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The Effect of Elimination Diet on Weight and Metabolic Parameters of Overweight or Obese Patients Who Have Food Intolerance

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Abstract Obesity is caused by the chronic low-level inflammation of white adipose tissue associated with the activation of the immune system. Food intolerance (FI) is one of the probable cause of this low-level inflammation. Food intolerance test had been done to the patients who were refractory to lose weight. In this study, we tried to prove that the elimination diet, based on test results, can help with weight loss in patients. 82 patients were enrolled in the study. Their ages were between 18-65 years and had BMI ≥ 25 kg / m². The FI test was done to all of them. The patients randomized to control or FI groups. The FI group was given food intolerance elimination diet (FIED) while the patients in the control group underwent a weight loss program by supervision of a dietitian. The patient's body weight, fat weight, lean body mass, body mass index, waist/hip ratio were measured before and after the diet program of the two groups. At the same time, fasting blood sugar, lipid and A1c levels were tested. In the FI group, patients significantly lost weight 86.60±20.93 kg (BMI=31.40±4.68 kg/m^2) to 77.99±14.23 kg (BMI=28.95±4.23 kg/m^2) ($p<0.05$). In the control group the body weight also decreased from 89.60±17.69 kg (BKI= 33.09±4.70 kg/m^2) to 88.69±18.44 kg (BKI= 32.44±5.09 kg/m^2) ($p<0.05$). Body fat weight decreased from 32.22±8.18 kg to 27.00±8.27 kg in the FI group while in the control group it was decreased from 36.18±10.50 kg to 36.17±12.76 kg ($p<0.05$). Triglyceride levels of the FI group decreased significantly than the control group ($p<0.05$). There was no significant change in fasting blood glucose, A1c and cholesterol levels of two groups at the end of study ($p>0.05$). In this study, people who cannot lose weight by low-calorie diet can lose weight and fat with elimination diet according to the results of FI test. FIED is also significantly effective in triglyceride levels.

Keywords: *food intolerance, obesity, elimination diet*

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1. Introduction

Obesity is a serious public health problem in the last decades. Its prevalence is increasing, especially in rapidly developing countries. Obesity brings a huge burden of health spending to the society. The World Health Organization (WHO) defined obesity as 'abnormal and excessive growth of the amount of fat in adipose tissue to significantly disrupt the health'. Obesity is a major risk factor for many chronic diseases. It effects cardiovascular, digestive, respiratory and hormonal systems and causes hypertension, type II diabetes mellitus, coronary artery disease, osteoarthritis, gall bladder disorders, reflux, cancer(breast, prostate, colon, endometrium, etc.),sleep apnea and respiratory failure diseases [1-6].

According to the new researches, chronic activation of the hereditary immune system may contribute to obesity by causing low-level inflammation in white adipose tissue. System iclow-grade inflammation, may contribute to the development of insulin resistance, diabetes mellitus and atherosclerotic vascular disease with obesity. Food intolerance caused by IgG antibodies may create a low-grade inflammation and atherosclerosis in obese people[7,8,9,10,11,12]. Studies support that the obese patients had increased levels of IgG [9].

According to the World Health Organization (WHO), approximately half of the world population has food intolerance (FI). FI is food reaction that caused by non-immunological mechanisms and is quite different from a food allergy that is the immune system reaction against a food [13,14,15,16]. Food allergies are triggered by immunological mechanisms. In the pathogenesis, an abnormal response develops by the defense system to food or food additives by immunoglobulin E (IgE) which is an important part of reaction.FI is an answer of the defense system is formed depending on the increase of IgG antibodies resulting in not fully digested specific nutrient. Discomfort associated with FI, are sometimes similar to the symptoms of allergies. But unlike allergies, symptoms and complaints of FI are seen in longer duration time than allergies. The negative effects of the food that we eat in FI begin to emergebetween3-24hours; food allergy symptoms in consumed food are emerging immediately after the formation of the response of the immune system

[8,13,14,15,16,17,18,19,20,21,22]. Therefore, due to the depletion of many nutrients fed by a normal human being within 24 hours, to determine the intolerant food is difficult for the individual.

The studies have shown that IgG antibodies against food intolerance are associated with inflammation [9,10,12]. The elimination diet used in the treatment of food intolerance is intended to remove food causing food intolerance from the diet [14]. In this study, we wanted to investigate the effects of the elimination diet that is implemented using there sults obtained from the FI test.

2. Materials and Methods

2.1. Subjects

82 patients (24 male, 58female) were included in the study. The mean age was 42.04±11.81 (18-65 years).The patients who couldn't lose weight by diet programs and who had a positive reaction to at least one nutrient in food intolerance test and a BMI value≥25kg/ m² were included in the study. The patients who had no food reaction in food intolerance test and who had any chronic disease (diabetes mellitus, coronary heart disease, renal diseases, etc.) were excluded from the study. Also individuals who use weight loss drugs and who had allergy to any drug or food and who overuse medications or have pure menstrual migraine or headache that associated a disorder were excluded from the study.

2.2. Study Protocol

The patients randomized to FI (n= 42) or control (n= 40) groups. FI test was first administered to patients. Special weight loss program to the control group and food intolerance elimination diet (FIED) to the FI group was given by a dietitian. Patients were monitored for compliance to the diet each month for 6 months.

The patient's weight, body fat weight, lean body mass, body mass index by bio-electrical impedance analysis was measured using the device InBody720 (Bios pace Corporation, Seoul, Korea) before and after diet. Fasting blood glucose (FBG), A1c, total cholesterol, LDL-cholesterol, HDL-cholesterol and triglyceride levels were measured before and after the study.

2.3. Food Intolerance Test

The blood was taken from the fingertip of the patients with lancet and sent to York Test Laboratories Ltd.(York, UK). Food intolerance test was performed with ELISA method (Enzyme-linked immunosorbant assay). Patients' food IgG reaction was identified as a result for each patient. If the patient does not have IgG antibody for any food, the test result is negative (no IgG reaction). If the test is positive, titration of the IgG levels are graded from +1 (low) to +3 (the highest).

2.4. Elimination Diet

Elimination diets are a method commonly used in both the diagnosis and treatment of undesirable food reactions. According to the York test results a list of foods was given to the patients. These lists of foods cause an IgG reaction according to the FI test. The patients were not allowed to consume these foods. The group who applied to have an elimination diet, was given a list of changes in food list by a dietitian.

2.5. Personal Special Weight Loss Program

The members of the control group participated in the research was given a special weight loss program according to the size, weight, physical activity, dietary habits and socioeconomic status. Control group were given advisory services on a balanced diet containing foods according to the positive and negative test results (IgG). Calorie content of the diet of individuals in implementing the FIED group and the control group were similarly been set.

2.6. Statistical Method

Statistical analyzes were performed with SPSS version 16.0 for Windows (SPSS Inc., Chicago, IL, USA).Normal distribution level of fitness parameters were checked after Shapiro Wilk normality test and the Levene homogeneity testing. For analysis of differences between control and experimental groups independent t-test was used. $P < 0.05$ was considered as the level of statistical significance. This study has been approved by Sifa University ethical committee and informed consents of all participants have been obtained prior to participation.

3. Results

3.1. Anthropometric Measurements

In our study, 42 individual had elimination diet and 40 patients in the control group had the personalized weight loss program. In the food intolerance group, an elimination diet had the macronutrient ratio of energy, carbohydrate, protein and fat were 1628 ± 45 kcal, 57.1% ± 0.3, 14.4% ± 0.2, 28.5% ± 0.2respectively. In the control group the weight loss program had energy, carbohydrate, protein and fat ratio were 1602 ± 34 kcal, 58.2 ± 0.4%, 13.5% ± 0.2, 28.3 ± 0.2% respectively.

There was no difference at the beginning of the research in the age, weight, BMI, fat weight, lean mass, waist/hip ratio values between groups. At the end of the study, the body weight of FI group decreased 86.60 ± 20.93 kg (BMI: 31.40±4.68 kg/m^2) to 77.99±14.23 kg (BMI:28.95±4.23 kg/m^2) ($p<0.05$). In the control group the body weight also decreased from 89.60±17.69 kg (BMI:33.09±4.70 kg/m^2) to 88.69 ±18.44 kg (BMI: 32.44±5.09 kg/m2) ($p<0.05$).Body fat weight decreased in the both FI and control group 32.22±8.18 - 27.00±8.27 kg, 36.18±10.50-36.17±12.76kgrespectively($p<0.05$).

There was no significant difference in the lean body mass before and after research in both groups. Waist/hip ratio decreased from 0.96±0.08 to 0.91±0.08 in the FI group ($p<0.05$) but there was no significant difference in the control group. While there was no difference in baseline values between the groups before the study, but at the end of the study there was statistically difference in BMI, weights, body fat, weight, waist / hip ratio between the groups (Table 1).

Table 1. Anthropometric measurements in the study of patients before and after (n=82)

	Before Study			After Study		
	FI* (n=42)	Control (n=40)	*p*	FI* (n=42)	Control (n=40)	*p*
Weight (kg)	86.60±20.93	89.60±17.69	0.49	77.99±14.23	88.69±18.44	0.005
BMI (kg/m^2)	31.40±4.68	33.09±4.70	0.11	28.95±4.23	32.44±5.09	0.001
Body Fat Weight (kg)	32.22±8.18	36.18±10.50	0.06	27.00±8.27	36.17±12.76	0.000
Lean Body Weight (kg)	47.42 ±9.21	48.39 ± 9.23	0.63	47.05 ±9.43	48.47 ± 10.29	0.52
Waist/hip (cm)	0.96± 0.08	0.98 ±0.09	0.06	0.91 ±0.08	0.98±0.10	0.002

*FI: Food Intolerance

The changes in anthropometric measurements were compared with the FI group and the control group. Changes in lean body mass in both groups were no significant difference (p >0.05). The changes in weight, fat weight, BMI, waist/hip ratio difference were statistically significant between the two groups (Table 2).

Table 2.Delta values for anthropometric measurements of patients (n = 82)

Δ	FI* (n=42)	Control (n=40)	
ΔWeight (kg)	-8.55 ± 12.86	-0.76±1.74	*p<001*
ΔFat weight (kg)	-4.86±3.06	0.47±4.22	*p<001*
ΔLean body weight (kg)	-0.02±1.64	-0.71±4.55	*p=0.364*
ΔBMI (kg/m^2)	-2.86 ±4.41	-0.68±2.17	*p<0.01*
ΔWaist/hip (cm)	-2.83±1.96	-0.29±1.85	*p<001*

*FI: Food Intolerance

3.2. Biochemical measurements

A statistically significant decrease in triglyceride levels in the FI group was shown compared to the control group at the end of study (p<0.05). The changes in FBG, A1C, total cholesterol, HDL-cholesterol, LDL-cholesterol, AST, ALT levels in the two groups were not statistically significant (Table 3).

Table 3. Biochemical values of the patients before and after

	Before Study			After Study		
	FI*(n=42)	**Control (n=40)**	***p***	**FI*(n=42)**	**Control (n=40)**	***p***
FBG (mg/dl)	98.00±10.90	101.47±12.38	0.18	96.05±11.67	103.95±13.39	0.50
A1c (%)	5.55±0.36	5.54±0.40	0.89	5.42±0.32	5.55±0.39	0.11
Total-cholesterol (mg/dl)	208.74±48.66	207.76±40.46	0.92	197.33±43.25	200.97±40.93	0.70
HDL-cholesterol (mg/dl)	50.79±13.32	46.13±10.69	0.09	50.93±13.88	46.08±9.73	0.07
LDL-cholesterol (mg/dl)	136.36±38.50	136.11±32.19	0.97	125.36±32.07	137.34±32.21	0.10
TG (mg/dl)**	169.50±96.04	177.34±65.62	0.67	141.50±65.94	170.08±55.94	0.03
AST (U/L)	20.72±8.16	21.11±8.06	0.83	19.14±6.87	20.87±8.25	0.31
ALT (U/L)	20.81±8.94	23.16±10.14	0.27	18.98±7.39	21.58±10.23	0.20

*FI: Food Intolerance, **TG: Triglycerides

4. Discussion

In this study, weight, BMI, fat mass and triglyceride levels of the FI group that carried out an elimination diet based on FI test results were significantly decreased. In surveys conducted in recent years, it has reached the conclusion that obesity is an inflammatory disease and the weight loss has been shown to decrease the inflammation [7,8,10,11,23,24]. The obese patients, who were given a diet according to the food sensitivity test results, were lost weight, body fat mass and decreased body mass index significantly. The elimination diet has been shown to reduce also reflux disease, chronic fatigue syndrome, headaches that the problems associated with food sensitivity and losing weight decreases the inflammation markers [25,26]. Inflammation is associated with IgG antibodies raised against the food sensitivity is supported by the studies. A correlation between inflammation markers and IgG levels were also shown [7,9,12,27,28,29,30]. Therefore IgG may play a role in the development of obesity.

Obesity is a complex disease caused by a result of genetics, diet, metabolism and physical activity. Also investigations have shown the association between the chronic activation of the heredity immune system that caused a low-level inflammation of white adipose tissue in obesity [7,8].

People who had FI is characterized as the production of antibodies immunoglobulin G (IgG) so low-grade inflammation may have a tendency to atherosclerosis [7,8,9]. Therefore, it has been suggested that IgG was to be involved in the development of obesity [24,27].Studies in obese adolescents showed that the formation of IgG antibodies to food antigens were more than the normal weight adolescents [27,28]. In our study, weight, body fat mass, and BMI parameters were significantly decreased in the FI group than the control group (p <0.05). Also in the elimination diet group compared to the control group, waist/hip ratio and triglycerides levels were decreased. In the FI group after the elimination diet the decrease in body fat, weight, body mass index and waist/hip ratio and triglycerides may be associated with improvement in serum IgG antibody concentrations. After the elimination

diet, we should repeat the FI test. This is the limitation of this study.

Food intolerance is seen as quite common in society [16,29]. In some functional digestive system diseases, food intolerance is much more frequent. Food intolerance prevalence is reported 20-65% in irritable bowel syndrome (IBS) patients. In a study, two groups of patients with diagnosis of IBS (n=27) and functional dyspepsia (n=28) were tested IgE and IgG levels for specific foods at 2007. In both patient groups higher IgG antibodies against specific foods were reported but there was no elevation in IgE antibody titers [30]. In studies IgG antibodies were higher in IBS patients [16,31,32,33,34].

In the literature, it is shown that when the foods those increase the IgG levels are eliminated from the diet, the 30-70% of patients had positive developments in the symptoms [31,32,35,36,37,38,39,40]. Marinkovich et al. showed the relationship between food sensitivity and specific IgG levels and he reported that food elimination diet improved the clinical symptoms of the patients [35]. Atkinson et al. searched the effect of elimination diet accordance to the FI test results in IBS patients and compared to placebo diet. This study showed a significant reduction in patients' symptom scores of IBS with the elimination diet [33,34,41]. FI tested 5211 people underwent 3-month elimination diet. It is reported that after elimination diet 72% of patients had enormous benefits with the symptoms of gastrointestinal, dermatological, neurological [31]. Mohammed et al. searched the effect of ALCAT diet on obese patients who had been tested for food intolerance. This study was performed on 27 patients whose mean age was 43 years. As a result, the body weight, total body fat and body mass index of the patients showed improvements with this diet [26].

In our study, we removed the nutrients that increase the IgG levels from the diet of overweight and obese individuals according to the FI test results and positive developments were observed in some parameters when compared to the control group. Elimination diet, by causing resting and the recovery of the immune system, may provide a decrease in antibody titers. The decreasing of immune complexes from the circulation eliminates the symptoms (IgE: 3 days, IgG has a half-life 23 days) [35].

5. Conclusion

Obesity is a major public health problem and is associated with many health risks and affects quality of life. The most effective treatment method of obesity is giving individuals a proper diet and monitor regularly. Individuals should be aware of diet mistakes in weight control, and should use new scientific methods for the treatment of obesity. One of the methods is to identify and remove the foods from the diet that are reactive in the food intolerance test.

In our study, the positive changes observed in biochemical and anthropometric measurements in individuals who have given the elimination diet with the special slimming diet programs. Positive clinical effect has been shown for the various diseases of the elimination diet. Despite the various diet programs, people who fail to weight loss, an elimination diet according to the FI test results may be useful in the personalized slimming diets. This method may be alternatively used in medical nutritional treatment of obesity.

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