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Effect of *Juglan Regia*on Patients Having Metabolic Syndrome: A Controlled Feeding Trial

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Abstract

Metabolic syndrome is a cluster of disorders diagnosed simultaneously in an individual. The percentage of individuals affected from this syndrome is escalating around the globe as well as in Pakistan mainly due to more consumption of energy dense foods and sedentary lifestyle. Dietary modification with nutrient dense foods is a globally adapted strategy to reduce the complexity of this issue. This present project has been designed to see the impact of nutrient dense walnuts consumption on selective biomarkers in human subjects. The screening of human subjects was done by taking the anthropometric measurements, lipid profile, blood glucose level and blood pressure whereas the dietary pattern of patients was collected by validated food frequency questionnaire. The proximate analysis of walnuts was also done. Twenty patients were selected and divided into two groups randomly. Experimental group consumed walnuts daily for 8 weeks and placebo group consumed the diet without walnut. Selective physical parameters included BMI was performed at the regular basis whereas, the blood samples were collected at 1st , 4th and 8th week of the study period followed by the evaluation of serum triglyceride and high density lipoprotein cholesterol level. Walnuts were found to be high in fat content i.e. 64.6% and also contained all other important nutrients as moisture (3.9%), ash (1.5%), protein (15.3%), fiber (1.5%) and nitrogen free extract (10.7%). Walnuts reduced triglycerides significantly and HDL was also raised significantly. No significant change was observed in BMI. Statistical analysis was employed to draw the conclusive outcomes of the research studies.

Keywords: Walnuts, Metabolic syndrome, Diabetes, Cardiovascular disease, High density lipoprotein

Introduction

The current time has seen the escalation of computerization and mechanization, with better transport resultant in modifications in lifestyle from active to sedentary and thus making a huge influence on human health [1]. The increase in metabolic syndrome has been fairly related to the attainments in public health during the 20th century, with people living longer due to elimination of many of the communicable diseases. Over the last 2 decades, focus on the metabolic syndrome has progressively increased, and studies have revealed that the prevalence of metabolic syndrome is steadily increasing in all populations worldwide, identifying this as one of the main global public health challenges of current times [2].The high prevalence of metabolic syndrome and cardiovascular disease (CVD) risk factors have been reported in South Asians. Although more than one fifth of the world population lives in South Asia, very few studies have been done on metabolic syndrome in this part of the world. It is estimated that a population with metabolic syndrome is three times as likely to have

and twice as likely to die from a heart attack or stroke compared to people without the syndrome. In addition, people with metabolic syndrome have a five-fold greater risk of developing type 2 diabetes (T2DM) [3].

Persian walnuts, (Juglans regia L), is one of the most important nutritive nut crop which belongs to the angiospermic family, Juglandaceae. Walnut kernel is a rich source of proteins, fats, vitamins, minerals and polyphenols which makes the fruit indispensible for human nutrition. They are also a good source of flavonoids, sterols, pectic substances, phenolic acids and related polyphenols. Walnuts have high amount of omega-6 and omega-3 polyunsaturated fatty acids which are essential dietary fatty acids. The main benefits of walnut kernels include lowering of cholesterol, increasing the ratio of high –density lipoprotein cholesterol to total cholesterol, reducing inflammation and improving arterial function. Walnuts contribute nutrients that are essential to a healthful lifestyle. The nutritional content differs from cultivar to cultivar which can be influenced by geno-types, different ecologies and soil types [4].

Various studies have shown that adding walnuts can significantly decrease total and LDL cholesterol. In an Iranian study, 52 volunteers were divided into 2 groups. One group ate 20 grams of walnuts per day and the other group ate none. After eight weeks, the walnut group lowered their triglyceride levels by 17.1% and increased their HDL cholesterol by 9%.Walnuts help to reduce body weight. In a Harvard Medical School study, 20 men and women with metabolic syndrome participated in a randomized, double-blind, crossover study of walnut consumption. Subjects consumed a shake containing either walnuts or a placebo in breakfast. After just three days, those drinking the walnut shake reported feeling more satisfied and less hungry [5]. Walnuts aid to control diabetes. Australian researchers studied 50 overweight adults with diabetes in one year where participants received low-fat dietary plan. But half the participants also ate 30 grams of walnuts per day. In the first three months the walnut group significantly lowered their fasting insulin levels. The health benefits of walnuts are attributed to the nutritional components it contains. Walnuts also reduce risk of developing cancer. The human study, which assessed the Mediterranean diet, found that eating walnuts reduced cancer mortality. Researchers suggested that omega-3 fatty acids, antioxidants, and phytosterols in walnuts are responsible for the benefits [6].

Material and Methodology

Area of research

The respective variety of walnuts (English walnuts) was purchased from local market of Faisalabad. All the proximate analysis were performed at National Institute of Food Science and Technology. Individuals were selected randomly from out-patient department of a public sector hospital and those who were previously diagnosed as the patients of cardiovascular diseases or diabetes by an authorized physician. Blood samples, physical examination, anthropometric measures and dietary patterns were analyzed to determine the extent of variations occur during the period of study.

Sample size and selection

The 5 major risk factors of metabolic syndrome; i.e. triglyceride level, high density lipoprotein cholesterol level, blood pressure, plasma glucose level and abdominal obesity was determined at the start of the study and 3 selected makers which include obesity, high density lipoprotein cholesterol and triglyceride level were chosen for further the study of 2 months. A randomized, controlled, parallel, study design was used.

20 patients were selected in the study. They were divided as follows:

Group A Placebo	(n=10)
Group B Experimental	(n=10)

Dietary evaluation and eating plan

Dietary evaluation of patients was done by food frequency questionnaire, during the study. A recommended eating plan was given to patients to follow during the whole period of trial. To access the effect of continual consumption of two servings of walnuts 25 g in each per day on the selective risk factors of patients with metabolic syndrome, this amount of walnut was provided to patients and prescribed them recommended eating plan. The volunteers of control group did not eat walnuts and just followed the recommended eating plan. The diets consumed during the trial were consisted of non-processed and traditional foods.

Determination of nutritive profile

Walnuts are analyzed for moisture content, crude protein, crude fat, crude fiber and ash content were determined.

Anthropometric measurements

Anthropometric measurements including height, weight. All information was gathered by using a questionnaire.

Results

Proximate analysis of english walnut

The proximate analysis of English walnuts was done. The results show that fats form the highest proportion of walnuts. Most of this fat is the unsaturated fat. In addition, walnuts are good source of proteins. Nutritional profile of english walnut shown in table 1.

Selective Marker of Metabolic Syndrome

Body Mass Index

Mean values were subjected to Fisher's Least Significant Difference (LSD) test. Group was non-significant (P<0.01), weeks and group x weeks was found to be non-significant. Mean comparison of in different groups of body mass index was also found non-significantly high 8th week (29.27±0.26) in control group and low in 8th week of experimental group (27.40±0.36) as compared to all others control and experimental groups. Overall mean of body mass index in consumption of Juglans regia (English walnut) was found non-significantly different in baseline (28.66±0.22), 4th week (28.49±0.25) and 8th week (28.33±0.29). Overall mean of body mass index in group was found non-significantly increased (29.09±0.14) in control and decreased (27.89±0.21) in experimental group (Table 2).

Triglycerides

Mean values were subjected to Fisher's Least Significant Difference (LSD) test. Group, weeks and group x weeks was found to be significant. Mean comparison of in different groups of triglycerides (mg/dL) was found significantly high baseline (285.08±2.94) in experimental group and low in 8th week of experimental group (270.58±2.75) as compared to all others experimental and control groups. Overall mean of triglyceride by the consumption of activity of Juglans regia (English walnut) was found in baseline (282.46±1.75), 4th week (279.04±2.86) and 8th week (276.71±2.89). Overall mean of triglyceride in group was found to be significantly high (281.28±2.84) in control and lower (277.53±4.01) in experimental group (Table 3).

High density lipoprotein

Mean values were subjected to Fisher's Least Significant Difference (LSD) test. Group, weeks and group x weeks was found to be significant (P<0.01). Mean comparison of in different groups of HDL (mg/dL) was found significantly high baseline (43.67±1.20) in control group and low in 8th week of control group (41.50±0.76) as compared to all others control and experimental groups. Overall mean of HDL by the consumption of Juglan regia (English walnut) was found in baseline (42.17±16.99), .4th week (42.50±0.74) and 8th week (42.79±0.73). Overall mean of HDL in group was found to be significantly high (43.17±0.69) in experimental and lower (42.30±1.01) in control group (Table 4).

Discussion

The chemical composition of walnuts was same as studied in research conducted on walnuts grown in New-Zealand [7]. First the proximate analysis of Juglan Regia was done at NIFSAT, UAF. The values of nutritional profile of walnuts is 3.9% moisture, 1.5% ash, 64.5% fats, 15.3% proteins,7.2% of dietary fiber and 10.7% of nitrogen free extract. The results of proximate analysis was very similar to this respective study in which fat content was 62.6-70.3 %, protein was 13.6-18.1% and the moisture content was 3.1-4.2% [8]. It also concluded in his study 3.58% moisture, 17.86% proteins, 67.45% fat and 1.77% ash in English walnuts [9]. Some of factors that effects the nutrient percentage ranges includes the climate conditions and geographical pattern. Thus, some of variations in nutritional profile are seen from different samples.

The height and weight measurements were interoperated to find the BMI. The walnut intake causes slight reduction in obesity (assessed by BMI) but it is statistically non-significant. The studies on nuts focus mostly on weight management rather than weight reduction on consuming high caloric nuts. Walnuts like the other nuts are rich in fat and calories but most of its fat in polyunsaturated fat that has no side effects related with the saturated fat. Dietary fibers found in almonds are responsible in the maintenance of BMI. More than half of this fat is poly unsaturated fat that lowers body weight. This is opposite to saturated fat which is major contributor of obesity. The unsaturated type fat promotes chewing. When this fat reaches into the small intestine it stimulates the release of cholycystokinin (CCK). CCK increases the satiety and further contributes toward reduction in obesity in humans. Thus, the weight does not increase on walnut consumption. Similar results obtained in studies of this research [10]. It observed slight increase in body weight on walnut intake for longer period but when it was adjusted with the energy expenditure the change

Table 1: Nutritional composition of english walnuts.

Component %	Sample 1	Sample 2	Sample 3	Average
Moisture	3.7±0.1	4.1±0.2	3.9±0.1	3.9±0.1
Ash	1.6±0.3	1.4±0.1	1.5±0.2	1.5±0.2
Crude Fat	64.7±0.3	64.5±0.2	64.6±0.1	64.6±0.1
Crude Protein	15.4±0.3	15.1±0.1	15.6±0.2	15.3±0.2
Crude Fiber	2.5±0.1	2.3±0.2	2.4±0.1	7.2±0.1
Nitrogen free extract	11.3±0.3	11.1±0.1	9.9±0.4	10.7±0.2

Table 2: Mean body mass index (kg/m2±SE) by consumption of Juglan regia.

BMI	Experimental	Control	Overall Means
Baseline	28.41±0.35	28.91±0.25	28.66±0.22a
4th Week	27.88±0.35	29.10±0.24	28.49±0.25b
8th week	27.40±0.36	29.27±0.26	28.33±0.29c
Overall Mean	27.89±0.21b	29.09±0.14a	28.49±0.15

Table 3: Mean triglycerides (mg/dL±SE) by the consumption of Juglan regia.

Triglycerides	Experimental	Control	Overall Means
Baseline	285.08±2.94a	279.83±2.71c	282.46±1.75a
4th Week	276.92±1.06b	281.17±3.94b	279.04±2.86b
8th week	270.58±2.75c	282.83±3.89a	276.71±2.89c
Overall Mean	277.53±4.01b	281.28±2.84a	279.40±1.77

Table 4: Mean high density lipoprotein (HDL; mg/dL±SE) by consumption of Juglan regia.

HDL	Experimental	Control	Overall Means
Baseline	42.17±1.24c	43.67±1.20a	42.17±.16.99c
4th Week	43.25±1.24b	41.75±0.82b	42.50±0.74b
8th week	44.08±1.16a	41.50±0.76c	42.79±0.73a
Overall Mean	43.17±0.69a	42.30±1.01b	42.73±1.3

became non-significant in human subject [11]. Weight change due to long time walnut intake when assessed in diabetic patients also showed a slight reduction [12]. The results of this study are also closer to the results of respective study where effect of consumption of walnuts on body mass index was observed in human subjects [13]. The finding concluded, the base line of BMI was 25. 1 in experimental group of human subjects and which after 12 weeks decreases to 24.8 by the regular intake walnuts in daily diet of which is statistically non-significant.

This study has proved significant effect of walnut on serum triglyceride in humans with hypertriglyceridemia and metabolic disorders. In present study, these were decreased from (282.46±4.75) to (276.71±4.89) in 8 weeks in experimental group. Thus, the triglycerides reduced in study of two months by the consumption of recommended serving of walnuts in diet. This is attributed to unsaturated fat content of walnuts. This further proves the health benefits of walnuts. These results of effect on triglycerides are closer to those seen in this in which the F value of TAG was 12.40 [14]. There was statistical reduction in TAG level of patients with dyslipidemia. The similar trend of results was also observed by Ros et al (2004) where there was F-value 9.74 for in human subjects. The intake of Juglans regia (English walnut) by patients having metabolic syndrome showed the sufficient increased in high density lipoprotein level in blood. HDL rose from (42.17±16.99) to (44.08±0.73) during the study of 8 weeks by regular consumption of walnuts. The poly unsaturated fatty acids linoleic acid and linolenic acid pose this beneficial change. The findings are consistent to that observed by [15], where a clear increase in HDL was seen, the increase was 3.87

and 3.86 in F-values respectively in experimental group of human. An overview of HDL, TAG and obesity revealed an alarming situation for which effort must be made to control or lower the cholesterol, triglyceride and raise the high density lipoprotein concentration levels by the consumption of walnut.

Conclusion

This study proved significance of English walnuts for biomarkers of metabolic syndrome. The study showed that English walnut (Juglans regia) are fairly high in fat content and have reasonable amount of all the essential nutrients. Regular walnut consumption positively affects the serum lipid profile. Walnut consumption poses fairly high reduction in triglyceride slight rise in high density lipoproteins. Walnut intake did not an affect the body mass index.

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