

ORIGINAL ARTICLE

THE EFFECTIVENESS OF AN INCENTIVE-BASED WEIGHT REDUCING TECHNIQUE AMONG UNIVERSITY PENDIDIKAN SULTAN IDRIS (UPSI) STUDENTS, MALAYSIA

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ABSTRACT

Increasing overweight and obesity prevalence are growing health concerns globally and in Malaysia due to various contributing factors such as life style, dietary intake (high sugar & high fat diets), less physical activities etc. In order to explore an effective weight reducing strategy for overweight and obese students; this study aimed to examine the significance of offering a monetary reward to students for weight reduction at the University Pendidikan Sultan Idris (UPSI), Malaysia. An experimental study was conducted among Forty Eight (48) University students selected based on criteria of Body Mass Index (BMI) above 25. The convenient sampling was used for 3-months weight reduction experimental program comprised of "repeated measure design" which involved multiple measurement of each subject and their exposure to all study conditions. Participants were divided into two groups: 12-pairs and 24-individuals to further compare results. Three introductory lectures were given to students by a nutritionist to educate both groups on 'nutritional aspects of everyday eating'. Participants were requested to attend follow-ups every two weeks to record their weight. ANOVA repeated measure with fixed effects were used to analyze data. Results indicated that "offering monetary reward" brought significant change in both groups students' weight reduction ($F(3.09, 142.24) = 18.16, p < 0.05$), and hasn't found significant comparative difference between two groups' weight reduction ($F(1, 46) = 2.74, p = 0.10$). The study reveals that offering monetary incentive or reinforcement to University-level students is an effective strategy in weight reduction either incentive is given to the groups or individuals. A similar long-term research project needs to be implemented and/or further research is required with large sample size to examine sustainability of weight losing behavior reinforced by monetary incentives.

Key Words: Experimental Study, Obesity, Incentive, Weight reduction

INTRODUCTION

According to World Health Organization (WHO) overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Weight that is higher than what is considered as a healthy weight for a given height is described as overweight or obese. People gain weight when they eat food having more calories such as high sugar & high fat intakes; than they burn through activity. This imbalance is the greatest contributor to weight gain. (US Department of Health and Human Services).

Asian Development Bank Institute estimated that approximately one billion people in Asia - pacific region were overweight or obese. Among them South East Asia had relatively low rate (26.3%) of overweight and obese adults compared to East Asia (33.06 %) and South Asia (28.85%). Although there is low rate of

obesity in South East Asia, Malaysia has the highest prevalence of obesity (2019)¹.

In 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million were obese, World Health Organization (WHO)² statistics shows that worldwide obesity has nearly tripled since 1975. The statistics are equally alarming in Malaysia, the 2015 National Health and Morbidity Survey (Ministry of Health, 2015) reported that 64% of the Malaysians are either overweight or obese based on BMI cut-off scores suggested by Clinical Practice Guidelines of Obesity (2015)³. Obesity statistics in Malaysia are increasing rapidly.

The World Health Organization (WHO) survey in 2010 ranked Malaysia as sixth in Asia with highest adult obesity rate. The University of Malaysia Specialist Centre has stat ed in 2018

that Malaysia has become fattest country in Asia in thirty (30) years which shows very speedy increase of obesity prevalence compare to 2010 (2018)⁴.

Comparatively prevalence of obesity and overweight in Malaysia over last couple of decades has matched some of developed countries. As the second National Health & Morbidity Survey (NHMS) in 1996 (Institute of Public Health (IPH) 1999) reported a prevalence of 17% overweight and 4% obesity in adults, while in third NHMS which was conducted in 2006 (IPH 2008) revealed an increase of overweight and obesity to 29% and 14% respectively.

The NHMS 2015 showed that the national prevalence of overweight, obesity and abdominal obesity had increased by 0.6%, 2.6% and 2.0% respectively as compared to the previous findings of NHMS 2011. Currently, the prevalence of obesity in Malaysia is also higher than the world prevalence of 13.0% in 2014 (www.who.int). As the number of people with obesity increases, the nation now is facing an upward surge of non-communicable diseases such as diabetes and cardiovascular diseases. The alarming trend of the obesity prevalence in Malaysia does not only require immediate revision of public health policies, but to provide supportive environment and commitments for Malaysians to work towards practicing healthier lifestyle.

It has been observed that lot of university students also falling in overweight and obesity category which can lead towards serious health problems and affect their productivity in professional lives. A study conducted on prevalence of overweight /obesity among medical students in Malaysia revealed that the prevalence of overweight and obesity among the medical students of AIMST University is on the high, which is comparable to the findings of earlier studies conducted in Malaysia, reinforcing the need to encourage healthy lifestyle, healthy food habits and a physically active daily routine, among the adolescents and youth of this country. (2012)⁵ Children and adolescents with obesity are five (05) times more likely to be obese in adulthood, leading to long-term morbidity and mortality (2017).⁶

For children and adolescents, the Malaysian National Health and Morbidity Survey (MNMHS) III reported a prevalence of 5.4% for overweight based on CDC (2000) weight-for-age chart.

Nutrition especially for young adults/university students is very crucial as they are in transitional phase from adolescent to adulthood. Obesity often results from the cumulative effects of years of eating patterns and physical inactivity established at a younger age. In this regard, the transition from adolescence to early adulthood is a critical period (2009)⁷, with longitudinal research showing that obesity prevalence increases notably during this time (2010)⁸. During these formative years, peer influence, transition from school to higher education or employment, new found independence and exposure to new foods, behaviors and environments create a complex ecological system that adolescents navigate and that influences future behaviors.

Although it is challenging to determine the exact cause of obesity in any individual, efforts aiming to quantify the contribution of modifiable risk factors to adolescent obesity would help to prioritize prevention and treatment strategies to reduce such obesity (2018)⁹. Eating behavior patrons can be some of modifiable contributing factors which need to be identified and addressed to reduce obesity among students. Similarly, there is need to examine the effectiveness of incentives in modifying eating behavior patterns among university students with aim to use study results for developing effective weight reducing programs.

The high prevalence of obese and overweight cases among Malaysians has prompted numerous efforts to curb obesity through health and awareness programs such as *Kempen Fit Malaysia* (2014)¹⁰. *Kempen Makanan Bersih* (2017)¹¹ and *Kempen Mencegah Obesiti* (2017)¹². Besides that, current treatment modalities in Malaysia include, but not limited to, surgical, pharmacological and behavioral treatment.

Pharmacological methods employ the use of medications to either suppress appetite or to increase satiety among patients (2016)¹³. However, a major concern with taking medications is the possible side effects of drug as Sibutramine has been associated with several cardiovascular symptoms (2016)¹³. Other considerations include long term effects of taking prolonged medication use such as kidney and liver failure.

In recent years, there has been a steady increase in the use of surgical methods to manage obesity which is expensive mostly. Medical costs aside, possible concerns have risen with respect to the

possible complications that may arise from these invasive procedures and in particular newer innovative bariatric surgeries (2017)¹⁴. Recent longitudinal studies into the extent of weight loss among Malaysian patients that have undergone bariatric surgery pointed to eating behavior as one of the predictor of weight loss (2018)¹⁵.

In a disease characterized by an imbalance of energy intake and output the most effective method would be to balance the energy intake and usage naturally. The third method uses this strategy via behavioral methods. Patients are offered reinforcement for weight reducing behaviors such as dietary and physical exercise. These methods target the primary risk factors associated with obesity which are excessive food intake and sedentary lifestyle (2016)¹³.

A meta-analysis was conducted showing that there were no changes in BMI with patients undergoing Mindfulness Cognitive Behavioral Intervention however, the training does reduce impulsive and binge eating behavior and increases physical activity (2016)¹⁶. Meanwhile, behavioral interventions have been shown to improve weight loss post operation, when used in conjunction with bariatric surgery (2016)¹⁷.

In two separate meta-analysis conducted by Shaw, O'Rourke, Del Mar & Kenardy (2006)¹⁸ and Alimaradi, Abdolahi, Aryan, Vazirjavid & Ajani (2016)¹⁹ indicated that successful and sustained weight loss among obese and overweight individuals is predicted by behavioral or cognitive interventions used in combination with diet and exercise. Alimaradi et al. (2016)¹⁹ cited issues such as lack of motivation and fear of failure in weight loss for the failure of conventional methods.

There is some evidence to suggest that this motivation drops during the course of a weight loss attempt. For example, adherence to weight loss recommendations such as self-monitoring, typically start at a high level and drop over time (2011)²⁰. One possible way to help encourage participants to continue the behaviors needed for weight loss after motivation has waned is to provide financial incentives for weight loss (2012)²¹. Financial incentives have been used as a way to encourage individuals to take part in preventative health behaviors, such as weight loss. (2004)²².

Available evidence indicates that financial incentives help promote short-term change, but

there is a dearth of evidence on longer-term programs and outcomes. Targeted incentives for specific risk groups have shown more success. With creative design, targeted use and evaluation, financial incentives for weight loss and healthy behavior may be a useful addition to the health policy toolkit. (2012)²³.

Keeping in view the seriousness of the increasing obesity rates in Malaysia it is very important to conduct more research to find out effective methods to reduce obesity and overweight by maintaining the motivation throughout the weight reducing process or program. As mentioned above adolescents/university students are one of the population groups who have high obesity and overweight prevalence. Therefore, the present study attempts to evaluate the effectiveness of an incentive based weight reducing technique among students of UPSI, Malaysia.

There were two (2) objectives of this study. First objective was to find out the effectiveness of monetary incentives for reducing weight among university students. Second objective was to compare effectiveness of monetary incentives for reducing weight between students participating in study as individuals and in groups.

The concept of this study is based on B.F. Skinner's operational conditioning behavioral theory through the practice of reinforcement. Therefore the researchers intended to examine the effectiveness of weight loss intervention by providing monetary incentive as a reward for every successful weight lost in terms of kilograms to reinforce weight losing behavior. Operant conditioning sometimes referred to as instrumental conditioning is a method of learning that occurs through rewards and punishments for behavior. Through operant conditioning, an association is made between a behavior and a consequence for that behavior (2013)²⁴.

The operant conditioning plays a powerful role in everyday learning. Reinforcement and punishment take place almost every day in natural settings as well as in more structured settings such as the classroom or therapy sessions (2019)²⁴. Operant conditioning relies on a fairly simple premise - actions that are followed by reinforcement will be strengthened and more likely to occur again in the future. For example if you tell a funny story in class and everybody laughs, you will probably be more

likely to tell that story again in the future (2019)²⁵. In this study monetary incentive has been used as a reinforcement to strengthen the weight losing efforts among students.

The study participants were divided into two major groups one group was comprised of students who participated as individuals. The second group was comprised of pairs to further see if there are any significant differences in level of motivation among two groups of study participants who are reducing weight individually or in groups. This concept was based on the impression that in pair students will have encouragement from each other to keep up their motivation for reducing weight.

The common health consequences of overweight and obesity include cardiovascular diseases (mainly heart disease and stroke), which were the leading cause of death in 2012 (WHO)²⁶; diabetes; high blood pressure; some cancers; breathing problems etc. Therefore obesity is major contributor to the global burden of disease and treatment is very expensive. It also drastically reduces quality of life and is costly in-terms of absence from work and use of health resources. (WHO)²⁶. Therefore it is important to reduce overweight and obesity to reduce burden of disease.

A study conducted on childhood obesity reveals that "Childhood obesity comes with an estimated price tag of an additional US\$19,000 per child when comparing lifetime medical costs to those of a normal weight child (2014)²⁷. Moreover, studies show most obese children and teenagers remain obese into adulthood (2014)²⁷.

"In order to understand the cost implications of obesity prevention efforts, it is necessary to accurately quantify the burden of childhood obesity if left untreated," (2014)²⁷. Thus, subject to study results; giving small amounts to students as a reward to reinforce their weight reducing behavior will be a cost effective measure as compare to allocate huge amounts for health budgets for expensive health care costs as "prevention is better than cure" (2014)²⁸.

The study hypothesis: First hypothesis, giving monetary reward to university students will help

in reducing their weight significantly. Second hypothesis, giving monetary reward to students in pairs will reduce more weight as compare to individuals.

METHODOLOGY

An experimental study was conducted among university students at UPSI, Tanjung Malim, Malaysia. The conceptualization and preparations were started in December 2018 & experiment was conducted from March to May 2019. The present study employed a repeated measures experimental design.

The sample of present study were recruited via advertisements on Facebook. A total of 320 University Pendidikan Sultan Idris (UPSI) students signed up for the study. Of the total 320, a 120 students who fulfilled the criteria of having Body Mass Index (BMI) exceeding 25 were selected to participate in the experiment. By using convenient sampling method a choice was given to selected students to join experiment either as an individual or in pair.

Based on participant's choice 120 students were divided equally into two groups. During the experiment some participants dropped from the study due to poor commitment. Additional some of students were disqualified by researchers due to subjects' negligence to attend weight reading session for two weeks consecutively. This resulted in a final sample of 48 (N 48) students divided equally into two groups. Group one (1) was comprised of twelve (12 pairs) and group two (2) was comprised of 24 individuals.

The experimental study was conducted over the period of three months and repeated measure design method was used to measure progress in reducing weight. All students were given a choice to participate as an individual or as pair (a group of two students). The study participants were informed about incentive of ringgit Malaysia RM 25 per kilogram weight loss for each student either participating as an individual or in a pair. Thus 24 students decided to join as a pair hence there were 12 pairs (twelve groups comprised of 24 students) and 24 students joined the study as an individual.

In order to increase study participants' knowledge and understanding about healthy diet and to provide them guidelines the researchers invited nutritionist to deliver presentations/lectures. The nutritionist informed them about food preferences and eating behavior patterns to help them in reducing weight.

The study participants were informed about objective, nature and procedure of the experiment and consent form was given as a mean to obtain their consent. A self-administered questionnaire/form was used in the study consists of 3 sections. First section of questionnaire gathered the demographic details from students, which included age, gender, height, race, current semester, name of faculty, contact details etc. The second section was comprised of questions to assess the level of physical activities and the third section was to obtain information about any current or past health issues experienced by the participants to find out about possible comorbidities as well as family history of obesity and family income. According to Department of Statistics (DOSM) Malaysians are categorized into three different income groups Top20%, Middle 40% and Bottom 40%. The top 20% median monthly income need to be RM 13,148, for middle 40% RM 6,275 and

for bottom 40% required monthly income is RM 3000.

The experimental study subjects were allowed to use any ways or methods to reduce weight which they think would be better for them in their weight reducing journey, provided that the method is not detrimental to their health. It was compulsory for students to measure their weight every two weeks' time at Eating Behavior Lab, of UPSI, under the supervision of researchers. In each weight reading session, the subjects were required to fill in a progress form and write about every single effort which they have done to lose weight in last two weeks' time. In order to do the statistical analysis ANOVA repeated measure with fixed effects were used to analyze the data.

RESULTS

Forty eight (48) students participated in the research. Table 1 represents participants' demographic characteristics, percentage of female students is 54.2% & 66.7% and 45.8% & 33.3% were male students. Majority of participants were under the category of obese with 70.8% in both groups and overweight were 29.2% in both groups.

Table 1: Demographic Characteristics of Group1 and Group2.

Demographic Variables	Group1 (Pair)	Group2 (Individuals)
Age(M, SD)	22.50 (1.75)	22.25 (2.45)
Gender		
- Male	11 (45.8%)	8 (33.3%)
- Female	13 (54.2%)	16 (66.7%)
Body Mass Index (BMI)		
- Overweight	7 (29.2%)	7 (29.2%)
- Obese	17 (70.8%)	17 (70.8%)
Economic Status	Middle Class Based on household income	Middle Class Based on household income
History of current and past chronic illness	No history of current and past chronic illness	No history of current and past chronic illness

The results are divided into two sections, the first section explores data using a Spaghetti plot. In second section, statistical inferential for a two-way mixed ANOVA with repeated measures was used.

Since the students were divided into two groups, the Spaghetti plot was created by using ggplot2 package in R software facilities. Figure 1 shown a Spaghetti plot (2016)²⁹ for individual weight reduction (in kg) versus time (in week) on two different groups. The first group (1) is on the single group, while the second group (2) is on the pairs groups. We plot the mean in the Spaghetti plot for each time point in week (triangle dot)

for both groups. By using locally weighted regression (lowess) facility in R to "smooth" over all the variability and give a sense of the overall or average trend of both groups (blue line) with 95 percent Confidence interval (shaded area). The plot clearly show the difference of averages trend based on two groups (single vs. pairs). The single group plot, shown that the mean trend slightly decrease linearly through times or weekly. However, for pairs group, the trend is slightly constant. Moreover, in general, the mean trend for weight loss within 12 weeks indicated slightly decrease in linear fashion.

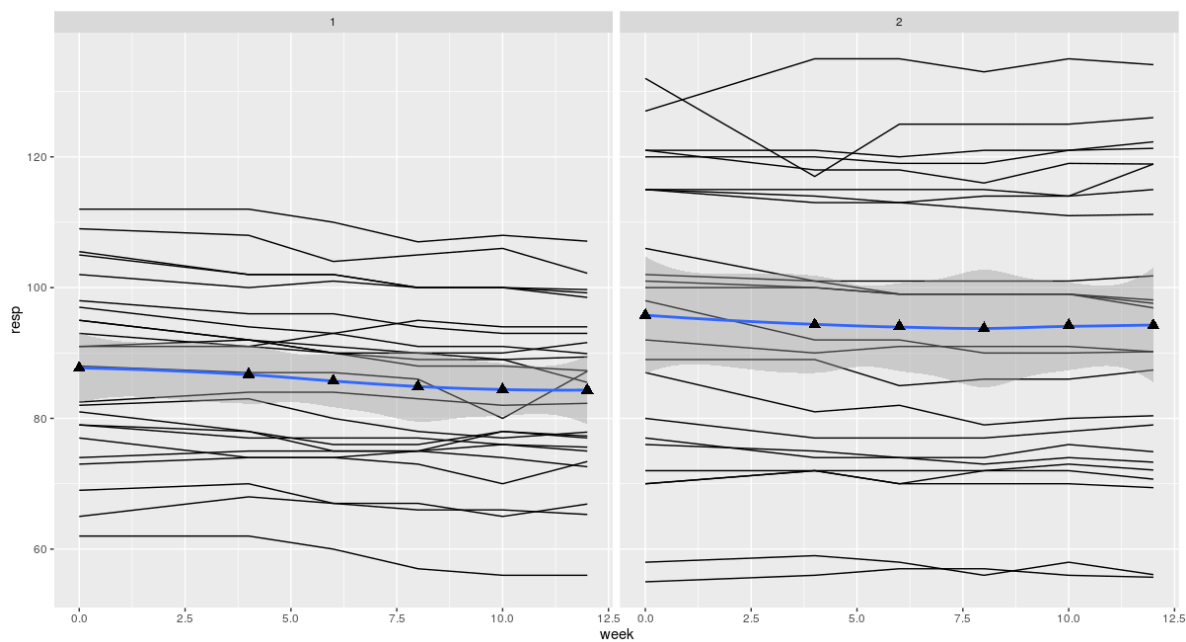


Figure 1: Spaghetti plot for weight (resp) versus time in week on two different groups. The first group (1) is on the single group, while the second group (2) is on the pairs groups.

Two-way mixed ANOVA with repeated measures was used to analyze data. The factors are weight measurements at 6 different points of time throughout the experiment for both groups. Mauchly's test of sphericity for the repeated measures variable indicates that repeated measures variable violated the sphericity assumption, $W = 0.18$, $\chi^2(14) = 74.82$, $p < .05$. Therefore, F statistics for the main effect of

Weight and its' interaction with Experimental Group is corrected with the Greenhouse-Geisser correction. There was a significant main effect of weight, $F(3.09, 142.24) = 18.16$, $p < .05$. This indicated significant weight differences measured at different time points in the experiment. The pairwise comparisons using Bonferroni adjustments for family wise error rate is tabulated below, in

Table 2 significant pairwise difference comparisons ($p < 0.05$) were found for Initial weight and week 6 to week 12 weights. Besides that, week 4 weight is also significantly different compared to week 6 to week 12 weights. Finally, week 6 weight is significantly higher compared to week 8 weight.

Table 2: Pairwise Comparison of Weight Measured at Different Time Points

Pair	Mean Difference	SE	p	95% CI
Initial Weight - Week 4 Weight	1.21	0.46	0.17	[-0.21, 2.63]
Initial Weight - Week 6 Weight	1.83*	0.37	0.001	[0.68, 2.99]
Initial Weight - Week 8 Weight	2.44*	0.41	0.001	[1.17, 3.71]
Initial Weight - Week 10 Weight	2.42*	0.43	0.001	[1.09, 3.74]
Initial Weight - Week 12 Weight	2.47*	0.43	0.001	[1.14, 3.80]
Week 4 Weight - Week 6 Weight	0.63	0.26	0.30	[-0.18, 1.43]
Week 4 Weight - Week 8 Weight	1.23*	0.30	0.002	[0.30, 2.16]
Week 4 Weight - Week 10 Weight	1.21*	0.32	0.007	[0.22, 2.20]
Week 4 Weight - Week 12 Weight	1.26*	0.36	0.01	[0.16, 2.37]
Week 6 Weight - Week 8 Weight	0.60*	0.18	0.02	[0.06, 1.15]
Week 6 Weight - Week 10 Weight	0.58	0.25	0.38	[-0.20, 1.37]
Week 6 Weight - Week 12 Weight	0.64	0.25	0.21	[-0.14, 1.41]
Week 8 Weight - Week 10 Weight	-0.02	0.21	1.00	[-0.66, 0.62]
Week 8 Weight - Week 12 Weight	0.03	0.21	1.00	[-0.61, 0.67]
Week 10 Weight - Week 12 Weight	0.05	.027	1.00	[-0.77, 0.88]

*significant at $p < 0.05$.

DISCUSSION

The study results have proved the first hypothesis that giving monetary reward to university students will help in reducing their weight significantly. It is an insightful study and results have indicated the importance of monetary incentive as an important reinforcer in reducing university students' weight. The results have revealed that measurement of weight reduction was in kilograms. The maximum weight reduction was eight (8) kilograms followed by six (6) and five (5) kilograms in three months' time period.

By selecting monetary incentive as reinforcer in weight reducing intervention for middle class university level students the objectives can be achieved significantly. However it is essential that the amount of monetary reinforcer should be carefully decided. As the incentive amount should not be either very small to not to have an impact or very big amount which requires a big budget.

It has been proved that the monetary incentive is important and useful for students in both ways either they participate in the study as an individual or in a pair. Nevertheless the results does not show any significant difference in

weight reduction to compare the importance of participating as an individual or in a group. Therefore second hypothesis "giving monetary reward to students in pairs will help in reducing more weight as compare to individuals" has not proved, which means monetary incentive can be equally important for pairs, groups or individuals.

A study conducted in 2017 in Singapore has shown that paying participants in a weight loss program just US\$160 can help them lose weight and keep the pounds off (2017)³⁰. Rewards or incentive based programs for participants joining a weight loss program is a low cost strategy to increase both the magnitude and duration of weight loss (2017)³⁰. A team from the Duke-NUS Medical School (Duke-NUS) and Singapore General Hospital (SGH) led the research, which has implications for insurance companies and employers looking for low cost strategies to improve population health.

As stated above obesity is increasingly prevalent worldwide, leading to the rise of non-communicable diseases such as cardiovascular disease, diabetes and cancer. Although obesity is largely preventable, it has been difficult to encourage healthier food choices and sustained physical activity (2017)³⁰. Therefore by using

insights from behavioral economics, Professor Eric Finkelstein from Duke-NUS and Dr. Tham Kwang Wei from SGH developed a rewards program to help overweight or obese adults lose weight. This study shows that the enhancement and maintenance of weight loss is feasible through a rewards program with participant ownership, coupled with an evidence-based, medical weight loss programme.” The results revealed that even small amounts of weight loss, sustained over time, confer great health benefits and can help prevent chronic disease (2017)³⁰. The program required participants to attend weekly sessions at the Lifestyle Improvement and Fitness Enhancement (LIFE) Centre where they were taught skills to maintain a healthy lifestyle and encouraged to lose at least five percent of their body weight. Additional rewards were offered for meeting five or eight percent weight loss goals (2017)³⁰.

As mentioned above there are many weight reducing methods which people practice generally such as dieting, exercise, weight losing medicines etc. Some methods are costly and some might be not suitable to gain proper results. A survey was conducted in seven shopping centers in Kuala Lumpur, Malaysia and its neighboring towns to assess the weight-loss practices of the general public. The survey results revealed that out of the 1032 people approached by the researcher, 389 (37.7%) admitted that they had tried to lose weight before (2002)³¹. The most common weight-loss method used was dieting (89.5%), followed by exercise (81%) and the use of slimming teas (24.9%).

Exercise (79.0%) was perceived as the most effective method for losing weight, followed by dieting (71.6%). Most respondents (60.6%) obtained their weight-loss products from the pharmacies but only 34.9% of these respondents had consulted the pharmacists on these products. The results of a similar study on dietary weight loss among working women in Malaysia shows that prevalence of successful weight loss was low (18.8%) among government working women in selected public funded institutions in Malaysia. Eat more fruits and vegetables, reduce the amount of eating food and reduce fatty food intake were the main dietary weight loss strategies used by these women (2014)³². Skipping meals is another weight losing practice. Skipping main meals and an unhealthy snacking pattern can lead to poor diet quality and consequently to the presence of chronic diseases. A study on unhealthy diet

practice reveals negative effect of unhealthy eating practices among adolescents on mental health. Targeted education should be implemented to improve psychological well-being (2016)³³. Maintaining healthy life style with healthier food choices and sustained physical activities is very important and need motivation to continue its practice.

The results of study conducted in Singapore with adults and the results of study “Effectiveness of an Incentive-Based Weight Reducing Technique among University Pendidikan Sultan Idris (UPSII) Students, Malaysia provide evidence that monetary incentives play an important role in enhancing participant’s motivation to reduce weight. Similar studies need to be conducted in Malaysia to further examine the long term sustainability of the efforts to control the obesity prevalence and prevent non-communicable diseases and contribute in reducing health budgets. Meanwhile small intervention programs can be designed to address the obesity prevalence among middle class adolescents by using monetary incentive approach.

As stated above at initial stage of study the sample size was large. However during the experiment some participants chosen to withdraw themselves from the research, citing hectic lecture schedules as the reason for withdrawing. May be the timing was not suitable for the students or possibly the reason of withdrawal was less attractive incentive amount which was Malaysian Ringgit 25 upon reducing per kilogram. Though it resulted in a final sample of 48 students but it can be a sufficient sample for an experimental study to investigate the hypothesis. As the study has significant results in terms of weight reduction, obtaining more data does not necessarily lead to more information. However with regards to time limitation it is recommended that duration of future studies should be comprised of six months at least to assess the sustainability of student’s motivation for reducing weight.

CONCLUSIONS

Participant’s body weight reduced significantly. Study has shown that monetary incentive is effective in motivating participants to lose weight. However there was no significant difference between group and individual participants. Monetary reward works equally in reducing weight for both groups.

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