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FEATURE

Effects of Educational Obesity Prevention Program on Lifestyle Knowledge, Attitude, and Practices Among Adults

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Abstract. Lack *of knowledge, poor attitude, and negative practices are the barriers to preventing overweight and its co-morbidities. There is a need to increase the knowledge, attitude, and practice(KAP) of obese individuals to ensure effective weight reduction. Therefore, this study aims to determine the effects of educational obesity prevention programs on KAP among adults. A pre-experimental research design was conducted with 31 adult outpatients in Penang, Malaysia, using a pre-and post-one group intervention study, which consisted of two parts: (a) group-based class; (b) educational materials via text messaging. The results showed significant improvement in knowledge (p = 0.015), attitude (p = 0.021) and practice (p < .001). There was no significant difference in KAP when considering the moderating variables of age and educational level, except gender in terms of knowledge and BMI in terms of attitude. The study concluded that the educational obesity prevention program had a positive effect on KAPs.*

Keywords: knowledge, attitude, practice, educational obesity prevention, Penang, Malaysia, pre-experimental study, adults

Introduction

Malaysia appears to be the fattest country among ASEAN countries, where the medical costs related to obesity have accounted for 10–20% of the country's healthcare spending, according to the Economist Intelligence Unit (2017). Obesity is responsible for a large proportion of costs to the health care system as well as society as it predisposes an individual to a greater risk of developing other co-

morbidities such as cardiovascular diseases, type II diabetes, hypertension, sleep apnea, and osteoarthritis (Hruby & Hu, 2015). The most recent data found in Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia (2020) revealed that the prevalence of overweight and obesity has become so much alarming that it affects half of the adult population (50.1%) aged more than 18 years old in Malaysia.

Recognizing the epidemic of overweight and obesity in Malaysia, there are a wealth of studies conducted on overweight individuals at different settings ranging from home, community, school, and workplace, which focused on the results of biometric data, the changes in diet and lifestyle practices with a pre-and post-intervention (Mazloomy-Mahmoodabad, Navabi, Ahmadi, & Askarishahi, 2017; Ministry of Health Malaysia, 2015). However, the impact of health education on lifestyle knowledge, attitude, and practice (KAP) towards obesity prevention has not been adequately documented in Malaysia. Therefore, a study that uses health education intervention on KAP was necessary.

Healthy lifestyle behavior is key to successful weight management (Kebbe, Damanhoury, Browne, Dyson, McHugh & Ball, 2017). This requires the change in knowledge, attitude, belief, value, and practice to yield behavior change. Hence, education is important to be imparted by health care professionals to individuals who desire to lose weight. Providing a multi-dimensions education about healthy lifestyles involving physical, mental, and emotional aspects is believed to be effective in guiding people to control their body weights in a healthy range and sustainable ways. The intervention program in this study was designed to promote healthy living among adults through education, real-life experiences, and hands-on activities to improve their KAP towards obesity prevention. The purpose of this study was to determine the effects of an obesity prevention program on lifestyle KAP among overweight adults.

Review of the Literature

The prevalence of overweight (BMI 23-27.5 kg/m^2) in Penang state, Malaysia, among adults was 37.3%, the highest among 15 states in Malaysia. Among the ethnic groups, Indians were the most obese (43.5%), followed by Malays (35.4%) and Chinese (21.9%). Other sociodemographic characteristics associated with a high obesity rate include female, occupation such as a government/semi-government employee, and monthly income of RM9000–RM9999 (Ministry of Health Malaysia, 2015). Viewing this trend, intervention programs for obesity prevention is imperative for the population living in Penang.

Multiple pieces of evidence support the importance of more physical activity and proper nutrition at the individual level or community level in the majority of the public health programs to address the physical and psychological aspects of obesity (Telles, Gangadhar, & Chandwani, 2016). A comprehensive, multi-component, and modern lifestyle approach should include lifestyle or behavioral training, dietary modification for calorie restriction, and increased physical activity (Bray, Frühbeck, Ryan, & Wilding, 2016). Education regarding healthy lifestyles can be delivered through speeches, questions and answers, group discussion, reviewing scenarios, video, role-play, and PowerPoint display, while the educational materials can include booklets, pamphlets, and brochures. An intervention on weight loss, which only focused on education without involving any lifestyle modification, has proved its effectiveness on weight reduction. The contents covered (a) knowledge about obesity, risk factors, and complication; (b) development of positive attitudes; (c) role of nutrition and exercise; and (d) strengthening social supports and self-efficacy. It was observed that the BMI, weight, and waist circumference among the participants dropped significantly ($p < 0.001$) after the educational intervention (Mazloomy-Mahmoodabad et al., 2017).

Regarding the delivery methods of education, text messaging can be a good option for adults as it provides convenience and flexibility to them to access the information. Attending scheduled classes can be challenging for working adults. Furthermore, mobile phone usage is very high in this new era, and hence, text messaging can ensure high accessibility to health information. Evidence shows that education delivered through text messaging via mobile phone is equally effective in promoting behavior change. Text messaging can generate alerts for the subjects to facilitate the implementation of lifestyle prevention strategies. Such an approach has several benefits: inexpensive, instant message delivery, flexible timing, and planned. Multiple studies showed that the approach of text messaging was effective for helping individuals to reduce weight and waist circumference (Silina, Tessma, Senkane, Krievina, & Bahs, 2017; Siopis, Chey, & Allman-Farinelli, 2015).

A group-based program provides room for interaction among the participants and creates positive peer pressure, motivating participants more to make lifestyle changes. Jamal, Moy, Mohamed, and Mukhtar (2016) have designed the group-based workplace intervention (GSLiM) program to create social support and improve self-efficacy in losing weight for obese Malaysian adults in the workplace. The group sessions included self-monitoring, cognitive-behavior sessions (staying motivated), exercise, and dietary change advocacy. Findings showed that the GSLiM program achieved a targeted weight loss of 6%, improved self-efficacy, and created positive support with lower intensity. Incorporating a group-based approach and

psychological sessions managed to achieve the psychological change needed to achieve weight loss.

Several studies that employed multi-component lifestyle intervention programs for obesity prevention have shown positive impacts on the changes of KAP. Rusali, Shahar, Wen, and Manaf (2016) have conducted a structured weight management program at the workplace among the sixty-four overweight and obese employees of the petroleum industry in Malaysia. During the scheduled program, knowledge about healthy eating, food group, balanced diet, healthy food choices were instilled into the intervention group. After which, it was found that the mean score of KAP at baseline of the intervention group was higher (77.6 ± 9.4%) than controls (61.0 ± 15.7%; $p < 0.05$). Thiabpho et al. (2018) have conducted a lifestyle modification program on weight loss for 60 obese women in Thailand. The education given to the participants included knowledge on obesity and its co-morbidities, health impacts from lifestyle modification and its obstacles, exercise, eating out strategies, food labels, and a food exchange list. Findings revealed that a greater improvement of KAP together with total weight loss, waist circumference, and blood pressure among the participants in the intervention group after the program, while the control group showed minimal improvement. This shows that by changing the KAP of the participants through education, they can achieve significant weight loss.

To successfully promote a target behavior, a desirable attitude should be formed first among the subjects during the education about prevention of obesity as education enables people to see both consequences of existing behavior and outcomes of desirable behavior (Zizzi et al., 2016). Mazloomy-Mahmoodabad et al. (2017) conducted an educational intervention on weight loss. They found that the mean score for attitude before and after the educational intervention has significantly improved. Mazloomy-Mahmoodabad et al. (2017) became more aware of themselves and acknowledged that their body weights were at risk for obesity. Such attitudes are important to lead them to produce healthy lifestyle behavior. A positive effect on the subject's behavior was observed following the educational intervention. It was found that more subjects were willing to take three servings of vegetables and two servings of fruits in their diet.

However, even with adequate knowledge and a correct attitude about weight control, it does not guarantee they can be translated into real action in weight reduction. This is supported by a cross-sectional study of 91 overweight adults in Nigeria, which showed that despite the majority of them had awareness about their weight status and had adequate knowledge about overweight and obesity, the participation rate in weight control and reduction program appeared to be very low (Bolarinde, Henry, & Daniel, 2018).

The theory used in this educational obesity prevention program is the *health belief model*. It is useful in enhancing someone's skills and the ability for lifestyle modification through health education. This model comprises several constructs such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. Increasing an individual's perception of severity and susceptibility regarding obesity enables individuals to understand the benefits and barriers regarding weight loss. It hence increases an individual's ability regarding healthy eating and lifestyle, and lastly creates stimulating cues to lose weight (Thiabpho et al., 2018).

Perceived susceptibility refers to someone's belief regarding the likelihood of developing obesity due to indulging in certain behavior. If the overweight subjects in this study believed they are vulnerable to a particularly negative outcome of being overweight, then they would be more motivated to modify their lifestyle (Woods, 2018). Perceived susceptibility can be examined through the perception of the subjects regarding their exposure to unhealthy eating habits and sedentary lifestyles and how likely they will perform it. Health education is hence important to increase their knowledge regarding the risk factors of obesity and highlight to them the unhealthy lifestyle practices.

Perceived severity refers to how serious an individual believes the complication and consequences of developing obesity as a result of a particular behavior. An individual is more likely to prevent obesity when understanding the undesirable complication associated with obesity (Woods, 2018). Perceived severity is examined by knowledge and awareness of obesity risk among the subjects. Hence, health education is given to increase awareness about the negative complications of obesity.

Perceived benefit is the perception of an individual regarding the value or usefulness of practicing certain health behavior. When the subjects see the positive benefits of lifestyle modification, they will be more motivated to practice (Kamimura et al., 2016). Hands-on activities and real-life experience in the prevention program enable subjects to learn and understand the benefits of eating healthily and being physically active.

Next, the perceived barrier is an individual's evaluation of the difficulties or obstacles associated with the target behavior. An individual may not be willing to consistently practice or perform the target behavior despite their understanding of its benefits if the barrier outweighs the benefits (McVay, Yancy, Bennett, Jung, & Voils, 2018). The perceived barrier can be measured through self-efficacy. Self-efficacy can be enhanced through a group-based workshop where group support can enhance one's confidence in practicing a healthy lifestyle.

Lastly, cue of action refers to the trigger for health behavior, which can be external such as mass media, or internal such as negative changes in bodily state (Woods, 2018). Motivation and peer pressure can trigger subjects to modify their lifestyle.

The obesity prevention program in this study involved group-based intervention, which covered multiple dimensions, as well as delivering the education via text messaging to the adults. The changes of lifestyle KAP among adults between the pretest and posttest were studied. The moderating effects by the variables such as age, gender, educational level, and BMI on the changes of KAP were also studied.

Methodology

There are many methods of conducting health intervention programs. However, this study used a group-based educational obesity prevention program that involved a pre-experimental research design, which included pretest and post-test. The education program was delivered in two modalities; face-to-face and through text messaging. The data was collected through Google Forms sent out through text messaging. The data was analyzed using both descriptive and inferential statistics. The details of the methodology are discussed in the ensuing sections.

Research Design

This was a quantitative study that used a pre-experimental research design. The pre-experimental research design involved planning for the intervention, implementation, data collection, and statistical data analysis to assess the impact of the intervention program (Farooq, Nóvoa, Araújo, & Tavares, 2016). A pretest questionnaire was administered through Google Form before the start of the intervention program to assess the lifestyle KAPs of a group of participants before the obesity educational intervention program was administered. At the end of the educational intervention program, a post-test questionnaire was used to assess the impact of the intervention program. In either case, the participants were given at least a week to complete the questionnaires with reminders through text messages.

Research Setting

This study was conducted in a hospital in Penang, Malaysia, with the outpatients who signed up for wellness screening. The patients did their medical tests, seen by doctors, and if necessary, they were recommended for an individual nutrition counseling session. Their medical reports were reviewed, and nutrition counseling that usually lasted for 1 hour was conducted within the hospital. Those qualified for the study that had additional education on obesity prevention were asked if they were willing to join the study. Informed consent and contact numbers of those willing to participate in the study were obtained, and a half-day training program was planned. The rest of the intervention program that lasted approximately two months was done through text massaging.

Population and Sampling

The study population comprised a total of 56 outpatients treated and referred for dietary counseling in a hospital in Penang over a period of 1 month. A purposive sample of 31 patients was drawn from the entire population. Those who were sampled for the study were patients that exhibited signs of high risk for obesity. Signed informed consent was obtained from these 31 participants who expressed their willingness to participate in a quasi-experimental study on an obesity educational intervention program. The participants were adults aged 18 years old and above. Individuals on medication for chronic illnesses, such as kidney failure, cancer, and any organ failure, were excluded from the study. Also, pregnant and breastfeeding women were not recruited for the study.

Data Collection

This study involved answering a validated standardized self-administered KAP questionnaire adopted from Reethesh et al. (2019). The participants answered the questionnaire through Google Forms as a pretest before receiving educational materials through text messaging and the half-day obesity educational intervention program as a group. At the end of the educational intervention program, the participants were asked to answer the same set of questionnaires as a post-test.

The reliability test of the standardized KAP questionnaire had Cronbach's α score of 0.75 for knowledge, 0.75 for attitude, and 0.63 for practices indicating good internal consistency. The knowledge part of the questionnaire assessed participants' knowledge regarding risk factors and complications associated with obesity. The attitude part assessed the perception on obesity and motivation to lose weight, and the practice part assessed dietary habits and physical activity levels in the participants' daily lives.

Half-Day Obesity Educational Intervention Program

The half-day obesity educational intervention program consisted of multiple components, including education on healthy eating, physical activities, motivation, and psychological sessions. These components were translated into a series of activities such as cooking demonstrations, group exercises, and video sharing. Table 1 shows the summary of the half-day program.

Table 1

Program Summary

No	Components	Activities	Duration
1	Introduction	-Introduction about the program	30 mins
		-Ice-breaking session	
		-Answering pretest	
2	Anthropometric measurement	-Measurement about height, weight, BMI, and body fats%	30 mins
3	Physical activity	-Stretching and flexibility exercise	1 hour
		-Aerobic dance	
4	Healthy eating	-Sharing about a balanced diet	1 hour
		-Cooking demonstration for healthy multi-colored, plant-based recipe	
5	Motivation and psychological session	-Motivational movie session and sharing	2 ½ hours

Educational Materials via Text-messaging

The program began with a pretest using Google Form link sent via text messages. This was followed by a set of educational reading materials sent individually to each participant through text messaging at separate times over seven days. Question and answer sessions were carried out via text messaging whenever the participants had any inquiries about the reading materials. Post-test was given to

all participants by the end of the entire program. The contents of educational materials that were shared with the participants were as shown in Table 2.

Table 2

Educational Materials

Day	**Topics**
Day 1	Introduction of overweight and obesity;
	Complication and risk factors of obesity;
Day 2	Concepts of weight loss;
	BMI and waist circumference;
Day 3	Healthy and safe methods for losing weight;
Day 4	Sugar contents of common beverages;
	Healthier food choices;
Day 5	Physical activity guidelines;
	Exercise examples;
Day 6	Balanced diet
	Healthy food plate and food portion;
Day 7	Calories of local foods;
	Tips of eating out healthily;

Data Analysis

In this study, the obesity prevention program and the questionnaires were assigned as the independent variable, whereas the dependent variables were KAPs of the participants during pre-and posttest. The data obtained from the pre and posttest questionnaires were tabulated in an excel file and then imported to SPSS V.24 for data analysis. Mean, standard deviation, and frequency distribution were used to describe the demographic data (age, gender, education level, and BMI) of the participants. Statistical tests were used to analyze the data.

Paired sample *t*-test was used to analyze the significant difference in the effects of an obesity prevention program on lifestyle KAPs among adults between pretest and posttest. Additionally, analysis of variances (ANOVA) test was used to analyze the significant difference on the effects of educational obesity prevention program on lifestyle knowledge, attitude and preventive practice among adults between

pretest and posttest when the moderating variables such as age, gender, educational level, and BMI are considered.

Ethical Considerations

Ethical approval was sought and issued by Ethical Review Board (ERB). This was done to safeguard both the research participants and the researcher. The ethical considerations during the process of this study included:

Informed consent. All participants were asked about their willingness to participate in the prevention program, to receive text messaging, and to answer the pre-and posttest questionnaire. The research purposes, data collection methods and analyses, benefits of the study, procedures of the prevention program, and duration for answering the questionnaire were explained to the participant before the commencement of the program. Participation was voluntary, and they were allowed to withdraw from the study at any given point in time. Those who agreed to participate were requested to sign the informed consent.

Risk or harm. The procedures of the data collection and prevention program were explained to the participant. There was no known physical and mental harm in participating in the study. Those who were considered vulnerable were excluded from the study.

Anonymity and confidentiality. The data of each participant was kept private and confidential and was only be accessed by the researchers. As the same person needed to answer both the pre-and posttest questionnaire, hence the names of the participants were recorded but were only seen by the researchers. The telephone number of each participant was added to the contact list on the researcher's phone for text messaging about the content of educational materials only. The data collected from both pre-and posttest questionnaires were for the study only. The responses of the participants were kept confidential in an Excel file that was only accessed by the researchers.

Results

The data analysis for this study was done using SPSS. Both descriptive and inferential statistics were performed to assess the impact of the intervention program. The inferential statistics included t-test and analysis of variances (ANOVA). The subsequent sections present the results.

Demographic Data of the Participants

The demographic data, including age, gender, educational level, and body mass index (BMI), were studied in this research, as shown in Table 3. Among 32 questionnaires distributed, 31 participants responded, indicating a response rate of 97%. There were 13 (42%) males and 18 (42%) females. The highest percentage of age distribution was below 30 years old, which accounted for 68%. The largest group had their highest educational qualification at diploma or degree level (81%), followed by Master's level (13%), and only 7% had secondary school level.

Table 3

Demographic Data of the Participants (n=31)

Demographic data	N	Frequency	Cumulative Frequency
Age			
< 30	21	68%	68%
30-34	9	29%	97%
≥35	1	3%	100%
Gender			
Male	13	42%	42%
Female	18	58%	100%
Educational level			
Secondary School	2	7%	7%
Diploma /Degree	25	81%	87%
Master's	4	13%	100%
Body Mass Index			
Underweight (< 18.5 kg/m^2)	0	0%	0%
Normal (18.5 – 22.9 kg/m^2)	5	16%	16%
Overweight (23.0 – 27.5 kg/m^2)	15	48%	65%
Obese (> 27.5 kg/m^2)	11	36%	100%

Both overweight and obese participants constituted 84%, with 48% and 36% respectively. None of them were underweight, and those who had normal weight only accounted for 16%.

The Effects of Obesity Prevention Program

To examine significant differences in the effects of an obesity prevention program on lifestyle KAPs among adults between the pretest and posttest, descriptive statistics and paired sample *t*-test were used to determine differences between the pretest and the posttest. The response rate was 100%, where all the participants (n = 31) answered both pre-and posttest questionnaires. The results on KAP are presented.

Knowledge

There were in total 14 questions in the questionnaire to assess the knowledge level about obesity. The questionnaire covered multiple aspects, such as the definition of obesity, its complication, sugar and fat intake, and methods of losing weight. Table 4 shows the mean knowledge score for post-test (M = 61.516, SD = 3.580) was higher than pre-test (M = 59.290, SD = 3.614). As shown in Table 5, there was a significant difference of improvement in knowledge between the pretest and the posttest groups, $t(30) = 2.585$, $p = .015$.

Table 4

Descriptive Statistics on Lifestyle Knowledge

	Mean	N	Standard Deviation	Standard Error Mean
Knowledge (Pre)	59.290	31	3.580	0.643
Knowledge (Post)	61.516	31	3.614	0.649

Table 5

Paired Sample Test of the Pretest and the Posttest on Lifestyle Knowledge

	t	Df	Sig. (2-tailed)
Knowledge (Posttest) – Knowledge (Pretest)	2.585	30	0.015

The findings demonstrated that the educational obesity prevention program had a positive impact on knowledge among the participants. The education topics included healthy eating, physical activities, motivation, and psychological session. This finding was consistent with a few studies on the effect of lifestyle intervention programs for obesity. Rusali et al. (2016) conducted a structured weight management program at the workplace among the 64 overweight and obese employees of the petroleum industry in Malaysia. It was found that the mean score of knowledge at the baseline of the intervention group was significantly higher than the control group ($p < 0.05$). Another lifestyle modification program on weight loss conducted by Thiabpho et al. (2018) among 60 obese women in Thailand showed an improvement in mean knowledge score following a thorough education program. Likewise, Parra, Ortega, Kanter, and Kain (2018) suggested that the use of text messaging to encourage healthy eating and physical activity using mobile technology platforms, such as WhatsApp was feasible. Viewing that intervention program requires a time commitment and active participation, intervention involving text messaging sent through mobile phones can be more convenient and accessible, which helps to promote participation in learning.

Attitude

There were 15 questions regarding attitude found in the questionnaire, which contains the perception, motivation, and self-efficacy about healthy lifestyle and losing weight. Table 6 shows the mean attitude score for post-test ($M = 3.611$, $SD = 0.379$) was higher than pre-test ($M = 3.432$, $SD = 0.554$). As shown in Table 7, there was a significant difference of improvement in attitude between the pretest and the posttest; $t(30) = 2.435$, $p = 0.021$. The increase in attitude score was parallel with the increase in knowledge score.

Table 6

Descriptive Statistics on Attitude

	Mean	N	Standard Deviation	Standard Error Mean
Attitude (Pre)	3.432	31	0.554	0.010
Attitude (Post)	3.611	31	0.379	0.068

Table 7

Paired Sample Test of the Pretest and the Posttest on Attitude

	t	Df	Sig. (2-tailed)
Attitude (Posttest) – Attitude (Pretest)	2.435	30	0.021

This finding was in line with other studies which reported that attitude towards obesity significantly increased following nutrition education or lifestyle intervention program (Addo et al., 2017; Padamavathi & Vijayalakshmi, 2016; Thiabpho et al., 2018). Furthermore, a recent study conducted by Shanthi, Kanniammal, Mahendra, and Valli (2019) had employed a similar program methodology as this study (delivering education on obesity to the participants and teaching reinforcement was made through phone following the education), and they found that favorable attitude towards obesity and weight reduction was seen among the participants during the posttest and the improvement was significant. This finding suggested that both intervention strategies of the group-based lifestyle intervention program and educational text-messaging brought a positive impact on attitude towards obesity.

Practice

There were 13 questions regarding practice found in the questionnaire, which contains the routine practices of food choices, physical activity, and eating habits. Table 8 shows the mean practice score for post-test (M = 3.154, SD = 0.338) was higher than pre-test (M = 2.794, SD = 0.265).

Table 8

Descriptive Statistics on Practice

	Mean	N	Standard Deviation	Standard Error Mean
Practice (Pre)				
	2.794	31	0.265	0.048
Practice (Post)	3.154	31	0.338	0.061

Table 9

Paired Sample Test of the Pretest and the Posttest on Practice

	t	Df	Sig. (2-tailed)
Practice (Posttest) – Practice (Pretest)	5.111	30	<.001

As shown in Table 9, there was a significant difference of improvement in practice between the pretest and the post-test groups; $t(30) = 5.111$, $p = <.001$. Abougalambou, AbaAlkhail, and Abougalambou (2019) suggested that a good knowledge level was associated with better attitudes and practice, and a good attitude level was associated with the practice. They believed the educational program helped improve patients' attitudes and practice towards chronic diseases. However, few findings from other studies showed that a good knowledge level or good attitude might not necessarily lead to good practice. This was supported by the findings shown in a nutrition education program by Addo et al. (2017), where the mean practice score among the children has dropped after the program. This could be explained by the short implementation period. Also, Verma, Mehta, Mehta, and Patyal (2019) also concluded that following their implementation of educational health programs, patients with metabolic syndrome were still not complying with good lifestyle practices despite having a good attitude. Abougalambou et al. (2019) suggested that practice is much more associated with self-efficacy.

Significant Differences on the Effects of Educational Obesity Prevention Program

The study also sought to examine significant differences in the effects of educational obesity prevention programs on lifestyle knowledge, attitude, and preventive practice among adults between the pretest and posttest when the moderating variables such as age, gender, educational level, and BMI are considered. Thirty-one participants answered both pre-and post-questionnaires. An independent sample *t*-test and ANOVA one-way were conducted and the results are presented.

Gender

This question addressed here was, do gender influence one's knowledge about overweight and obesity, one's attitude towards obesity prevention, and one's lifestyle practice in the prevention of obesity? Table 10 indicates no significant difference in the scores of attitude and practice between male and female participants, except for the score of knowledge. A statistically significant difference was observed in the scores of knowledge between male and female participants, *t*

(29) = -2.763, p = 0.010. Female participants (M = 4.056, SD = 4.425) had a significant higher mean score in knowledge compared to male participants (M = -0.308, SD = 4.211). These results, however, contradicted the findings of Bolarinde et al. (2018), which showed no significant difference in knowledge level towards overweight and obesity between male and female participants. Bolarinde et al. (2018), however, found that the attitude towards obesity prevention among females was significantly higher than males.

Table 10

Independent Sample T-test to Test the Difference between the Pretest and the Post-test in the Lifestyle KAPs When Gender is Considered

Difference	Female		Male		*F*	*df*	*t*	*p*-value
	M	*SD*	*M*	*SD*				
Knowledge	4.056	4.425	-0.308	4.211	0.312	29	-2.763	0.010
Attitude	0.174	0.403	0.185	0.432	0.078	29	0.07	0.945
Practices	0.295	0.384	0.450	0.400	0.002	29	0.285	0.396

Age

The one-way between-group analysis of variance (ANOVA) was conducted to explore the difference between pre-and posttest when age was considered. Table 11 indicates that age had no significant moderating effect on the differences in KAPs. This result indicates that age did not influence the outcome of the obesity prevention program. This result was consistent with Abouhamda et al. (2016), who found that age did not have a significant influence on the knowledge about obesity. But, such a result was contrary to the findings of a study by Liu et al. (2018), whereby significant difference was found in the nutrition-related knowledge among different age groups. The age groups categorized in this study were 17-30 years, 31-40 years, and 41 years and above. The score of nutrition-related knowledge among these age groups was found to be significantly different, where the older age group scored higher. It was suggested that the level of nutrition knowledge increases as the age grows older. The distribution of the age of the participants in this study was skewed to below 30 years old. Hence, its moderating effect was not profound.

Table 11

ANOVA to Test the Difference Between the Pretest and the Post-test in the Lifestyle KAPs When the Age is Considered

Difference	<30		30-34		≥35		*F*	*df*	*p-value*
	M	*SD*	*M*	*SD*	*M*	*SD*			
Knowledge	2.381	4.489	1.778	5.954	3.000	0.000	0.059	2	0.942
Attitude	0.213	0.465	0.059	0.222	0.533	0.000	0.826	2	0.448
Practices	0.352	0.402	0.427	0.377	-0.077	0.000	0.746	2	0.483

Educational Level

Does different education level affect the level of KAP with regards to obesity prevention? The one-way between-group analysis of variance (ANOVA) was conducted to explore the difference between pre-and posttest when the educational level was considered. Table 12 indicates that there was no significant difference in terms of pre-and post- KAPs when adjusted for educational level, namely comparing secondary school, diploma/degree, and master.

Table 12

ANOVA to Test the Difference Between the Pretest and the Post-test in the Lifestyle KAPs When the Educational Level is Considered

Difference	Secondary School		Diploma/ Degree		Master		*F*	*df*	*p-value*
	M	*SD*	*M*	*SD*	*M*	*SD*			
Knowledge	0.000	11.314	3.040	4.383	-1.750	1.893	2.094	2	0.142
Attitude	-0.100	0.141	0.203	0.429	0.167	0.363	0.494	2	0.616
Practices	0.000	0.000	0.375	0.408	0.442	0.323	0.948	2	0.400

This result indicates that the outcome of the obesity prevention program was independent of the educational level of the participants. This result was consistent with Abouhamda et al. (2016) who found that educational level did not significantly influence the knowledge about obesity. However, this finding was in contrast with a study conducted by Hatta, Rahman, Rahman, and Haque (2017), where they found that as the educational level increased, the knowledge and attitude also increased. Another study tested KAP on obesity among young adults with medical background and non-medical background, found that those with medical background had a higher score (Waghmare, Pathak, Das, Mendhe & Kesh, 2019).

Body Mass Index (BMI)

The one-way between-group analysis of variance (ANOVA) was conducted to explore the impact of different categories of BMI on KAPs. Table 13 indicates that there were no significant changes in KAP during the pre and posttest when BMI was considered, except for the attitude score, F (2, 28) = 3.561, p = 0.042.

Table 13

ANOVA to Test the Difference Between the Pretest and the Post-test in the Lifestyle KAPs When the Body Mass Index is Considered

Difference	Normal (18.5 – 22.9 kg/m^2)		Overweight (23.0 – 27.5 kg/m^2)		Obese (> 27.5 kg/m^2)		*F*	*df*	*p-value*
	M	*SD*	*M*	*SD*	*M*	*SD*			
Knowledge	4.200	5.762	0.733	3.955	3.364	5.201	1.511	2	0.238
Attitude	0.507	0.293	0.218	0.376	-0.024	0.408	3.561	2	0.042
Practices	0.231	0.272	0.462	0.394	0.280	0.427	1.006	2	0.378

The results suggest that the outcome differed in terms of attitude of the participants when BMI was considered. Post-hoc comparisons using the LSD test indicated that the mean score of attitude for normal-weight participants (M = 0.507, SD = 0.293) was significantly higher than obese participants (M = -0.024, SD = 0.408). The association between one's BMI and perception of body weight was studied by Jajulwar, Meshram, and Saji (2017) and they revealed that the majority of the overweight and obese subjects perceived that being obese poses risks for health consequences.

Conclusion

This study concludes that the educational obesity prevention program was effective in improving knowledge (p = .015), attitude (p = 0.021) and practices (p < .001) among the participants. In terms of moderating variables, the female gender shows better knowledge of obesity prevention compared to their male counterparts. In terms of BMI, those with normal BMI show a more positive attitude towards obesity prevention compared to obese participants. It is also concluded that education delivered via text messaging was effective, especially for young working adults aged 18-35 years old. The engagement between participants and the coach becomes closer when text messaging is used. Questions from the participants can be addressed immediately, which allows them to take action with greater confidence. This method also offers time flexibility and convenience to the participants, where they can access the information anywhere or anytime, and only a mobile phone is required. Besides that, the group-based, multi-component, half-day program has provided a platform for participants to interact with each other in real. This created a stronger sense of motivation in everyone to be healthier and better and a positive atmosphere for healthy lifestyles. Peer support within the group also increased the confidence level in everyone to be healthy.

For the educational obesity prevention program in the future, it is recommended that the delivery methods of the lectures, activities, and education via text messaging can be done in more interesting manners, integrating with the state-of-the-art technology (mobile application), particularly for young adults, and involving more two-way communication between the researcher and participants. Health professionals, such as health educators, nurses, nutritionists, or dietitians, are recommended to be the project leader of such health promotion programs and adopt the findings or methodology of this study into the care plans for their potential patients. For future research, a similar longitudinal study can be conducted with a control group and a larger sample size.

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