

The effect of food service system modifications on staff body mass index in an industrial organization

Reza Hosseini¹, Mostafa Mirghotbi^{1,*}, Katayoun Pourvali¹, Seyed Masoud Kimiagar¹, Bahram Rashidkhani¹, Tina Mirghotbi²

¹National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

²School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

*Corresponding Author: email address: M.Mirghotbi@sbmu.ac.ir (M. Mirghotbi)

ABSTRACT

Due to the adverse effects of obesity and overweight on health status of people, organizations that provide daily food aim for a healthy Body Mass Index among their staff. The purpose of this applied randomized controlled trial (RCT) was to study the effect of modifications in the food service section and nutritional intervention on the BMI of staff in an industrial center. In this applied randomized controlled trial which lasted for 40 days, 116 overweight people ($BMI \geq 26$) were randomly selected and divided into control and test groups. Individual daily food plan was prepared by a dietitian and nutritional education sessions were held for test group. At the management level, food menu was modified reduce the calorie intake by at least 1000 Kcal per day for the test group and also cost less for the center. The kitchen staffs were trained to promote healthy cooking and improving the food taste. The satisfaction level of food service was also evaluated before and after the intervention, using a questionnaire. To analyze the findings, SPSS 16 software, independent t-test and paired t-test, and Macnemar test were used. The results showed that BMI in test group decreased from 27.5 ± 2.36 to 26.8 ± 2.15 ($p < 0.05$), while in control group increased by 0.5 Kg/m^2 . Similar result was observed in weight change. The level of satisfaction of food service following changes in the menu increased significantly in both groups. Also, cost of food and use of fat were reduced by 15% and 8%, respectively. Dietary interventions and improving the nutritional knowledge along with modification in food service system could result in better weight management in organization staff using canteen food.

Key words: BMI; Overweight; Obesity; Food service management

INTRODUCTION

The prevalence of obesity in the world and Iran has become a worrying issue [1, 2]. According to the World Health Organization (WHO) it is estimated that it will become a major health problem by the year 2020 [3]. One of the main concerns of organizations including industrial centers, which have periodical health examinations is the health of their staff and the subsequent adverse effect it can have such as the financial burden. In 2009, a cross sectional study in Shahid Beheshti Medical university staff ($n=503$) between 25 and 45 years of age who consumed the canteen food showed that 39% were overweight and 11%

were obese ($BMI: 25.3 \pm 4$). The participants claimed that most of the extra weight was gained after they started the job. A significant correlation was found between BMI and consumption of meat snacks, fruits, vegetables, and number of meals in a day [4]. In 2011, another study suggested that frequent use of canteens by staff was associated with unhealthy dietary habits and obesity in a Norwegian adult population [5].

Therefore, the aim of this study was to examine how modifications in the food system of an industrial center can affect staff Body Mass Index. From dietary point of view, in 2007, Geasser et al. stated that the increased prevalence of overweight

and obesity in the United States since approximately 1980 is associated with an increase in carbohydrate intake, with no appreciable change in absolute intake of fat and suggested that as overall dietary quality tends to be higher for high-carbohydrate diets and a low-fat dietary strategy with emphasis on fiber-rich carbohydrates, particularly cereal fiber, may be beneficial for health and weight control [6]. In another study, Linde et al, reported that intake of fast food and fried foods containing high amount of saturated fatty acids was associated with high BMI in both men and women while eating high fiber cereal, fruit, and overall fiber intake were associated with lower BMI. They also concluded that nutrition education sessions are more effective on weight control than emphasizing on specific food [7]. In 2008, Hollis et al. managed to reduce the BMI of patients attending a surgical center in USA in six months. The cases were between 25 and 45 years of age and following the weight reduction did not need surgery anymore. 79% of the participants had a BMI ≥ 30 and the interventions included increased physical activity, increased intake of fruits and vegetables (3 or more units per day), reduced fat intake, and nutrition education. Following the intervention, BMI was reduced in 92% of the cases [8]. In case of organizations food service plays an important role. Foodservice directors rated the food production and management of organization factors more relevant to their present position than did clinical dietitians [9]. Thus, the senior managers and foodservice directors in organizations are encouraged to solve the high BMI problem by any possible mean to avoid additional costs due to food and non-food losses, such as risking the health of personnel and disadvantages of medication, which would be a burden on the centre. Based on the above findings and Linde et al. [6] and Hollis et al [8] suggestions, it seems that in organizations with overweight and obese staff, offering a healthy menu, educating both the kitchen staff and personnel, and modifying the food service is needed. The aim of this study was to study the effect of modifications in the food service section on the BMI of staff in an industrial center. The changes were made across all parts of food service system

and also nutritional interventions were applied in order to reduce staff BMI.

MATERIALS AND METHODS

This study was carried out at Gostar Sazeh Sepand Rad Industrial Center, located in Tehran, Iran, in 1390 (2011). Production management is the job of coordinating and controlling the activities required to make a product, based on the standards with the lowest cost [10, 11, 12]. In general, modifications of the food system were implemented to achieve the objectives of study. Therefore the following five categories were selected: 1- Improving kitchen equipment and controlling production line. 2- Supervising purchase and receipt of raw food ingredients. 3- Designing food menu to provide healthier and low calorie menu. 4- Making changes on raw materials including cooking and procuring food (it should be said that this process could involve no cooking but lead to an edible food, an appetizer and or desert). 5- Presenting final product with lower cost.

Making corrections in the management of food services in this complex needed a cultural and educational background, which began several months before beginning of the study. 1500 people were employed by this industrial centre which by applying statistical methods, 116 members (58 for test group and 58 for control group) was selected. The method of sampling was simple random selection in which all people have the same chance for being selected [13].

The entry criteria included; Body Mass Index (BMI) ≥ 26 , daily consumption of canteen food, increased BMI since the start of employment, no physical activity, no specific genetic or special disease, and dissatisfaction towards the menu, food taste, or food diversity. If the selected sample matched the entry criteria of study and also agreed to participate, it was considered as a sample and otherwise it was eliminated at this stage.

BMI was determined by measuring weight and height of the selected staff and the rest of criteria were confirmed by interviewing. Following completion of the selection stage, the samples were randomly divided into two groups of test and

control and were consented. The amount of individual calorie intake per day was determined, individually. The main food menu was obtained from the contractor and according to the contract in between, the cost of each meal (on average) was calculated. Following consultations, the positive changes on the food menu was made to adjust both calorie and cost.

The next step of this study was to hold educational nutrition workshop; the first session was held seven months before commencing the study. After achieving a quorum (at least 25 persons) and making required scheduling for repetition or to present newer topics, 20 educational courses were held with one week intervals. Each session lasted 2 hours of which the last 30 minutes was used to answer questions of participants. To explain the food plan for the rest of the day (outside working hours) and ask for their compliance, a separate session with the selected samples was held.

This should be mentioned that two separate nutritional education sessions were also held for kitchen personnel who took part in the study. In the first session the aim of this research and in the next session new cooking methods, compliance with the new food menu, and also dividing the tasks were explained. The food menu available in the canteen provided 2500 to 3000 Kcal per day for each person in three meals (breakfast, lunch and dinner). Regarding the calorie needs of the staff and based on the Harris-Benedict formulae, which also took into account the physical activity of the individual, the new menu with an average 1700 to 1800 Kcal per day for men and about 1350 to 1400 Kcal per day for women was planned.

Based on their personal needs and their physical activity 200 to 300 Kcal were added to their intake. However, with the reduction of at least 1000 Kcal per day for each individual, favorite result in weight loss and BMI was expected. The dietary intervention lasted for 40 days. In addition, a questionnaire was designed to evaluate satisfaction of food service and food menu prior to the start of interventions. To prepare this questionnaire, observations of study executive during educational sessions, the kitchen, and menu were considered. Consequently, a set of questions depending on the status and general aim of the study were prepared. These questions were pre-tested by a few personnel. The problems were found and corrections were made. At the end of study a similar questionnaire was designed to evaluate staff satisfaction. To study the relationship between quantity variables, independent T-test and paired T test were used; to study the qualitative variables K2 test; and to determine the satisfaction of samples following changes in food menu Macnemar test was applied using SPSS 16.

RESULTS

From 116 randomly selected and consented subjects participating in the study, 101 subjects remained until the end of study; ten women and 4 men left the study for personal and official reasons. In both groups %58.8 (n=30) of participants were male. The Mean±SD weight of test group is presented in table1. Following the interventions control group faced a 360-gram weight increase and test group experienced 830-gram weight reduction. Both changes were statistically significant ($p < 0.05$).

Table 1. Weight change following intervention in control and test groups

	Number	Weight before intervention	Weight after intervention	Changes	P-value
Control	51	96.5±3.35	96.8±1.43	0.36	0.01
Test	51	91±1.8	90.2±1	-0.83	0.00
P-value	102	0.00	0.009	0.318	

After the study, control group weight increased while test group experienced a significant weight reduction.

At the beginning of the study, BMI of test and control group were 27.5 ± 2.36 and 28.5 ± 2.35 kg/m^2 , respectively which was higher than 26 kg/m^2 selected as the study entry criteria. There were no significant differences between two

groups' BMI before commencing the study. Following the 40-day intervention and reducing the daily calorie intake the BMI of test group reduced significantly, while an increase was observed in the controls ($P < 0.05$)(Table 2).

Table 2. Changes in BMI following intervention

	Number	BMI before intervention	BMI after the intervention	Changes	P-value
Control	51	28.5±2.35	29±2.4	+0.5	0.02
Test	51	27.5±2.36	26.8±2.15	-0.73	0.00
P-value		0.032	0.00	0.00	

Data shows that following the study (40 days), control group BMI increased significantly while there was a decrease in the test group. The changes were significant ($P < 0.05$).

The satisfaction level was related to the three topics of food menu, quality of tasting and food variety. One case of dissatisfaction caused the sample to be classified as dissatisfied. The findings show that before the interventions % 43.1 of the test group and all of controls were dissatisfied with at least one of the aforementioned topics. Following the intervention the rate of satisfaction significantly increased and reached %56.9 and %100 for test and control groups, respectively.

In addition, the small life style changes advised to the test group seemed to motivate them in order to follow a healthier life style. The nutritional advices seemed to capture attention of all staff, even the people who were in normal BMI ranges but had decided to take part in those sessions. A main indicator could be the significant BMI reduction in the test group in 40-day time.

In the food management section, the cost of food preparation had decreased by %15. Reducing the fat in the cooking of food by 8% had a significant effect on the quality of the provided meals which might be one of the reasons for increased satisfaction of the staff in both groups.

DISCUSSION

Modification of the food service system in this study resulted in presenting healthier food with fewer calories to the staff. Also, the reduced cost of final meal was as advantage for the center. Nutritional education of the test group led to a healthier lifestyle choice for them which was apparent in the significant weight and BMI reduction during the intervention period. Another important achievement was the significant increase in staff satisfaction towards the meal.

The aim of this research was to study the effect of modifications in food management system along with nutritional interventions on body mass index

of the staff in an industrial centre. Regarding the hypotheses and findings of this research it could be said that the modifications in the food system increased the staff satisfaction significantly. Moreover, by reduction of at least 1000 Kcal per day on average for the test group, favorite results were seen on weight and BMI.

The results we achieved are agreeable with most other studies conducted in similar settings. In studies done by both Hollis et al. and Yahia et al. increasing fruit intake and physical activity had resulted in decreased BMI [8, 14]. Also, in 2006, Linde et al. showed that high calorie intake and low physical activity has led to increased BMI among NHS staff in United Kingdom and nutritional education sessions for weight control had a positive effect on their health status [7]. In addition, Tanumihardjo et al. achieved BMI reduction in target group by using nutrition education, increasing fruit and vegetables intake, and reducing 500 Kcal of daily intake [15].

However, the control group in this study weighed gain during the intervention period. The reason could be that the changes in the food menu, which significantly increased their satisfaction, led to consuming bigger portions and increased their daily calorie intake. It should be mentioned that this group received no nutritional intervention which has been a main factor in successful weight reduction in other studies. The role of nutritional education session cannot be ignored as frequent eating in staff canteens in the Kjøllestad study was negatively related to socio-economic position and positively associated with unhealthy dietary habits. This partly explained higher odds for obesity among frequent users of staff canteens [5]. Also, regarding the food satisfaction the reason for lower satisfaction of the test group in comparison with the controls following the study could result from the fact that

the nutritional knowledge of the test group increased their expectance from a healthy food menu.

Based on the findings, it seems the number of meals, plus high volume and more-than-usual calories provided by the canteen food were the factors that caused BMI increase in target population of the present study. Therefore the need for a healthy replacement should be available in order to achieve weight management goals in organizations. After implementation of changes the body mass index and also the weight of test group was reduced which emphasizes on the fact that physical activity and reduction of

consumed calorie is one of the preventive ways for obesity and leads to weight loss and decreased BMI. However, in order to maintain the healthy weight, self-monitoring of weight, physical activity, and increased fruit and vegetable consumption is recommended as an effective approach [16]. In conclusion, due to reduced physical activity and the high prevalence of overweight and obese staff in organizations that provides daily meals it can be suggested that nutrition education of the staff and modification of food management system to provider healthier food can have long term health benefit for the staff and reduce the costs of organization, as well.

REFERENCES

- 1.Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of Childhood and Adult Obesity in the United States, 2011-2012. *JAMA*. 2014; 311(8):806-814.
- 2.Janghorbani M, Amini M, Willett WC, Mehdi Gouya M, Delavari A, Alikhani S, Mahdavi A. First nationwide survey of prevalence of overweight, underweight, and abdominal obesity in Iranian adults. *Obesity*. 2007; 15(11):2797-808.
3. World Health Organization. Global strategy for non-communicable disease prevention and control (draft). Geneva, Switzerland: World Health Organization; 1997. Publication no. WHO/NCD/GS/97.1
- 4.Kavian F. Study of the outbreak of obesity and distribution of fat and the factors affecting them in the female employees of Shahid Beheshti University of Medical Sciences [thesis]. Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
- 5.Kjøllestad MR, Holmboe-Ottesen G, Wandel M. Frequent use of staff canteens is associated with unhealthy dietary habits and obesity in a Norwegian adult population. *Public Health Nutr*. 2011; 14(1):133-41.
- 6.Gaesser GA. Carbohydrate quantity and quality in relation to body mass index. *J Am Diet Assoc Med*. 2007; 107(10):1768-80.
- 7.Linde JA, Utter J, Jeffery RW, Sherwood NE, Pronk NP, Boyle RG. Specific food intake, fat and fiber intake, and behavioral correlates of BMI among overweight and obese members of a managed care organization. *Int J Behav Nutr Phys Act*. 2006; 26(3):42.
- 8.Hollis JF, Gullion CM, Stevens VJ, Brantley PJ, Appel LJ, Ard JD, Champagne CM, Dalcin A, Erlinger TP, Funk K, Laferriere D, Lin PH, Loria CM, Samuel-Hodge C, Vollmer WM, Svetkey LP. Weight Loss During the Intensive Intervention Phase of the Weight-Loss Maintenance Trial. *Am J Prev Med*. 2008; 35(2):118-26.
- 9.Nettles MF, Gregoire MB, Partlow CG. Relevance of competencies to graduate education and experience in food service management. *J Am Diet Assoc*. 1993; 93(8):877-80.
- 10.What is Food management? 2014. [cited 20 Apr 2014]. Available From: www.wisegeek.com/what-is-food-management.htm.
- 11.Ghavam Sadri M, Derakhshani K. Food management: a guide for food service centers. Baray Farda Publications, Tehran. 2004; 1-15. [In Persian]
- 12.Park JE, Park K. Park's Textbook of Preventive and Social medicine. Trans. Malek Afzali H, Shojaei Tehrani H. 2nd edition, Samat publications, Tehran. 2003; p 110.
- 13.Dawson-Saunders B, Trapp RG. Basic and Clinical biostatistics. Trans. Sarafranz AA, Ghafarzadegan K. 4th Ed., Ferdowsi Mashhad university publications. 2004; pp150-155

14. Yahia N, Achkar A, Abdallah A, Rizk S. Eating habits and obesity among Lebanese university students. *Nut J.* 2008; 7:32-37.

15. Tanumihardjo SA, Valentine AR, Zhang Z, Whigham LD, Lai HJ, Atkinson RL. Strategies to increase vegetable or reduce energy and fat intake induce weight loss in adults. *Exp Biol Med (Maywood).* 2009; 234(5):542-52.

16. Akers JD, Cornett RA, Savla JS, Davy KP, Davy BM. Daily self-monitoring of body weight, step count, fruit/vegetable intake, and water consumption: a feasible and effective long-term weight loss maintenance approach. *J Acad Nutr Diet.* 2012; 112(5):685-692.

Due to lack of author cooperation to provide the data used in the text “The effect of food service system modifications on staff body mass index in an industrial organization”, the article is retracted.