
RESEARCH ARTICLE

A Scientific Critique and Eight-week Case Study Addressing Psychological, Social and Environmental Factors for Healthy Eating by Twice Daily Consumption of a Meal Replacement by APOC

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ABSTRACT

Psychological and physical disabilities or impairments create barriers to aspects of healthy eating, thus nutritional needs. A Formulated Meal Replacement (FMR) can reduce those barriers and often can be seen as a necessity in optimising nutritional needs. Healthy eating is interdependent on psychological, social, and environmental factors. In recent years FMRs have become a popular nutrition method to help individuals reach their healthy eating goals. FMRs do solve several problems which may impact healthy eating, such as different social determinants of health, adherence, and permitting some unhealthy behaviours in relation to nutrition, such as more calories available for alcohol or other discretionary nutrition choices. However, FMRs do have a drawback when considering the product serving for different ages, genders, and activity levels. APOC is a nutrition-based company that has developed an FMR. APOC FMR allows easy adherence to self-administration of an appropriate serving for an individual's age and gender at its simplest form, weight, and activity level at its more complex form. This paper provides two phases. Firstly, discussing the scientific rationale for APOC FMR's nutrition, including addressing psychological, social, and environmental factors contributing to healthy eating. Secondly, the importance of the FMR for the case study of an individual with a disability. The APOC FMR significantly assisted the individual in healthy eating. It is important to note that the actual reasons that APOC FMR contributes to healthy eating in individuals who have a disability or impairment can be replicated to abled or only slightly limited individuals.

KEYWORDS

Formulated meal replacement, healthy eating, psychosocial barriers, social determinants of health, motivational interviewing, disability

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1. Introduction

One of the key difficulties in sustaining healthy eating is behaviour [Dibsdall et al. 2003]. Behaviour is a manifestation of multiple intrinsic psychological factors. The most superficial psychological influencers of behaviour are adherence, unhealthy behaviour, and addiction [Hall et al. 2007]. These factors are described as superficial, as they are a presentation of unresolved and unprocessed psychological issues, many times on the spectrum of trauma, but not always. However, resolving and processing psychological issues – especially trauma – can be very difficult to treat. In these cases, an individual may be more advantageous to employee a behavioural change to bypass the psychological factors leading to unhealthy eating habits. There are at least 82 identified behavioural change theories, models, and strategies [Davis, 2015]. Nevertheless, motivational interviewing and reward replacement is most appropriate in the context of healthy eating.

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A key barrier to eliciting behavioural change is the social determinants of health (SDH). The key concepts of the SDH as defined by the World Health Organisation (WHO) are employment conditions, social exclusion, public health programmes, women and gender equity, early childhood development, globalisation, health systems, urbanisation, measurement, and evidence [WHO, 2020]. The SDH identified by the Australian Institute of Health and Welfare (AIHW) are living areas (remoteness), socioeconomic groups, gender equity, and being of Indigenous or non-Indigenous background [AIHW, 2019].

A fundamental SDH that a FMR can address is the health status – as impairment or disability – of an individual. Individuals with a disability are at higher risk of malnutrition in comparison to individuals without a disability. In Australia, these individuals are generally either participant in the National Disability Insurance Scheme (NDIS) or a veteran under the Department of Veteran Affairs (DVA). The most available literature on the correlation between disability and malnutrition only studies the impact of how malnutrition can cause disability. Although this is a serious and fundamental issue in nutrition, there is a burden on the literature in an exploration of how malnutrition is prevalent in those with disability. In saying this, the literature has and does report the risk of nutritional inadequacies in those with disability [Rempel, 2015; Pelizzo, 2017]. This includes insufficient dietary energy intake, increased nutritional losses, oral intake dysfunctions, physical exertions, and metabolic disturbances. More so, however, excluding physical and mental health, there appears to be a lack of how the specific psychology of living with a disability influences malnutrition.

Two further SDH that is crucial to the psychology of behaviour is indigenous status and location. These factors can lead to and have a high risk of causing obesity. Obesity is another key health status that a FMR addresses. Obesity is a prevalent disease in Australia in 2017-18, affecting 31% of the Australian population [AIHW, 2020]. In Australia, the Indigenous population suffers from obesity more than non-indigenous Australians. [National Indigenous Australians Agency, 2020]. Obesity in the Australian Indigenous community is an at-risk health issue. Female Indigenous Australians are slightly more at risk of being obese than Indigenous Australian males [Australian Institute of Health and Welfare, 2016]. Obesity and being overweight are significant contributors to the burden of disease in Indigenous Australians [Brenkert, 2002]. A high Body Mass Index (BMI) is a comorbidity for 64% of diabetes amongst Indigenous Australians, 46% of chronic kidney disease, and 39% of coronary heart disease.

Table 1. Indigenous Australians verse non-indigenous Australians for sub-population obesity risk [9]

SDH	Australian Indigenous prevalence
General population	46% of Indigenous Australians are obese compared to 30% of non-indigenous Australians
Rural	Rurally, less Indigenous Australians are overweight or obese, at 62% of the population compared to 76% of the non-rural counterparts

Obesity can be mitigated or even prevented through healthy eating. To address healthy eating, a FMR can be integrated to divert the attention of psychological factors inhibiting healthy eating.

2. Psychology of healthy eating

Multiple factors influence the psychology of healthy eating and include personality, motivation, feedback and reinforcement, arousal, anxiety, and stress. Social and environmental factors that influence psychological factors include health behaviour change and adherence, communication, motivational interviewing, group dynamics, and social influence.

3. Psychology of social marketing

A significant consideration of social influence is social marketing. Social marketing of health contains ethical considerations which are not evident in commercial marketing. Such as developed to focusing on influencing behaviour change voluntarily, solving social problems, and improving societal welfare, health, and well-being [Jones, 2006]. Ethical issues that are unique to social marketing are the treatment of selective groups of people. Different populations are generally treated differently from others, with a change of surrounding controversial and sensitive topics, i.e., the rights of an individual compared to the rights of a society [Jones, 2016]. Other ethical issues that can be faced by social marketing in the influence of psychology for healthy eating are manipulation, self-serving, beneficial consequences, offensive advertising, fairness, intrusiveness, honesty, waste of scarce resources, and playing favourites [Brenkert, 2002].

Table 2. Other ethical considerations in social marketing for healthy eating [Eagle, 2014]

Ethical consideration	Meaning
Dissonance	The creation of psychological discomfort and even bringing up trauma when discussing health issues
Obfuscation	The creation of confusion amongst different classes of people
Desensitisation	Exposure over time to the same health risks and health problems can desensitise people on the central issue
Culpability	Locating the problem in an individual and targeting them
Opportunity cost	Selecting health problems over others because of cost, opportunity, or success
System activation	Campaigns not reaching the intended audience
Social forming	The marginalisation in the society of unhealthy minorities
Social reproduction	Having the opposite effect on society of the desired outcome and reinforcing the habits that the campaign wanted to change

4. Psychology of motivational interviewing

Motivational interviewing is a basic counselling technique for building motivation to change behaviour. The technique assists in constructing rapport by establishing a therapeutic relationship. The skills for motivational interviewing can be represented by the acronym OARS [Hettinga, 2005].

'O' stands for asking **o**pen-ended questions, usually followed by a couple of reflections. In an open-ended question, the talking is mostly done by the patient. This gives the interviewer opportunity to understand and listen to the patient's values and goals.

'A' stands for **a**ffirmations, taking the context of appreciation and understanding into statements and compliments. Affirmations help build rapport by validating and supporting the patient during the process of behavioural change. When efforts for change are noticed, affirmations become a patient's strengths.

'R' stands for reflections, involving patient statement rephrasing. This allows the interviewer to implicitly capture the meanings and feelings of a patient. By reflections, the interviewer is encouraging the continuation of personal exploration, assisting the patient in understanding their motivations. Reflections are a simple tool to desire change through amplification and reinforcing of patient motivation.

'S' stands for **s**ummarising and links interview discussions with the patient; In hindsight, 'checking-in' with the patient to reinforce that the interviewer understands the patient. Summarising ensures a mutual understanding of the discussion between the interviewer and the patient. It allows the patient and interviewer to point out discrepancies between the current situation and future goals. The ultimate achievement of summarising is demonstrating that the interviewer is listening and understands the perspective of the patient.

Table 3. Examples of motivational interviewing
OARS techniques verse conventional interviewing in the context of healthy eating [Lubman, 2012]

Acronym	Motivational interviewing question
O	I understand you have some concerns about your eating habits. Can you tell me about them?
A	I appreciate that it took a lot of courage for you to discuss your eating habits with me today. You appear to have a lot of resourcefulness to have coped with these difficulties for the past few years. Thank you for hanging in there with me. I appreciate this is not easy for you to hear.
R	You enjoy the psychological effects of unhealthy eating habits in terms of how it helps you deal with your emotions after a stressful day. But you are beginning to worry about the impact your eating habits are having on your health. In fact, until recently, you weren't too worried about what you ate because you thought you had it under control. Then you found out your health has been affected; your doctor said a few things that have made you consider that eating habits are a health issue.
S	If it is okay with you, just let me check that I understand everything that we've been discussing so far. You have been worrying about the types of food you've been eating in recent months because you recognise that you have experienced some health issues associated with your dietary intake, and you've had some feedback from your doctor that you need to change what you're eating. But the few times you've tried to stop eating unhealthy food, it has not been easy, and you are worried that you can't stop. How am I doing?

There are four categories of change in targeted questioning for motivational interviewing [Hettinga, 2005]. These are disadvantages of the status quo, advantages of change, optimism for change, and intention to change. These categories are known as 'strengthening commitment to change'. These questions are designed to enhance goal setting and allow a patient to change their plan to reach their goals.

For example, "If you can think of a scale from zero to 10 of how important it is for you to lose weight. On this scale, zero is not important at all, and 10 is extremely important. Where would you be on this scale? Why are you at ___ and not zero? What would it take for you to go from ___ to (a higher number)?"

This technique allows a patient to identify any discrepancies between their current situation and their goal. A core factor in motivation for change is identifying discrepancies.

5. Phase 1: APOC FMR Evaluation

5.1 Methods

The Australian Government National Health and Medical Research Council (NHMRC) nutrient reference values for Australia and New Zealand and Food Standards Australia New Zealand (FSANZ) databases were searched for pertinent information. The APOC FMR was then compared against the recommended guidelines.

5.2 Results

5.2.1 Protein

Table 4. Australian and New Zealand recommended dietary intakes (RDIs) for protein by age and gender [16]

Age	Gender	RDI (g/day)	RDI (g/kg)
Child (4-8 years)	Male	20	0.91
	Female	20	0.91
Child (9-13 years)	Male	40	0.94
	Female	35	0.87
Adolescent (14-18 years)	Male	65	0.99
	Female	45	0.77
Adult (19-70 years)	Male	64	0.84
	Female	46	0.75
Elderly (> 70 years)	Male	81	1.07
	Female	57	0.94

Table 5. Australian and New Zealand protein RDIs verse protein derived from a serve of APOC FMR for different ages and genders

Age	Gender	RDI (g/day)	APOC FMR (g/day)	% RDI requirement
Child (4-8 years)	Male	20	8	40%
	Female	20	8	40%
Child (9-13 years)	Male	40	16	40%
	Female	35	16	45%
Adolescent (14-18 years)	Male	65	32	49%
	Female	45	24	53%
Adult (19-70 years)	Male	64	34	53%
	Female	46	27	58%
Elderly (> 70 years)	Male	81	40	49%
	Female	57	32	56%

APOC FMR provides approximately half the daily protein requirements for age or gender in line with the NHMRC Nutrient Reference Values of RDI for protein. The protein provided by gender and age-specified serve of APOC FMR provides between 40-58% of the RDI for protein per age and sex.

The APOC FMR meets the *Australian and New Zealand Food Standards Code – Food Standard 2.9.3 for formulated meal replacements and formulated supplementary foods* for minimum protein content of 12 g per serve of FMR. A guideline of a 20% error margin is permitted in food nutrient calculations [Gorton, 2007].

5.2.2 Vitamins and minerals

The APOC FMR provides 25% of the RDI of calcium, iodine, iron, magnesium, phosphorus, zinc, vitamin A, vitamin C, vitamin D, vitamin E, and 25% of each B vitamin; thiamine, riboflavin, niacin, pyridoxine, folate, and cyanocobalamin. This is in line with the RDIs set in the *Australia New Zealand Food Standards Code – Schedule 1 – RDIs and ESADDIs*.

Table 6. Micronutrients in APOC FMR compared to the Australian and New Zealand RDI guidelines

Age	RDI	APOC FMR (g/day)	% RDI requirement
Calcium	800 mg	200 mg	25%
Iodine	150 µg	37.5 µg	25%
Iron	12 mg	3 mg	25%
Magnesium	320 mg	80 mg	25%
Phosphorus	1,000 mg	250 mg	25%
Zinc	12 mg	3 mg	25%
Vitamin A	12 µg	3 µg	25%
Vitamin C	40 mg	10 mg	25%
Vitamin D	10 µg	2.5 µg	25%
Vitamin E	10 µg	2.5 µg	25%
Thiamine	1.1 mg	275 µg	25%
Riboflavin	1.7 mg	425 µg	25%
Niacin	10 mg	2.5 mg	25%
Pyridoxine	1.6 µg	0.4 µg	25%
Folate	200 µg	50 µg	25%
Cyanocobalamin	2.0 µg	0.50 µg	25%

5.2.3 Psychological factors

Table 7. How APOC FMR reduces psychosocial barriers to healthy eating

How APOC FMR reduces factors of social and environmental barriers to healthy eating	Application to barriers of psychological factors to healthy eating
Calorie dense for optimal nutrition allowing discretionary choices in diet	Adherence
Allows minimalistic change and implementation into lifestyle/diet	More likely for successful behaviour change
Cost is around \$1-6 per FMR serve (a meal replacement), making it affordable for those of lower socioeconomic status	Anxiety and stress
Saving time by reducing or eliminating meal preparation time	Motivation
Simplicity of FMR is more likely to be sustainable over a strict diet	Feedback

5.2.4 Social factors

APOC is a registered Government disability provider with the NDIS. As such, APOC is part of a social network and a community.

6. Phase 2: a case study

6.1 Case study rationale

In Australia, there exists the NDIS. The NDIS is a government-funded public scheme to assist with the financial aspect of disability needs and care that meet the NDIS *reasonable and necessary* threshold. Nutrition supports for those living with a disability were only fully updated and implemented on 1 October 2019. The NDIS was first implemented for disability funding on 1 July 2013. This

means that for over six years, nutrition did not receive government-approved recognition as reasonable and necessary for those living with a disability. Although the NDIS now covers nutrition-funded supports, many individuals (and disability organisations) do not have the full knowledge to manoeuvre around the necessities of aspects of nutrition inadequacies for those living with a disability.

To be able to follow guidelines for exercise and diet, psychological well-being is paramount. A FMR, in particular, APOC FMR, can allow an individual to elicit some addictive and unhealthy behaviours in relation to exercise participation and nutrition. This case study will investigate if the allowance of addictive or unhealthy behaviours may improve mental skills in relation to behaviour change identification and application of best practice behavioural strategies and theories, leading to social, psychological, and environmental factors.

According to the ABS, in Queensland, Australia (where the case study is held), an estimated 18.3%, approximately 938,100 people, have a disability [ABS, 2018]. Of these, 32.2%, approximately 302,068 have a severe disability. People with disabilities face considerable psychosocial and environmental barriers to meeting healthy lifestyle requirements [Rimmer, 2012]. According to the AIHW, adults with a disability, aged 18-64, are 32.5% more likely not to meet healthy lifestyle requirements compared to adults without a disability [AIHW, 2019].

6.2 Recruitment

The sole participant in this case study is the researcher. A 31-year-old male, post-graduate educated, with an active medical history of psychological and physical disability contributing to insufficient physical activity and excessive sedentary behaviour.

6.3 Bias minimisation

The participant remained abstinent during the study from ready-to-eat or ready-to-drink meals, vitamin or mineral supplements, professional dietician, or other nutritional advice for the purpose of control during the experimental phase. However, upon study completion and follow-up, the participant consulted with a dietician about how to integrate a nutrition plan into the participant's life.

6.4 Intervention

The case study participant will have two age, and gender-relevant APOC FMR shakes per day. Once upon waking for breakfast and one in the afternoon. The APOC FMR flavour chosen was the vegan caramel. The intervention will last for eight weeks between Wednesday 6 October 2021 and Wednesday 1 December 2021.

6.5 Qualitative design and results

The participant was surveyed for self-efficacy in a motivational interview style. The participant was asked about how the pre-and post-intervention fit the RULE acronym; resist the righting reflex, understand the own motivations, listen with empathy, and empower [Lubman, 2012].

Table 8. Motivational interviewing self-efficacy answers pre- and post-intervention

Acronym	Pre-intervention	Post-intervention
R	<i>I feel the right-way to healthy eating is a strict diet following the AGHE guidelines.</i>	<i>I discovered that if I meet nutritional guidelines, I can eat as I like. There is no right-way.</i>
U	<i>My motivation is to increase my independence.</i>	<i>I'm increasing my independence and worrying less about my nutrition.</i>
L	<i>It re-traumatizes me every time I ask my carers to make my food because my disability is reinforced.</i>	<i>I rely less on being asked what I need, how to prepare, etc. I enjoy this as I feel more 'normal'.</i>
E	<i>I'm sick of feeling like my life is one massive treatment. I'm hoping I can integrate the APOC FMR into my life.</i>	<i>I feel like I have taken healthy eating into my control. This doesn't feel like a treatment but my lifestyle.</i>

6.6 Quantitative design and results

Pathology blood results were taken pre-and post-intervention.

Table 9. Pathology blood values pre- and post-intervention

Pathology value	Pre-intervention - 06/10/2021	Post-intervention - 01/12/2021
Total cholesterol	5.5 mmol/L	5.1 mmol/L
HDL	0.63 mmol/L	0.59 mmol/L
LDL	4.80 mmol/L	3.61 mmol/L
Calcium <i>adjusted for albumin</i>	2.09 mmol/L	2.23 mmol/L
ALT	78 U/L	69 U/L
AST	46 U/L	38 U/L
Uric acid	0.49 mmol/L	0.43 mmol/L
Vitamin D ₃	30 nmol/L	52 nmol/L

7. Discussion

During the Phase 2 case study, between pre-and post-intervention pathology results of blood draws, the participant significantly improved in liver biomarkers; total cholesterol, LDL, HDL, ALT, AST, uric acid, and calcium adjusted for albumin. Interestingly vitamin D₃ increased. This may be conducive to increased calcium, the added vitamin D₃ to the APOC FMR, or the psychological relief of having nutrition adequately met by APOC FMR, thus allowing more independence and outdoor exposure for the participant.

It appears the greatest impact of using APOC FMR in the diet is reducing psychosocial barriers to healthy eating whilst increasing positive psychosocial factors. This includes the psychosocial factors listed below:

Table 10. Positive influence on psychosocial factors of healthy eating by twice daily consumption of APOC FMR for eight weeks

Psychosocial factor	How APOC FMR helped
↑ Adherence	Ease and time saving of preparation
↑ Motivation	Positive pathology results
↓ Anxiety	Money saving per meal
↓ Stress	Bypassing the need for dietetics and nutritional understanding
↑ Reinforcement	Greater allowance for discretionary food choices
↑ Behaviour change	Insignificant lifestyle change
↑ Feedback	Sustainable behavioural change
↑ Social influence	Part of a brand tailored to NDIS
↑ Arousal	Greater allowance for discretionary food choices
↓ Unhealthy behaviour	Reduces discretionary cravings due to adequate nutrition
↓ Addiction	Reduced alcohol consumption due to less anxiety and stress

Introducing APOC FMR to the diet of those facing psychological, social, and environmental barriers to healthy eating can benefit individuals. Principles of motivational interviewing can be applied at a larger population social marketing level. For instance, in the aspect of disability, inspirational quotes can be employed in healthy eating marketing strategies involving the APOC FMR. Such as a simple, optimistic motivational language with an active voice as inspirational quotes from sports people with disabilities.

Table 11. Social marketing inspirational quotes from athletes with disability that can influence factors in motivational interviewing [Bits of Positivity, 2012]

Athlete	Quote
Joey Reiman	"Hard things are put in our way, not to stop us, but to call out our courage and strength."
Emma Thompson	"Being disabled should not mean being disqualified from having access to every aspect of life."
Margaret Meade	"If we are to achieve a richer culture, we must weave one in which each diverse human gift will find a fitting place."
Simone Weil	"Equality is the public recognition, effectively expressed in institutions and manners, of the principle that an equal degree of attention is due to the needs of all human beings."
Mary Kay Ash	"Aerodynamically, the bumblebee shouldn't be able to fly, but the bumblebee doesn't know that, so it goes on flying anyway."
	"Know me for my abilities, not my disability."
Robert M Hensel	"I don't have a disability; I have a different-ability." "I have a Disability; yes, that's true, but all that really means is I may have to take a slightly different path than you."

A social marketing campaign for healthy eating with the APOC FMR can further reduce psychosocial barriers through group dynamics and social influence. By creating a sense of community, inspirational community members, and displaying inclusive images in the context of healthy eating. Accessibility, discrimination, and psycho-emotional disablism all play roles in social exclusion for those with disabilities [Barnes, 2005].

Barriers include self-efficacy, insecurity, self-identity, self-invalidation, stereotypes, and psycho-emotional disablism. These barriers are essential to be aware of as it shows that the biggest factor in unhealthy eating stems from the psycho-emotional barrier. This allows the social strategy to target a more specific and personal area.

7.1 Fruit consumption

The majority of Australians do not meet the Australians Guidelines for Healthy Eating (AGHE) recommendations for fruit consumption. APOC FMR can make adherence to this recommendation easier. An individual is aware that by consuming two APOC FMR shakes a day and two pieces of fruit, most of their basic nutritional needs are met, i.e., protein and micronutrients. This can be a motivational and reinforcement factor for individuals to adhere to dietary guidelines for fruit recommendations.

Fruit plays a vital role in healthy weight management, energy levels, growth, and development. In the AGHE brochure for healthy eating for adults, it is recommended for adult men and women to eat two serves of fruit per day [NHMRC, 2015]. In adults, consuming the recommended serves of fruit contributes to the maintenance of healthy weight and energy needs. In older people, consuming the fruit recommendation contributes to maintaining muscle, strength, and a healthy weight.

In the AGHE brochure for healthy eating for children, male and female children aged 9-18 years are recommended to eat two serves of fruit per day. For male and female children aged 4-8 years, 1.5 serves are recommended, and for male and female children aged 2-3 years, one serve of fruit is recommended [NHMRC, 2015]. Children and adolescents should meet the fruit recommendations set by the AGHE to contribute to the maintenance of healthy weight, meeting energy needs, normal growth, and development.

Fruit consumption is important for energy, fibre, antioxidants, and micronutrients. The water from fresh fruit is more effective at hydration and electrolyte balance than just drinking plain water. The extensive phytochemical (phytonutrients) composition of fruit also assists metabolic functions, weight maintenance, brain development, and neurogenesis [Murugaiyah, 2015].

According to the Australian Bureau of Statistics (ABS), a report released in 2016 on Australian dietary guidelines [ABS, 2016] reported that the average Australian (over two years of age) only consumes 1.5 serves of fruit (inclusive of dried and juiced fruit) per day. Children on average consume 1.7 serves of fruit per day. Children 2-8 years on average are meeting the recommendations set by the AGHE. However, Australians over nine years of age are, on average, consuming under the recommendation set by the AGHE. Consumption of the APOC FMR can be a simple dietary method of increasing fruit consumption by Australians.

8. Conclusion

The APOC FMR is a nutritional supplement drink providing protein and micronutrients, which with some adjustments in serve size, can be used by either gender for any age four and up. The aim of this case study was to research the effects on the psychology of healthy eating by implementing an FMR into the participants' diet. The implementation of an FMR significantly increased healthy eating behaviours by improving the psychological outcomes of the participant. As a secondary outcome, blood pathology outcomes improved over the eight-week intervention.

Meeting healthy eating recommendations is a major factor in good health. Australians with a disability are 2.7 times more likely to suffer from negative health outcomes when compared to Australians without a disability [20]. Assistance in daily activities, self-care, mobility, and communication play a role in healthy eating habits in those with disabilities [Queensland Government, 2018]. Any attempt to increase the likelihood of healthy eating in people with disabilities should be encouraged, as there is a causal link between lack of healthy eating and poorer health outcomes. A simple frontline method of increasing healthy eating by reducing psychological, social, and environmental barriers to meet nutritional recommendations is through the APOC FMR.

This study was limited by significantly risk-of-bias, including blinding, controls, and the exclusion of other participants. The results, however, maintained a positive outcome. Further study is warranted on material intervention methods, such as an FMR, to improve psychological outcomes of healthy eating.

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Conflict of interests: The author is granted a patent by the Australian Patent Office for an innovative FMR and consults for APOC [APOC, 2022].

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