




The Nutrition Society of Australia 46th Annual Scientific Meeting was held at the Parmelia Hilton in Perth WA on 29 November–2 December 2022

Conference on ‘Sustainable nutrition for a healthy life’

Cultural adaptations and tailoring of public health nutrition interventions in Indigenous peoples and ethnic minority groups: opportunities for personalised and precision nutrition

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Indigenous peoples and ethnic minority groups often experience poor diet quality and poor health outcomes. Such inequities may be partially due to nutrition interventions not meeting the unique cultural and linguistic needs of these population groups, which could be achieved using co-creation and/or personalised approaches. Cultural adaptation or tailoring of nutrition interventions has shown promise in improving some aspects of dietary intake, but this requires careful consideration to ensure it does not inadvertently exacerbate dietary inequities. The aim of this narrative review was to examine examples of cultural adaptations and/or tailoring of public health nutrition interventions that improved the dietary intake and to consider implications for the optimal design and implementation of personalised and precision nutrition interventions. This review identified six examples of cultural adaptation and/or tailoring of public health nutrition intervention in Indigenous peoples and ethnic minority groups across Australia, Canada and the US. All studies used deep socio-cultural adaptations, such as the use of Indigenous storytelling, and many included surface-level adaptations, such as the use of culturally appropriate imagery in intervention materials. However, it was not possible to attribute any improvements in dietary intake to cultural adaptation and/or tailoring *per se*, and the minimal reporting on the nature of adaptations limited our ability to determine whether the interventions used true co-creation to design content or were adapted from existing interventions. Findings from this review outline opportunities for personalised nutrition interventions to use co-creation practices to design, deliver and implement interventions in collaboration with Indigenous and ethnic minority groups.

Cultural adaptations: nutrition interventions: personalised nutrition: Indigenous: review

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Indigenous peoples and ethnic minority groups often experience poor diet quality and poor health outcomes⁽¹⁾. Although widely recognised for decades, these groups are most strongly associated with dietary and health inequities⁽²⁾, which persist in high income countries such as Australia^(3,4). For example, compared with non-Indigenous Australians, Australian Indigenous peoples are 2.1 times more likely to die before their fifth birthday, and 1.7 times more likely to have a disability or restrictive long-term health condition⁽³⁾. Comparable to global estimates⁽⁵⁾, data suggest that just under one-fifth (19%) of health inequities in Australia are related to dietary risk factors, including high alcohol consumption and inadequate fruit and vegetable consumption⁽³⁾. Dietary inequities are shaped primarily by structural factors, such as socioeconomic position⁽⁶⁾, yet culturally insensitive nutrition interventions are likely to exacerbate inequities. Thus, to address dietary risk factors effectively, nutrition interventions that are co-created to be sensitive to the cultural needs of Indigenous peoples and ethnic minority groups are required.

Cultural adaptation is broadly defined as any modification that changes the approach to a service delivery or a treatment Regimen to accommodate the target populations' cultural beliefs, attitudes, language, context and/or behaviours⁽⁷⁾. Based on the six stages of cultural adaptation outlined in the Barrera and colleagues' adaptation model⁽⁸⁾, such changes should consider the needs of the target population by engaging in meaningful collaboration during intervention design, development, testing, implementation and evaluation. Cultural factors relevant to Indigenous peoples and ethnic minority groups have been examined previously^(9,10), including a review of Aboriginal and Torres Strait Islander culture that identified six broad domains: (1) connection to and caring for country, (2) traditional knowledge and cultural beliefs, (3) language, (4) self-determination and leadership, (5) family, kinship and community and (6) cultural expression and continuity⁽⁹⁾. These cultural factors are, thus, important considerations when adapting nutrition interventions⁽¹¹⁻¹³⁾.

Cultural adaptation of nutrition interventions

Evidence from meta-analyses suggests that culturally adapted interventions are more effective at changing health-related practices than non-adapted interventions⁽¹⁴⁾. Cultural adaptations within the context of nutrition interventions for Indigenous peoples⁽¹¹⁾ and ethnic minorities^(12,13) have been reviewed previously. To better understand the breadth of approaches used to achieve cultural adaptations, Kreuter *et al.*⁽¹⁵⁾ categorised these into five approaches: peripheral, evidential, linguistic, constituent involving and socio-cultural. In addition, Resincow *et al.*⁽¹⁶⁾ have proposed a two-dimensional model for understanding the depth of cultural adaptations, in which adaptations are described as either surface level or deep level changes. To combine both approaches, Vincze *et al.*⁽¹¹⁾ described a framework for classifying

the breadth and depth of cultural adaptations so that each of the five approaches are defined as surface or deep changes. As a result, peripheral and evidential cultural adaptations are positioned as surface changes, linguistic and constituent-involving adaptations are either surface and/or deep changes and socio-cultural strategies are deep changes. For example, peripheral changes are surface level as they provide the appearance of being culturally appropriate and include the use of colours, imagery and music that are relevant to the target group. In contrast, socio-cultural changes are deep level as they entail efforts to recognise, reinforce and build upon the cultural values of the group (such as traditional knowledge and cultural expression) to ensure that the intervention fits the context and values of group members. Consideration of socio-cultural adaptations aligns with efforts to consider the lived and living experiences of the communities that they serve so that inequities in social and/or economic resources are not widened further^(17,18). As such, socio-cultural changes incorporating lived experience can be incorporated into well-established frameworks that consider intervention development as a dynamic process involving iterative cycles of development with stakeholder input throughout⁽¹⁹⁾.

Reviews of cultural adaptations of nutrition interventions for Indigenous peoples and ethnic minority groups are limited in number and scope⁽¹¹⁻¹³⁾. There is a need to summarise evidence for both target groups to understand whether cultural adaptation of existing interventions is appropriate or whether it is preferable to develop new, tailored interventions in consultation with community members (i.e. co-creation)⁽²⁰⁾. In the case of the latter, there may be significant opportunities for the consideration of culturally tailored interventions within the rapidly advancing field of personalised and precision nutrition⁽²¹⁾, as tailored interventions have proven more effective at improving individuals' dietary patterns than one-size-fits-all approaches⁽²²⁾.

Cultural adaptation/tailoring in the context of personalised and precision nutrition

There is no consistent definition of personalized and precision nutrition, as definitions differ depending on the field and scope of research⁽²³⁾. For the purpose of this review, personalised nutrition is defined as an approach in which sociodemographic characteristics, cultural and social heritage, dietary patterns and preferences, behaviours and practices and other relevant biopsychosocial information are used to design nutrition interventions that are relevant and acceptable to individuals within a community or population⁽²²⁾. In turn, the overarching term of precision nutrition is defined as a methodology to integrate biopsychosocial information at scale^(24,25). Therefore, in broad terms, personalised and precision nutrition interventions both aim to maintain or improve health and well-being by personalising the design and delivery of interventions based on information on the characteristics of individuals^(24,25). Thus, cultural adaptations and tailoring to help ensure the design and delivery

of nutrition intervention is sensitive to cultural values of the target group, such as traditional knowledge and beliefs, represent just one way to personalise public health interventions to potentially improve their effectiveness.

Aims

The aim of this narrative review was to examine key examples of cultural adaptations and/or tailoring of public health nutrition interventions and to consider their implications for the future design and implementation of personalised and precision nutrition interventions.

This review includes examples from Australia, Canada and the US. These countries were selected as they are high-income countries with persistent dietary and health inequities between Indigenous and non-Indigenous populations and ethnic minorities and White population groups⁽²⁶⁾ and are often designated 'immigrant nations' due to high proportions of immigrant families and ethnic minority groups⁽²⁷⁾. We included studies from prior systematic reviews that had the strongest study designs and/or that achieved the highest quality ratings (where available). To help inform the effective design of future nutrition interventions, we included only studies that had one or more positive impact(s) on dietary intake (defined based on statistically significant changes in dietary intake, where available). Importantly, we attempted to distinguish between culturally adapted and culturally tailored interventions wherever possible.

Indigenous peoples

Culturally adapted or culturally tailored nutrition or multi-component interventions for Indigenous people are reviewed below and are summarized in [Table 1](#). These include SHOP@RIC intervention in rural and remote Indigenous communities in the Northern Territory of Australia⁽²⁸⁾, the Sandy Lake Health and Diabetes Project in First Nations peoples living in Northern Canada⁽²⁹⁾ and the Navajo Healthy Stores program among Indigenous peoples in the US^(30,31).

SHOP@RIC was a stepped-wedge RCT offering a 20% price discount on fruits, vegetables, water and artificially sweetened soft drinks, implemented with or without in-store consumer education in 20 stores in remote Indigenous communities in Australia⁽²⁸⁾. As detailed in [Table 1](#), the intervention included elements of cultural adaptation (peripheral surface changes) and tailoring (socio-cultural deep changes), such as education material that drew on the importance of elders in knowledge transfer. The intervention was implemented in close collaboration with community leaders and store managers. It included store promotional materials (to promote the price discount) developed by an expert working group, along with consumer educational materials developed by experts and community residents. Complete implementation of the store promotional materials and consumer education was not achieved in all 20 stores (e.g. the promotional materials were displayed for approximately half of the intervention period in 13 stores). Nonetheless, findings showed that the price discounts

were associated with a 12 g increase in per-person sales of fruits and vegetables (15% of an additional serving daily), while consumer education had a small additive effect on vegetable purchases after 6-month follow-up. While price discounts were associated with small positive shifts in purchases of bottled water, they were also associated with increased purchases of foods/drinks high in sodium and total energy. Overall, the effect sizes achieved in the study were small, included both positive and negative effects on food purchasing, and were mostly associated with price discounts, rather than the culturally adapted/tailored educational materials.

The Sandy Lake Health and Diabetes Project is an ongoing community-wide, multi-component intervention to reduce high rates of diabetes in an Indigenous community in Northern Canada⁽²⁹⁾. The intervention was designed using a participatory research approach to ensure cultural appropriateness and community ownership of the overall program. Program elements reflected cultural adaptations (evidential and peripheral surface changes) and tailoring (constituent involving and socio-cultural deep changes). The intervention included store-based activities to increase availability of healthy foods and promote their intake (e.g. taste testings, labels for healthy foods), in-home nutrition, physical activity and health education, a diabetes radio show, a school diabetes curriculum for children in grades 3–4 (which included storytelling using Indigenous characters) and a community walking trail ([Table 1](#)). Limited evaluation of the school curricula found a decline in sugar intake from 30% to 25% of energy and an increase in intake of grains and milk over a 2-year period among a small sample of students. Notably, this community-research partnership has been sustained for 22 years, which is an important outcome in its own right. Nevertheless, due to limited and weak evaluations conducted to date, it is difficult to determine whether the dietary intakes of community members improved due to the program and if any benefits that did occur were due to cultural adaptation/tailoring.

The Navajo Health Stores program in the US was an intervention in Navajo Nation food stores, designed through extensive consultations with community members and implemented by local staff. Intervention elements reflected cultural adaptation (evidential and peripheral surface changes and linguistic deep changes) and tailoring (constituent-involving and socio-cultural changes), such as materials that drew on historical tales created by an Apache artist ([Table 1](#)). The intervention entailed weekly to bi-weekly interactive sessions such as cooking demonstrations and taste-testing of healthier foods, along with educational displays, shelf labels and increased availability of healthier promoted foods. Higher exposure to intervention was associated with lower BMI, increased intentions to eat healthfully, greater use of healthier cooking methods and increased self-reported procurement of healthy foods after 14-month follow-up. However, it is difficult to attribute these improvements to cultural adaptation/tailoring *per se*, given that the control stores did not receive any intervention.



Table 1. Examples of culturally adapted and tailored nutrition interventions for Indigenous peoples and ethnic minority groups that achieved positive impacts on dietary intake

Study, author	Target group	Intervention			Length, study design	Dietary outcome	Results
		Community involved in design	Cultural adaptation and/or tailoring	Description			
Indigenous peoples SHOP@RIC Stores Healthy Options at Remote Indigenous Communities, Brimblecombe <i>et al.</i> ⁽²⁸⁾	Indigenous peoples living in Australia All rural and remote NT indigenous community members (across 20 communities)	Yes—working group with remote food retail and public health expertise, trained local community residents, store managers and public health nutritionists who worked in the communities	Adaptation: Peripheral, surface Tailoring: Socio-cultural Education material draws on eating behaviour context, including the importance of family and relationships, the autonomy granted to children, the role of elders in knowledge transfer, and the pivotal sense of freedom to choose.	Intervention: 20 % price discount on F&V purchases with and without consumer education Control: Waitlist intervention (up to 8 months).	6-month stepped wedge RCT	F&V purchases	Price discount alone was associated with a 12.7 % (4.1– 22.1) increase in purchases of F&V; the effect of 12 g per capita daily
Sandy Lake Health and Diabetes Project Kakekagumick <i>et al.</i> ⁽²⁹⁾	First Nations Peoples of Canada All community members in Sandy Lake Reserve	Yes—iterative co-design with community members, local Oji-Cree teachers, elders of the community	Adaptation: Evidential, surface Peripheral, surface Tailoring: Constituent-involving, deep Socio-cultural School lessons included intergenerational learning and storytelling using Indigenous characters	Intervention: store program, home visit program, radio show, school-based curriculum and community walking trail	3-year pre-post-trial (dietary outcomes specific to 2-year evaluation)	Percentage energy from sugars	Decrease to below 25 % of energy from sugars (statistical data not reported)
Navajo Health Stores, Gittelsohn <i>et al.</i> ⁽³⁶⁾	Native American Adults the Navajo Nation	Yes—iterative co-design with health organizations, community members and store representatives	Adaptation: Evidential, surface Peripheral, surface Linguistic, deep Tailoring: Constituent-involving, deep Socio-cultural Materials draw on importance of family and respect for elders, use of indirect educational style/ historical tales and were created by an Apache artist	Intervention: increased availability of healthy foods in stores, healthy food promotions in store and on local media, in store cooking demonstrations Control: stores with no intervention	14-month RCT	Healthy food intentions, cooking methods, and food getting	Improved healthy food intentions ($P \leq 0.01$), healthy cooking methods ($P \leq$ 0.05) and healthy food getting ($P \leq$ 0.01)
Ethnic minority groups Promotoras de salud pilot program, Balcazar <i>et al.</i> ⁽³⁴⁾	US Mexican Americans living in Texas with low incomes and education, n 98	Yes—iterative co-design with community members, community health workers and community-based organisations	Adaptation: Linguistic, deep Tailoring: Socio-cultural Spanish versions of educational modules and a <i>fotonovela</i> (a story illustrated with photos) designed and delivered by Spanish-speaking community health workers	Intervention: educational modules and a <i>fotonovela</i> designed and delivered by community health workers Control: pre-intervention	9-week pilot RCT	Salt and sodium intake, cholesterol and fat intake (self-reported as 'healthy habits')	Improved intake of salt and sodium ($P = 0.036$) and cholesterol and fat ($P = 0.022$)

Cultural adaptations of nutrition interventions

Table 1. (Cont.)

Study, author	Target group	Intervention				Length, study design	Dietary outcome	Results
		Community involved in design	Cultural adaptation and/or tailoring	Description				
Amigos en Salud, Babamoto <i>et al.</i> (33)	US Hispanic adults living with type 2 diabetes in Los Angeles, <i>n</i> 189	Non-specified	Adaptation: Linguistic, deep Socio-cultural Bilingual Hispanic community health workers with lived experience of diabetes and training to deliver self-management strategies incorporating patient cultural and spiritual beliefs	Intervention: bilingual and culturally trained community health workers Control: standard care or case management nurses	6-month RCT	Fruit intake	Intervention group was more likely to report ≥ 2 servings of fresh fruit daily vs controls (OR 2.43; 95 % CI 1.13–5.23)	
Pilot test of a Chinese menu plan and education for type 2 diabetes, Deng <i>et al.</i> (35)	Canada Chinese adults living with type 2 diabetes in Alberta, <i>n</i> 17	Partially—Chinese adults provided information on barriers to uptake of dietary recommendations	Adaptation: Linguistic, deep Socio-cultural Bilingual Chinese study coordinator, recipes used traditional Chinese cooking methods adapted to ingredients available in Canadian grocery stores, Chinese-language resources using culturally relevant, available and affordable foods, building on Eating Well with Canada's Food Guide (Chinese version)	Intervention: culturally relevant menu plan and nutritional information	12-week pilot pre-post-trial	Diet quality (Healthy Eating Index for Canada)	Increased Healthy Eating Index for Canada scores (5.3 ± 7.5 —out of 100 maximum score; $P = 0.010$)	

RCT, randomised controlled trial; OR, odds ratio.



Ethnic minority groups

Selected examples of culturally adapted or culturally tailored nutrition or multi-component interventions for ethnic minority groups are reviewed below and summarized in Table 1^(12,32). These include studies of Hispanic Americans living with type 2 diabetes⁽³³⁾, Mexican Americans with low levels of income and education⁽³⁴⁾ and Chinese immigrants living with type 2 diabetes in Canada⁽³⁵⁾.

One RCT examined the effectiveness of using trained lay community health workers to deliver culturally adapted care⁽³³⁾. Hispanic Americans with newly diagnosed type 2 diabetes attending inner-city health clinics receiving culturally adapted care (as an adjunct to standard care) were compared with patients receiving case management from linguistically competent and culturally sensitive registered nurses (as an adjunct to standard care) or standard care alone⁽³³⁾. Participants received an average of 11.3 individual sessions with a community health worker over 6 months. Educational sessions were based on existing American Diabetes Association standards and were adapted to each participant's needs. Elements of linguistic and socio-cultural deep adaptation were used, such as educational materials that considered cultural and spiritual beliefs (Table 1). In addition, case management participants received diabetes care and education from linguistically competent and culturally sensitive nurses monthly, or as needed, in addition to standard care. The group that received culturally adapted care from community health workers was more likely to report consuming ≥ 2 servings of fresh fruit daily and had greater odds of decreasing their BMI and of exercising ≥ 3 times per week compared to the standard care group. However, it is unclear whether the benefits conferred by community health worker intervention were due to cultural tailoring or if at least part of the benefits may have been due to the greater intensity of the community health worker intervention compared with standard care.

A second small pilot RCT examined a culturally tailored, community health worker-delivered, 9-week program among Mexican Americans in the US with low levels of income and education⁽³⁴⁾. Elements of deep linguistic adaptation and socio-cultural tailoring were used, such as the use of a *fotonovela* (a story illustrated with photos; Table 1). *Promotora* (lay community workers) were trained to deliver existing educational curricula regarding hypertension control, developed for the Hispanic/Latino community in the US by Spanish-speaking community health workers. They also helped to develop additional educational materials that were tailored for the target population based on results from a community assessment and survey. The control group received one educational session in Spanish. Self-reported improvements in fat/cholesterol and salt/sodium consumption differed significantly between groups at post-intervention, as did the perceived benefits of behaviours that help to control blood pressure. Similar to the studies described above, the control group received a less intensive intervention rather than an untailed

version of the same program, which precludes causal attributions to the culturally tailored nature of the intervention.

A pre-post, mixed methods study evaluated the provision of a 12-week culturally adapted menu plan and four individual nutrition education sessions among Chinese adults living in Alberta, Canada⁽³⁵⁾. There was evidence of deep linguistic and socio-cultural adaptations (Table 1). For example, existing curricula were delivered by a bilingual study coordinator who spoke English and Mandarin Chinese. At post-intervention, participants significantly improved their overall diet quality and intake of fruits and vegetables. These dietary changes were accompanied by significant reductions in waist circumference and improved lipid profiles. Participants also reported that the program enhanced their nutrition knowledge and encouraged them to make positive dietary changes such as eating foods with a lower glycemic index; reducing portion sizes; reducing added fat, sugars and salt and reducing intake of unhealthy snacks. Participants perceived that the cultural relevance of the menu plans was an important advantage of the program. Nevertheless, as a small study with no comparison group, it is difficult to attribute changes to the intervention or to its cultural adaptations.

Summary

The above studies provide some suggestive evidence that culturally adapted/tailored interventions have potential to improve nutrition-related outcomes. However, although many of the studies were RCTs, it is not possible to attribute their outcomes to cultural adaptation/tailoring *per se*, given that none of the control groups offered the same intervention in a non-culturally adapted/tailored manner. Moreover, in all cases, the culturally adapted/tailored intervention was more intensive than the control condition, which may account for any beneficial effects observed. Similar limitations have been reported in a systematic review of 13 RCTs of culturally adapted Internet and mobile-based health promotion interventions, with none of the included studies comparing a culturally adapted digital intervention with a non-culturally adapted version of the same intervention⁽¹³⁾.

Strength of the studies reviewed is that most were implemented among populations with low educated and low incomes, which are priority groups for intervention because these groups often experience poor diet quality and poor health outcomes⁽¹⁾. The most common example of cultural adaptation identified in this review was linguistic translation, which is a basic essential requirement to ensure that the dietary advice is inclusive and comprehensible to multi-cultural communities. There was also a mix of deep socio-cultural adaptations, such as the use of Indigenous storytelling⁽²⁹⁾, and surface-level adaptations, such as the use of culturally appropriate imagery in intervention materials^(35,36). However, it was often difficult to determine the level of cultural adaptation/tailoring due to insufficient details, which may be due to some of the studies being published prior to the use of reporting checklists⁽³⁷⁾. In particular, interventions

within food stores were often described as culturally tailored (i.e. developed from the ground-up in partnership with communities) despite the fact that they used interventions commonly found in the literature (e.g. shelf labels, cooking lessons), suggesting that researchers may have played a role in delineating priorities for intervention. We also noted that outcome assessment often reflected western perspectives of healthy eating, such as Deng *et al.*'s⁽³⁵⁾ use of the Healthy Eating Index for Canada to evaluate the diet quality of Chinese immigrants.

This review identified important considerations that should be taken into account when evaluating the evidence base for culturally adapted and culturally tailored nutrition interventions. These considerations include the quality of cultural adaptations, such as whether they were surface or deep changes⁽¹¹⁾ and whether they considered the heterogeneity that exists within each cultural group when making adaptations. The lack of detail in the reporting of cultural adaptations and tailoring in the included studies highlights the need for researchers to adequately describe who and what was involved in the design and delivery of these elements. Moreover, as the focus of most of the included studies was on cultural adaptations, rather than tailoring, researchers should consider whether the best approach is to adapt existing interventions that may have been developed for predominantly White, educated, middle income groups or to co-create new, tailored interventions for Indigenous peoples and ethnic minority groups in consultation with community members. Culturally adapted/tailored interventions may be perceived by target population groups as a form of cultural assimilation because the topics and methods of intervention have been defined by western researchers⁽³⁸⁾. As such, they may not truly reflect the needs, priorities and perspectives of Indigenous peoples and ethnic minority groups.

There is significant scope for personalised nutrition interventions to consider the role of culture and context in the design and delivery of interventions at scale. In the Food4Me study, a pan-European 6-month web-based RCT, 1607 individuals were randomised across seven European countries to one of three levels of personalised advice (based on diet; diet and phenotype or diet, phenotype and genotype). To date, this remains the largest trial of personalised nutrition to demonstrate that personalised advice improves diet quality to a greater extent than generalised dietary advice⁽³⁹⁾. However, over 95% of participants were White, and most were in managerial or professional occupations^(40,41), highlighting the need for high-quality personalised RCTs in diverse population groups, including Indigenous and ethnic minority groups. With regards to cultural adaptations, the Food4Me study tailored the dietary assessment tool to include culturally specific foods from each of the seven countries and made intervention materials available in the language of each of the seven countries^(40,42). However, while each individual received personalised advice via the web-based platform, the design and format of this personalised feedback were standardised across all individuals from all countries.

Many personalised/precision nutrition approaches rely on artificial intelligence algorithms to design and deliver dietary advice to individuals and groups via digital delivery models, such as mobile and web-based applications. However, a recent review of artificial intelligence systems identified three sources of potential biases: biases resulting from the characteristics of the population from which data were collected, the subjective bias of the annotator and the timing of when artificial intelligence processes are trained⁽⁴³⁾. Moreover, although there is evidence that culturally appropriate digital interventions are acceptable among Indigenous peoples and ethnic minority groups, co-creation is critical to their acceptability^(44,45). Therefore, unless personalised/precision nutrition algorithms are designed with these biases and co-creation needs in mind, precision and personalised nutrition interventions may embed biases that disadvantage Indigenous peoples and ethnic minority groups. Such artificial intelligence-assisted personalised nutrition interventions are more likely to avoid such biases and to be more effective if they are co-created with and use data collected from the target population, ideally in real-time as the intervention is developed and implemented. In addition, frameworks have been developed to help researchers to consider how to reduce such biases. For example, Juengst *et al.*⁽⁴⁶⁾ proposed a framework based on transparency, trust and community welfare that aims to ensure the benefit of precision approaches outweigh any possible public health risks to individuals, families and vulnerable members of the population. The focus on vulnerable members of the community makes this framework potentially applicable for examining cultural adaptations.

Recommendations for research, policy and practice

The studies included in this review provide some evidence that cultural adaptation and cultural tailoring can contribute to positive changes in dietary intake among Indigenous peoples and ethnic minority groups. However, the limitations in the design of these studies, as detailed earlier, should be addressed in future research to test the hypothesis that culturally adapted and/or tailored nutritional interventions are more effective in improving dietary intake than those that are not adapted and/or tailored. This review identified limited examples of cultural tailoring, indicating the need for the incorporation of principles of co-creation and co-design, taking personalised and precision nutrition interventions beyond surface-level adaptations and meeting deeper socio-cultural needs of Indigenous peoples and ethnic minority groups. In addition, we observed a need for more detailed and systematic reporting of the approaches used to achieve cultural adaptations and tailoring. This goal could be assisted through the application of frameworks, such as that by Vincze *et al.*⁽¹¹⁾, for categorising the breadth and depth of cultural adaptations.

Although evidence of effectiveness remains limited, it is nevertheless important to ensure that personalised

nutrition interventions reflect the cultural considerations of targeted groups. Without this, personalised interventions are likely to widen dietary inequities by not being sensitive to the needs of the target groups. As such, this review highlights the opportunity to design culturally adapted and/or tailored dietary advice for individuals at a population level, while still recognizing the importance of addressing structural barriers to a healthy diet. Nutrition-specific considerations will be important to ensure the inclusion of culturally appropriate food examples and culinary methods that reflect the diversity of the target population. These nutrition-specific considerations are particularly relevant to the countries included in this review, where colonisation has created barriers between Indigenous peoples and their traditional foods (i.e. limited food sovereignty).

Conclusions

This narrative review examined six examples of cultural adaptation/tailoring of nutrition interventions among Indigenous peoples and ethnic minority groups across Australia, Canada and the US. All studies used deep socio-cultural adaptations, such as Indigenous storytelling, and many also included surface-level adaptations, such as culturally appropriate imagery and language translation in intervention materials. Minimal reporting on socio-cultural adaptations limited our ability to determine whether the interventions used true co-creation to tailor content or adapted a pre-existing intervention, which was further compounded by study design limitations (i.e. lack of non-culturally adapted/tailored control groups). It was, therefore, also not possible to attribute any improvements in dietary intakes to cultural adaptation and/or tailoring *per se*. Nonetheless, this review highlights opportunities for large-scale personalised and precision nutrition interventions to incorporate principles of co-creation, in collaboration with Indigenous peoples and ethnic minority groups, to design, deliver and implement interventions that are culturally appropriate and more effective.

Acknowledgements

The authors would like to thank the organiser of the Nutrition Society of Australia 2022 Conference for their invitation to prepare this review.

Financial Support

K. M. L. was supported by the National Health and Medical Research Council (NHMRC) of Australia Emerging Leadership Fellowship (APP1173803).

Conflict of Interest

None.

Authorship

Substantial conception and contribution to the design of this work were made by K. M. L. and D. L. O. K. M. L. and D. L. O. drafted the manuscript with all co-authors contributing critical review to drafts of the manuscript. All authors approved the final manuscript.

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