Kazemi and Salehi, 2:2
http://dx.doi.org/10.4172/scientificreports.635

Open Access Scientific Reports

Research Article Open Access

The Effect of Diet Education on Lipid Profiles Control among the Overweight Individuals Referring to Valie-E-Asr Clinic, Shiraz, Iran

Moosa Salehi[1] and Asma Kazemi[2]*

[1]*Ph.D of nutrition, associated professor of Health and Nutrition School, Shiraz University of Medical science*
[2]*M.Sc. Student of Nutrition, Shiraz University of Medical Science, Health and Nutrition School, Iran*

Abstract

Introduction: The prevalence of obesity is increasing worldwide. In Iran, the prevalence of obesity is 22% in 15-39 year-old individuals and 40% in those between 40 and 69 years old. These measures have been reported as 16% and 26%, respectively in the rural population. One of the debatable issues which cause obesity is the meal frequency. The present study aimed to investigate the effect of distributing daily calorie into six or more meals on weight loss and health marker improvement (blood pressure, serum glucose, and lipid profile).

Methods: The present pre-post study was conducted on 68 females and 38 males with BMI of 25-30 in a period of 6 months. At first the subjects' eating patterns and their energy intakes were evaluated. The participants had 3 meals per day before the intervention. Afterwards, they were required to have 6 almost equal meals per day and were permitted to increase their meals to more than 6 if they needed to.

Results: Increasing the meal frequency led to reduction in serum FBS, 2hpp, TG, and total as well as LDL cholesterol. Despite the increase in HDL and the decrease in systolic and diastolic blood pressure, these changes were not statistically significant.

Conclusion: The increase in the meal frequency led to improvement in serum glucose and lipid profile control.

Keywords: Meal frequent; Education; Overweight

Introduction

Obesity is one of the most prevalent nutrition disorders with increasing trend among people of all ages in all over the world [1]. Among people who are older than 20, 65% are obese or overweight and there is no evidence showing improvement in this trend [2]. In Iran, the statistics show that 20% of the urban population who are between 15 and 39 years old and 40% of those between 40 and 69 years old are obese. These measures have been reported as 16% and 26%, respectively in the rural population [3]. Changes in dietary eating and physical activity are considered as the major causes of increasing trend of obesity prevalence [4]. Some eating behaviors such as meal frequency, skipping breakfast, distribution of eating occasions throughout the day have been suggested to influence weight [4]. In the recent years, the studies about meal frequency and its effects on various aspects of health have been encouraged [5]. Some of these studies which have been conducted on animal models have shown the effects of meal frequency on body composition [4,6-8]. So experts believe that less meal frequency and higher amounts of food in each meal lead to an increase in fat synthesis and finally obesity [9]. Unfortunately, there is limited information about the effects of meal frequency on body composition, different health markers, thermic effect of food, energy consumption, nitrogen balance, and satiety in human [5] and the results of studies investigating the relationship between meal frequency and weight/body composition have been criticized because of underestimation of calorie intake which is especially common among obese people [10]. Even in the studies in which the effect of underestimation was eliminated, a significant negative relationship was reported between meal frequency and BMI as well as abdomen to hip ratio [10]. However, no significant relationship was reported between meal frequency and its effects on weight loss when calorie intake was less (about 700 calories per day). Both the people who ate one meal per day and those who ate 9 meals per day lost 5% of their weight in a 2 month period [11-15]. Other studies on obese [16] and normal individuals [17] have investigated the effects of 8 meals per day in comparison to one meal per day and concluded that eating food in more meals induced a significant difference in blood lipid, glucose, cholesterol, and hormonal levels. The current study aims to investigate the effects of daily calorie distribution in 6 meals or more on weight loss and health markers (blood pressure, glucose and lipid profile) improvement in comparison to traditional 3 meals pattern in the overweight individuals who referred to Vali-e-Asr hospital, Shiraz, Iran.

Materials and Methods

After the procedures were approved by ethics committee of Shiraz University of Medical Sciences subjects who referred to Valie-e-Asr clinic were invited for participation in the study. We excluded people who were diabetics or case of chronic disease or used any specific drugs. BMI of all the subjects were within the range of 25-30. According to the previous studies, a sample size of 86 subjects was selected for the present pre-post study which was increased to 150 after taking the probable missing into account. Eating behavior was assessed using 24 hours food recall.

Study design and diets

Our pre-post study lasted for 6 months. At first the subjects' eating patterns and their energy intakes were evaluated using 24 hour food recall and a questionnaire about the number and amount of their meals. They mostly had 3 large meals per day. Then they were trained on how to distribute their daily energy into 6 isocaloric meals. They

***Corresponding author:** Asma Kazemi, M.Sc. Student of Nutrition, Shiraz University of Medical Science, Health and Nutrition School, Iran, E-mail: kazemiasma@rocketmail.com

Received December 17, 2012; **Published** February 09, 2013

Citation: Kazemi A, Salehi M (2013) The Effect of Diet Education on Lipid Profiles Control among the Overweight Individuals Referring to Valie-E-Asr Clinic, Shiraz, Iran. 2: 635 doi:10.4172/scientificreports.635

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were educated to divide the exchange of grain, meat and substitution, dairy, fat and fruit to 6. In each meal they ate 1/6 of the exchange for each food groups. The type and amount of food was the same as they ate before the intervention. Individuals were called every month and were encouraged to continue their follow up. The subjects were weighed on an electronic balance and their height was measured with Seca meter prior the study and after 3 months at the end of the study.

Biological and anthropometric data collected: Venous blood samples were taken using venous retention needles prior and at the end of the study and analyzed for FBS, 2hPP, total cholesterol, triglyceride, HDL-C, and LDL-C concentrations, and systolic as well as diastolic blood pressure. Finally, the data were analyzed using the SPSS statistical software (version 16). The serum glucose was measured with an enzymatic colorimetric test (ACCU-CHEK Active, Roche, Shanghai, China). Plasma total cholesterol, HDL-C, LDL-C, and triglycerides, were measured based on photometric method (Autoanalyser BT 1500). Blood pressure was measured using a sphygmomanometer with an appropriate cuff.

Data were analyzed in SPSS, version 16. Paired t-test was used for comparison of the measurements before and after the study.

Results

In this study, 36 percent of the participants were male. Up to the end of the study, 106 subjects (68 females and 38 males) remained in the study and 44 ones were missed due to various reasons. Moreover, the average baseline age for females and males was 45 and 44.7 years, respectively. In addition, the average BMI of the female and male subjects at the beginning of the study was 29 and 27.7, respectively. The females' and males' means of weight, BMI, and blood markers before and after the study are presented in tables 1 and 2, respectively.

	Before the intervention	After the intervention	Significance
Weight	74.83 ± 6.27	70.3 ± 5.94	0.001
BMI	29.00 ± 2.18	27.26 ± 2.12	0.001
FBS	90.95 ± 13.16	85.43 ± 8.71	0.005
2hpp	161.73 ± 13.12	155.31 ± 9.31	0.002
SBP	149.50 ± 8.82	142.25 ± 8.28	0.001
DBP	88.13 ± 5.78	81.65 ± 4.87	0.001
TG	170.40 ± 17.69	149.11 ± 25.90	0.001
Cholesterol	198.55 ± 33.97	181.13 ± 28.94	0.002
LDL	144.82 ± 16.77	137.68 ± 14.47	0.009
HDL	38.53 ± 3.85	43.14 ± 4.31	0.001

Table 1: Mean ± SD of the health markers in female subjects.

	Before the intervention	After the intervention	Significance
Weight	80.89 ± 7.70	76.78 ± 7.22	0.001
BMI	27.72 ± 1.23	26.32 ± 1.26	0.001
FBS	88.32 ± 10.5	82.89 ± 6.45	0.005
2hpp	160.18 ± 14.16	153.56 ± 9.54	0.002
SBP	148.18 ± 9.76	131.94 ± 9.57	0.001
DBP	87.94 ± 5.50	81.45 ± 3.89	0.001
TG	170.37 ± 17.74	135.94 ± 17.26	0.001
Cholesterol	197.59 ± 37.32	145.13 ± 16.41	0.002
LDL	144.51 ± 16.07	132.89 ± 11.09	0.009
HDL	37.64 ± 4.88	38.97 ± 4.53	0.175

All the health markers were significantly decreased on 6 isocaloric meals in comparison to the traditional meal pattern (3 large meals) ($p<0.05$) except HDL in male. The indicated increase in HDL value in male was not significant ($p=0.175$).

Table 2: Mean ± SD of the health markers in male subjects.

Discussion

To the best of our knowledge, the present study is the first to evaluate the effects of 6 isocaloric meals per day on obesity. In the current study, having 6 meals per day led to a significant reduction in weight and BMI compared to the traditional 3 meals per day diet. The results of the studies investigating the effect of meal pattern on weight loss are inconsistence [5,18,19]. The findings of most of the previous studies are limited because of short duration and small sample size [5]. These findings are in agreement with those reported by Ma et al. [4] and Franko et al. [8]. Ma et al. [4] investigation indicated that having 4 or more meals per day was associated with a lower risk of obesity [4]. Furthermore, Franko et al. [8] performed a study on 2375 females in order to investigate the effect of meal frequency on body weight. After adjustment for calorie intake and age, they found that the subjects who ate 3 meals per day had a significantly lower BMI in comparison to those who ate 2 meals per day [8]. The reduction in BMI fallow higher meal frequency may be because of increase in TEF (Termal effect of food) [20] or appetite regulation [21].

The findings of the current research showed that increasing the meal frequency led to a decrease in serum TG, LDL, and total cholesterol. Our result is similar to most of previous studies. Gwinup et al. [22,23] carried out some descriptive researches to investigate the effect of nibbling versus gorging on serum lipid profile and glucose in humans. In a study, 5 hospitalized females and males were trained to consume their meals in 3 manners; first in one meal, then in 10 meals, and finally in 3 meals, and energy and composition were the same in the 3 diets. In that study, each diet was continued for 14 days and the results showed that the one meal per day diet led to increase in blood lipid profile, while the 3 and 10 meals per day diets induced a small decrease in serum lipid, such as serum phospholipids, esterified fatty acids, and cholesterol. Furthermore, the findings of a cross-sectional study showed that as the meal frequency increase, either total cholesterol or LDL cholesterol level decrease even after adjustment for the confounding factors. In addition, both mean total cholesterol and LDL in the subjects eating more than 6 meals per day were 5% less than those who just ate 1 or 2 meals per day. Similarly, Edelstein et al. [24] reported that those who ate 4 or more meals per day had significantly less total and LDL cholesterol compared to those who ate 1 or 2 meals. In meal patterns with higher meal frequency energy is providing continuously for the cells, so releasing free fatty acid from fat tissue for sourcing energy, which occur in fasting, decreases [25]. Also it may be related to weight loss induced as the result of increasing meal frequency as weight loss is accompanied with resistance to insulin and finally serum lipid impairment.

The results indicate a decrease in FBS and 2hpp glucose following 6 isocaloric meals pattern for 6 months compared to traditional meal pattern. This result is similar to that of Gwinup et al. [22] who reported lower serum glucose and insulin secretion when the participants were administered 4 smaller meals with 40-minute intervals in comparison to one large meal. Moreover, Jenkins et al. [26] investigated blood glucose changes in response to meal frequency and found that the diet containing 17 snacks and isocaloric diet with 3 meals had similar effects on blood glucose changes; however, the serum insulin showed a significant decrease in the 17-snack diet. This is because of increase in meal pattern which means lower free fatty acid in serum which induces resistance to insulin and lower glucose tolerance [22,23].

Results of the present study indicate that 6 isocaloric meals induced an improvement in both systolic and diastolic pressure. This finding is similar to that of Stote et al. [27] who compared the effects of consuming

3 meals per day and 1 large meal per day on the health markers in their randomized cross over study. Each participant consumed both diets for 8 weeks with an 11-week washout period between. All the participants consumed the required energy for weight maintenance. According to the results, a significant increase was found in blood pressure and total and LDL cholesterol in the participants who ate 1 meal per day.

Conclusion

Our data indicate that 6 isocaloric meals pattern in comparison to the current meal pattern (3 meals per day) led to weight loss and improve in Serum lipid profile control.

Acknowledgements

Research Improvement Center of Shiraz University of Medical Sciences, Shiraz, Iran and Ms. A. Keivanshekouh are appreciated for improving the use of English in the manuscript.

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