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RESEARCH ARTICLE

Effectiveness of weight loss program among young adults using diet and physical activity approach

Siti Sabariah Buhari[1*], Nuri Naqieyah Radzuan[1], Nor Zafirah Abd Rahman[1], Nabilah Md Ahir[1], Kartini Ilias[2], Safiah Md Yusof[3]

[1]Centre of Nutrition & Dietetics, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia; [2]Department of Basic Sciences, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia; [3]Nutrition and Dietetics, Medical and Health Sciences, International Medical University 126, Jln Jalil Perkasa 19, Bukit Jalil, 57000 Kuala Lumpur, Federal Territory of Kuala Lumpur

[*]Corresponding Author

Siti Sabariah Buhari
Email:
sabariah6204@uitm.edu.my

Abstract:

Obesity among young adults has been a major concern in the health status of Malaysian populations. Increasing obesity rates among young adults in the Malaysian population need to be tackled using intervention programs involving behavioural approaches and delivered on an individual basis. This study aimed to assess the effectiveness of a weight loss program using a diet and physical activity approach among young adults. This study was conducted among young adults from a university in the Selangor region. Convenience sampling was used in recruiting the subjects. Subjects were overweight and obese young adults (BMI 25.0-39.0 kg/m2) and were grouped into a control group with no treatment and an intervention group which was supervised by certified trainers and dietitians along with the 12 weeks programs. To evaluate the dietary practice before the intervention, Multiple pass 24 hours diet recall was conducted among the groups. The short version of the International Physical Activity Questionnaire (IPAQ) was administered to assess the subject's physical activity level before the intervention program. This group was reassessed in the 8th and 12th weeks. This program was useful in reducing the percentage of body fat but not BMI and waist circumference. However, time and intervention effects show a large effect size on BMI respectively where the intervention group showed an -3.2% loss in BMI while the control group only showed -0.3% loss. The impact of strict intervention monitoring among subjects helped in the modification of behaviour changes across time. The study demonstrated the ability of intervention program through nutrition education and hands-on improving healthy eating, exercise, and weight among the subjects. This may help to improve the efficacy of behaviour changes among the obese population to continue their healthy lifestyle.

Keywords: weight loss, diet, physical activity, young adults

1. INTRODUCTION

Obesity and overweight are defined as abnormal or high-fat accumulation in the body that can affect health and body functions. An individual is classified as overweight or obese when the Body Mass Index (BMI) of the individual is more than 25 kg/m^2. BMI is the simple equation of weight for height. BMI greater than or equal to 25 kg/m^2 is classified as overweight while BMI greater than or equal to 30 kg/m^2 is obese (WHO, 2000).

The prevalence of obesity showed an increment from 2003 to 2011 with 12.2% to 15.1% respectively (Jan et al., 2015). Several factors such as a sedentary lifestyle, reduce physical activity level, and unhealthy eating habits led to these problems (Chan et al., 2017). In addition, being female, Malay/Indian ethnicity with low education level founds to be determinants of obesity in Malaysia (Tan et al., 2017).

Most weight loss programs that involve dietary changes, and behavioral counseling with physical activity have weight loss compared to the control/education group or counseling-only group (Gudzune et al., 2015). Community Preventive Services Task Forces recommended a combination of diet and physical activity programs help to with greater weight loss and reduction of new-onset diabetes. The program involved weight loss goals, and individual or group sessions regarding diet and physical training. A study showed the

combination of alternate-day fasting and exercise resulted in changes in body weight, composition, and lipid profile instead of using an individual approach (Bhutani et al., 2013). A cross-sectional study among adults in Australia found large proportions of obese subjects work hard to lose weight by changing their dietary patterns and increasing their level of physical activity without assistance from GPs and any specialists (Yoong et al., 2012). Most fad diets such as juicing or detoxification diets use the concept of caloric restriction and do provide weight loss however these diets led to weight gain once the subjects resume their normal diet (Obert et al., 2017). The study also agreed that intermittent fasting and paleo diet implementation resulted in weight loss as it highlighted a decrease in energy intake. A review pointed out, another option for weight loss and maintenance can be achieved by intermittent fasting or alternate-day fasting (Johnstone, 2015). Effective dietary intervention that is palatable and satiating, fulfill nutritional needs improves fat loss, and preserve lean mass are required to promote long-term adherence and sustained positive impacts on metabolic and disease markers.

As the key contributor to energy expenditure, physical activity plays a main role in energy balance and weight control (WHO, 2016). Any body movement produced by skeletal muscles resulting in energy expenditure can be defined as physical activity (Powell et al., 2011; Lu & Hwang, 2020). An intervention study revealed, high-intensity training results in significant weight loss and helps improve cardiovascular health (Obert et al., 2017). Increasing physical activity, both through lifestyle changes and planned exercise is considered an integral component of weight loss and maintenance (Phelan et al., 2012).

2. MATERIALS AND METHODS

Study design

A randomized control trial was conducted between an intervention group of young adults at a university in the Selangor region. Thirty-six subjects undergo intervention programs with certified dietitians and trainers within 12 weeks. On the other hand, the control group was left without further intervention.

Subjects

Male and female young adults aged between 18-35 years old in the university were selected using convenience sampling. Recruitment of subjects was based on the inclusion criteria where the subjects must have no history of any medical conditions or not be on any medication or supplements to avoid harm along the intervention program. Anthropometric measurement and multiple pass 24 hours diet recall of the subjects were elicited in both control and intervention groups. In order to exclude all the injured participants from participating in this study, a Physical Activity Readiness Questionnaire (PAR-Q) was distributed

Anthropometry measurement

Measurement of height, weight, and body fat percentage performed according to standard procedures. Height was measured using SECA 217 stadiometer while weight was measured with minimal clothing using a digital scale SECA 813. Body fat percentages were determined using Omron body fat analyzer model HBF 306.

Nutrient intake

Prior to the intervention program, Multiple pass 24 hours diet recalls were used to assess the nutrient intake of the participants by registered dietitians. Subjects were guided to recall and express the amount of all food and beverages consumed using household measurements. Dietary analyses were conducted using Nutritionist Pro based on Malaysian Food Composition. Throughout the intervention, subjects were required to record 3 days of food diary weekly for monitoring. At the end of the intervention, diet analysis was assessed again to compare the difference in dietary patterns after education was given to the subjects. The intervention group was also tagged with a personal dietitian with a ratio of subjects to dietitian of 1 to 4 per group. They were provided nutrition education and behaviour modification process throughout the program. The topics of group education for this study were; planning for weight loss and how to write a diet record, how to lose weight in a healthy way, understanding food exchange lists and food labelling, portion size control, and strategies to maintain weight loss for a total of the 12-week intervention program.

Physical activity level

The physical Activity Readiness questionnaire was used to ensure the readiness of the subjects to participate in the training and the International Physical activity questionnaire (IPAQ) translated into Malay with verification was distributed to the subjects to measure the level of physical activity level. The intervention group received 30 minutes of high-intensity interval training three times per week with a physical trainer.

Data analysis

Statistical analyses were performed using IBM Statistical Package for Social Sciences (SPSS version 21). The accuracy of the diet report has been analyzed by running the EI: BMR (Goldberg et al., 1991). To study the effectiveness of the intervention program, a generalized linear model was used to compare the effectiveness of the program towards a change in body mass index, percentage of body fat, waist circumference, dietary intake, and level of physical activity.

3. RESULTS AND DISCUSSION

3.1 RESULTS

Table 1 General characteristic of subjects (N=50)

	Control Group (n=25)	*Intervention group (n=25)*
Age	21.7 (1.1)	21.8(1.2)
Gender	2.0(0.0)	1.9(0.3)
Race	1.0 (0.0)	1.0(0.0)
Education level	3.96(0.2)	4.1(0.3)
Source of income	1.8(0.9)	2.1(1.0)

A total of 50 young adults consisting of 3 males and 47 females were included in this study. The mean age of young adults involved in the intervention study was 21.7±1.1 years in the control group and 21.8±1.2 in the intervention group. The majority of the subjects were female with mean gender of 2.0±0.0 and the current level of education was undergraduate. With regard to the source of income, most of the control group received scholarships for their studies.

Independent t-tests for preliminary data on Body Mass Index (BMI), body fat, waist circumference, total energy intake, total protein intake, total carbohydrate intake, total fat intake, MET, and Total Exercise per week were conducted. Independent test for preliminary data shows no significant difference except for body fat content between the control group and intervention group.

Anthropometry measurement

Table 2 profile of anthropometry measurement during pre-intervention (pretest) and post-intervention (posttest) based on body mass index (kg/m^2), body fat(%), and waist circumference (cm) (present as mean±SD)

Parameter	*Intervention group* (n=25)	*Control group* (n=25)	*P (partial eta square)* Time effect	Group effect	Interventi on effect
BMI			0.000	0.000	0.418
Pretest	32.6±5.6	31.1±4.0	(0.444)	(0.310)	(0.014)
Posttest	31.7±5.6	31.0±3.9			
Body Fat			0.000	0.000	0.214
Pretest	39.6±6.3	36.1±3.3	(0.362)	(0.499)	(0.032)
Posttest	36.4±5.0	36.6±3.3			
Waist Circumference			0.000	0.000	0.415
Pretest	95.2±8.7	91.34±7.6	(0.702)	(0.275)	(0.014)
Posttest	88.3±8.9	88.4±8.15			

P(<0.05)-significant

Analysis of anthropometry measurement showed there was a significant difference in body fat percentage of the subjects but no significant difference for body mass index and waist circumference measurement. However, time effect and intervention effects both shows F(1,48)=38.3 with large effect size (ŋp>0.14) and F(1,48)=21.549 (p<0.05) with (ŋp>0.14) large effect size on BMI respectively. Nevertheless, there is -3.2% loss of BMI among the intervention group and only -0.3% loss in the control group.

For waist circumference, the analysis showed -7.2% reduction for the intervention group while the control group reduced about -3.1%. The analysis also showed time effect give F(1,48)=27.3 (p<0.05) with (ŋp>0.14) large effect size on percentage of body fat while intervention effect also showed F(1,48)=47.7 (p<0.05) with (ŋp>0.14) large effect size. For waist circumference, time effect showed F(1,48)=113.214 (p<0.05) with large effect size (ŋp>0.14) and intervention effect showed that F(1,48)=18.232 (p<0.05) also had large effect size (ŋp>0.14).

Nutrient intake

Table 3 dietary intake profile during pre-intervention (pretest) and post-intervention (posttest) based on total energy (kcal/d), protein, carbohydrate, and fat intake (g/day) (present as mean±SD)

Parameter	Intervention group (n=25)	Control group (n=25)	P (partial eta square) Time effect	Group effect	Intervention effect
Total energy intake (TEI)			0.000	0.094	0.001
Pretest	1398.3±377.5	1371.7±291.0	(0.542)	(0.057)	(0.198)
Posttest	919.9±200.4	1193.2±297.7			
Total protein intake (TPI)			0.000	0.172	0.419
Pretest	54.1±14.6	56.8±18.5	(0.226)	(0.039)	(0.014)
Posttest	42.5±12.9	49.3±14.0			
Total carbohydrate intake (TCI)			0.000	0.288	0.004
Pretest	166.4±40.4	157.4±33.5	(0.505)	(0.023)	(0.158)
Posttest	108.5±15.9	134.3±41.7			
Total Fat Intake (TFI)			0.000	0.204	0.000
Pretest	61.9±19.6	57.6±14.3	(0.460)	(0.033)	(0.228)
Posttest	37.9±12.7	51.4±13.3			

P(<0.05)-significant

There was a significantly different energy intake. Time effect showed F(1,48)=56.703 (p<0.05) with large effect size (ŋp>0.14) on total energy intake. Intervention effect showed F(1,48)=11.817 (p<0.05) with large effect size (ŋp>0.14). Time effect showed that F(1,48)=14.034 (p<0.05) with large effect size on total protein intake while intervention effect also showed F(1,48)=14.172 (p<0.05) with large effect size. Time effect showed F(1,48)=48.938 (p<0.05) with large effect size on carbohydrates intake and intervention effect also showed F(1,48)=9.025 (p<0.05) with large effect size. Time effect showed F(1,48)=40.961 (p<0.05) with large effect size on total fat intake and intervention effect showed F(1,48)=9.025 (p<0.05) with large effect size.

Physical activity

Table 4 physical activity profile during pre-intervention (pretest) and post-intervention (posttest) based on total met and exercise per week (present as mean±SD)

Parameter	Intervention	Control group	P (partial eta square)

Commented [SSBB1]:

	group (n=25)	(n=25)	Time effect	Group effect	Intervention effect
Total MET			0.100	0.684	0.529
Pretest	1364.5±1426.7	1427.6±1334.3	(0.055)	(0.003)	(0.008)
Posttest	2080.3±1612.2	1750.1±1924.2			
Exercise per week			0.072	0.184	0.475
Pretest	96.2±78.0	86.0±55.5	(0.066)	(0.036)	(0.001)
Posttest	138.2±86.7	104.4±100.3			

Time effect showed that $F(1,48)= 2.806$ ($p<0.05$) with small effect size while intervention effect showed $F(1,48)=0.402$ 9$p<0.05$) with medium effect size on MET.

Time effects showed that $F(1,48)= 3.394$ ($p<0.05$) with medium size effect on exercise per week while intervention effect showed $F(1,48)= 0.518$ ($p<0.05$) with small effect size on exercise per week. Group effect also showed $F(1,48)=1.818$ ($p<0.05$) with small effect size.

3.2 DISCUSSION

Data from National Health and Morbidity Survey (NHMS) found, women usually report a significantly higher prevalence of low and moderate physical activity than men thus leading to the risk of overweight/obesity (Chan et al., 2017). The study assessed the effectiveness of dietary and physical activity intervention in weight reduction in improving body composition and behavioral change. This program was successful in reducing body fat composition in the intervention group but not body mass index and waist circumference. This may be due to the limitation of time. This research shows that weight loss programs are more effective in a combination of physical activity and dietary counseling. The combination of lifestyle and exercise intervention shows improvement in body fitness which is body weight, body mass index, and percent body fat (Park et al., 2007; Foster-Schubert et al., 2012). Based on previous studies, physical activity must be incorporated with any dietary restriction to induce weight loss (Chaput et al., 2010; Cox, 2017). There was a significant reduction in fat intake from the baseline data when subjects received advice on dietary fat reduction and increasing consumption of vegetables and fruits (Ello-Martin et al., 2007; Whigham et al., 2012). This is in contrast with the other study, where there are no significant changes in the intake of macronutrients and micronutrients prior to and after the intervention program among the two groups (Heydaru, Freud & Boutcher, 2012). Correction of mealtimes is also implemented for the subjects. This is supported by a study on the effectiveness of food timing and weight loss where late lunch eaters have a slower weight loss rate within 20 weeks of observation as compared to those early eaters (Garaulet et al., 2013).

NHLBI suggested clients should be assisted with negative energy balance by adapting healthier dietary and physical activity choices to achieve 5-10% initial weight loss for the first 6 months. The main aim of weight loss is to focus on the reduction of total caloric intake instead of proportions of carbohydrates, fat, and protein (Sacks et al., 2001; Kim, 2020). The macronutrient would be determined by the patient's taste preferences, method of preparation, and culture as well as the medical condition of the clients as the experts would prescribe based on the patient's metabolic profile and risk factor (Sacks et al., 2001; Nordmann et al., 2011; Blumenthal et al., 2010; Elmer et al., 2006; Limon-Miro, Lopez-Teros & Astiazaran-Garcia, 2019; Reber et al., 2019). Recommendation from AHA/ACC/TOS Guideline for the management of overweight and obesity in adults suggest overweight or obese individuals would benefit from a prescription of 1200-1500kcal for women and 1500-1800kcal for men with considering patients preferences and health status (Jensen et al., 2014).

Self-monitoring strategy is one of the useful techniques in achieving lifestyle goals, thus the clients are required to track their own dietary intake, physical activity, and weight throughout treatment. The benefits of diet monitoring are, the trainer will get real-time data on the dietary pattern as it relates to daily intake and helps in reflecting and planning in dietary coaching. This benefit also helps in tracking physical activity by recording the item and steps of the subjects (Kushner, 2014).

Recommendations WHO suggests adults do 150 minutes of moderate-intensity aerobic exercise in a week or 75 minutes of vigorous-intensity exercise throughout the week (WHO, 2010). Our results were supported by a study, where a combination of a behavioral weight management program and physical activity results in weight loss compared to physical activity alone (Johns et al., 2014). According to another study, body fat was not reduced with resistance training alone without an energy restriction diet (Joseph et al., 2001; Miller et al., 2018; Bellicha et al., 2021). Physical activity that combined resistance training and aerobic training showed more significance in weight loss and fat loss (Arciero et al., 2006; Ho et al., 2012). The most important component of physical activity in weight loss is creating a negative energy balance or more calorie expenditure than energy intake. Other than that, the frequency and duration of exercise did not contribute to the improved outcomes of body weight, body fat, and waist circumference. Based on a previous study, 30-minute intervention sessions for 5 days a week and 50 minutes sessions for 2 days a week showed significantly lower body fat percentage for the intervention group compared to the control group (Bayne-Smith et al., 2004). A finding from the previous study also showed a change in body composition in 9 weeks with a significant

decrease in body mass index, and waist circumference (Heydari, Freud & Boutcher, 2012). The study results were consistent with another study, where intervention effects are significant and promote weight loss (Goodpaster et al., 2010, Lee & Lee, 2021). The short-time intervention did give positive effects in reducing weight (John et al., 2011; Jakicic et al., 2015). Another study showed that HIIT in 2 weeks was enough to increase the skeletal muscle however, body weight did not change after the moderate or HIIT period but there is a significantly high reduction in subcutaneous fat. Besides that, HIIT also reduces total body mass, fat mass, and trunk fat (De Feo, 2013). Besides that, another study revealed that HIIT benefits from HIIT exercise are increased cardiorespiratory fitness, work capacity, improved insulin sensitivity, and induce improvement in fitness in overweight or obese. Besides that, HIIT is a time-effective therapy for body fat level management in overweight and obese, the 12 weeks of HIIT are able to reduce body fat and trunk fat (Keating et al., 2014). This concluded that moderate and high-intensity exercise is effective in reducing fat mass and body weight and was beneficial for overweight and obese body composition changes.

Even though the program was run within 12 weeks intervention program, subjects were advised to maintain the lifestyle changes within 6 months. However, the data is unable to present in this paper due to unavoidable circumstances. The findings also support the recommendations of behavioral changes should include compliance towards low calories diet and increased physical activity. Our study also shows the adherence of the subjects to high-intensity training with a certified trainer. Within the maintenance phase, the subjects also were supervised by the trainer to engage in physical activity and monitor dietary intake. A study reported after 8 weeks of physical activity intervention, there was a significant reduction in body fat percentage and body weight about 2.02% and 3.28kg each in males meanwhile about 1.89% and 3.75kg reduction in females among overweight and obese individuals (Elumalai, Salimin & Ahmad, 2014; Salimin et al., 2015). Other studies have also proved that within 8 weeks of intervention with physical activity there was a significant reduction in body weight, and BMI among obese individuals, and physical activity intervention is effective in reducing body weight, BMI, body fat percentage, and waist circumference (Norkhalid et al., 2015; Martins et al., 2011).

4. CONCLUSION

The program found that overweight and obese subjects who voluntarily undergo the intervention program lost their BMI at the end of the 12 weeks program. Subjects unable to be follow up after 6 months of the intervention program as some are not available at the campus. Engagement of the subjects with the intervention program with strict monitoring from the trainer and dietitian contributes to positive changes towards a healthy lifestyle. Strict monitoring may help in the frequent use of knowledge applications in reducing calorie and fat intake. Disclosed physiological adaptations and poor adherence to behavioral changes were the main barriers to the maintenance phase. Hence, these barriers should be highlighted in the strategies for developing weight loss interventions.

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