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TREATING OBESITY BY LOW-GLYCEMIC INDEX DIET

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Summary. *The glycemic index (GI) has been proposed as a method of ranking foods on the basis of their postprandial glycemic effect. The experimental evidence and clinical trials suggest that a low-GI diet could be an effective treatment for overweight and obese individuals. The aim of this study has been to study the effects of low-GI diet on weight control, blood pressure and some biochemical parameters during a 12 week treatment period. Moreover, the study objective has also been to compare effects of two weight loss diets differing in GI (lower- and higher-GI) on blood pressure and the body weight regulation. Participants were non-diabetic, obese individuals (n=80) randomized to receive the low-GI diet or the high-GI diet for 12 weeks. Eating a low- GI diet showed a reduction of total serum cholesterol, serum triglycerides and blood glucose levels after a 12-week treatment, which is clinically relevant. The low- GI diet has a better effect on the body weight, body mass index (kg/m^2) and blood pressure reduction in the obese, so it should be given preference in dietotherapy of obesity whenever possible. This study suggests that the GI is a valid and potentially useful concept of management of obesity.*

Key words: *Glycemic index, diet, obesity*

Treating obesity by low-glycemic index diet

Historically, carbohydrates have been thought to play only a minor role in promoting weight gain and in predicting the risk of development of chronic disease (1). Most of the focus has been on reducing total dietary fat (2). During the last 20 years, fat intake has decreased, while the number of individuals who were overweight or developed a chronic conditions have dramatically increased. Simultaneously, the caloric coming from carbohydrate have also increased (1). These observations suggest that dietary factors other than fat play an important role in the body weight regulation. One such factor may be the glycemic index (GI).

The concept of GI was proposed in 1981. as a way of ranking foods according to their postprandial glycemic effect (3,4). After the consumption of a meal rich in carbohydrates there occurs a sudden increase, and after that a decrease of blood glucose levels, which is known as the glycemic response. The glycemic response of the body after the digestion of carbohydrate-containing food can be compared with standard food such as white bread, or glucose (whose GI is 100). This value is called the glycemic index and is ranked in the scale 0–100 depending on the velocity and power of increasing blood glucose levels after the intake of that quantity of the food which contains 50g of carbohydrates (4,5). Postprandial glycemia is influenced by both quantity and quality of carbohydrates.

The World Health Organisation and the Food Agricultural Organisation support the choice of low-GI foods in healthy individuals (5), but there is still no international consensus as to the clinical usefullness of the GI concept in the dietary management of obesity and other non-communicable diseases (6-11).

The aim of this study has been to analyse the effects of low-GI diet on weight control, blood pressure and some biochemical parametars during a 12 week treatment period. Moreover, the study objective has been also to compare effects of two weight loss diets differing in GI (lower- and higher-GI) on blood pressure and body weight regulation.

Subjects and methods

Obese, non-diabetic subjects (n = 80) were randomized out of the group of patients who visited Dietetic Centre (Public Health Center, Niš) in the first three months of the year 2003. The entrance criterion for involvement in this research was age (over 18, under 68), body mass index over 25m/kg^2, and stable body weight in the 3 consecutive months prior to the research. In addition, subjects had had stable smoking habits in the previous 6 months, they were not oncological, endocrinological, or psychiatric patients, and among the subjects there were no pregnant women, or toxin addicts. During the study subjects did not take medicaments or any therapy that would influence body weight regulation. There was no difference in the use of medicaments during the entire research period. Prior to the research, there was obtained participants' consent to their involvement in a clinical study.

The dietary energy intake for each patient was

calculated according to the baseline metabolism (multiplying the table values by 1.3) and then by subtracting 500 kcal from the accounting recommended daily energy intake. Prescribed daily energy intake was never lower than 1,200 kcal. The diet supplied about 25% of calories from fat, 15% from protein and 60% from carbohydrates, designed to be consistent with Food Guide Pyramid (12,13).

Subjects were randomized to receive one of two energy-restrictive diets, low-GI diet, using foods with low GI (under 55) or high-GI diet, mostly of foods with high glycemic index (over 70). Low-GI food include most type of pasta, baked beans, green peas, rice, vegetables, high fiber, low-sugar cereals as well as yogurt, apples, tomatoes etc. High-GI foods include bread, potatoe, banana, carrots, ice-cream etc.

Physical activity was to remain at stable levels for individuals throught the 12-week study period. All subjects were moderately physically active during the body weight regulation program (no more than 1 hour of briskly walking a day).

Blood pressure and anthropometric variables were measured in both group of the patients at the start of the dietary treatment, after 4 week and at the end of study period. At the same time in patients with low -GI diet, were analyzed total cholesterol, blood triglycerides and blood glucose levels using standard biochemical procedures.

Continous variables are presented as means ± standard deviation unless otherwise stated. They were analyzed with the use of a two-sample t-test. Categorial data were analyzed by using Pearson's chi-square analysis. Non normal data were analyzed with Wilcoxon's rank-sum test. All statistical analysis was performed with SPSS Stata Software 6.0.

Results

There were no significant differences in demografic data between the study groups (Table 1).

Baseline anthopometrical data, biochemical data and blood pressure have been shown on the Table 2. The two study group showed significant differences in body weight and body mass index. In the group of individuals with high-GI diet mean BMI (kg/m^2) was 31.83 ± 5.30, but in the low-GI diet group mean BMI (kg/m^2) was 35.71 ± 8.64. So, baseline body mass index was significantly higher in patients with low- GI diet (P< 0.05).

Table 1. Demographic characteristics for subjects assigned to the high-GI diet and low-GI diet groups

Variable	High- GI diet (n=40)	Low- GI diet (n=40)
Sex (% male)	22.5	22.5
Age (y)	48 ± 15	48 ±14
Rank	18 – 66	21 – 68
Marital status (% married)	84	89

Total cholesterol and triglyceride serum levels were all statistically significantly higher in the patients starting low- GI diet in comparison with the patients in high- GI diet group (P<0.01). No significant differences for blood glucose levels were showed among both patient groups.

Systolic blood pressure was significantly higher in the group of individuals with low- GI diet, but there was no significant difference between group in diastolic blood pressure.

Table 2. Baseline characteristics of health measures in subjects

Variable	High- GI diet (n=40)	Low- GI diet (n=40)	P-value
Weight (kg)	84.67 ±15.31	96.86 ±17.48	P<0.01*
Body mass index kg/m^2	31.83 ± 5.30	35.71 ± 8.64	P<0.05*
Cholesterol (mmol/L)	5.54 ± 1.18	7.19 ± 1.97	P<0.01*
Triglycerides (mmol/L)	1.57 ± 2.61	3.35 ± 2.61	P<0.001†
Glycemia (mmol/L)	5.42 ± 1.50	5.75 ± 1.98	P>0.05†
Systolic pressure (mmHg)	126 ±19.60	138.5 ±22.79	P<0.05*
Diastolic pressure (mmHg)	79 ±13.02	82.13 ±12.81	P >0.05*

*determined with two-sample t-test
† determined with Wilcoxon's rank-sum test

Table 3 The effects of low-GI diet in participants (n=40)

Variable	Baseline	After 4 weeks	After 12 weeks	P
Weight (kg)	96.86 ± 17.48	91.03 ± 17.03	87.48 ± 17.11	P<0.001*
Body mass index (kg/m^2)	35.71 ± 8.64	33.33 ± 7.03	32.19 ± 6.81	P<0.001*
Systolic pressure (mmHg)	138.5 ± 22.79	132.75 ± 18.50	126.12 ± 17.30	P<0.001*
Diastolic pressure (mmHg)	82.13 ± 12.81	80.13 ± 9.77	75.50 ± 8.38	P< 0.001*
Cholesterol (mmol/L)	7.19 ± 1.97	6.37 ± 1.66	6.04 ± 1.70	P<0.001*
Triglycerides (mmol/L)	3.35 ± 2.61	2.32 ± 2.0	2.30 ± 1.33	P < 0,01†
Blood glucose (mmol/L)	5.75 ± 1.98	5.4 ± 1.85	5.24 ± 0.98	P < 0,01†

*determined with two-sample t-test, † determined with Wilcoxon's rank-sum test

Table 4. The effects of high -GI diet in participants (n=40)

Variable	Baseline	After 4 weeks	After 12 weeks	P
Weight (kg)	84.67 ± 15.31	80.48 ± 14.23	77.46 ± 12.93	P<0.001*
Body mass index (kg/m^2)	31.83 ± 5.30	30.25 ± 4.87	29.32 ± 4.41	P<0.001*
Systolic pressure (mmHg)	126 ± 19.6	126.13 ± 19.43	125.25 ± 18.64	P> 0.05*
Diastolic pressure (mmHg)	79 ± 13.02	78.25 ± 9.64	74.12 ± 10.31	P< 0.05*

*determined with two-sample t-test

Table 3 has been showed the effects of low-GI diet in subjects. After 12 weeks of low-GI dietotherapy, all tested parametres significantly decreased in subjects consumed low-GI diet.

The effects of high-GI diet on participants' anthropometric characteristics and blood pressure have been showed on Table 4.

In subject with high-GI diet, bodu weight and body mass index significantly decreased after 12 weeks.

Systolic blood pressure remained statistically unchanged after study period ($P>0.05$), whereas diastolic blood pressure showed significantly lower values.

Discussion

This research has confirmed that low- GI dietotherapy, after 12 weeks, can provide more favourable results in obese persons when compared with a corresponding high- GI diet.

The high - GI diet leads to a smaller body weight reduction 7.2 kg as compared with the low- GI diet group – 9.4 kg. Moreover, the body mass index decreased more in the low-GI diet group compared with the high-GI diet group, and this corresponds to the previously described research (14-19).

According to literature data (20,21), low- GI meals contribute to the body weight regulation in 2 ways: by providing satiety and by fat oxidation due to carbohydrate consumption. Low-GI -diets can sustain insulin sensitivity and increase the weight loss potential of low-fat food (22). The faster digestion and glucose apsorption after consumption of high-GI meals induces a sequences of hormonal and metabolic changes that promote hunger and subsequent body weight gain in obese persons

In this study the low- GI diet has had a better effect on the blood pressure reduction in obese individuals, also exerting an overall cardiovascular benefit. It is possible that the amount of the weight loss had a significant effect on the degree of improvement in the blood pressure.

There were also changes from baseline in serum lipids and blood glucose levels in persons exposed to the 12-week low-GI diet, which is clinically relevant. In another study (23,24), individuals with the low-GI diet had also favorable changes in the lipoprotein profile. In a recent study conducted in Australian overweight subjects, eating a low-GI diet showed a reduction of A1c, tryacylglycerol and LDL cholesterol after 12 weeks of treatment (20). Another study using a low-GI index diet in healthy French men demonstrated a reduction of fat mass and tryacylglycerol after a 5-week period and these changes were accompanied by decrease in the expression of some genes implicated in lipid metabolism (21).

We cannot definitively conclude that a high-GI foods restriction alone accounted for this independent effect and future evaluating studies are needed. Other nonncontrolled variables, such as the proportion of complex carbohydrates or the ratio of carbohydrate to fiber, or other unknown variables may have contributed to this effect too. In addition, more precise biochemical measurements would be needed to confirm this effect of a low-GI diet.

We can conclude that GI is a valid and potentially useful concept of management of obesity and a low-GI diet seems to be a promising alternative to the standard energy restricted diet. Such a diet could be of benefit to obese people and might play a role in improvement of the lipid profiles, suggesting a therapeutic potential in non-communicable diseases.

The current evidence supports the WHO/FAO recommendation to maintain a high-carohydrate diet but to choose low-GI starchy foods. Decreasing dietary GI by reducing the intake of high-glycemic beverages and replacing refined grain products and potatoes with minimally processed plant-based foods such as whole grains, legumes, fruits and vegetables may better regulate body weight in obese individuals.

The presented results provide a basis for more serious clinical and epidemiological studies in our population, which would monitor the influence of glycemic index on larger numbers of obese subjects in more detail.

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ISHRANA SA NISKIM GLIKEMIJSKIM INDEKSOM U LEČENJU GOJAZNOSTI

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Kratak sadržaj. *Glikemijski indeks (GI) predstavlja metod za podelu namirnica na osnovu njihovog postprandijalnog glikemijskog odgovora. Dokazi iz eksperimentalnih i kliničkih studija ukazuju da ishrana sa niskim GI može biti efikasna u lečenju gojaznosti. Cilj ovog istraživanja je bio ispitati uticaj 12-to nedeljne dijetoterapije sa niskim GI na kontrolu telesne težine, regulaciju krvnog pritiska i neke biohemijske parametre kod gojaznih. Poseban cilj istraživanja je bio uporediti delovanje dve redukcione dijete sa različitim GI na krvni pritisak i regulaciju telesne težine. Ispitanici su bili pacijenti Savetovališta za dijetetiku (n=80) koji su izabrani metodom slučajnog izbora i bili na redukcionoj dijeti sa niskim GI ili sa visokim GI tokom 12 nedelja. Ishrana sa niskim GI dovela je do snižavanja nivoa holesterola u serumu, triglicerida i glikemije nakon 12 nedelja, što je od kliničkog značaja. Dijeta sa niskim GI povoljnije je delovala na kontrolu telesne težine, indeks telesne mase (kg/m^2) i redukciju krvnog pritiska kod gojaznih, i može joj se dati prednost u dijetoterapiji gojaznosti kad god je to moguće. Neophodne su detaljnije studije sa većim brojem ispitanika koje bi potvrdile ove pilot rezultate.*

Ključne reči: *Gojaznost, dijeta, glikemijski indeks*