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The Effect of Home-Based Intervention Program on Body Composition, VO_2 max and Vital Capacity among Sedentary Females Leaving in Unstable Country

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Abstract: The aim of this study is to investigate whether a home-based physical activity and dietary awareness intervention program could improve on body composition, VO_2max and vital capacity among sedentary females leaving in an unstable country. The intervention program was conducted for 12-weeks and consisted of two groups which were experimental and control groups. Total subjects selected in this study were 44 and was equally distributed for both groups. Body Composition was measured using the equation of BMI and skinfold thickness. While VO_2max and Vital Capacity were measured using step test and Jaeger Spirometer, respectively. Data was collected three times i.e. baseline pre-test, post-test1, and post-test2, but only the experimental group participants received the intervention program. Results reported that there were significant improvements in body mass index, body fat, VO_2max and vital capacity as compared to controls group. The reported t values were, respectively. As the conclusion, home-based physical activity and dietary intervention program can positively influence sedentary undergraduate female students' physiological variables especially in term of improving the VO_2max capability.
Keywords: Home-based intervention, Body mass index, Body fat, VO_2 max, Vital capacity, undergraduate female students, Iraq

Introduction

The importance of good diet and physical activity to reduce the rates of disease and death from chronic diseases has been clearly stressed (McGinnis & Foege, 1993). Poor diet and physical inactivity caused 310,000 to 580,000 deaths per year and are major contributors to disabilities that result from diabetes, osteoporosis, obesity, and stroke (Pribis, Burtnack, McKenzie, & Thayer, 2010). However, in some unstable countries, performing physical activity outside their home is challenging due to the security reason. In order to do so, the physical activity programme involving these unstable regions must be designed to be carried out in their home. People in Iraq, for example, had been facing this unsafe problem for a decade due to the war. The unstable condition in the country had a direct influence on the physical activity, lifestyle and daily behaviour among the people. Women especially suffer more and not able to enjoy their freedom, economic independence and social activity as before. They are usually feeling very disappointed because of the restriction for them to participate in physical activity and this condition is getting worse as the women also been discriminated by the community and men in particular in certain events (Madi, 2007). A study in Iraq showed that the majority of Iraqi rural women have a weak level of nutrition awareness, and 55% of them were not educated enough towards dietary behaviour and attitude (Humairi, 2015). Obesity rates among females aged 15 and above in Iraq were reported to be higher as compared to their counterparts in the Eastern Mediterranean Region that was 36.2 vs. 26.5 in obesity. The finding result among the Iraqi female was found to be closely related to inactive lifestyle and bad dietary behaviour (GHO, 2013; Ali, Allela, Salih, & Ahmed, 2019)

Lifestyle and behavioural factors, such as daily physical activity, play a role in prevention of chronic diseases, including cardiovascular disease, diabetes, and obesity (Cooper & Hancock, 2011; Hardin, Hebert, Bayden, Dehart, & Mazur, 1997; Rowlands, Eston, & Ingledew, 1999; Strong et al., 2005). By being physically active played an essential role in increasing health and well-being. In order to achieve all these benefits, specific guidelines were recommended to improve body composition, VO_2max, and vital capacity starting from the minimum amount of physical activity and increasing dietary knowledge (Agriculture & Services, 2010;

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Committee, 2008). However, there is still a need for further investigation to determine the effects of such interventions on the on body composition, vo_2max and vital capacity of the individuals who are living a sedentary life, especially intervention with combination of physical activity and dietary awareness tailored to be carried out at home as a result of unsecured and unsafe outside home environment. Hence, this study was conducted to investigate whether a combination of physical activity and the dietary awareness home-based intervention program could improve on body composition, VO_2max and vital capacity among sedentary females leaving in an unstable country.

METHODOLOGY

Study Design

This is an experimental study that consisted of two groups. The first group is the control group that follow the existing program that was implemented by their university, and the second group was the experimental group that will be following the physical activity and dietary awareness program design by the researcher. Each group consisted of 22 participants. The duration of the intervention was 12-weeks and data was collected three times i.e. baseline pre-test (before starting the intervention), post-test1 (after 6-week), and post-test2 (after 12-week). The study was approved by Research Ethics Committee of University Putra Malaysia and the scientific committee in the College of Education in Soran University. Prior to the study, written consent was obtained from all 44 participants.

Population and Sampling

The target population of the present study was the non-sport freshman female university students in Iraq. Soran university was randomly selected from 14 universities in the Northern Region of Iraq by simple random sampling. Random sampling was further used and as a result, Education faculty was selected out of the five Colleges of Soran University with a total number of 160 participants. In order to ensure that the participants were not really active, they were asked to answer the physical activity questionnaire of the Transtheoretical (TTM) Model (O'Connor, 1994). Based on the TTM model results, 44 subjects who were fit into the research sedentary requirement were selected as subjects in this study. The descriptive profile between both groups was shown in Table 1.

Intervention

The intervention program consisted of a combination of physical activities and dietary awareness for 12-weeks. The students were exposed to the exercise and practice some of the movement adapted from well-known physical activity guidelines prior to the intervention (Committee, 2008). This is to ensure that they knew how to perform the movement when starting the intervention at home. The exercises were adapted from well-known physical activity guidelines considering increasing in intensity and distance progressively for every 4-weeks i.e. weeks 4 and weeks-8 (Committee, 2008). The students will be practising five days a week based on the 2008 Physical Activity Guidelines recommendation (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008). Meanwhile, for dietary awareness, the students attended small sections of dietary awareness talk and discussion two times per week. The aim of these sessions was to increase the knowledge of the importance of maintaining a good diet. The participant will attend the session according to their free time through the 12-week duration of the intervention as suggested by Bandini et al. (2010). The content of the food awareness program is arrange according to the suggestion by (Agriculture & Services, 2010; Bandini et al., 2010).

Instrument

According to Barbosa, Chaves, and Ribeiro (2012), Carl A. Burtis and Ashwood (1999), Gollnick, Armstrong, Saubert iv, Piehl, and Saltin (1972), and Jednacz and Rutkowska-Sak (2015) the physiological variable in this study was divided in to two parts such as (i) body composition, and (ii) cardiorespiratory measurement. The body composition measurement parameters were body mass index (BMI) and body fat mass. BMI was measured by the equation of BMI, which depends on weight and the square of height for the student, while the body fat mass was measured using the skinfold method. Cardiorespiratory measurement parameters were (i) VO_2max and (ii) Vital Capacity. The steps test was used to measure VO_2max among the students. This test was reported to have high-reliability score r=0.82 (Johnson & Nelson, 1969). Meanwhile, vital capacity was measured by a Jaeger Spirometer (Model Master Screen-PTF from Germany). This model was reported to be very reliable to measure vital capacity (Azevedo, Luiz, Rocco, & Conde, 2012)).

Statistical Analysis

In order to show that the experimental and control groups were at the same level before receiving the treatment, a t-test was calculated for both body composition and cardiorespiratory variables at baseline pre-test. This is to ensure that both groups were similar in term of their body composition and cardiorespiratory ability before starting the treatment. Independent t-test was used to compare the ability of two groups before and after they

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had received the treatment. In addition, a repeated measures of ANOVA were also being used to show the interaction between group and test. If the result was significant, post hoc Bonferroni test will be applied to compare the mean scores.

Results

The Independent sample t-test was used to compare the mean scores of the conducted test between the two groups in pre-test (Table 2). All the results show that there was no significant difference between the mean scores of the physiological variables for experimental and control groups. These initial tests suggested that the students in both groups possessed a statistically equivalent level of measurement of their physiological variables before any treatment was conducted. The descriptive statistics (mean and standard deviation) for the physiological variables presented for both groups (experimental and control) was shown in Table 3.

The results of repeated measures ANOVA on BMI showed that the interaction between group and test was statistically not significant body mass index ($F_{(1.293,\ 54.290)}$ =2.434, p=.177, η2=0.055). While, the results of repeated measures ANOVA on physiological variables (body fat, VO_2max, and vital capacity) showed that the interaction between group and test was statistically significant body fat ($F_{(2,\ 84)}$ =6.246, p=0.003, η2=0.129), VO_2max ($F_{(2,\ 84)}$ =57.277, p=0.001, η2=0.577), and vital capacity ($F_{(1.654,\ 69.485)}$ =16.839, p=.001, η2=0.286), respectively. Therefore, post hoc test Bonferroni was applied to compare the mean scores. This sStudy found that after 6 weeks post-test and 12 weeks post-test2 conducting the home-based intervention program, significant differences were founds Variables such as VO_2max and vital capacity improve faster and only required 6 weeks duration to showed significant improvement. For the VO_2max variable continues significant improvement was also reported after 12 weeks of implementing the intervention program. On the other hand, for vital capacity further improvement was reported, however, the result was not significant. Other variables such as BMI and body fat were reported to take a longer duration to showed significant improvements. Both variables only reported significant improvement after the subject's undergone 12 weeks of the intervention program as is shown in Table 4.

Discussion

The effectiveness of interventions that focus on improving diet and physical activity on the individuals' health has been shown in different studies (Brown & Summerbell, 2009; Coghill & Cooper, 2008; Collins et al., 2011; Danielsen, Svendsen, Mæhlum, & Sundgot-Borgen, 2013). Studies also had found that home-based interventions programme was effective in term of improving physiological variables for sedentary adult from the age of 18 years and above (Dunn et al., 1999; Goodpaster et al., 2010; Järvelä et al., 2012; Harris et al., 2018), and were especially beneficial when it was combined both physical activity and dietary awareness program (Artinian et al., 2010; Harrison, 2007; Loprinzi, Smit, & Mahoney, 2014; Söderlund, Fischer, & Johansson, 2009). The similar finding was reported in this study where the 12-week combination of physical activity and dietary awareness intervention programme found to improve the physiological variables (BMI, body fat, VO_2max and vital capacity) among undergraduate female students in Iraq. This showed that interventions programs had successfully improved the physiological variables among participants without considering the environment where the participants live. The physical activity includes walking which it is a popular, and acceptable form of activity particularly among populations who are the most physically inactive. Hence, just simply by walking more will lead to increased physical activity level, decreased body weight, body mass index, and percentage of body fat in previously sedentary adults (Committee, 2008; Cooper & Hancock, 2011; Kassavou, Turner, & French, 2013; Woods et al., 2018) However, in order to achieve the maximum results, it was recommended that the intervention consists of combining physical activity and diet awareness program. This was agreed with the study by Söderlund et al. (2009) who reported that training program with moderate intensity alone cannot be effective unless it combines with diet to treat overweight and obese individuals.

Wiklund et al. (2014) found that a short-term of 6 weeks regular exercise can improve some physiological variables even in the absence of weight loss in sedentary women. Similar findings were also found in this study where VO_2max and vital capacity reported positive changes after 6 weeks' intervention program. When the duration of the intervention was prolonged up to 12-weeks, more improvement was indicated in the other physiological variables i.e body mass index, body fat, and VO_2max as compared to the participants in the control group. This finding was consistent with previous studies in terms of the effectiveness of this duration on the levels of change in physiological variables (Artinian et al., 2010; Goodpaster et al., 2010; Järvelä et al., 2012; Loprinzi et al., 2014). The improvement of the physiological variables in the experimental group might closely relate to the simple exercise used in this study. In addition, easy to understand information about choosing a healthy diet was also made available for the subjects. This made the students excited to practice the program because they can easily carry out this program themselves at home.

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Tjønna et al. (2013) demonstrated that exercise programs that involve relatively moderate or high intensities for a brief duration of three times a week for 8–16 weeks can produce large increases in VO_2max in healthy individuals. Whenever the intervention programs are conducted for longer duration it will show a positive result in terms of VO_2max and vital capacity irrespective of the difference in the type of the intervention program (Petajan et al., 1996; Ponichtera-Mulcare, Mathews, Barrett, & Gupta, 1997; Soroush et al., 2013; Tjønna et al., 2013). This is what confirmed by the results of this research which it showed that there was a significant difference in VO_2max and vital capacity between experimental and control groups and respectively in post-test1 after 6 weeks. The results showed that after 6 weeks of practising the program the experimental group improved their VO_2max and vital capacity. While, after 12 weeks, post-test 2 showed that VO_2max kept improving significantly, it can be implied that whenever the duration of the program is longer, the program would be more effective. As for vital capacity, the level was improving in the post-test 2, however, the result was not significant.

In conclusion, the health benefits of physical activity with dietary and there role in preventing many chronic diseases are well established (Artinian et al., 2010; Azevedo et al., 2012; Blissmer et al., 2006; Boyle, Jones, & Walters, 2010; George et al., 2011). Physical activity is important in everyday life and low levels of physical activity and physical fitness are independent risk factors for chronic diseases and premature mortality among adults (Katzmarzyk, 2010). As indicated by Harrison (2007) study, where he pointed out that a 12-weeks intervention of diet combined with physical activity was effective in decreasing overweight and obesity. Interventions that combine physical activity and diet awareness program tailored to the individual's daily life will be easily practised and accepted by them. This compatible program will be very usefully for the individual living in the unsafe environment because less assistance was needed. Hopefully, this might help the sedentary females' improved their physiological variables and finally affect their life positively.

Conclusions

The participants in the experimental group improved their physiological variables in comparison to the controls, confirming that a home-based physical activity and dietary awareness program tailored for sedentary undergraduate female students can produce effective behavioural changes. Hence, female with sedentary lifestyle as the result of living in an unsafe environment (force them to stay at home), may apply this intervention at home and hopefully, this will help them and change their life positively. A follow-up study is recommended to confirm the adherence of the positive behavioural changes beyond 12-weeks to study the benefits of a home based intervention program for a long duration. It would also be useful to replicate the program both for male undergraduate students and in the community to study the effect of a home based intervention program on different gender in the Iraqi environment.

Table 1: Descriptive Profile between Experimental and Control Groups

Variables	Experimental		Control	
	Mean	Std. Deviation	Mean	Std. Deviation
Weight (kg)	59.72	12.45	55.45	8.98
Height (m)	1.56	0.06	1.575	0.07

Table 2: Independent sample test of pre-test for experimental and control group

Physiological variables	t-test for Equality of Means		
	T	Df	Sig. (2-tailed)
Body Mass Index	0.091	42	0.928
Body Fat Mass	0.578	42	0.566
VO_2max	0.086	42	0.932
Vital Capacity	0.622	42	0.538

Table 3: Descriptive statistics score for physiological variables for experimental and control groups

Physiological Variables	Experimental		Control		Experimental	Control	Experimental	Control
	Baseline Pre-test				Post-test1		Post-test2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Body Mass Index (kg/m2)	24.18	4.25	24.18	24.18	24.18	4.25	24.18	24.18
Body Fat Mass	14.38	0.70	14.38	14.38	14.38	0.70	14.38	14.38

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(%)								
VO_2max (ml.kg.min)	36.90	2.23	36.90	36.90	36.90	2.23	36.90	36.90
Vital Capacity (cc)	886.36	216.68	886.36	886.36	886.36	216.68	886.36	886.36

Note: SD-Standard Deviation

Table 4: The physiological variables mean difference between experimental and control groups in pre, post-test1 and post-test2

	Time	(I) Group	(J) Group	Mean Difference (I-J)	SE	P value	η2
BMI	Pre-test	EXP	CON	0.114	1.255	0.928	0.00
	Post-test1	EXP	CON	-1.695	0.993	0.095	0.065
	Post-test2	EXP	CON	-2.218*	0.887	0.016	0.13
BF	Pre-test	EXP	CON	0.117	0.202	0.566	0.008
	Post-test1	EXP	CON	-0.092	0.173	0.598	0.007
	Post-test2	EXP	CON	-0.520*	0.153	0.001	0.216
VO_2max	Pre-test	EXP	CON	0.058	0.669	0.932	0.00
	Post-test1	EXP	CON	3.153*	0.571	0.001	0.421
	Post-test2	EXP	CON	7.465*	0.663	0.001	0.751
V.C	Pre-test	EXP	CON	40.909	65.803	0.538	0.009
	Post-test1	EXP	CON	245.455*	54.383	0.001	0.327
	Post-test2	EXP	CON	272.727	45.129	0.001	0.465

Note: BMI= Body mass index, BF= Body fat, VO_2max= maximal oxygen uptake, V.C= Vital capacity

Based on estimated marginal means

* The mean difference is significant at the .05 level. Adjustment for multiple comparisons: Bonferroni.

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