ORIGINAL ARTICLE

A Pedometer-based Intervention with Daily Walking Steps and its Relationship with Nutritional Status among Overweight/Obese University Students in Kuala Terengganu

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ABSTRACT

Introduction: The aim of this study was to determine the effects of pedometer-based intervention and the relationship between daily walking steps and nutritional status among overweight/obese university students in Kuala Terengganu. **Materials and methods:** The study was an 8-week intervention study that included 23 overweight/obese university students. After 7 days of baseline activity, anthropometric data such as weight, height and waist circumference and a one-day dietary record were taken. The participants were divided into a control and case group. The control group (n=15) was instructed to continue with their normal activities and habits throughout the 8 weeks. The case group (n=8) was instructed to walk based on the targeted number of steps. Data such as body weight, waist circumference and a one-day dietary record were taken after the intervention. **Results:** Both case and control group show significant differences in body mass index (BMI) with p=0.017 and p=0.047 respectively. However, there is a large and significant difference between walking steps and BMI before and after intervention for the case group. There were no differences in any other study parameters during the 8-week study. **Conclusion:** In conclusion, short-term intervention with a pedometer increased physical activity and positively affected the BMI of overweight/obese participants. The use of a pedometer was efficient in measuring daily physical activity ($r = 0.756$, $p < 0.05$).

KEYWORDS: walking steps, intervention, nutritional status, pedometers, physical activity

INTRODUCTION

In Malaysia, the advancement of technology and rapid growth of socioeconomic status as well as modernization leads to adaptation of a less physically active lifestyle among Malaysians. According to the Malaysia National Health and Morbidity Survey (NHMS) 2015, there has been an increase in the prevalence of physical activity to 66.5%, compared to NHMS 2006 at 56.3%.[1] However, NHMS also showed that there are 30.0% overweight while 17.7% obese in Malaysia.[1] Therefore, in order to promote adaptation of healthy lifestyles and physical activity among Malaysian, Malaysia government had introduced a "10,000 walking steps a day" campaign.

In recent studies, practicing a 10,000 walking steps a day has shown significant benefits in maintaining body mass index (BMI). A 10,000 walking steps per day are essential in improving physical level as well as improving body mass index (BMI).[2] In addition, practicing 10,000 walking steps a day or more for several weeks has demonstrated effectiveness in lowering blood pressure, increasing exercise capacity and reducing sympathetic nerve activity in hypertensive patients.[3] In 2004, a study done by Thompson et al. showed that practicing 10,000 steps a day can maintain normal BMI and had a lower body

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fat percentage.[4]

Therefore, to determine the effect of 10,000 walking steps per day towards BMI, an 8-week intervention study using a pedometer as a measuring equipment was conducted. Few studies have investigated the effectiveness of daily walking steps on body mass index (BMI). Therefore, this study aims to investigate the effectiveness of daily walking steps and their relationship with nutritional status among overweight/obese university students in Terengganu.

This study is important, as the majority of the Malaysian population is not physically active at the recommended level. As recommended by the Ministry of Health (MOH) Malaysia, 10,000 daily walking steps per day is beneficial; walking is the simplest form of exercise.[5] The study is significant so that population can be more physically active through the 10,000 daily walking steps. Additionally, this study may improve the daily walking steps and Body Mass Index (BMI) of overweight/obese university students in Malaysia, especially in Kuala Terengganu.

MATERIALS AND METHODS

Subject recruitment

This was an intervention study that has been carried out in Kuala Terengganu, the capital of Terengganu, for a duration of two months. Kuala Terengganu was selected as the subject location as few nutritional assessments have been conducted along the east coast of Malaysia. Furthermore, the awareness and level and knowledge about the 10,000 steps per day program among residents in Kuala Terengganu remain insufficient. Calculation of minimum sample size was based on Charan and Biswas.[6] Calculations showed that the minimum sample size for this study was 18 overweight/obese university students. The following shows the calculation of minimum sample size:

$$= \frac{2SD^2 \left(Z_{\frac{\alpha}{2}} + Z_{\beta}\right)^2}{d^2}$$

$$= \frac{2(2312)^2(1.96+0.84)^2}{(3334)^2}$$

= 8 respondents per group

Where SD = Standard Deviation from previous study or pilot test

$Z_{\alpha/2}$ = 1.96 at type 1 error of 5%

Z_{β} = 0.84 at 80%

d = difference between mean value

Source: Ghazali et al.[7]

Hence, there should be 16 respondents (8 respondents for each intervention and control group). Taking into account of 5% drop out rate, thus the desired sample size for this study is 18 overweight/obese university students in Kuala Terengganu. In this study, a double arm pre and post intervention study was used to conduct the survey. A total of 23 respondents (university students aged 18 and above with BMI more than 25) were recruited. The respondents were grouped into a case group and control group. In the control group, a total of 15 respondents participated in this study, with 7 more participants than the case group. According to previous studies, several intervention studies had small scale sample size and are heterogeneous as well, as shown in Table I.

It is clearly shown that all samples in the studies above were non-homogenous and involved small sample sizes ranging from 19 to 51 respondents. Nevertheless, all of these studies showed significant results. For example, a study done by Soh and colleagues showed that although the sample size for both intervention and control was different, the result showed improvement for several cardiovascular disease risk factors.[8] Therefore, we can conclude that the sample size for intervention program may not necessary be homogenous and large.

Framework Design

A framework design as shown in Fig 1 was constructed before the intervention study began. Firstly, the sample population was defined. Overweight/obese university students were defined in the sample study per the increments of overweight and obesity reported by Malaysia National Health Morbidity Survey (NHMS). NHMS 2015 shows that the prevalence of obesity in Terengganu has escalated to 11.9% among adolescents aged less than 18. The data showed an increment of 6.2% from 5.7%, as reported in Malaysia National Health Morbidity Survey (NHMS)

Table I: Sample Size of Previous Studies

Researcher	Year	Study	Location	Sample size	Result
Moreau et al[10]	2001	Increasing daily walking lowers blood pressure in post-menopausal women	United State	Total respondent: 24 Intervention : 15 Control : 9	Study shows that a 24 week walking program meeting ACSM-CDC physical activity recommendation is effective in lowering systolic blood pressure.
Sohn et al[30]	2007	Effects of a 6-Month Walking Study on Blood Pressure and Cardiorespiratory Fitness in U.S. and Swedish Adults: ASUKI step study	United State, Swedish Adults	Total respondent: 19 Intervention : 8 Control : 10 Loss : 1	Study indicate that healthy individuals who took part in a pedometer intervention improved several cardiovascular disease risk factor.
Cadmus-Bertram et al[31]	2015	Randomized Trial of a Fitbit-Based Physical Activity Intervention For Women	Sandiego, California	Total respondent : 51 Intervention:26 Control : 25	Shows increased in physical activity.

2011. The eligible criteria for this sample selection was that the respondent must be age 18 and above, a university student without any medical conditions, possess a BMI of more than 25kg/m^2, were not on any special diet at the time of study and voluntarily participate in this study. Purposive sampling was used for sample selections. Ethical approval for this research was received from the Human Ethic Board of Committees of Universiti Malaysia Terengganu with reference number: UMT/JKEPM/2017/8.

Baseline measurements such as height, weight and waist circumference of the respondents were taken prior to the intervention. The participants were divided into two groups through single blinded randomized controlled trials into an intervention group and control group. Each respondent in each group was given an OMRON-HJ320 pedometer for measuring their daily walking steps.

The intervention group was given an intervention program in which they needed to reach the targeted steps according to the plan of the intervention, whereas the control group continued their normal lifestyle without altering their usual physical activities for a period of 8 weeks. After 8 weeks, the measurements of BMI and waist circumference of all respondents were measured again. The daily walking steps of both groups were analyzed to investigate whether there is an effect of daily walking steps towards BMI and waist circumference.

Research Instruments

A pedometer and self-administered questionnaire were used as instruments during data collection. The OMRON HJ320 pedometer was used to record the daily walking steps of the respondent, while the questionnaire was used to collect other relevant data such as socio demographic profile, anthropometry measurement, level of physical activity as well as dietary intake.

OMRON HJ320 is a user friendly step counter that features advanced 3D Smart Sensor technology. OMRON HJ320 step counter pedometer is an accurate instrument which can be used to calculate daily walking steps and miles travelled. The instrument was placed in the upper front pocket of clothing, in the front pocket of pants, bag or attached to belt or pants. At the end of the day before midnight, respondents were required to report the wear time and also steps accumulated on a log sheet before removal or switch-off. To determine the daily walking steps, respondents were instructed to carry their pedometer with them at all times, except during sleep and shower or other activities that involved water, for 7 consecutive days for approximately three months. The three months included one baseline measurement month and another two months for intervention program.

The questionnaire contains four sections: socio-demography, anthropometry measurements, physical activity and 24 hour dietary recall. Section A, socio-demography, included age, gender, race and religion to denote the characteristics of respondent. Section B consisted of the anthropometry measurements of the respondent, which included the measurement of body height, body weight, body mass index (BMI) and waist circumference. Body mass index (BMI) is the

most commonly used health indicator to determine optimal weight according to body height. The limitation of BMI is it is a ratio of body weight to height and does not directly measure body fat distribution. Hence, waist circumference measurement was taken so that the data could be more accurate, as the measurement of waist circumference provides the information in terms of fat distribution. Section C involved the physical activity questionnaire used to determine respondents' physical activity levels and sedentary behavior. The questionnaire used in this part was the shortened version of International Physical Activity Questionnaire (IPAQ) which is accessible from the USDA website (https://snaped.fns.usda.gov/materials/international-physical-activityquestionnaire-ipaq).

The questionnaire consists of six items which asked about the frequency and duration of vigorous intensity, moderate intensity and walking physical activity. It was then scored using a categorical scale, in which the three levels of physical activity are low, moderate and high as shown in Table II. It was categorized based on the total amount of time spent in each level which was calculated based on the number of days involved per week multiply with the minutes spent performing the activity in a day.[9] The number of minutes consumed in each activity category was used to multiply with the particular MET score for different activity category to assess the total weekly physical activity (METMin week-1).[10]

For the last section, Section E required respondents to estimate their 24 hour dietary recall so that the energy intake data of the population was recorded. The dietary recall was recorded before the intervention and after the intervention.

Table II: International Physical Activity Questionnaire (IPAQ) Scoring Protocol

Classification	Criteria
Low	Lowest level of physical activity. Those individuals who not meet criteria for categories moderate or high are considered low/ inactive
Moderate	Any one of the following 3 criteria: • 3 or more days of vigorous activity of at least 20 minutes per day OR • 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day OR • 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/ week
High	Any one of the following 2 criteria: • Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/ week OR • 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/ week

Source: Adapted from International Physical Activity Questionnaire (IPAQ) Scoring Protocol

Intervention program

Prior to the study, baseline measurements of all respondents were taken, including weight, height and waist circumference. 7-days of walking steps and one-day 24-hour dietary recall were also taken. There were two groups in this study which were control group and case group respectively. For the control group, all respondents maintained their lifestyle as usual whereas for the case group, they underwent a series of intervention program which they were required to increase their daily steps to a targeted walking steps. Previous intervention programs conducted by other researchers had different intervention programs and durations.[2,7,11-17] In the end, the intervention program used by Talbot and colleagues was adapted in this study.[13] The Talbot et al. intervention program was more suitable for Malaysian population especially students.[13] The intervention for this study was modified to participants' baseline step count and increased by 10% every 2 weeks. This duration of period was supported by a study done by Croteau as his study showed a significant increase in daily

walking steps and decrease in body mass index (BMI) for 8-weeks duration.[14] After 8 weeks of intervention, measurements such as weight, waist circumference and one day dietary recall were taken from both control and case groups. All in all, the intervention studies contained 4 phases where each phase lasted for 2 weeks. For the first phase, a 10% from baseline step count was added to baseline followed by 20% of baseline step count for the second phase and 30% of baseline step count for the third phase. At the end, the respondents accumulated a 40% baseline step count for the fourth phases.

Data Analysis

Statistical Package for the Social Sciences (SPSS) was used for data analysis. Descriptive statistics such as mean, frequency and percentage were used to present the data including anthropometry measurement, physical activity classification as well as socio demographic data. Firstly, a normality test was conducted to determine the normality of the data collected. Wilcoxon Signed Rank test was used to determine the significance differences between baseline walking steps and BMI and post program walking steps and BMI among the intervention and control group at $p < 0.05$. For 24-hour dietary recall data, a program known as Nutritionist Pro was used to determine the total energy intake of the respondents.

RESULTS AND DISCUSSION

Demographic profile

23 participants completed the study (15 participants in control group and 8 participants in case group). Table III showed the detailed characteristics of the respondents. Most of the respondents were female, aged 23 and were predominantly Malay. All the respondents were university students. Hence, occupational status was not available. As for physical activity classification, most of the participants were classified as low physical activity in both the case (75 %) and control (93.3 %) groups. This may be due to majority of the respondents being female and thus more likely to be involved in light and moderate intensity activities such as daily chores, grocery shopping and gardening.[18-19]

Baseline Anthropometric Measurements, Nutritional Status and Walking Steps of Respondents

For the case group, median BMI was 27.60 kg/m^2 (11.00), and median waist circumference was 90.70 cm (16.10) as shown in Table IV. The waist circumferences of the respondents did not meet the recommendations of the WHO (2008). Average calorie intake was 1498.75 kcal (656.25). Meanwhile, for the control group, the median BMI of the respondents were 30.00 kg/m^2 (4.10) with the waist circumference of 91.40 cm (14.00). The respondents were classified as obese as their median BMI was greater than 30.00 kg/m^2. Average calorie intake was 1512.74 kcal (1155.41).

Baseline daily walking steps were taken for 7 consecutive days. Table V shows the average daily walking steps of respondents for 7 consecutive days. The case group only achieved an average of 2721.60 (2390.50) walking steps per day, while the control group achieved a total of 4604.60 (3573.3) per day. According to the physical activity standards established by Tudor-Locke and Basett, taking less than 5000 walking steps per day is classified as sedentary lifestyle index.[20] However, in 2009, two subdivisions were added to the original sedentary lifestyle index, namely less than 2500 steps per day labelled as basal activity and 2500 and 4999 labelled as limited activity. Therefore, we can conclude that respondents in case group experienced a sedentary lifestyle with basal activity whereas respondents in control group experienced a sedentary lifestyle with limited activity. None of the respondents achieved the recommended 10,000 steps per day.

In contrast to previous studies, the baseline walking steps for case group respondents are considered low. A study done by Ghazali et al. showed that the baseline walking steps for the respondents was 7102 ± 2321.[7] A similar study also showed the baseline walking steps for control group was 3938.95 ± 1276.29, point-of-decision prompt (POD) group was 4055.44 ± 1763.13 and aerobics group was 4043.8 ± 1095.87.[21] Another study also showed a similar result.[22] According to their study, the baseline walking steps for their respondents were 3920.40 ± 661.10. However, all the respondents that participated in the intervention were employees in the Malaysia Government agencies.[7,21-22] All the respondents in the previous studies were classified

as sedentary lifestyle with limited activity[20] except for Ghazali et al.'s study[7], in which the respondents were employees of the Ministry of Youth and Sport.

All in all, the baseline walking steps from Malaysia studies were considered as having sedentary lifestyle physical activity. Study done by Chan et al.[18] showed that the baseline walking steps of respondents were 7029 ± 3100 whereas for study done by Thompson et al.[4], the baseline walking steps were 8354 ± 3249. Meanwhile, a study done by Miyazaki et al.[17] also showed similar result where the baseline for their study was 8827.6 ± 3923.7. A study by Stanford University found that Malaysia's average daily steps is approximately 3963 steps per day, more than 46 other countries.[23]

Table III: Respondents' Socio-Demographic Profile (n=23)

Characteristics	Number of respondent	
	Case n (%)	Control n (%)
Gender		
Male	3(37.5)	3 (20.0)
Female	5(62.5)	12 (80.0)
Age (Years)		
20	-	2 (13.3)
21	-	1 (6.7)
22	3 (37.5)	4 (26.7)
23	3 (37.5)	5 (33.3)
24	1 (12.5)	2 (13.3)
25	-	-
26	1 (12.5)	1 (6.7)
Race		
Malay	5 (62.5)	10 (66.7)
Chinese	3 (37.5)	5 (33.3)
Religion		
Islam	5 (62.5)	10 (66.7)
Buddhism	3 (37.5)	5 (33.3)
Body Mass Index (BMI)		
Overweight (BMI $\geq$ 25)	5 (62.5)	7 (46.7)
Obese (BMI ≥ 30)	3 (37.5)	8 (53.3)
Physical Activity		
Low	6 (75.0)	14 (93.3)
Moderate	2 (25.0)	1 (6.7)
High	0	0

Effect of an 8-weeks pedometer based intervention and its relationship with daily walking steps

The intervention program was run for 8 weeks. Each day, walking steps of respondents from two groups were continuously collected. For the intervention's first phase, the targeted walking steps were increased by 10% from the baseline walking steps for the first phase (week 1 and week 2), 20% from baseline for the second phase (week 3 and week 4), and so on as shown in Fig II. Lastly, a total of 40% from baseline was increased for the final phase (week 7 and week 8). The case group experienced an increment in walking steps from 3748 (2307.5) steps to 4438 (2432.0) steps, followed by 4839 (3491.0) steps to 5401 (3829.75) steps. For the control group, they did not need to fulfill the goal of the targeted walking steps. During the whole intervention program, their walking steps shifted from 4443.0 (2342.0) steps to 4442.0 (3111.0) steps followed by 3667.0 (3061.0) steps and 3443.0 (3392.0) steps. In the third (week 5 and week 6) and fourth (week 7 and week 8) intervention phase, the respondents gradually decreased the number of walking steps.

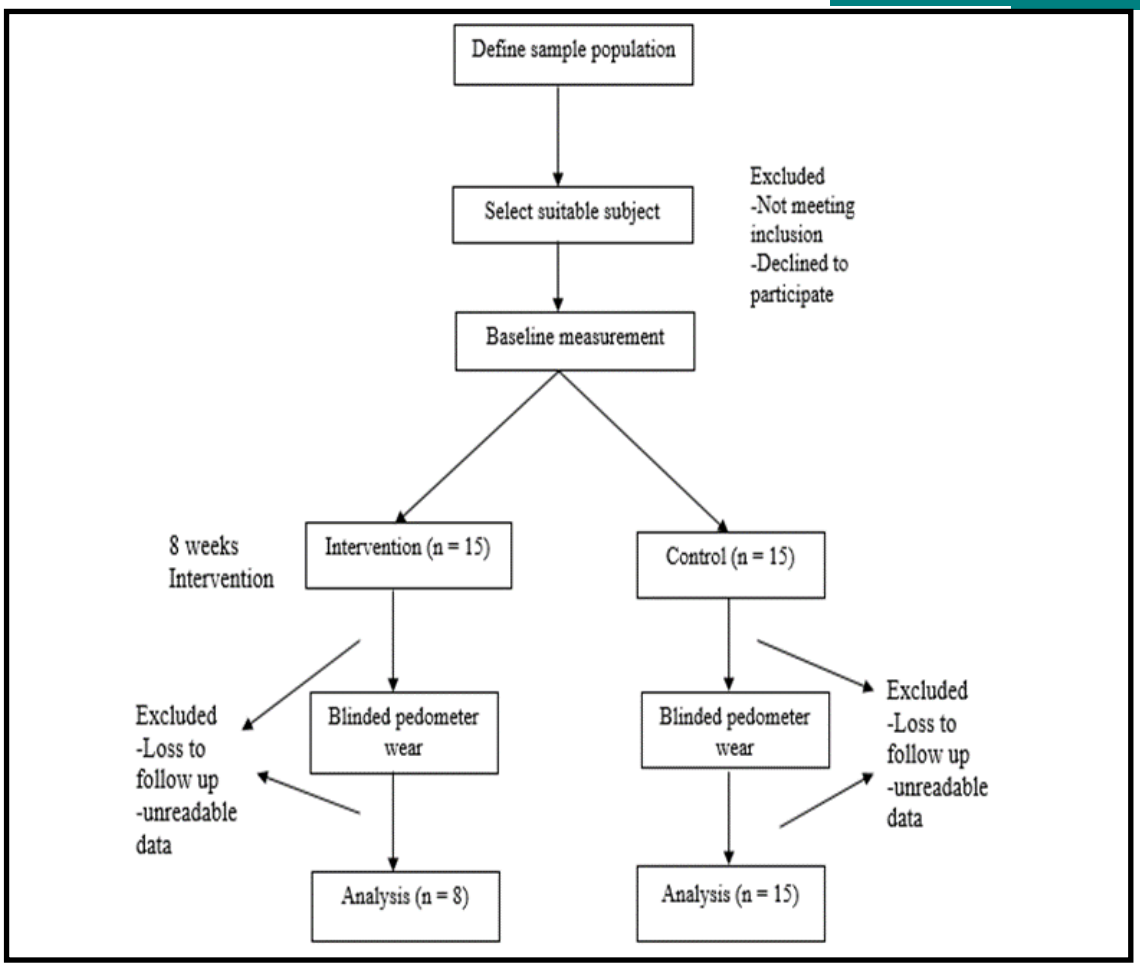

Figure 1: Research Framework design

Nutritional status differences between pre- and post-intervention for case group and control group was assessed using Wilcoxon Signed Rank Test. Wilcoxon Signed Rank Test is a non-parametric test for Paired T Test as the sample size was not normal. Wilcoxon Signed Rank Test is designed to use a repeated measure in which respondents are measured on two occasions, pre- and post-intervention. Table VI shows the differences of nutritional status between pre and post intervention for the two groups.

Table IV: Anthropometric Measurements and Total daily energy intake of the Respondents

Anthropometric measurements	Median (IQR)	
	Case (n=8)	Control (n=15)
Height (cm)	160.00 (18.80)	160.00 (14.00)
Weight (kg)	74.50 (21.50)	74.00 (9.00)
Body Mass Index (BMI) (kg/ m^2)	27.60 (11.00)	30.00 (4.10)
Waist circumference (cm)	90.70 (16.10)	91.40 (14.00)
Average calorie intake (kcal)	1498.75 (656.25)	1512.74 (1155.41)

Value expressed as median (IQR).

The median body mass index (BMI) of respondents in the case group decreased from 27.60 kg/m^2 to 27.18 kg/m^2. BMI had reduced nearly 0.42 kg/m^2 (0.17) after the intervention program. Interestingly, the control group also showed decreased in BMI, from 30.00 (4.10) kg/m^2 to 28.98 (3.58) kg/m^2. Both case and control groups, showed a significant difference for BMI before and after the intervention at $p < 0.05$. Thus, sample effect size (r) was used to determine the strength of the variable. The effective sample size (r) between walking steps and BMI in case group is 0.60 and that of the control group is 0.36. According to Pallant[24], r = 0.60 had a strong effect and r = 0.30 had a medium effect. The result is similar with study done by Duncan et al.[25], as their respondents were overweight and obese as well. Similar results also appeared in a study done by Araiza et al.[26], in which both control and case group showed difference in the reduction of BMI. Their study highlighted that the case group had a higher reduction in BMI (0.7 kg/m^2) as compared to control group (0.3 kg/m^2). Therefore, this study findings are in agreement with those of Araiza et al.[26] Other variables such as waist circumference and energy intake did not show any significant differences. The

waist circumference of the respondents showed a decrement but did not have significant values observed. The results were found to be similar to an intervention conducted by Castres et al. which also showed no significant difference in waist circumference.[27] However, this contradicts a previous study done Kajioka et al. in which no significant differences were found between walking steps and anthropometrics. However, that study found that increasing physical activity can reduce abdominal fat accumulation.[28] It is interesting to note that the energy intake in the case group was found lower during the pre-intervention but become higher after the intervention compared to the control group, but surprisingly the observed differences of energy intake between pre and post intervention were not significant for both groups at p<.05. The result was in agreement with Koulouri et al.[29] and Kajioka et al.[28] findings which showed that there was no significant differences between dietary intake and physical activity. Their' studies showed that the increased number of step counts did not significantly change their energy intake, number of meals and dietary compositions. Their studies had pointed out that a larger scale of study is needed for a better result. This result also may be explained by the fact that the intervention program involved a structured series of walking steps without involving any diet interventions.

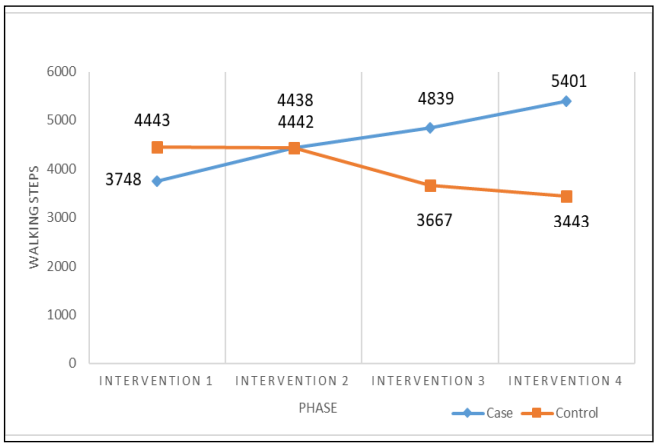

Figure 2: Distribution of walking steps according to intervention phases

As compared to several previous studies, the effectiveness of this intervention study was considered as moderate due to several reasons. Firstly, in Araiza et al.'s study, the intervention program was conducted for a duration of 6 weeks and it showed a high effect sample size of 0.84.[26] For Haines et al. study, the intervention program run for a duration of 12 weeks which was 4 weeks more than the current study.[16] However, the effect sample size was 0.62, which was slightly higher than this study. While a study done by Berry et al. showed a high effect sample size of 1.92 with a larger sample size of eighty respondents and a longer intervention duration (6 months).[15] The effectiveness of this current study can also be supported by a study done by Kang et al. in which their intervention study lasted between 8 weeks and 15 weeks and showed moderate effect.[30] Their study also stated that the intervention program that targeted to accumulate 10,000 walking steps per days was more likely to have higher reduction in BMI. This can be supported by Castres et al. study which showed an effect sample size of 1.92.[27] This is because the participants were instructed to increase their walking steps by 1000 steps until accumulating 10,000 walking steps. By the end of the study, a total of 70% of participants (26 out of 35 participants) were able to complete the intervention program.

Table V: Baseline Daily Walking Steps

Day	Median (IQR)	
	Case (n=8)	Control (n=15)
1	2335.00 (2013.30)	6143.00 (3037.00)
2	2586.00 (4705.30)	4155.00 (1708.00)
3	2343.00 (690.50)	3988.00 (5327.00)
4	3389.00 (3153.50)	4688.00 (2524.00)
5	2094.50 (389.80)	3346.00 (3534.00)
6	2178.00 (2966.30)	4687.00 (4121.00)
7	4125.50 (2815.30)	5239.00 (4762.00)
Total average	2721.60 (2390.50)	4606.60 (3573.30)

Value expressed as median (IQR).

Relationship between Walking Steps and Physical Activity Level

A Spearman correlation test was used to determine the relationship between physical activity assessed by pedometers and International Physical Activity Questionnaire (IPAQ). Based on the results, there is a strong relationship between daily walking steps and physical activity level ($r = 0.756$, $p = 0.03$) as shown in Table VII. This indicates that the physical activity recorded by pedometers was compatible with physical activity scored by IPAQ. These findings

Table VI: Differences of Nutritional Status between Pre and Post Intervention among Case Group (n=8) and Control Group (n=15)

Variable	Pre-intervention median (IQR)	Post-intervention median (IQR)	Sig.value, p	Effect size, r
Case Group				
BMI (kg/m^2)	27.60 (11.00)	27.18 (11.17)	0.017*	0.60
Waist circumference (cm)	90.70 (16.05)	87.20 (14.76)	0.080	
Energy intake (kcal)	1498.75 (656.25)	1606.39 (1218.54)	0.404	
Control Group				
BMI (kg/m^2)	30.00 (4.10)	28.98 (3.58)	0.047*	0.36
Waist circumference (cm)	91.40 (14.00)	86.40 (10.12)	0.169	
Energy intake (kcal)	1512.74 (1155.41)	1485.17 (769.60)	0.363	

* Significant of p<0.05

are supported by Regaieg et al. and Leong et al.[31,9] Regaieg et al. showed that the IPAQ scores were significantly related to pedometer step counts (r=0.66, p<0.001) with strong relationship, r=0.57 at significant level, p<0.001.[31] Their study also showed that the IPAQ indicated an acceptable reliability and validity when used to measure the physical activity in overweight or obese Tunisian adolescents. Leong et al. also found that daily walking steps among adults in Kuala Terengganu were slightly corresponded to their physical activity level at p < 0.01.[9]

Table VII: Relationship between Walking Steps and

Variable	Physical Activity Level	
	Spearman Correlation (r)	p-value
Daily Walking Steps	0.756	0.030*

*Significant relationship at p<0.05

Relationship between Walking Steps, BMI and Waist Circumference

There were no significant relationships found between BMI, waist circumference and walking steps for both case and control group after intervention. This result is not compatible to a study done by Chan and colleagues in 2004.[18] According to Chan et al., there was a relationship between walking steps with waist circumference.[18] The study also mentioned that those with fewer steps was associated with increased in waist circumference. Their findings were not in agreement with the findings from this study which probably due to the larger sample size effect. Another study conducted by Thompson et al. also showed similar findings. Their study revealed that there was a significant relationship between the average steps per day with waist circumference.[4] The reason may be due to the average body weight of respondents in Thompson et al. mostly found in the normal range, unlike the respondents in this study, who were either overweight or obese.[4]

CONCLUSION

It is clear that this sample of students in this study is in the low active group. None of the respondents achieved the recommended 10,000 walking steps per day, as they only accumulated less than 5000 steps per day in both baseline and during the intervention programs. From the Wilcoxon Signed Rank Test, both control and case groups showed significant differences between walking steps and BMI with p = 0.047 and p = 0.017, respectively. Results showed that increasing walking steps lead to a reduction in BMI. There is a large effect of significant difference between BMI and walking steps before and after intervention for the case group. Other than that, no significant differences were found between walking steps and other study parameters (waist circumference and energy intake). Despite the beneficial effects of walking and the massive promotions done by the Ministry of Health, few practice it in daily life, although it is the simplest form of exercise. This study may indirectly create public awareness on the importance of increasing daily walking steps. Further study could assess the long-term effects walking steps intervention towards

other study parameters, including biochemical assessments of the participants.

CONFLICT OF INTEREST

The authors confirm that there are no known conflicts of interest associated with this publication.

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