether it can be used as a reliable parameter to link with health outcomes. Hence, the aim of this research was to assess the stability of PRAL and its components over a 10-year time period.

Methods

The present study used longitudinal data from the Flemish Policy Research Centre Sport, Physical Activity, and Health (data collected in 2002–2004 and 2012–2014). A random original sample of 1569 healthy volunteers between 18 and 75 years, sufficiently representative of the Flemish population in terms of geographic distribution, age, gender and educational level, was selected in 2002. All the participants of the present study received information about the tests and measures and signed an informed consent prior to participation. The study was approved by the ethical and medical committee of the KU Leuven. Sampling, dropout analysis, characteristics of the participants and dietary assessment analyses have been described in depth elsewhere.[17] In brief, three-day dietary records, including two weekdays and one weekend day, from 570 healthy participants (373 men (65.4%) and 197 women (34.6%)) were available. Amounts of foods and drinks consumed were weighed if possible. If not, weighed estimates were made using standard household measures. Becel Nutrition software (Unilever Co.; Rotterdam, The Netherlands) was used to analyse dietary records. The calculated macro- and micronutrients were used to calculate PRAL for each participant on both measure points using the following formula[1]:

$$\begin{aligned}\text{PRAL (mEq/day)} = {} & (0.49 \times \text{protein (g/day)}) \\ & + (0.037^{*} \text{ phosphorus (mg/day)}) \\ & - (0.021^{*} \text{ potassium (mg/day)}) \\ & - (0.026^{*} \text{ magnesium (mg/day)}) \\ & - (0.013^{*} \text{ calcium (mg/day)}).\end{aligned}$$

Statistical analysis was performed using SPSS 24.0. To check the distribution of PRAL values, a Kolmogorov–Smirnov test was performed. In case of outliers for the different components affecting PRAL, a plausibility check with total kcal intake was performed. To check if mean protein intake and micronutrients used for calculating PRAL were in line with national recommendations[20] a one-sample *t*-test was applied. Paired samples *t*-tests were performed to compare PRAL value and the different PRAL components between 2002–2004 and 2012–2014. Stability between the two assessments was computed using Pearson correlation and intra-class correlation coefficient (ICC). Stability is considered with a correlation of $r \geq 0.50$, following Bloom's stability definition.[21] To estimate the measure of agreement between the two test times, PRAL was categorised into quintiles using the 20–40–60–80 percentiles. Changes of PRAL were estimated using the Cohen's Kappa measure of agreement. Frequencies of participants in the same quintile, in an adjacent quintile and non-adjacent quintile for 2002–2004 versus 2012–2014, were calculated. Level of significance was set at $p < 0.05$. Findings of the study were reported in accordance with the STROBE-nut guidelines.[22]

Results

From the original sample of 1569 healthy volunteers in 2002–2004, 420 men and 232 women returned at follow up in 2012–2014. Dietary data at both measure points were available from 570 participants (373 men (65.4%) and 197 (34.6%) women). An overview of mean age and body mass index (BMI) of the participants is given in Table 1.

A priori analysis showed significantly different values for men and women for overall PRAL ($P < 0.001$); therefore, all further analyses were split up by gender. An overview of the mean values for PRAL and the components of PRAL, for men and women, both for the first (2002–2004) and second (2012–2014) assessment is given in Table 1. Only in men, intakes of protein, potassium and phosphorus differed significantly between the first and second assessment. There were no significant differences in overall PRAL, the other components in men and all the components in women.

Table 2 presents correlation coefficients for PRAL and its components. PRAL showed low stability for men and very low stability for women. In addition, for the different components of PRAL, stability was low, with lower scores for women compared to men.

Besides a low correlation, poor agreement between the first and second assessment was also found with low kappa values of PRAL for both men (0.072; $P = 0.006$) and women (0.080; $P = 0.024$). Only 25.5% of men and 28.1% of women were categorised in the same quintile for PRAL on both assessments. Most of the participants moved to a non-adjacent category during the second assessment (Table 3).

Discussion

The aim of the present study was to evaluate the stability of PRAL and its components over a follow-up period of 10 years.

Table 1 Mean (SD) of the characteristics of the sample, potential renal acid load (PRAL) and components of PRAL

	Men (n = 373)			*Women (n = 197)*		
	2002–04 Mean (SD)	*2012–14 Mean (SD)*	p	*2002–04 Mean (SD)*	*2012–14 Mean (SD)*	p
Age (years)	47.0 (10.3)	57.6 (10.3)	< 0.001	45.4 (8.4)	55.9 (8.3)	< 0.001
Body mass index (kg/m^2)	25.4 (2.7)	25.7 (3.0)	< 0.001	23.5 (3.1)	24.1 (3.4)	< 0.001
PRAL	7.3 (19.5)	6.2 (17.7)	0.327	0.8 (14.8)	–0.3 (17.3)	0.467
Protein (g/day)	98.2 [(b)] (25.6)	93.3 (25.1)	0.002	80.2 (22.3)	77.1 (18.6)	0.092
RDI[(a)]: protein (g/day)	64.7–93.6	66.9–96.7		53.9–77.9	54.9–79.3	
Potassium (mg/day)	3843.8 (1063.2)	3705.7 (1026.2)	0.023	3291.6 (935.5)	3280.7 (909.4)	0.890
RDI: potassium (mg/day)	3000–4000	3000–4000		3000–4000	3000–4000	
Calcium (mg/day)	909.0[(b)] (402.0)	870.7[(b)] (336.4)	0.080	869.4[(b)] (375.2)	820.3[(b)] (291.3)	0.107
RDI: calcium (mg/day)	950	950		950	950	
Phosphorus (mg/day)	1657.0[(c)] (458.8)	1596.6[(c)] (428.5)	0.022	1348.0[(c)] (359.3)	1345.0[(c)] (344.7)	0.921
RDI: phosphorus (mg/day)	800	800		800	800	
Magnesium (mg/day)	368.2[(c)] (104.4)	361.8[(c)] (99.4)	0.279	304.4 (82.5)	317.2[(c)] (80.8)	0.062
RDI: magnesium (mg/day)	350	350		300	300	

RDI, Recommended Daily Intake.
[(a)] Recommended Daily Intake[20] calculated based on norms (0.83–1.2 g/kg body weight) and mean body weight (men 2002–04 = 78.0 kg, men 2012–14 = 80.6 kg; women 2002–04 = 64.9 kg, women 2012–14 = 66.1 kg).
[(b)] Significantly lower than norm for daily intake ($p < 0.05$).[20]
[(c)] Significantly higher than norm for daily intake ($p < 0.05$).[20]

Table 2 Correlation coefficients of potential renal acid load (PRAL) and its components between 2002–04 and 2012–14

	Pearson correlation				*ICC*			
	Men		*Women*		*Men*		*Women*	
	r	p	*r*	p	*r*	p	*r*	p
PRAL	0.358	<0.001	0.168	0.019	0.356	<0.001	0.165	0.010
Protein	0.312	<0.001	0.236	0.001	0.312	<0.001	0.232	0.001
Potassium	0.375	<0.001	0.291	<0.001	0.375	<0.001	0.291	<0.001
Calcium	0.359	<0.001	0.202	0.004	0.353	<0.001	0.196	0.003
Phosphorus	0.345	<0.001	0.247	<0.001	0.344	<0.001	0.247	<0.001
Magnesium	0.383	<0.001	0.320	<0.001	0.382	<0.001	0.320	<0.001

Dropout analysis showed that the subjects used for analysis scored better on different health-related parameters compared to dropouts.[17] Consequently, the results of the present study may only be generalised for the healthier part of the population. Despite this, our mean PRAL was of a similar magnitude as found in the literature. For women mean PRAL values of 1.9 ± 10.6[14], 4.9 ± 12.3[16], -7.2 ± 12.4[2], -5.5 ± 12 and 1.0 ± 14[7] and for men mean values of 3.3 (IQR –1.9 – 9.3)[15], -4.5 ± 12.2[2], -3.6 ± 12 and 3.9 ± 14[7] have been described. Although in men, protein, potassium and phosphorus intake decreased, mean PRAL values did not differ significantly between the two assessments. In women, mean PRAL values also showed no significant differences between the two assessments. In another study, PRAL values over time have been described; for example, mean PRAL values did not differ significantly throughout the study period in a three-year follow-up study with six assessment moments.[12] The results of the present study, however, show that this is no guarantee for stability, and thus, stability over time should not be automatically accepted. Despite comparable mean PRAL values over time, only low to very low stability of PRAL and its components was found in the present study. This was shown by the Pearson correlation and ICC, which both show a value below the 0.50 level of stability, as well as by the changes to mean PRAL quintiles after 10 years, where the majority of subjects moved to an adjacent and non-adjacent category.

Other calculations based on dietary measurements, such as dietary indices, are not stable. Previous research on the same data showed poor stability of the Healthy Eating

Table 3 Percentage of subjects in the same quintile, adjacent or non-adjacent quintile after 10 years

	Frequencies 2002–04 vs 2012–14 *(%)*	
	Men	Women
Same category	25.5	28.1
Adjacent category difference	35.8	30.6
Non-adjacent category difference	38.7	41.3

Index-2010. However, contrary to our results, there was a significant difference between the first and second assessment, that is, diet quality increased for men and women after a 10-year period.[19] In the abovementioned study of Mertens *et al*., the stability of intake of different foods and macro- and micronutrients, which could have an influence on the stability of the overall dietary index, was not calculated and could be seen as a limitation. Another limitation to be mentioned in the previous as well as the present study could be the use of three-day dietary records. Although validated against a seven-day dietary record, long-term conclusions based on a dietary assessment from a three-day dietary record should be interpreted with caution.[23] Estimates of micronutrient values used for calculating PRAL could not be appropriate because of the relatively short period of dietary assessment and, therefore, have an impact on the outcome of the study. Nevertheless, nutrients of interest, except for calcium, were according to the Recommended Daily Intake.

Our findings suggest that even though mean PRAL values remain similar over time, baseline measurements of PRAL are not reliable for long-term conclusions as their stability was low. These results confirm the findings of Fenton *et al*., who described PRAL as an indicator for urine pH[1,2] but with only fair to moderate stability over a five-year interval for fasting morning urine measures of the dietary acid load.[24] To ascertain reliable results, stable parameters should be included. As shown in the present and previous study,[19] parameters based on dietary intake data may be unstable. This is a point of interest because, in many prospective studies, associations between a parameter at baseline and health outcome at follow up are often investigated. Therefore, measurements at multiple time points of all investigated/influencing parameters are required.

Although comparable mean values are found with 10-year between measurements when estimated by means of a three-day dietary record, because of the lack of stability of PRAL, cautiously interpreting results of PRAL at baseline and clinical outcome over time in prospective research is warranted.

Funding source

Data collection was possible through funding by the Policy Research Centre Sport. The Policy Research Centre Sport is funded by the Flemish government.

Conflict of interest

The authors declare that they have no conflict of interest.

Authorship

DA and PC designed the research and idea for the study. VV conducted research, analysed the data and wrote the first draft. EM, RC and SK performed the data collection. DA and PC revised the manuscript. All authors are in agreement with the manuscript. The authors declare that the content has not been published elsewhere.

References

1 Remer T, Manz F. Potential renal acid load of foods and its influence on urine pH. *J Am Diet Assoc* 1995; **95**: 791–7.
2 Welch AA, Mulligan A, Bingham SA, Khaw KT. Urine pH is an indicator of dietary acid-base load, fruit and vegetables and meat intakes: results from the European prospective investigation into cancer and nutrition (EPIC)-Norfolk population study. *Br J Nutr* 2008; **99**: 1335–43.
3 Alexy U, Kersting M, Remer T. Potential renal acid load in the diet of children and adolescents: impact of food groups, age and time trends. *Public Health Nutr* 2008; **11**: 300–6.
4 Remer T, Dimitriou T, Manz F. Dietary potential renal acid load and renal net acid excretion in healthy, free-living children and adolescents. *Am J Clin Nutr* 2003; **77**: 1255–60.
5 Garcia AH, Franco OH, Voortman T *et al*. Dietary acid load in early life and bone health in childhood: the generation R study. *Am J Clin Nutr* 2015; **102**: 1595–603.
6 Jia T, Byberg L, Lindholm B *et al*. Dietary acid load, kidney function, osteoporosis, and risk of fractures in elderly men and women. *Osteoporos Int* 2015; **26**: 563–70.
7 McLean RR, Qiao N, Broe KE *et al*. Dietary acid load is not associated with lower bone mineral density except in older men. *J Nutr* 2011; **141**: 588–94.
8 Han E, Kim G, Hong N *et al*. Association between dietary acid load and the risk of cardiovascular disease: nationwide surveys (KNHANES 2008-2011). *Cardiovasc Diabetol* 2016; **15**: 122.
9 Kiefte-de Jong JC, Li Y, Chen M *et al*. Diet-dependent acid load and type 2 diabetes: pooled results from three prospective cohort studies. *Diabetologia* 2017; **60**: 270–9.
10 Xu H, Akesson A, Orsini N, Håkansson N, Wolk A, Carrero JJ. Modest U-shaped association between dietary acid load and risk of all-cause and cardiovascular mortality in adults. *J Nutr* 2016; **146**: 1580–5.
11 Deriemaeker P, Aerenhouts D, Hebbelinck M, Clarys P. Nutrient based estimation of acid-base balance in vegetarians and non-vegetarians. *Plant Foods Human Nutr* 2010; **65**: 77–82.
12 Aerenhouts D, Deriemaeker P, Hebbelinck M, Clarys P. Dietary acid-base balance in adolescent sprint athletes: a follow-up study. *Nutrients* 2011; **3**: 200–11.
13 Alexy U, Remer T, Manz F, Neu CM, Schoenau E. Long-term protein intake and dietary potential renal acid load are associated with bone modeling and remodeling at the proximal radius in healthy children. *Am J Clin Nutr* 2005; **82**: 1107–14.
14 Pedone C, Napoli N, Pozzilli P *et al*. Quality of diet and potential renal acid load as risk factors for reduced bone density in elderly women. *Bone* 2010; **46**: 1063–7.
15 Luis D, Huang X, Riserus U *et al*. Estimated dietary acid load is not associated with blood pressure or hypertension incidence in men who are approximately 70 years old. *J Nutr* 2015; **145**: 315–21.
16 Kataya Y, Murakami K, Kobayashi S, Suga H, Sasaki S. Higher dietary acid load is associated with a higher prevalence of frailty, particularly slowness/weakness and low physical activity, in elderly Japanese women. *Euro J Nutr* 2017. https://doi.org/10.1007/s00394-017-1449-4.
17 Mertens E, Deforche B, Mullie P *et al*. Longitudinal study on the association between three dietary indices, anthropometric parameters and blood lipids. *Nutr Metab* 2015; **12**: 47.

18 Pourmasoumi M, Karimbeiki R, Vosoughi N *et al*. Healthy eating index/alternative healthy eating index and breast cancer mortality and survival: a systematic review and meta-analysis. *Asia Pac J Oncol Nurs* 2016; **3**: 297–305.
19 Mertens E, Clarys P, Mullie P *et al*. Stability of physical activity, fitness components and diet quality indices. *Euro J Clin Nutr* 2017; **71**: 519–24.
20 Voedingsaanbevelingen voor België. Hoge Gezondheidsraad, 2016. (Available from: http://www.nubel.com/assets/voedingsaanbevelingen-2016.pdf, accessed 1 March 2018).
21 Bloom BS. *Stability and change in human characteristics*. New York: Wiley, 1964.
22 Lachat C, Hawwash D, Ocke MC *et al*. Strengthening the reporting of observational studies in epidemiology-nutritional epidemiology (STROBE-nut): an extension of the STROBE statement. *PLoS Med* 2016; **13**: e1002036.
23 Deriemaeker P, Aerenhouts D, Hebbelinck M, Clarys P. Validation of a 3-day diet diary: comparison with a 7-day diet diary and a FFQ: 1946: board# 97 8: 30 AM–9: 30 AM. *Med Sci Sports Exerc* 2006; **38**: S328.
24 Fenton TR, Eliasziw M, Lyon AW, Tough SC, Brown JP, Hanley DA. Low 5-year stability of within-patient ion excretion and urine pH in fasting-morning-urine specimens. *Nutr Res* 2009; **29**: 320–6.

Received: 29 March 2019 | Revised: 5 September 2019 | Accepted: 10 September 2019

DOI: 10.1111/1747-0080.12586

ORIGINAL RESEARCH

Nutrition & Dietetics
Journal of the Dietitians Association of Australia
WILEY

Benchmarking the research track record and level of appointment of Australian dietetic academics

Kieran Broome PhD, Lecturer in Occupational Therapy[1] | **Libby Swanepoel PhD, Lecturer in Nutrition and Dietetics**[2]

[1]Department of Occupational Therapy, School of Health and Sport Sciences, University of the Sunshine Coast, Sunshine Coast, Queensland, Australia

[2]Department of Nutrition and Dietetics, School of Health and Sport Sciences, University of the Sunshine Coast, Sunshine Coast, Queensland, Australia

Correspondence
Libby Swanepoel, School of Health and Sport Sciences, University of the Sunshine Coast, Locked Bag 4, Maroochydore DC, QLD 4558, Australia.
Email: lswanepo@usc.edu.au

Abstract

Aims: Research involvement is fundamental to the practice of dietetics. The present study aims to benchmark the research track record of Australian dietetic academics, and to provide insight into how research productivity informs the level of appointment of academics across the career pathway.

Methods: Australian dietetic faculty websites and corresponding Scopus database profiles were used to support a bibliographic analysis of Australian dietetic academics' research track record. Current research productivity in relation to academic attributes, level of appointment, and institutional characteristics were explored.

Results: In Australia, dietetic academic level of appointment is logarithmically related to number of publications and relatively consistent across regions and university networks.

Conclusions: Benchmarking provides universities with guidance regarding the performance to expect from academics at each academic level as well as feedback regarding recruitment and promotion practices. The present study provides an important benchmark for Australian dietetic academics and offers implications for individual academics and university management.

KEYWORDS

academic, benchmarking, bibliometrics, nutrition and dietetics, universities

1 | INTRODUCTION

Research is fundamental to nutrition and dietetic practice, providing the foundation upon which we base our decision and recommendations.[1] Research not only underpins practice, education and training, but dietitians additionally use research to contribute to the agenda of organisations and comment on proposed regulations and public policy. The National Competency Standards for Dietitians in Australia highlight the importance of research as one of the four competency domains: Application of critical thinking and integration of evidence into practice.[2] Universities are major contributors to research efforts to underpin and inform academic teaching, capture ongoing research funding and as a professional responsibility to their disciplines. University management places a high regard on research metrics at an institutional level, however individual research metrics are needed to support individual academics' progression through their academic career and to provide realistic targets for performance.

Between professions and countries there are marked differences in the expected and observed research metrics of their academic cohorts, especially in the arena of peer-reviewed journal articles. Bibliometric methods, that is, the statistical analysis of research publications and databases, allow us to explore these differences. For example,

academics in health-related fields typically have more developed journal-based research tracks records than mining engineering and criminology academics.[3] In the field of occupational therapy, Canadian academics are typically more progressed in research than their Australian colleagues.[3]

Little is published about the research track record of dietetic academics. When considering the broader bibliometric research literature surrounding nutrition and dietetics, one study explored research activity in Arab countries.[4] While not reporting the research activity of individual scholars, they did identify that the focus of research in Arab countries is on food technology and chemistry, as opposed to nutrition-related health, and identified that much of the scholarship in the region came from four nations.

Benchmarking, as a method of organisational improvement, has been applied to the discipline of Nutritional Science with respect to learning and teaching.[5] The last exploration of dietetic academic research productivity was in 1988 in the United States of America, where it was identified through a survey that around a quarter of academics spent no time on research and only half had achieved a research publication.[6] There have been significant developments in research funding and university mandates over the last three decades, thus it is timely for a review of the research productivity and track record of dietetic academics to provide more contemporaneous benchmarks.

The current study aims to benchmark the research track record of Australian dietetic academics, and to provide insight into how research productivity informs the level of appointment of academics across the career pathway from associate lecturer to professor.

2 | METHODS

The Scopus database was used to support a bibliographic analysis of Australian dietetic academics' research track record. The methods were adapted from a previous study benchmarking the research track record and level of appointment of Australian occupational therapy academics.[3] The data were collected from September to October 2018. Using only publicly available data, the study received ethical exemption from the authors' institutional Human Research Ethics Committee. Although the data were publicly available, this study reports only aggregate statistics and does not focus on any individual's performance in order to maintain relative privacy.

The study was limited to dietetic academics who were currently working in a teaching and research position in an Australian university. A fourth-year dietetics student completed the initial data collection. Universities selected were those that had a program of study accredited with the Dietitians Association of Australia. The university publicly available webpages were reviewed to identify staff. Biographies, teaching commitments and/or publications were reviewed where available to ensure that staff were dietetic academics. Academics who taught or published only in the field of nutrition were excluded from the present study, as were staff who were in research only or clinical only (eg, clinical educator or fieldwork coordinator) positions as their research track record was likely to skew the data. The authors reviewed the list of academics for accuracy, with the second author being an experienced academic in the field and having an awareness of the dietetic academic workforce in Australia.

Subsequent to the academics being identified for the study, their corresponding profile in the Scopus database was accessed. While there are many research databases that track publications and citations (eg, Web of Science, Google Scholar), Scopus was selected as a database with a systematic scope limited to higher quality journals publications. As academics can potentially work across multiple names (eg, nicknames, maiden and married names) during their career, the collected data was reviewed by the first author based on her knowledge of the field and the second author based on relative consistency between level of appointment and research track record. Where potentially discrepancies were found, the academic's publicly available webpage was perused to identify if multiple names were used across publications, and if so secondary profiles were accessed and summated metrics were manually computed.

Data collected on the individual academics included their name (which was subsequently removed from analysis after matching with their Scopus profile occurred), gender, university of employment, level of appointment and whether they held a doctorate. Gender was coded based on the pronouns used in the profile or other published works about the academic. Holding a doctorate was identified based on whether the academic used the title of "Dr," reported a qualification of a PhD or professional doctorate, or where the academic used the title of Associate Professor or Professor but did not publish their qualifications (it was assumed that they held a doctorate based on standard requirements of Australian universities). The level of appointment was converted to a scale of 1 to 5 to accommodate the different nomenclature used by universities including the more traditional Australian range (associate lecturer, lecturer, senior lecturer, associate professor, professor) and its more Americanised counterpart (senior teaching fellow, assistant professor, associate professor step 1, associate professor step 2, professor). The network affiliation of the academic's university was also recorded (Group of Eight, Innovative Research Universities, Australian Technology Network, Regional University Network or unaffiliated). The region

where the university's primary campus was based was also recorded, and the estimated population of the region was tabulated. This was based on a Google search, given that more formalised methods such as local government areas or statistical areas from the Australian Bureau of Statistics did not always reflect the actual scope of the region that each university typically serviced. From the population statistic, an academic was considered being in a metropolitan setting if the local area had more than one million people, or a regional setting if the university region had less than one million people. This reflects the current Australian geography where most capital cities have more than one million inhabitants. Nine universities were considered regional and six were metropolitan.

From the matching Scopus profile, four key metrics were recorded: H-index, number of publications, number of citing documents and number of co-authors. These numbers are an aggregate of each academic's research track record. The H-index is a metric that is calculated from the maximum number of publications by an author that have each achieved that number of citations. For example, if four published articles by an author had been cited at least four times each, that author would have an H-index of four. While the H-index has been criticised by some researchers as a relatively blunt measure, it continues to be broadly accepted and used as a useful measure (among others such as Altmetrics and raw scores) of balanced publication quantity and quality.[7,8]

Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 24. The data were cleaned through logic processes (eg, checking that number of publications was greater than or equal to H-index) to check for human error in transcription from the Scopus database to the study database. Both quartiles and means with standard deviations were computed. While quartiles were considered more accurate for reporting due to the nonparametric nature of the data, means and standard deviations were also reported to allow comparisons to published statistics for other disciplines and countries. Given the nonparametric nature of the data, nonparametric inferential statistics (chi-square, Mann-Whitney *U*, Kruskal Wallis tests) were used to explore associations within the data.

Backwards stepwise linear regression modelling was also used to create a predictive model of the level of appointment of Australian dietetic academics based on research track record and other data collected in the present study. Due to the nonparametric nature of the data, a range of transformations were trialled with the H-index, number of publications and number of citing document variables (initial Kolmogorov-Smirnov test, $P < .001$), with logarithmic transformations being the most effective in improving normality (Kolmogorov-Smirnov test $P = .2$, $P = .2$ and .029, respectively).

Using only publicly available data, the study received ethical exemption from the University of the Sunshine Coast Human Research Ethics Committee.

3 | RESULTS

One hundred and forty-eight dietetic academics were identified across Australia, spread across 15 programs. The majority of dietetic academics held a doctorate (76.4%), worked in metropolitan universities (64.2%) and were female (87.2%). There was no significant difference between metropolitan and regional universities as to whether their staff held a doctorate.

The majority of dietetic academics were employed as a lecturer or assistant professor (43.2%), with the remaining employed at senior lecturer (26.4%), associate professor (14.2%), professor (12.2%) and associate lecturer (4.1%) levels. There was no significant difference between regional and metropolitan universities with regards to the spread of appointment levels. The research track records of Australian academics are shown in Table 1.

The data for H-index, number of publications and number of citing documents tended towards a Pareto distribution. An example of this distribution is shown in Figure 1 for number of publications (separated by metropolitan and regional universities). The findings for number of publications were less pronounced than the typical Pareto principle (where 20% of persons produce 80% of outputs), with the top 20% of academics responsible for only 62% of total publications. Number of citing documents more closely adhered to the Pareto principle, with the top 20% of academics achieving 74% of total citations. Total number of co-authors followed a more uneven distribution, with a large number of academics having around 150 co-authors.

The research track record did not significantly differ between regional and metropolitan universities. In contrast, holding a doctorate had a strong association with H-index ($P < .001$), number of publications ($P < .001$), number of citing documents ($P < .001$) and number of co-authors ($P < .001$) with those holding a doctorate having a more developed research track record. Those without a doctorate had a median of two publications, while those with a doctorate had a median of 26 publications. There were no significant associations between membership of any of the university networks and research track record, except for Group of Eight university members having a larger number of co-authors ($P = .039$, mean of 66.67 vs 47.82). Males had a significantly higher H-index ($P = .014$), number of publications ($P = .031$) and number of citing documents ($P = .011$), but not number of co-authors ($P = .076$). There was no difference in the spread of genders across academic levels.

TABLE 1 Research track record of Australian dietetic academics

	Academic level					
	Associate lecturer (n = 6)	**Lecturer (n = 64)**	**Senior lecturer (n = 39)**	**Associate professor (n = 21)**	**Professor (n = 18)**	**All (n = 148)**
H-index						
Range	0-2	0-18	2-24	3-36	7-48	0-48
Mean (SD)	0.83 (0.983)	3.81 (3.681)	8.69 (5.741)	15.76 (7.848)	25.17 (10.656)	9.27 (9.423)
Quartiles (Q1/2/3)	0/0.5/2	1/3/5	4/8/13	10/14/20	15.75/24.5/33	3/6/13.75
Number of publications						
Range	0-7	0-77	2-92	8-169	35-191	0-191
Mean (SD)	2.50 (3.017)	9.61 (12.225)	27.18 (21.752)	65.52 (39.866)	107.22 (49.995)	33.33 (42.144)
Quartiles (Q1/2/3)	0/1.5/5.5	2/6/12	10/21/38	34/52/87.5	56.5/96/157.5	6/14/42.75
Number of citing documents						
Range	0-29	0-1417	4-2254	24-4479	134-6171	0-6171
Mean (SD)	8.17 (12.400)	136.89 (232.603)	445.05 (512.655)	1104.95 (1067.548)	2575.67 (1775.409)	646.84 (1116.056)
Quartiles (Q1/2/3)	0/1/20.75	3.75/41.5/191.75	86/187/728	347/997/1370.5	953.5/2441/3871.75	28/169/844
Number of co-authors						
Range	0-23	0-137	7-150	29-150	42-150	0-150
Mean (SD)	6.50 (8.983)	22.23 (26.570)	55.49 (35.406)	103.29 (43.925)	127.78 (32.528)	54.70 (50.589)
Quartiles (Q1/2/3)	0/4/11.75	5.25/16.5/27.25	28/50/78	67/99/150	96.5/150/150	13.25/33.5/93.75

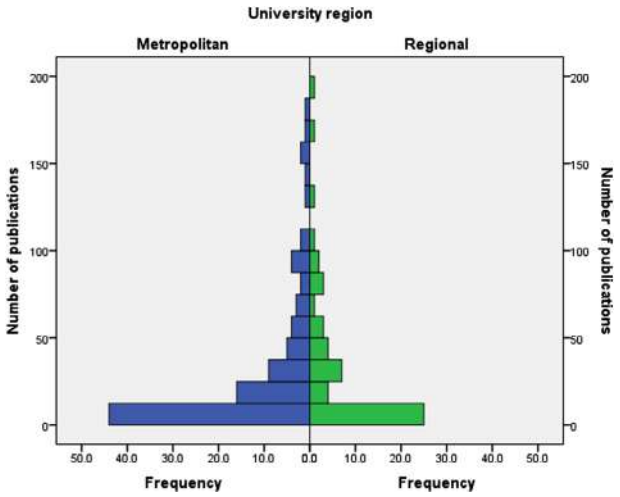


FIGURE 1 Number of publications by regional and metropolitan universities

Linear regression modelling revealed a simple model ($P < .001$) that explained 54.6% of variance in the level of appointment (where associate lecturer = 1 to professor = 5). The model did not include the 13 academics with no research track record, of which 3 were associate lecturer/senior teaching fellow and 10 were lecturer/assistant professor) as these became missing data after logarithmic transformation. A single variable (logarithmic transformation of number of publications [$B = 1.423$, SE = 0.112]) and constant ($B = 1.191$, SE = 0.154) constituted the coefficients, with both inputs being highly significant ($P < .001$). Unstandardised residuals were moderately spread with an SD of 0.73. There was no significant difference in unstandardised residuals between universities, regions or networks suggesting relatively consistent application of the model. Acknowledging that linear regression should be conducted with caution due to the ordinal nature of the level of appointment, confirmatory analysis was conducted using backward stepwise ordinal regression, revealing the same constituent variable (logarithmic transformation of number of publications) and similar significance ($P < .001$) and variance (Cox and Snell $R^2 = 0.538$).

4 | DISCUSSION

The data provides a clear benchmark for the expected level of appointment of Australian dietetic academics based on research track record. The linear model explains more than half of the variance in level of appointment. For academics wishing to calculate their expected level of appointment based on research track record, they may use the following algorithm (where associate lecturer to professor are levels 1 to 5, respectively):

$$\text{Level of appointment} = 1.191 + (1.423 \times \text{Log10}(\text{number of publications})).$$

Where an academic achieves a predicted level of appointment between, for example, 2.5 and 3.5, their research track record is comparable to a senior lecturer level. Due to the simplicity of the model, a simpler interpretation may be to provide the range of publications, numbers typical for each level. Based on the equation generated from the linear regression, an associate lecturer would typically have 0 to 1 publications, lecturers 2 to 8, senior lecturers 9 to 41, associate professors 42 to 208, and professors 211 or more publications. These ranges closely follow the benchmarked ranges and quartiles for associate lecturers, lecturers, and senior lecturers, however, the linear regression equation overestimates the publication requirements for associate professors and professors. It is suggested that the equation is used to assist academics progressing through levels 1 to 3. Associate professors and professors might seek publication targets within the quartile ranges listed in Table 1 while justifying their professorial appointment with other contributions such as research impact, grant success or leadership.

This model was distinctly different to the model for a similar cohort, Australian occupational therapy academics (Broome and Gray[3]). Unlike Australian dietetic academics, Australian occupational therapy appointment levels were also influenced by regional or metropolitan setting, H-index and holding a doctorate. The constant for the equation for occupational therapy academics was also noticeably higher than the current study (1.826 vs 1.191), suggesting that occupational therapy academics are likely to be appointed more than half a level higher than their dietetic counterparts with similar research track records. The reasons for this difference may be wide and varied, for example, lower benchmarks for occupational therapists, valourisation of clinical backgrounds or experience, or differences in leadership, teaching and research focus for career advancements. Further research would need to explore these hypotheses. In occupational therapy, most academics are appointed at lecturer level or above, even with minimal research track record or no doctorate.[3] Additionally, the model does not consider significant career interruptions or how past performance predicts future performance at different levels. The model reflecting dietetic academia denotes typical university job descriptions where a lecturer/assistant professor would usually hold a PhD and have a developing research track record.

It was interesting to note that the dietetic model focused solely on number of publications and did not include any metrics relating to reach (H-index or number of citing documents). This may reflect current conventions in the field where quantity of publications is highly regarded. Perhaps, it is reflective of reach being assumed (the ratio of citations to documents was much higher for dietetics than occupational therapy) which may reflect the more focused scope of the profession with a narrower range of research topics. Current government initiatives seek to move away from a "publish or perish" mentality to a greater focus on impact, research utilisation and sectoral engagement. The state of research in dietetics has significantly advanced from 30 years ago, where only half of dietetic academics in the United States of America had one or more publications.[6] Currently, more than 90% of Australian dietetic academics have at least one publication, and more than half have 14 or more publications. It is expected that research conventions will continue to evolve over time.

While there are no contemporary comparison data for dietetic academics internationally, dietetic academics in Australia perform strongly against other health disciplines. A selection of comparisons against other disciplines are shown below for the most populous level of appointment (lecturer/assistant professor, Table 2) and the highest level of appointment (professor, Table 3). Australian dietetic academics at a lecturer level tend to have a less developed research track record than many health professions, but have a strong research track record at the professorial level compared to other professions.

TABLE 2 Comparison between disciplines for research track record at the lecturer/assistant professor level

Discipline	Mean H-index	Median H-index	Mean number of publications	Median number of publications	Source
US surgeons	6.8				Ashfaq et al[9]
US social work	5.10				Carter et al[10]
Canadian occupational therapy and physiotherapy		5			MacDermid et al[11]
Otolaryngologists	4.62				Svider et al[12]
US plastic surgeons	4.59				Therattil et al[13]
Australian dietetics	3.81	3	9.61	6	Current study
Australian psychology			4.54		Malouff et al[14]
Australian occupational therapy	1.46	1	3.86	2	Broome and Gray[3]

TABLE 3 Comparison between disciplines for research track record at the professorial level

Discipline	Mean H-index	Median H-index	Mean number of publications	Median number of publications	Source
US surgeons	27.9				Ashfaq et al[9]
Australian dietetics	25.17	24.5	107.22	96	Current study
Australian psychology			55.96		Malouff et al[14]
US social work	19.37				Carter et al[10]
Canadian occupational therapy and physiotherapy		18			MacDermid et al[11]
Otolaryngologists	15.6				Svider et al[12]
US plastic surgeons	15.3				Therattil et al[13]
Australian nursing and midwifery	14.3	14	76	69	McKenna et al[8]
Australian occupational therapy	13.5	13	71.31	68.5	Broome and Gray[3]

It was interesting to note that while males typically had a more developed track record, gender did not influence the level of appointment. While this is not unusual in bibliometric studies of academic levels, it contrasts with the findings for a number of different cohorts such as US social work academics and Australian psychologists were men tended to have a higher H-index and number of publications at each academic level.[10,14] Some authors like Geraci et al[15] and Carter et al[10] argue that a lack of accounting for gender in academic appointment is discriminatory, as women may have less opportunity to advance their research track record but should not be held back from academic level advancement. For Australian dietetic faculty, the current situation is equal pay for equal research record.

The findings from the present study suggest benchmarks for appointment to different academic levels. It should be acknowledged that the metrics measured in the present study only account for around half of variance in academic level. Teaching performance and scholarship, engagement with the community and leadership are also key aspects of the academic role and are also like to have an influence on the level of academic appointment. As acknowledged previously, the current level of appointment relies heavily on the number of publications. Other measures such as impact, readership and translation were not recorded in the present study and may be important factors in the contemporary political climate. Even within the field of bibliometrics, some authors suggest alternative measures such as the L-index[16] that help to control some of the limitations of the H-index. In the present study, these metrics would have been cumbersome to calculate as the Scopus database does not yet automatically calculate this metric.

For individual academics, the linear equation from the present study provides information on which to gauge their own academic career. Achieving a certain number of publications should not automatically translate into appointment at a corresponding academic level, as academic promotion should draw equally on teaching and engagement excellence depending on the career track of the individual academic. However, to guide academics to reflect on their own performance against benchmarks, a simple calculator has been constructed in Excel. Persons with no research track record should typically be appointed at associate lecturer level, notwithstanding other factors such as clinical or teaching expertise. Knowing the limitations of the formula described above, the calculator works well to from associate lecturer to associate professor levels, but the formula in the Excel calculator has been adapted to make suggestions as to whether you might consider applying for promotion to professorial level.

Benchmarking provides universities with guidance regarding the performance to expect from academics at each academic level as well as feedback regarding recruitment and promotion practices. The present study suggests that the research track record of each academic level is relatively consistent across universities, across university networks, and metropolitan vs regional universities. In line with previous studies in the field,[3] academics with a doctorate had a stronger research track record and the doctorate remains an important training opportunity and milestone towards a research career, with those without a doctorate rarely progressing past a handful of publications.

The appointment and promotion of dietetic academics primarily on the number of publications is problematic as it pays little attention to reach. Evaluating individual research performance should ideally incorporate productivity, scientific impact and research quality.[17] In future, university management might consider taking a more balanced approach in setting minimum benchmarks for research reach as indicated by the H-index or number of citations.

The present study provides an important benchmark for Australian dietetic academics. Future studies may replicate the methods in other countries to provide contextually relevant benchmarks. The study will likely need replication within a decade to re-establish current benchmarks, as history suggests that there is an ongoing evolution of research productivity within universities.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

This study was conceptualised by both authors. The authors acknowledge Emily Hendrie for collecting the data for this study as part of her university studies. Both authors reviewed and prepared data for analysis. Data analysis was conducted by the first author. Both authors interpreted the data and contributed to the preparation and revision of the manuscript. Both authors are in agreement with the manuscript and declare that the content has not been published elsewhere.

ORCID

Libby Swanepoel https://orcid.org/0000-0002-5551-897X

REFERENCES

1. Manore M, Myers E. Research and the dietetics profession: making a bigger impact. *J Acad Nutr Diet*. 2003;103(1):108-112.
2. Dietitians Association of Australia. *National Competency Standards for Dietitians in Australia*. Deakin, Australia: Dietitians Association of Australia; 2015.
3. Broome K, Gray M. Benchmarking the research track record and level of appointment of Australian occupational therapy academics. *Aust Occup Ther J*. 2017;64:400-407.
4. Sweileh WM, Al-Jabi SW, Sawala AF, Zyoud SH. Bibliometric analysis of nutrition and dietetic research activity in Arab countries using ISI Web of Science database. *SpringerPlus*. 2014;3(178):1-7.
5. Samman S, McArthur J, Peat M. Defining core elements and outstanding practice in nutritional science through collaborative benchmarking. *Asia Pac J Clin Nutr*. 2006;15(1):6-9.
6. Schiller M, Rudge S, Ballinger P. Research activities and interests of dietetic educators. *J Am Diet Assoc*. 1988;88(9):1070-1075.
7. Hu J, Stone N, Bartoszko J, Thoma A. An evaluation of H-index as a measure of research productivity among Canadian academic plastic surgeons. *Plast Surg*. 2018;26(1):5-10.
8. McKenna L, Cooper SJ, Cant R, Bogossian F. Research publication performance of Australian professors of nursing and midwifery. *J Adv Nurs*. 2018;74(3):495-497.
9. Ashfaq A, Kalagara R, Wasif N. H-index and academic rank in general surgery and surgical specialities in the United States. *J Surg Res*. 2018;4:884.
10. Carter TE, Smith TE, Osteen PJ. Gender comparisons of social work faculty using H-index scores. *Scientometrics*. 2017;11(3):1547-1557.
11. MacDermid JC, Fung EH, Law M. Bibliometric analyses of physical and occupational therapy faculty across Canada indicate productivity of rehabilitation research. *Physiother Can*. 2015;67(1):76-84.
12. Svider PF, Choudry ZA, Choudry AJ, Baredes S, Liu JK, Eloy JA. The use of the h-index in academic otolaryngology. *Laryngoscope*. 2013;123(1):103-106.
13. Therattil PJ, Hoppe IC, Granick MS, Lee ES. Application of the H-index in academic plastic surgery. *Ann Plast Surg*. 2016;76(5):545-549.
14. Malouff J, Schutte N, Priest J. Publication rates of Australian academic psychologists. *Aust Psychol*. 2010;45(2):78-83.
15. Geraci L, Balsis S, Busch AJB. Gender and the h index in psychology. *Scientometrics*. 2015;105(3):2023-2024.
16. Belikov AV, Belikov VV. A citation-based, author- and age-normalized, logarithmic index for evaluation of individual researchers independently of publication counts. *F1000Research*. 2015;4:884.
17. Sahel J. Quality versus quantity: assessing individual research performance. *Sci Transl Med*. 2011;3(84):84cm13.

How to cite this article: Broome K, Swanepoel L. Benchmarking the research track record and level of appointment of Australian dietetic academics. *Nutrition & Dietetics*. 2020;77:160–166. https://doi.org/10.1111/1747-0080.12586

Received: 25 August 2019 | Revised: 21 October 2019 | Accepted: 23 October 2019

DOI: 10.1111/1747-0080.12597

ORIGINAL RESEARCH

Nutrition & Dietetics Journal of the Dietitians Association of Australia WILEY

Hidden Jedi: A critical qualitative exploration of the Fellow credential and advanced expertise

Claire Palermo PhD, FDAA, Associate Professor[1,2] |
Louise Allen BNutDiet (honours), APD, Research Assistant[2] |
Janeane Dart Grad Dip Diet, AdvAPD, Senior Lecturer[1] |
Eleanor J. Beck PhD, FDAA, Professor Head of Discipline[3] |
Lynne Daniels PhD, FDAA, Emeritus Professor[4] |
Susan Ash PhD, FDAA, Adjuct Professor[1,4]

[1]Department of Nutrition and Dietetics, Monash University, Clayton, Victoria, Australia

[2]Monash Centre for Scholarship in Health Education, Monash University, Clayton, Victoria, Australia

[3]The School of Medicine, Faculty of Science, Medicine and Health, University of Wollongong, Wollongong, New South Wales, Australia

[4]School of Exercise Nutrition Sciences, Faculty of Health, Queensland University of Technology, Kelvin Grove, Queensland, Australia

Correspondence
Claire Palermo, Department of Nutrition and Dietetics & Monash Centre for Scholarship in Health Education, Monash University, Wellington Road, Clayton, Victoria 3800, Australia.
Email: claire.palermo@monash.edu

Abstract

Aim: The present study aimed to describe the characteristics of a Fellow and critically review factors relevant to recognition and promotion of excellence within the profession of dietetics in Australia.

Methods: Through the development of revised Competency Standards for the Fellow credential, a critical qualitative approach drawing on action research was used whereby members of the profession were given a voice in the research process. Six focus groups with a total of 30 participants explored descriptions of expertise and perceptions of Fellow by the profession and determinants of uptake. Focus groups were conducted during February and March 2018. Data were examined using a thematic analysis approach, with additional meaning explored through cultural historical activity theory.

Participants/setting – A purposive sample of Australian dietitians.

Results: Fellows embodied leadership, impact, influence, innovation and inspiration, internal and external to the profession and this was reflected in the revised Competency Standards. Potential Fellows perceived they were not capable of achieving the standard required. A lack of recognition of the credential both from within the community of dietetics, and externally, was identified. The role of the social system in which these credentials operate including the role of the professional association in awarding the credential are relevant.

Conclusions: Changes to the standards, and the system, may improve perceptions and uptake of the credential. This example provides highly relevant insights for the profession internationally.

KEYWORDS

action research, cultural historical activity theory, dietetics, focus group, qualitative research, recognition, registration

1 | INTRODUCTION

Credentials define the qualifications and scope of practice of health professionals.[1] They provide a minimum standard for quality performance internally, and to other professionals and the general public externally. Often articulated in Competency Standards, these higher order credentials, such as Fellow, generally recognise advanced expertise. The Fellow title across many professions implies a certain exclusivity and honour in the professional sense. Fellow has come to mean a member of a learned group, either in an academic sense or as a member of an exclusive society.[2] Internationally there is variation around what defines a 'Fellow'. The meaning and status of Fellow credentials differs within and across professions, as well as across countries.

Internationally in dietetics, achievement of the Fellow credential typically involves demonstration of achievement of a range of selection criteria using a portfolio form of assessment[3-5] (see also Table S1). Despite these differences, expertise is generally considered to involve leadership, together with specialisation in an area of practice.[6,7] The Fellow title may have different connotations to advanced or expert practitioner credentials, the latter assuming advancement of skill and expertise, while a Fellow may include honorary recognition related to volunteerism among other attributes. There is potential conflict between obtaining a credential or honour through only peer recognition (e.g., the Academy of Nutrition and Dietetics Medallion Awards or the British Dietitians Association Fellowship), compared to a process where individuals may apply or sit for a credentialing examination. In Australia, to date, only 22 dietitians, less than 1% of membership typical of other dietetics associations, have been awarded the Fellow credential.[8] This may reflect confusion in the term, the credential and its marketing by the profession, or how it is achieved and awarded. To the authors knowledge, there has been no exploration of the meaning of the term Fellow within the dietetics profession including reasons why (or why not) members might seek such credentials.

The Dietitians Association of Australia (DAA) first awarded the credential of Fellow (FDAA) in 2004 and the related Competency Standards, demonstrating leadership across varied practice contexts had not been reviewed since that time. The present study aimed to describe the characteristics of a Fellow and critically review factors relevant to recognition and promotion of excellence within the profession of dietetics. This process informed the development of new Competency Standards for the credential of FDAA, with the intention of facilitating change to the recognition of Fellows within the profession. More specifically the research aimed to address the following research questions:

- How is professional expertise understood in the context of the Fellow credential?
- How are the Fellow credential and related processes perceived?
- What factors potentially contribute to the poor uptake of the credential?
- What changes might be made to improve engagement with the credential?

2 | METHODS

A review of the FDAA Competency Standards was commissioned by the DAA providing an opportunity to explore the meaning of the credential and reasons for limited uptake. This review was preceded by a review of the National Competency Standards[9] and Advanced Accredited Practicing Dietitians (Advanced APD) Competency Standards.[7] These three sets of competency standards aim to describe the career progression of dietitians upon entry to the workforce from beginner (competent) progressing through to expert.

A critical qualitative approach was used.[10,11] Taking a critical approach allows researchers to work with those for whom the phenomenon exists, to examine issues of politics and power in shaping behaviour, analyse context and structure and facilitate change.[10] As such, this approach facilitated the ability to describe the work of a Fellow as well as identify the underlying factors (including geographical, historical, social, cultural, environmental and physical) influencing the perceptions of the existing credential and its low uptake by the profession. In addition, this research explored the extent to which the recognition of professional *expertise* was thought to extend beyond experiences and included structures and powers that influenced uptake of the credential. Ethics approval was obtained from Monash University Human Research Ethics Committee (Approval number 12233).

The methodology drew on action research[12] to examine the underlying factors or social structures of the situation and the experience of participants.[13] The research was supervised by a current Fellow and undertaken by three advanced practitioners (at the time of the study) and another Fellow with the support of a dietitian doctoral research candidate. As insiders, the researchers could use their lived experiences of the issue under investigation and focused on developing new knowledge to change current approaches to the attainment of the credential.[14] The researchers applied reflexivity whereby researchers acknowledged their role and perspectives, sought alternative understanding of the problem and challenged each other's interpretation of the data.[15]

Purposive sampling[16] was used to recruit experienced practitioners believed to represent rich cases from the

community best able to consider critical analysis of the Fellow credential. This sample included those recognised as advanced in their practice, including practitioners who had previously applied for the credential, and those who had not applied but were known experts in the profession. The sampling approach aimed to provide insight into the challenges experienced practitioners faced during the application process, and provide a voice to those who had not applied despite their potential for success. Neither of these group had previously been asked of their opinion of the credential. An invitation was sent out via the DAA weekly email to recruit practitioners with the Advanced APD credential (total n = 124) in addition to existing Fellows (n = 12) and selected senior dietitians who were either not Fellows or AdvAPDs (n = 4) at the time of the research.

Focus groups were chosen as the primary method for data collection because of their ability to generate discussion and debate among participants.[17] In addition, through joint discussions, the focus groups aimed to support shared development of ideas for potential changes required to the credential and process for application. As such focus group questions explored perceptions of the key attributes of the most distinguished member of the profession, how Fellow differs from advanced practitioner, perceptions of the Fellow credential and why the uptake is low, and process of attainment (Table 1). Questions were drafted by the first author (C.P.) and discussed with all authors for their suitability to explore the research questions prior to use.

All those volunteering to participate were scheduled to participate in a focus group and informed consent obtained. The last author (S.A.), a Fellow and experienced researcher, acted as the facilitator for all focus groups, while the first author was present, took notes and supported exploratory conversation through prompting. Both facilitators were experienced qualitative researchers and focus group moderators. As researchers with the experience of applying for either AdvAPD or Fellow credential, they had a unique insider perspective of the politics and power that have influenced the process and were in a position to facilitate change. The focus groups were conducted via Zoom (Zoom Video Communications, Inc. ©2018) videoconference technology whereby individuals joined the discussion on their personal video enabled device where available. Each focus group was scheduled for 1 hour, audio recorded and transcribed verbatim by a transcription service. Focus groups were conducted during February and March 2018.

As focus groups were conducted and transcripts became available, the first and last author read and conducted initial interpretation of the discussions to

TABLE 1 Focus group questions to explore perspectives of the DAA Fellow credential, what influenced uptake and what needs to change

Questions	Logic underpinning	Critical inquiry
Can you briefly introduce yourselves, your name, where you currently work/your work role?	To develop rapport among participants so they feel free to share ideas	Inspire a sense of ease to support freedom to talk freely and make change
Can you tell me your perceptions of the Fellow credential of DAA?	Opinion of credential to assist in interpreting responses for different participants in difference contexts	Areas that need to change, perceptions of power.
In your opinion, why is the uptake of the program low?	Explore real and perceived factors (geographical, historical, social, cultural, environmental and physical) influencing the opinions of the credential	Explore historical, context behind the credential and factors potentially influencing change
In your opinion, what are the key work roles of the most distinguished members (the most qualified) of our profession?	Identify work role, activities and practice of Fellow and how these are perceived by the profession	Give a voice to current Fellows and those who may consider applying for the credential into the future
What does/would having this credential as a fellow mean to you?	Identify what factors affecting application or identification with the role.	Identify issues of power or inequity and areas in need of change
If you have applied or considered applying for Fellow credential what was the process like?	To identify barriers to application that may be cultural or practical and identify ideas for consideration in new application process.	Identify issues of power or inequity and areas in need of change
Is there anything else you would like to say or recommend that we consider?	Opportunity for participants to reflect on why they attended, what they had hoped to say and offer any thought that had not been prompted by key questions.	Recommendations for change

continually reflect on whether research questions were being answered and if the questions needed redefining, typical of a critical approach.[11] While there was depth concepts among experienced practitioners, in line with our critical action research approach, these participants identified that the perspectives of less experienced, but dietitians potentially eligible for the APD credential, were not captured. This resulted in the scheduling of an additional focus group which was planned to capture the perspectives of less experienced dietitians approximately 10 years post-graduation to explore their perspective on the credential, what it meant to them and any power structures within the profession they perceived as influencing this perspective. This level of experience was suitable as the minimum time frame for dietitians to seek the credential of FDAA is 10 years post-graduation. Dietitians Association of Australia administrative staff sent an email to all dietitians who graduated in 2008 (approximately 300) inviting them to participate in the study with three dietitians volunteering to participate. Three individuals volunteered to participate in this focus group.

The same set of qualitative data was used for both the revision of the FDAA competency standards and to answer the research questions of the present study. The process of constructing the Competency Standards was applied to the data in line with the process for developing standards for entry level and advanced level practice.[7,9] Once all transcripts were received data were analysed using thematic analysis.[18] Initially inductive open coding of the data was undertaken independently by the first and last author. As the codes appeared to represent categories previously identified in defining the advanced practice of the profession,[7] the same coding framework was applied to this new set of data (Table 2). In addition to this deductive approach, any codes not reflected within

TABLE 2 Coding framework for analysis of focus group data

Innovate	Develops innovative methods and approaches to solving nutrition issues or services • Being entrepreneurial in their approaches and seeking alternative or new ways of doing things • Continually striving to challenge current practice and embrace change • Being early adopters of new evidence, leading others to change practice and renewing the way things are done • Being strategic in placing themselves in positions where they can lead change. Looking for opportunities to extend themselves and equip themselves to be able to create solutions to problems
Inspire	Inspires and motivates others. Acts as a mentor, teacher, leader, supporter coach to others such that they achieve great things. Senior manager role. • Being asked for advice by others inside and outside the profession • Being approachable and willing to assist others in their area of expertise • Mentoring, student supervision or making yourself available to others seeking guidance • Building the capacity of others to do well and achieve nutrition outcomes through guiding other's approach to practice • Sharing expertise rather than holding on to knowledge and experience for themselves only
Impact	Demonstrates impact on health and nutrition outcomes and/or services. Engaged in professional and personal development such that service/practice improves and has an impact on nutrition of individuals, groups or populations. • Involved in service improvement, research and informing change to practice • Pushing boundaries of practice or extending the typical scope of practice in a specific area or may include a traditional area of practice (through experience but also through additional training, qualifications or higher degrees) • Linked to patient/client/family, service improvement or population health outcomes • Raising the standards of practice to improve dietetic services, strive for better health and nutrition outcomes and provide leadership on the health impact dietitians can make
Influence	Exerts significant influence. Advocating for the profession of nutrition and dietetics within and external to the profession. Engages in change management. • Supports the profession to develop and change through mentoring, supervision and unplanned support • Works effectively in teams (across multiple disciplines and practice contexts) as recognise the role of others in improving nutrition outcomes • Build the capacity of others, lead others and engage in networks to advance their practice as well as others • Development and maintenance of key collaborations and partnerships that involve transferring the capacity to prioritise and improve nutrition to others through leadership • Promoting the profession of dietetics to consumers and other relevant stakeholders

Note: For all: Experts in the field, approachable, needs to have higher level interpersonal skills and negotiation and conflict resolution skills, commitment to seeking external feedback and continually reflecting on practice to continually improve performance, resilience, personal development essential for good and advanced level practice.

the existing framework were also extracted from the data. All focus group data were analysed using this coding framework in *NVivo12* (QSR International, 2018) by the second author (L.A.). A subset of one focus group each was analysed by two other authors (J.D., E.J.B.) to enhance rigor and credibility. It was during this time that the need to conduct an additional focus group for less experienced yet eligible dietitians was identified as described above. This initial analysis was sent back to all participants to provide feedback and gather further depth. Quotes were selected from each focus group, rather than each participant to protect anonymity and provide further illustration of the findings. In addition, to provide extra dimension to the analysis and support addressing all of the research questions, the researchers considered the use of theory to explain the concepts identified. Cultural history activity theory (CHAT)[19] was chosen to explain the concepts identified in particular the power structures influencing application processes.

Cultural historical activity theory has been used to explain the complexity of the health-care workplace.[20,21] The theory describes the interactions between individuals in their social system and 'considers how identities are constructed through work-based practices and how the management of identity relates to historically determined roles and rules'.[20(p300)] This theory suggests that individuals negotiate their role with a social system to achieve specific goals.[22] As such, the theory facilitates an analysis of professional practices and systems of activity as a whole.[19] It was therefore deemed appropriate for the study of individuals' engagement with the Fellow credential.

Activity systems describe collective activity undertaken by individuals within the system, with different roles, functions and perspectives. They have six components: (a) The subject (or actor), (b) an object (things that lead to the sought after outcome), (c) the tool(s) (either material or conceptual) employed by the subject to pursue the sought-after outcome, (d) the community – the people who share with the subject an interest in the object, (e) the rules that control the subject's activities toward an object and (f) the division of labour – what is being done by whom toward the object. The relationship between the subject and the community is mediated by the rules and division of labour. The division of labour includes division of tasks, power, positions, access to resources and rewards.[19] This theory was used to interpret results whereby both the perspectives of the system and subjects were analysed. As analysts, the researchers attempted to view the activity system from above while also selecting a subject through whose eyes the interpretation of the activity was constructed.[23] In the context of this research, the promotion of and recognition of excellence within the profession of dietetics is the activity system considered by this research, and a potential fellow, the subject. The other elements of the system are described in Figure 1.

3 | RESULTS

Six focus groups were conducted with 30 participants (28 female, two males, mean years of DAA membership 28 years, including six Fellows, 50% response rate, 19 AdvAPDs, 15% response rate and five APDs), with representation from all states across Australia. There were between four and six participants in each focus group and the discussion lasted for between 45 and 61 minutes. Thirteen out of the 30 participants (43%) provided written feedback on the preliminary analysis. The data suggested that a Fellow operated at a level of advanced practice beyond their organisation and usually beyond the profession. They engaged in activities for the benefit of the profession irrespective of personal benefit. New competency standards for the level of credential were developed (see https://daa.asn.au/apd-program/apd-program-handbook/fellow-of-apd/). In addition, four key themes identified factors relevant to recognition and promotion of excellence within the profession. Namely, (a) Fellows exhibit high level leadership; (b) the credential is out of reach; (c) they will never be good enough and (d) a lack of recognition deters applicants.

Theme 1: *Participants described Fellow practice as inclusive of visionary* high level leadership. *Fellows were described as leaders who continue to grow personally and professionally while encouraging and mentoring emerging leaders at all levels, as well as empowering others to grow and emerge as leaders in their own right. They advocate for the profession of nutrition and dietetics across a breadth of environments and can influence, inspire and innovate to solve practice problems and change practice with demonstrated evidence of their impact. They were described as leaders who speak with a reasoned and relatively united voice about the profession of nutrition and dietetics – leaders who bring people together rather than creating conflict, acting in the best interests of the profession.*

> '....recognition of that really, really exceptional area of practice. Advanced is very high but that really exceptional practitioner with those real national and international leadership qualities'. (Focus group B, AdvAPD)

Fellows were described by participants as pioneers, using opportunities to take risks to promote new ideas

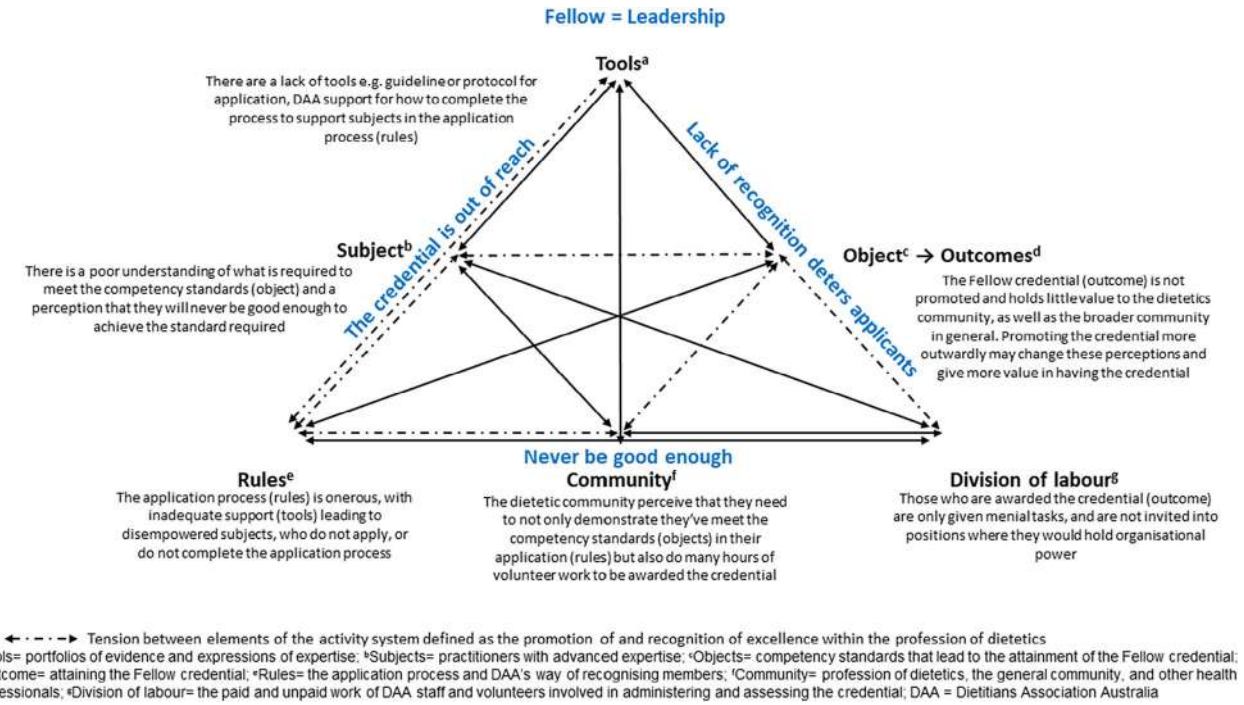


FIGURE 1 Conceptualisation of themes from results in the context of CHAT. Adapted from Foot.[19] CHAT, cultural historical activity theory

and to change public (health) policy. They showed strategic thinking and high-level negotiation skills across a broad range of activities, and not just in their area of specialisation. Fellows develop expertise in others, nurturing, coaching and training, and acting as a role model. They build capacity in career structures and scaffold excellence and growth with an outward looking focus, rather than on their own career development. Their expertise was contributed over and above their paid work with a clear focus on volunteering.

The expertise of Fellows was described as evident through their contribution to a large body of evidence and demonstrated impact. Their ability to lead practice areas and teams and have a senior governance role was also evident. Fellows were able to manage difficult decisions in resource management and lead and evaluate large programs, with a reach across the organisation beyond their own area of specialisation. Fellows demonstrated both internal and external advocacy demonstrating tangible outcomes as a direct result of advocacy. They excelled in partnership-building and represented dietetics outwardly by influencing other organisations. The participants reported that the current competency standards for Fellow somewhat reflected this expertise but were overly complex.

Theme 2: *Participants described the current processes and standards make the credential* out of reach. *The processes involved in applying for the credential were perceived as onerous. This was perceived from participants who had not yet applied and real for those who had embarked on the process.*

> '.... it shouldn't be an easy process, but I think we've made it fairly cumbersome'. (Focus group A, Fellow)

They perceived that DAA had established a difficult process to ensure the bar was set high enough and felt the process had multiple road blocks that prevented them to attaining the credential.

> '...we tend to.. make ...so many hurdles around just to set up rules and ways of doing things. We inadvertently trip people up or make life difficult for them'. (Focus group B, AdvAPD)

This correlated with a description of the volume of evidence that was required for the application and the magnitude of the task to compile for consideration. The number of competencies and areas that required evidence were reported to relate to the need for large volumes of data to support the application case.

> '...I just got exhausted and gave up and that was 18 months ago and I really now wonder

> if I will ever finish it because I just thought I'm just too busy, I'm too tired and trying to come up with creative ways to meet this is just too hard'. (Focus group B, AdvAPD)

Many participants mentioned that the presence of research and evaluation as a key domain of competency implied that only academics were 'worthy' of the credential and that meeting the standards for research and evaluation was impossible for those not working in an academic setting. On the contrary, they agreed that those in the profession working at an advanced level should be engaging in research activities, informing nutrition and dietetic practice and beyond. It was stated that this was easier to demonstrate when working in a university environment however all participants felt that undertaking research in its broadest sense was essential at Fellow level. This may be difficult to demonstrate if working as a practitioner, especially in regional settings or in positions where driving policy was the main work role, and was cited as a barrier to applying.

Participants were aware of infrastructure within the DAA to support applications to advanced practice, but participants explained that nothing was in place to support application to Fellow, leaving participants to describe the process as 'guesswork'. A lack of clarity around what is required and no clear outline of how applications were assessed was also described with some participants, inferring there may be a hidden agenda.

Theme 3: *Some participants expressed feelings of self-doubt that they might not succeed. This self-doubt was evident with the participants discussing fear, lack of resilience and* never being 'good' enough *to ever achieve the credential. A focus on perfectionism and lack of resilience was suggested as a reason for not applying. Upon exploration, this was reported to stem from the fact that those who were already Fellows were highly esteemed in the profession and members of a 'special' group. Others perceived a significant gap in their abilities compared to the existing Fellows.*

> 'there is a much higher bar than there perhaps is, and some of that perhaps stems from the first group of Fellows were such high achievers, that the bar was set at that level...' (Focus group A, Fellow)

There was also the perception that within a female dominated profession there was a lack of self-efficacy and belief in abilities, leading to a perception that the participants would never be able to achieve the standard required.

The Fellows themselves reported that anyone applying would benefit from mentoring especially if one area of competency was weaker than others. Many participants indicated that they had not considered applying for the advanced credential until a mentor had tapped them on the shoulder and encouraged them to apply. The participants described that the process should be a continuous one, rather than clear pass/fail, with applicants close to meeting the competency standards given a chance to reapply or address the deficiencies rather than be rejected outright. Feedback on unsuccessful applications was considered blunt and non-specific.

> 'I think people also don't apply because they're afraid of putting themselves out to a committee, that they're afraid that they won't get up. Perhaps they're not very resilient as well.' (Focus group A, Fellow)

Theme 4: *The participants perceived a* lack of recognition. *While individuals were recognised, their status as Fellows was invisible to the profession, especially at professional events, and to the broader community. Younger participants in the focus groups stated that having the Fellow credential is not talked about so therefore not aspired to within the profession and that, without a profile with the public, there was little incentive to apply. There remained confusion among participants as to whether the Fellow was a credential or an honour. They explained that the credential was seen as being awarded rather than as an achievement requiring the demonstration of advanced competencies. The credential was viewed as recognition from peers rather than as a marketing tool to the general public or a credential within your workplace that provided return on the investment made to apply. In particular, it did not necessarily lead to a promotion or a higher salary.*

> 'so for me there's no return on investment .... I'm not going to get a pay rise, it's not going to do anything for me'. (Focus group D, APD)

Some participants wondered what role the Fellows actually played and others suggested that rather than being feted by the profession, they were asked to do rather onerous tasks.

> 'I don't think we use our Fellows near enough in that capacity around being an expert voice if you like.... they're work horses

> rather than esteemed members that we can draw on that collective wisdom. So it's that wisdom that we need to draw on and to have them as a network of wise practitioners.' (Focus group C, AdvAPD)

Many felt that applying for Fellow was a DAA activity with little meaning beyond the association. The focus group of Fellows themselves lamented the fact that there was no opportunity for Fellows to meet to celebrate new awardees or even to celebrate their own successes and felt unsure how DAA saw their role. Rather it was up to the individual to apply the credential how they saw fit. Retired Fellow participants were concerned their skills were seen as no longer relevant, even though they were willing to continue to contribute. There was certainly a theme that the profession needs to celebrate the Fellows more and use them much more strategically in mentoring members of the profession such that it can continue to grow and maintain a suitable succession plan.

> '..we...need to think about what...we do about the Fellows....visibility, so that the wisdom and that experience is still accessible to everybody'. (Focus group A, Fellow)

In the context of CHAT, the recognition of and promotion of excellence within the profession of dietetics was the activity system considered by this research. These data support that the advanced expertise needed to become a Fellow, embodies leadership, impact, influence, innovation and inspiration internal and external to the organisation. Within the activity system, there are tensions and disconnections between several of the elements in the system that may help to explain why the uptake of the Fellow credential is so low (Figure 1).

The application process (rules) which involves collation of evidence to demonstrate the competency standards (objects) is perceived as onerous as the guidelines or protocols for how to complete the application are perceived to be out of reach (tools). This leaves the subjects disempowered, either not attempting or not completing applications for Fellow DAA. The Fellow credential itself (outcome) is not marketed and as a result there is a perception that it may hold little value within the dietetic community, but also the broader community (community). The activity system wholly exists to recognise excellence, and yet the data suggest that our community (the profession of dietetics and the wider community in which they serve) perceives the credential to carry little weight or were not even aware of the credential. External promotion of the credential may change the perception of the outcome to these dietitians and thus drive uptake. There is a perception that in order to be awarded the credential the subjects not only need to provide evidence of achieving the competency standards but also need to have contributed large amounts of unpaid work to DAA. This creates a tension between the dietetic community and the rules, whereby the unwritten expectation of volunteer time to the association is perceived as a rule. Potential applicants' reported low self-efficacy may be explained by a disconnection between the subjects and the objects, by a poor understanding of what is actually required or that the objects themselves (the current Competency Standards) do not actually reflect the practice of a Fellow. The power perceived in those who have the credential and are allowed to assess incoming applications describes a division of labour that may influence the outcome. In other contexts, there is very little 'power' as those with the credential are often only delegated relatively menial tasks (division of labour) that do not utilise their expertise. So, for example, after the initial awarding of the credential, there is no recognition of what role these experts might play in the organisation. They are not awarded positions of organisational power or recognised as significant stakeholders providing long-term perspective. Thus, there is confusion around whether the credential is a passive recognition at the end of an individual's career, or something which should be more dynamic to promote the profession externally.

4 | DISCUSSION

The present study aimed to describe the characteristics of a Fellow and review factors relevant to recognition and promotion of excellence within the profession of dietetics, and in doing so facilitate change to the recognition of Fellows within the profession. This exploration may have implications for other professions considering higher-level credentials. A number of juxtapositions were found between perceptions and reality around the credential. For example, holding the credential of Fellow meant a recognition of leadership and expertise for the recipient. However, enabling those qualities of leadership and expertise to promote the profession widely as well as enabling potential applicants to apply was recognised as lacking. The Fellow credential is positioned within a range of cultural and historical factors in the professions, which may have prevented engagement of individuals with the process and the title. Namely, potential applicants to the credential reported feeling disempowered by the system, that they will never be good enough to achieve the standard required, together with a lack of recognition of the credential from within the community of dietitians and externally. This may be a reflection of the

profession's culture where those acting at a very high level may remain hidden. Whether these findings are transferable to dietetics professional cultures in other countries remains unknown.

Translating the findings of the present study into improvements to the application process have been adopted.[8] Our findings suggest that the utilisation of the existing Fellows to support those working at an advanced level to prepare their application and achieve the standards through mentoring, will improve uptake, as will the addition of tools to help guide the process in Australia. Involving all members of the profession regardless of credential in the application process may support a shared understanding of the process and credential. Cultural change within the profession, in the way it promotes and uses Fellows, as well as an increase in the number of Fellows, will be further evidence that change has been accomplished.

The key finding that some members of the profession perceived they would never be 'good enough' to be awarded the Fellow credential, may be explained by the female dominance in the profession. The most recent estimates indicate approximately 94% of the profession are female.[24] While being female in itself is not linked to low self-efficacy, there is evidence to suggest that females are more likely to experience 'imposter phenomenon'. The phenomenon has been described as a set of attributes and behaviours of high-achieving women who grapple with accepting their capability and success.[25] The self-esteem gap between men and women is recognised across cultures,[26] with men far more likely to seek 'promotion' than women. If this phenomenon exists within the discipline, then it may not matter what the Competency Standards state or what the activity system portrays as influential against uptake. Rather, more explicit work managing the deep perceptions that precede this perspective in our profession's high achieving female cohort would be needed. Changing the process (rules/tools) to explicitly address this issue could be beneficial for those who are able to overcome self-doubt. A formal process for mentoring potential candidates by Fellows may also assist. The literature suggests that women are also more likely to follow rules, explaining our findings of how the rules are a potential barrier.[27] This female predominance in the profession internationally may mean that imposter phenomenon needs to be considered in the implementation of advanced practice credentials. Rules around self-assessed processes with peer nomination may also need to be considered.

The key findings that expertise is about leadership and recognition is synonymous with other literature in dietetics suggesting that advanced practice is distinguished by leadership rather than just specialisation (particularly years of experience alone) in an area of practice.[6,7] For a profession to truly advance and create change, leadership is required and this should be supported by the professional association. In the existing Fellow credentialing system for dietitians in Australia there is currently no appeal or complaints process, nor training of assessors. The DAA has power over which Fellows are called upon for certain responsibilities but there are limited plans in terms of how to use the Fellows for the profession's strategic gain. There is no strategic use of the Fellows by the Board of DAA and development of a specific strategy for such promotion and skill utilisation may be of value. More work is required to translate the findings from this critical analysis into a system that supports leadership in practice.

The strengths of the present study include the steps used to ensure trustworthiness of the data with multiple researchers involved in data collection and analysis and the overlay of the data analysis with CHAT allowing for multiple interpretations to be considered. The data is limited to only those in the profession who chose to respond to participation requests and while adequate depth and breadth of data were obtained to adequately address the research questions, the perspectives of those who did not participate, particularly those seeking the credential that were not already credentialed as Advanced or Fellow, is not known and may provide alternative explanations.

The present study found that expertise within the Australian dietetics profession is positioned within a range of cultural and historical factors that may have prevented engagement of individuals with the process of application and ultimately the Fellow credential. Potential Fellows report feeling disempowered by the system and perceive they will never achieve the standard required. A lack of recognition of the credential from within the community of dietitians and externally was also identified as a factor. The implications of these results for dietitians and other professions alike include acknowledging the role of the social system in which credentials operate and the competing forces within the system that may explain unpredicted outcomes. Change to the system will likely improve uptake. Professions awarding expertise through a Fellow credential need to consider the factors within the activity system that may predict or influence the professions' behaviour around the credential.

CONFLICT OF INTEREST

C.P. is Associate Editor of *Nutrition and Dietetics* journal.

AUTHOR CONTRIBUTIONS

C.P. and S.A. conceptualised the study with advice from L.D., E.J.B. and J.D. S.A. and C.P. collected the data.

L.A. analysed the data with support from C.P., S.A., E.J.B. and J.D. C.P. wrote the first draft with contributions from all authors. All authors reviewed and commented on subsequent drafts of the manuscript.

ORCID

Claire Palermo https://orcid.org/0000-0002-9423-5067
Louise Allen https://orcid.org/0000-0003-1087-2235
Janeane Dart https://orcid.org/0000-0002-7563-0395
Eleanor J. Beck https://orcid.org/0000-0002-3448-6534
Lynne Daniels https://orcid.org/0000-0002-1278-1284
Susan Ash https://orcid.org/0000-0003-2078-7560

REFERENCES

1. Department of Health and Human Services Victorian Government. *Allied Health: Credentialling, Competency and Capability Framework (Revised Edition). Driving Effective Workforce Practice in a Changing Health Environment*. Vol 2017. Melbourne, Australia: Victorian Government Health and Human Services; 2014.
2. Middleton S, Walker K, Leigh T. Why fellowship? Peak professional bodies, peer recognition and credentialing in Australia. *Collegian*. 2009;16:177-183.
3. Bradley R. Fellow of the American Dietetic Association credentialing program: development and implementation of a portfolio-based assessment. *J Am Diet Assoc*. 1996;96:513-517.
4. British Dietetic Association. BDA Honours. https://www.bda.uk.com/about/awards/honours. Accessed May 23, 2019.
5. Way M, Voevodin M. *Developing a Professional Recognition Program for Dietitians. Final Report to the DAA Board*. Canberra, Australia: Dietitians Association Australia; 2004.
6. Maillet JOS, Brody RA, Skipper A, Pavlinac JM. Framework for analyzing supply and demand for specialist and advanced practice registered dietitians. *J Acad Nutr Diet*. 2012;112:S47-S55.
7. Palermo C, Capra S, Beck E, Dart J, Conway J, Ash S. Development of advanced practice competency standards for dietetics in Australia. *Nutr Diet*. 2017;74:327-333.
8. Dietitians Association of Australia. *Fellow of DAA*. Canberra, Australia: Dietitians Association of Australia; 2018:2018.
9. Palermo C, Conway J, Beck E, Dart J, Capra S, Ash S. Methodology for developing competency standards for dietitians in Australia. *Nurs Health Sci*. 2016;18:130-137.
10. Swaminathan R, Mulvihill T. *Critical approaches to questions in qualitative research*. New York. NY: Routledge; 2017.
11. Denzin N. Critical qualitative inquiry. *Qual Inq*. 2017;23:8-16.
12. Reason P, Bradbury H. *Handbook of Action Research: Participative Inquiry and Practice*. London, UK: Sage; 2001.
13. de Koning K, Martin M. *Participatory Research in Health. Issues and Experiences*. Wiltshire: Redwood Books; 1996.
14. Sikes P, Potts A. *Researching Education from the Inside. Investigations from within*. New York, NY: Taylor and Francis; 2008.
15. Fade S, Swift J. Qualitative research in nutrition and dietetics: data analysis issues. *J Hum Nutr Diet*. 2011;24:106-114.
16. Harris JE, Gleason PM, Sheean PM, Boushey C, Beto JA, Bruemmer B. An introduction to qualitative research for food and nutrition professionals. *J Am Diet Assoc*. 2009;109:80-90.
17. Willis K, Green J, Daly J, Williamson L, Bandyopadhyay M. Perils and possibilities: achieving best evidence from focus groups in public health research. *Aust N Z J Public Health*. 2009;33:131-136.
18. Braun V, Clarke V, Terry G. Thematic analysis. *Qual Res Clin Health Psychol*. 2014;24:95-114.
19. Foot K. Cultural-historical activity theory: exploring a theory to inform practice and research. *J Hum Behav Soc Environ*. 2013;24:329-347.
20. Ajjawi R, Rees C, Monrouxe L. Learning clinical skills during bedside teaching encounters in general practice. *J Workplace Learn*. 2015;27:298-314.
21. Larsen D, Wesevich A, Lichtenfield J, Artino A, Brydges R, Varpio L. Typing knots: an activity theory analysis of student learning goals in clinical education. *Med Educ*. 2017;2017:687-698.
22. Varpio L, Aschenbrener C, Bates J. Tackling wicked problems: how theories of agency can provide new insights. *Med Educ*. 2017;51:353-365.
23. Engeström Y, Miettinen R. Introduction. In: Engeström R, Miettinen R, Punamaki L, eds. *Perspectives on Activity Theory*. New York, NY: Cambridge University Press; 1999:1-18.
24. Health Workforce Australia. *Australia's Health Workforce Series. Dietitians in Focus*. Adelaide. Australia: Health Workforce Australia; 2014.
25. Clance P, O'Toole M. The imposter phenomenon: an internal barrier to empowerment and achievement. *Women Ther*. 1987;6:51-64.
26. Bleidorn W, Arslan R, Denissen J, et al. Age and gender differences in self-esteem—a cross-cultural window. *J Pers Soc Psychol*. 2016;111:396-410.
27. Egan M, Matvos G, Seru A. When Harry Fired Sally: The Double Standard in Punishing Misconduct. 2017. https://www.nber.org/papers/w23242. Accessed November 5, 2019.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Palermo C, Allen L, Dart J, Beck EJ, Daniels L, Ash S. Hidden Jedi: A critical qualitative exploration of the Fellow credential and advanced expertise. *Nutrition & Dietetics*. 2020;77:167–176. https://doi.org/10.1111/1747-0080.12597