Exploring the Relationship Between Body Image Perception and Nutritional Knowledge, Attitudes, and Practices: A Cross-Sectional and Intervention Study Among University Students in Brunei Darussalam

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Abstract

Background: Body image, defined as internal cognitions, feelings, evaluations, and behaviours related to one's appearance, significantly influences adolescents and young adults (AYAs) between the ages of 15 and 30. Negative body image is associated with various psychological issues, including eating disorders and obesity, which are prevalent in AYAs. This paper describes a research protocol which aims to study the association between body image perception and dietary knowledge, attitude, and practices and also aims to evaluate the effectiveness of a newly developed video-based intervention in improving these outcomes among Brunei Darussalam University students.

Objective: The primary objective is to assess the association between body image perception and dietary knowledge, attitude, and practices among university students in Brunei Darussalam. The secondary aim is to develop and evaluate the effectiveness of video education intervention in improving nutritional knowledge, attitude, and practices, and body image perception among Brunei Darussalam University students.

Methods: The research will assess body image satisfaction using Figure rating scales, including the Body Image Coping Strategies Inventory, and gather data on the Knowledge, Attitude and Practice on Healthy Lifestyle Questionnaire (KAP-HLQ) and socio-demographic factors through questionnaires. Phase I consisted of a systematic review which has already been published and Phase II is a pilot study of the intervention and outcome measurements which is currently underway. In the current paper, baseline data collection (Phase III) will form the cross-sectional study to measure body image perception and dietary knowledge, attitudes, and practice outcomes. Students aged 18-25 will be recruited across three universities in Brunei Darussalam to complete validated online questionnaires. The online video intervention will be delivered to the students in Phase IV of the research, consisting of one theme per week over three weeks: Nutritional Knowledge; Physical Activity and Nutrition; and Mindfulness and Mindful Eating. The intervention is underpinned by the Health Belief Model and the contents will be validated by qualified nutritionists and psychologists. Follow-up data will be collected in Phase V immediately after the intervention ends. Associations between body image perception and nutrition and physical activity knowledge, attitudes, and practice scores will be examined through Pearson's correlation coefficients. The association of body shape and body image perception will also be examined through chi-square tests. The effect of the intervention on dietary outcomes at follow-up will be assessed using chi-squared analyses for individual items and multilevel linear regression models for the combined scores. Intervention effectiveness on body image perception at follow-up will be assessed using multilevel random effects linear regression models for the separate items, the combined scores of the three components (appearance fixing, avoidance, and positive rational acceptance), and the overall score.

Results: Expected Outcomes: The findings will provide insights into the complex relationships between body image, nutritional knowledge, mindfulness, eating habits, and socio-demographic variables in the Bruneian context. The study aims to develop an appropriate educational intervention that is focused on nutritional knowledge, physical activity, nutrition, mindfulness, and mindful eating. The aim of the study is to achieve positive outcomes such as increase in nutritional knowledge or a reduction in

body image dissatisfaction. The nutritional education is tailored for AYAs to promote healthy body image and improve dietary practices.

Conclusions: Conclusion: This research will fill a critical gap in understanding body image issues and nutritional knowledge among AYAs in Brunei, fostering evidence-based interventions to promote healthier lifestyle choices and improve overall well-being. Clinical Trial: Ethical approval for this study was obtained by the Institute of Health Sciences Research Ethics Committee (IHSREC), ref: UBD/PAPRSBIHSREC/2024/16; the Office of the Assistant Vice-Chancellor (Research, Innovation & Sustainability) and the University Research Ethics Committee (UREC), ref: UBD/IHS/B3/8; and the Department of Planning, Development, and Research, ref: KP/DP/19. A doctoral thesis of the research will be submitted, and a presentation will be made for evaluation at the Pengiran Anak Puteri Rashidah Sa'adatul Bolkiah Institute of Health Sciences (PAPRSB IHS), Universiti Brunei Darussalam. The research study findings will be submitted as peer-reviewed journal articles and presented at relevant conferences as posters and/or oral presentations.

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Authors: Baladandapla Shivappa Pushpa, Siti Norhedayah Abdul Latif, Sharimawati Sharbini, Zaidah Rizidah Murang and Siti Rohaiza Ahmad.

ABSTRACT

Introduction: Body image, defined as internal cognitions, feelings, evaluations, and behaviours related to one's appearance, significantly influences adolescents and young adults (AYAs) between the ages of 15 and 30. Negative body image is associated with various psychological issues, including eating disorders and obesity, which are prevalent in AYAs. This paper describes a research protocol which aims to study the association between body image perception and dietary knowledge, attitude, and practices and also aims to evaluate the effectiveness of a newly developed video-based intervention in improving these outcomes among Brunei Darussalam University students. **Methods and analysis:** The research will assess body image satisfaction using Figure rating scales, including the Body Image Coping Strategies Inventory, and gather data on the Knowledge, Attitude and Practice on Healthy Lifestyle Questionnaire (KAP-HLQ) and socio-demographic factors through questionnaires. Phase I consisted of a systematic review which has already been published and Phase II is a pilot study of the intervention and outcome measurements which is currently underway. In the current paper, baseline data collection (Phase III) will form the cross-sectional study to measure body image perception and dietary knowledge, attitudes, and practice outcomes. Students aged 18-25 will be recruited across three universities in Brunei Darussalam to complete validated online questionnaires. The online video intervention will be delivered to the students in Phase IV of the research, consisting of one theme per week over three weeks: Nutritional Knowledge; Physical Activity and Nutrition; and Mindfulness and Mindful Eating. The intervention is underpinned by the Health Belief Model and the contents will be validated by qualified nutritionists and psychologists. Follow-up data will be collected in Phase V immediately after the intervention ends. Associations between body image perception and nutrition and physical activity knowledge, attitudes, and practice scores will be examined through Pearson’s correlation coefficients. The association of body shape and body image perception will also be examined through chi-square tests. The effect of the intervention on dietary outcomes at follow-up will be assessed using chi-squared analyses for individual items and multilevel linear regression models for the combined scores. Intervention effectiveness on body image perception at follow-up will be assessed using multilevel random effects linear regression models for the separate items, the combined scores of the three components (appearance fixing, avoidance, and positive rational acceptance), and the overall score. **Expected Outcomes:** The findings will provide insights into the complex relationships between body image, nutritional knowledge, mindfulness, eating habits, and socio-demographic variables in the Bruneian context. The study aims to develop an appropriate educational intervention that is focused on nutritional knowledge, physical activity, nutrition, mindfulness, and mindful eating. The aim of the study is to achieve positive outcomes such as increase in nutritional knowledge or a reduction in body image dissatisfaction. The nutritional education is tailored for AYAs to promote healthy body image and improve dietary practices. **Conclusion:** This research will fill a critical gap in understanding body image issues and nutritional knowledge among AYAs in Brunei, fostering evidence-based interventions to promote healthier lifestyle choices and improve overall well-being.

Strengths and limitations of this study

- Cross-sectional study assessing body image perception and dietary knowledge, attitude, and

practices among university students.

- Development and delivery of a video-based nutrition, physical activity, and mindfulness intervention
- The lack of a control group reduces the inference and validity of the effectiveness of the intervention compared to standard practice.

INTRODUCTION

In 2016, it was estimated that 28.2% of adults in Brunei Darussalam were obese, which represents an increase from 27.2% in 2011 [1]. Adolescents and Young Adults (AYAs), defined as young people between the ages of 15 and 30 years [2], are at particular risk of developing obesity when entering university and taking on responsibility for their eating habits and lifestyle [3]. One cross-sectional study found that 28.8% of Universiti Brunei Darussalam students were overweight or obese, where overweight/obese students were observed to visit fast food restaurants more frequently than healthy-weight students [4]. Although most students ate frequent meals and had good nutritional knowledge, they often displayed poor dietary behaviours such as skipping breakfast, frequently snacking, and having a low daily intake of fruit and vegetables [4]. Addressing these poor eating habits is key to improving overweight and obesity outcomes among university students.

Research shows that body image perception is one of the early risk factors for unhealthy dietary habits [5–8] and there is growing evidence that unhealthy body image is related to chronic diseases such as obesity and physical inactivity [9]. Body image is a multidimensional construct that encompasses the way we perceive, think, feel, and behave towards our bodies, which lies on a continuum between a healthy body image and an unhealthy body image [9]. Body image perception is measured by examining the difference between actual and ideal body size [5]. Perceptions of body image are constantly changing, with greater use of social media being associated with higher levels of body dissatisfaction and eating disorders [10]. Consequently, there is a need to explore how university students perceive their body image and how this relates to their dietary behaviours.

University students acquire their nutrition knowledge from a variety of sources; however, this information is not always comprehensive or scientifically sound. Evidence has shown that nutritional education may be able to bridge the gap between knowledge and dietary habits in AYAs. One Korean classroom-based nutrition education was shown to increase fruit, vegetable, and milk intake and to reduce rates of skipping breakfast and body image misperception [11]. Introducing Indonesian adolescents to nutrition guidelines with a short-animated movie was shown to not only increase nutrition knowledge, but to reduce fried food, snack, and sugar intake and increase vegetable consumption compared with students in the control group of the study [12]. Similarly, a social media-based nutrition education intervention among Chinese college students resulted in an increased intake of fruits and vegetables, dairy products, and soybean products [13].

Psychological factors are known to play a key role in eating habits and nutritional intake. One study evaluating body image perception and food intake showed that large discrepancies between real and ideal body images are correlated with somatic and body dysmorphic symptoms leading to chronic stress and reduced well-being [14]. Research has also shown that female college students who have a normal body image perception have healthier dietary patterns, including lower saturated fat intake and higher monounsaturated fat intake [15]. Two systematic reviews that examined the effectiveness of interventions in promoting positive body image in adults found a strong correlation between educational interventions and improved positive body image [16,17]. One study conducted with female university students found that a mindfulness-based intervention promotes a positive body image [18]. Therefore, addressing body image perception through interventions should be considered in improving mental well-being and dietary behaviours to tackle the growing obesity issue among university students in Brunei

Darussalam.

The current study comprises five research phases which aim to assess and improve body image perception and nutritional behaviour outcomes in Brunei Darussalam university students. The first phase (Phase I) consisted of a systematic review which found that nutritional education interventions improved unhealthy food intake and body image misperception, particularly on nutritional knowledge/self-efficacy, healthy dietary habits, physical activities, and fruit and vegetable intake [19]. It also found a negative association with excess weight gain, obesity, and unethical weight reduction practices, leading to dissatisfaction with body image [19]. Phase II of the research will not be outlined in this protocol paper as it is already being undertaken and involves the piloting of the newly developed video-based intervention and an adapted version of the Knowledge, Attitude and Practice on Healthy Lifestyle Questionnaire (KAP-HLQ) questionnaire for the Brunei Darussalam population. Phase III of the research aims to investigate the association between body image perception and dietary knowledge, attitudes, and practices among 18-to 25-year-old university students in Brunei Darussalam and will also form the baseline outcome measures. The video-based nutritional education intervention will be delivered in Phase IV of the research and the effectiveness of intervention on improving body image perception and dietary knowledge, attitude, and practices will be assessed in Phase V.

OBJECTIVES

The primary objective is to assess the association between body image perception and dietary knowledge, attitude, and practices among university students in Brunei Darussalam. The secondary aim is to develop and evaluate the effectiveness of video education intervention in improving nutritional knowledge, attitude, and practices, and body image perception among Brunei Darussalam University students.

METHODS AND ANALYSIS

Study design

The baseline data collection (Phase III) will form the cross-sectional study which aims to measure body image perception and dietary knowledge, attitudes, and practice outcomes among university students in Brunei Darussalam. The intervention will be delivered to the students in Phase IV of the research and follow-up data will be collected in Phase V.

Study population and recruitment

The inclusion criteria include Brunei citizens and residents aged 18-25 years old from Universiti Brunei Darussalam (UBD), University Technology Brunei (UTB), and Universiti Islam Sultan Sharif Ali (UNISSA). Individuals who are on prescribed/restricted diets and who are unable to change their dietary behaviours e.g. pregnant women and students receiving dialysis treatment will be excluded from participating in the study. Exclusion criteria will also consist of people with disabilities which prevent them from being able to change their physical activity behaviours and students who have taken part in the pilot study of the questionnaires and intervention (Phase II).

Study adverts will be shared by assistant registrars of each university and prospective research study participants will contact the primary researcher to express their interest in the study. The students will be sent a participant information sheet and written informed consent will be obtained by digitally clicking YES at the start of the online baseline questionnaires (Phase

III). A minimum sample size of 225 students will be recruited (75 from each university) with an equal sample distribution of both sexes. Once students have completed the baseline questionnaires, they will have access to the online video intervention materials (Phase IV). The research participants will be asked to complete follow-up questionnaires immediately after they finish engaging with the intervention (Phase V). The online Qualtrics platform will be used for disseminating the online questionnaires to collect data for all study outcomes. Completed questionnaires will only be accessed by the primary researcher. Data from questionnaires will be stored in anonymised form, using participant identification numbers, in secure password-protected folders.

Intervention

The intervention will focus on three themes: Nutritional Knowledge; Physical Activity and Nutrition; and Mindfulness and Mindful Eating (see Table 1). Each theme will be covered through three videos each week; therefore, the intervention will consist of nine videos in total and delivered over three subsequent weeks. The three themes are based on the National Dietary Guideline key messages [20] and aim to foster enduring changes in dietary behaviours by integrating psychological insights into the relationship between food and body image. Integrating mindfulness meditation into mindful eating exercises helps develop foundational skills for stress management and a healthier relationship with food. The Mindfulness and Mindful Eating theme will be conducted under the guidance of Dr Siti Norhedayah Binti Hj Abdul Latif, a certified positive psychology practitioner.

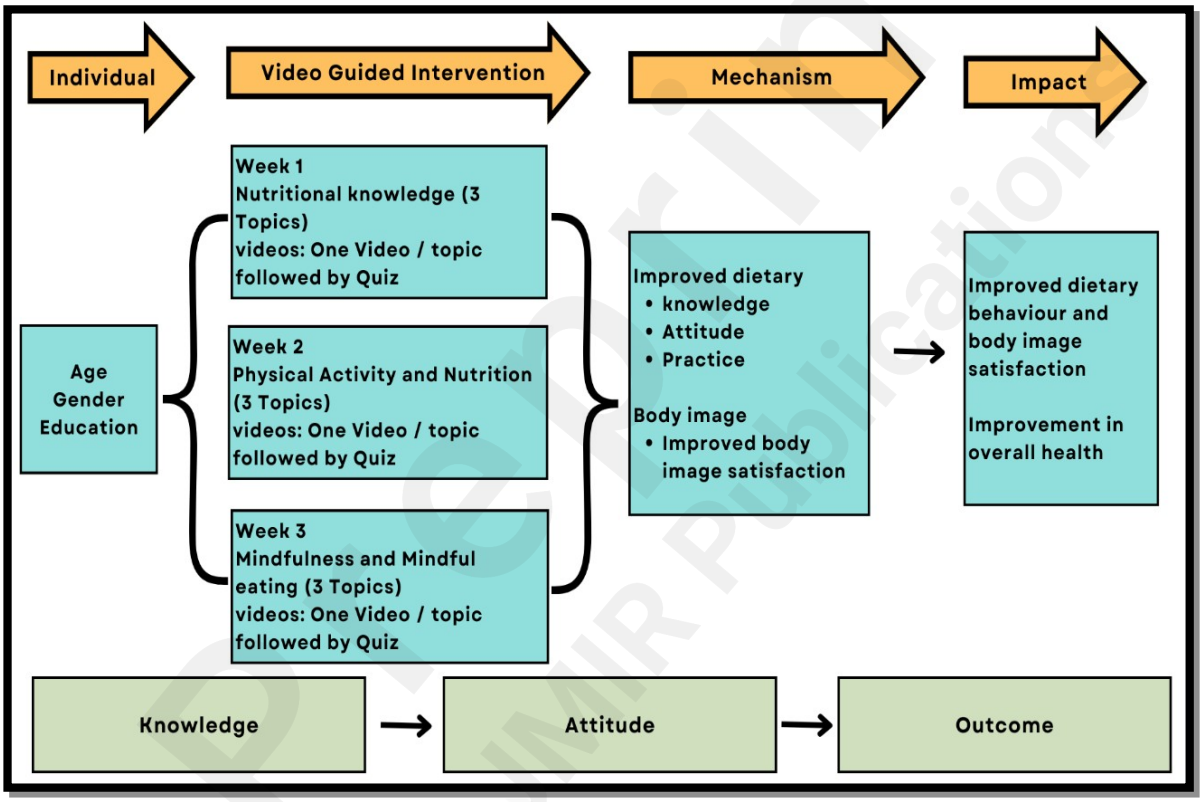
Table 1: Intervention components

Week	Theme	Topics	Quiz
Week One	**Nutritional Knowledge**	This theme will cover three topics. There will be a short 4–5-minute video per topic: • To include a wide variety of nutritious foods daily • Incorporate Fruits and Vegetables • Moderate Protein Intake	There will be a quiz under each topic consisting of 5 questions
Week Two	**Physical Activity and Nutrition**	This theme will cover three topics. There will be a short 4–5-minute video per topic: • Body Mass Index (BMI) • Daily Energy Requirements • Physical Activity Recommendations	There will be a quiz under each topic consisting of 5 questions
Week Three	**Mindfulness and Mindful Eating**	This theme will cover three topics. There will be a short 4-5-minute video per topic: • Building Awareness and Cultivating Presence • Managing Impulses and Stress Reduction • Mindful Eating Exercises and Integration into Daily Life	There will be a quiz under each topic consisting of 5 questions

Animated videos will be based on storylines and created with the Videoscribe platform. The first step in this process is to create an engaging story that supports the educational objectives of the intervention. The story will then be transformed into a series of scenes and animations, with the components arranged using the platform's user-friendly drag-and-drop

interface and synchronised with the commentary. To ensure accuracy and reliability, a psychologist and nutritionist will validate the animated content after its development. This step is critical to ensure that the information presented is scientifically sound and consistent with current nutritional guidelines and best practices. It will also verify the accuracy of the content and necessary adjustments will be made to ensure clarity and factual integrity. This validation process will enhance the credibility of the animated videos. Before being delivered to the students in Phase IV of the research, the intervention will be piloted with a small sample of students during Phase II, which is currently underway. The intervention will be reviewed and refined, if necessary, based on observations from this Phase II pilot study.

Figure 1: Logic Model



The conceptual framework for understanding how nutritional knowledge influences body image and food intake involves a complex interplay of several factors. Nutritional knowledge forms the basis of attitudes towards diet and body image, which in turn influence behavioural intentions towards healthy eating and exercise [21]. These intentions are a crucial antecedent to actual changes in food intake and body image [22]. However, this process is influenced by socio-demographic factors such as age, gender, and education level which affect how knowledge is acquired and applied [23,24]. This line of thought was closely linked to the theory that more knowledge makes people more aware and thereby encourages them to act responsibly. As shown in the logic model (Figure 1), an increase in knowledge is anticipated to lead to the development of positive attitudes and behaviours.

According to the model of responsible behaviour, the likelihood of a person engaging in a particular behaviour is influenced by several variables, including knowledge, attitudes, sense of personal responsibility, locus of control, and intention to act [25,26]. By integrating mindfulness

into nutrition education, people can gain a better understanding of their eating habits, hunger signals, and emotional triggers related to food [27]. Increased mindfulness allows them to make conscious and thoughtful choices about what, when, and how much they eat, which fosters a more intuitive and balanced connection to food [28]. In addition, mindfulness practices help to reduce stress, emotional eating, and impulsive food choices, which support long-term dietary adjustments and overall health and well-being [29]. Interventions in education that combine nutrition and mindfulness practices offer a comprehensive approach to promoting healthy eating behaviour and a positive relationship with food and one's body and therefore it is imperative that a mindfulness component was included in this intervention [30].

The Health Belief Model (HBM) is one of the most recommended frameworks in the field of nutrition education programmes. The constructs of this model — perceived susceptibility, severity, benefits, barriers, and incentives for action — can be used as the basis for the content and communication strategies of nutrition education programmes. These constructs help design effective nutrition programmes by addressing specific beliefs and perceptions that influence health behaviours and ultimately lead to better health outcomes [31]. Our intervention will be based on the HBM to plan and implement the programme. When interventions include video content, cognitive load theory is also considered to optimise learning and retention [31].

Study outcomes and measurements

Research participants will gain access to a series of online questionnaires covering socio-demographic information; dietary and physical activity knowledge, attitudes, and practices (KAP-HLQ) [32]; the Figure Rating Scale [33]; and the Body Image Coping Strategies Inventory (BICSI) [34]. The validated questionnaires will have been piloted in Phase II of the research and will be available in both Malay and English based on each student's preference. These questionnaires will be integrated into the Qualtrics platform, ensuring confidentiality and data security throughout the process. The 'knowledge' component of the KPA-HLQ questionnaire consists of 42 multiple-choice questions, each with four response options. The 'attitude' section is made up of 27 statements where the Likert scale response options are: 'Strongly Disagree'; 'Disagree'; 'Between Agree and Disagree'; 'Agree'; and 'Strongly Agree'. 28 items relate to the 'practice' component which also follows Likert scale response options. The BICSI questionnaire comprises three components: appearance fixing (10 items); avoidance (8 items); and positive rational acceptance (11 items). The 29 items in the questionnaire have Likert scale response options: 0 – 'Definitely Not Like Me'; 1 – 'Mostly Not Like Me'; 2 – Mostly Like Me'; and 3 – 'Definitely Like Me'.

Data Management

The research team will use Qualtrics, a secure data management system, to enter and

transcribe data. Questionnaires will be uploaded to the Qualtrics platform, and participants will be invited to join the study by the university's assistant registrars. The platform will capture participants' responses, and participant identification numbers will be used to ensure that survey data remains anonymous. The data will be stored in password-protected folders for security.

Statistical analyses

All statistical analysis will be conducted using R Studio version R4.3.3. The demographic characteristics obtained from the participants will be summarised using means and standard deviations for continuous variables (e.g. age) and frequencies and percentages for categorical variables (e.g. sex). The responses to the KAP-HLQ questionnaire will be assessed as an overall mean score and a mean of each of the three components: 'knowledge', 'attitude', and 'practice' towards healthy eating. Similarly, the BICSI questionnaire will be assessed using mean scores for each component and overall: 'appearance fixing', 'avoidance', and 'positive rational acceptance'. The mean scores for the KAP-HLQ and BICSI questionnaires, and the mean scores for the subcomponents, will all be tested to check the assumption of normality through Kolmogorov Smirnov tests.

For the cross-sectional analyses in Phase III of the research, the associations between body image perception (BICSI questionnaire) and nutrition and physical activity knowledge, attitudes, and practice scores (KAP-HLQ questionnaire) will be examined through Pearson's correlation coefficients. The association of body shape, as measured through the eight-figure chart (Figure Rating Scale), and body image perception will also be examined through chi-square tests. The effect of the intervention at follow-up (Phase V) will be assessed using chi-squared analyses for the 42 individual items in the KAP-HLQ questionnaire and using multilevel linear regression models for the combined overall scores, and for the three component scores (knowledge, attitude, and practice), both unadjusted and adjusted for baseline scores. The 29 aspects of the BICSI questionnaire at follow-up will be assessed using multilevel random effects linear regression models, unadjusted and adjusted for baseline scores, on the separate items, the combined scores of the three components (appearance fixing, avoidance, and positive rational acceptance), and the overall score.

ETHICS AND DISSEMINATION

Ethical approval for this study was obtained by the Institute of Health Sciences Research Ethics Committee (IHSREC), ref: UBD/PAPRSBIHSREC/2024/16; the Office of the Assistant Vice-Chancellor (Research, Innovation & Sustainability) and the University Research Ethics Committee (UREC), ref: UBD/IHS/B3/8; and the Department of Planning, Development, and Research, ref: KP/DP/19. A doctoral thesis of the research will be submitted, and a presentation will be made for evaluation at the Pengiran Anak Puteri Rashidah Sa'adatul Bolkiah Institute of Health Sciences (PAPRSB IHS), Universiti Brunei Darussalam. The research study findings will be submitted as peer-reviewed journal articles and presented at relevant conferences as posters and/or oral presentations.

DISCUSSION

This protocol was prepared for a doctoral research study entitled "Exploring the Relationship between Nutritional Awareness and Body Image: An Intervention Study among University Students in Brunei Darussalam", which will be conducted at three universities in

Brunei Darussalam. The associations between body image perception and socio-demographic factors with nutrition knowledge and psychological factors remain unexplored among Bruneian university students. To date, few studies have examined the influence of psychological factors such as body image perception on eating behaviours, and there is currently no published evidence on interventions which aim to address body image perception in the AYA population of Brunei Darussalam. This will be the first interventional study in Brunei on body image perception and KAP of diet. The findings of this study may inform public health policies in Brunei and other countries with similar demographics. Additionally, the study could contribute to the development of university health programs and guide future interventions targeting young adults in Brunei and Southeast Asia.

Similar studies conducted in Asian population reported a significant improvement in nutritional knowledge following intervention and there were positive changes in attitudes and practices toward healthier eating habits [35 and 36]. Studies also reported improvements in physical activity levels as a result of nutritional interventions [36-40]. One study reported a reduction in body image misperception [41], and another reported a notable increase in body image satisfaction three months after the intervention [42]. Systematic review reported appropriate educational interventions would address misconceptions and the underlying issues related to eating problems [19]. Hence by identifying key socio-demographic and psychological factors, and developing a targeted educational intervention, this study aims to contribute to improved health outcomes for Bruneian university students. Such interventions will be critical in promoting healthy eating habits and positive body image perceptions, ultimately helping to curb the obesity epidemic in Brunei Darussalam. The findings of this study will address the growing problem of poor eating habits and the increasing rates of overweight and obesity among AYAs. We acknowledge that the lack of a control group could be a limitation, as it might affect the ability to evaluate the effectiveness of the intervention.

Authors' contributions: BSP has written the article, SS and ZRM have reviewed and provided the feedback, and SNAL, and SRL have provided the input for the study design, methodology and intervention design. All authors contributed to the overall study aim and development of the design. All authors made critical comments on drafts of the paper.

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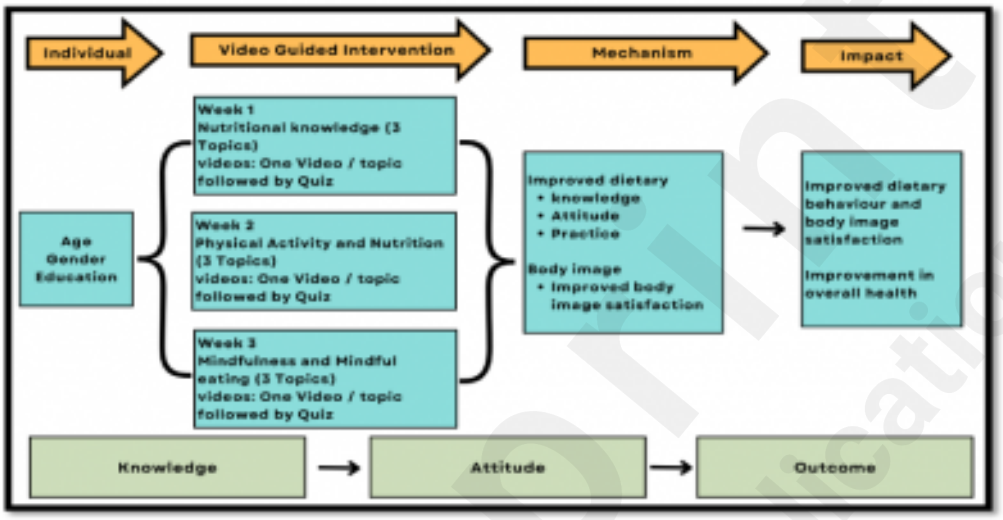
Supplementary Files

Figures

Logic model illustrating short- and long-term outcomes of the nutrition education intervention targeting Asian adolescents.

Figure 1: Logic Model



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