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Clinical efficiency of diet and physical exercises in patients with abdominal obesity and renal dysfunction

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Abstract
The purpose of our study was to evaluate the impact of diet and dosed physical exercises on clinical and laboratory parameters of initial renal dysfunction in patients with abdominal obesity with or without arterial hypertension (AH).
Materials and methods. The effectiveness of diet and physical activity was studied in 46 patients with abdominal obesity and initial manifestations of renal damage with or without arterial hypertension. The first group's data are shown below. The average age of patients with abdominal obesity without arterial hypertension was 24,0±1,4 years, men were 14 (45.2%), women - 17 (54.8%). Average BMI was equal 33.1 [31.0; 37.4] kg / m^2. The group consisted of patients with abdominal obesity without hypertension who were assigned diet and dosed exercises. This group included patients with or without disturbances of carbohydrate and lipid metabolism, able of accomplishing exercise and diet. The second group's data are shown below. The average age of patients with abdominal obesity and arterial hypertension 1 degree was 33,0±1,6 years; men were 5 (33.3%), women - 10 (66.7%). Blood pressure (BP) was between 140-152 / 86-96 mm Hg, average BMI - 32.1 [31.0; 33.8] kg / m^2. Diet and exercises were assigned similar to the first group. All patients adhered recommendations. In addition to using general methods of clinical research conducted anthropometry, electrocardiography, ultrasound of the kidneys, determination of GFR using 24-hour urine collection without adjustment for body surface area, immunoreactive insulin, carbohydrate and lipid metabolism, level of leptin in plasma; urine albumin, urine protein, urine β_2-microglobulin, HOMA-IR, urine albumin/urine creatinine ratio, urine protein/urine creatinine ratio, urine β_2-microglobulin/urine creatinine ratio.
Results. Significant reduction ($p<0.001$) of body weight from 97.0 [87.5, 106.0] to 92.0 [84.0, 100.0] kg, BMI from 33.1 [31.0; 37.4] to 31.2 [29.7, 35.9] kg / m^2 and other anthropometric parameters were observed in 100% of cases in the first group under the influence of diet and physical activity. The levels of SBP and DBP were within normal limits and did not change significantly. Weight loss of 5.0 kg led to a significant decrease ($p<0.01$) in GFR an average of 1.9 mL / min, β2-mg - 0.6 mg / 24 h. and urine β2-mg / urine Kr ratio - 0.4 mg / g. Leptin levels significantly ($p<0.01$) reduced in this group of patients. Carbohydrate and lipid metabolism improved in parallel with the decrease in body weight. Level of total cholesterol decreased from 5.3 [4.5, 6.1] to 4.9 [4.2, 5.8] mmol / L, LDL - from 3.4 [2.9, 4.5] to 3.2 [2.5, 4.1] mmol / L, fasting insulin levels - from 31.0 [27.7, 38.6] to 29.1 [22.3, 39.4] mcMO / ml, index HOMA-IR - 7.2 [5.9, 10.2] to 6.5 [4.7, 9.1], fasting glucose level - from 5.2 [4.6, 6, 2] to 5.1 [4.5, 5.9] mmol / L, glucose after carbohydrate test - from 6.9 [5.6, 7.5] to 6.5 [5.5, 7.5] mmol / L. Diet and dosed exercises did not affect for TG, HDL and AI. Diet and dosed exercises have no contraindications, except for changes in the general food and mode of motor activity. In the second group weight loss and waist circumference were observed in 100% of cases, influenced by diet and physical activity. BMI significantly reduced from 32.1 [31.0; 33.8] to 31.6 [29.7; 32.5] kg / m^2, waist circumference decreased from 102.0 [96.0; 115.0] to 95 [92.0, 112.0] cm, weight - from 95.0 [83.0; 106.0] to 90.0 [80.0; 100.0] kg under the influence of diet and physical activity. Consequently, the dynamics of body mass and waist circumference in this group was similar group 1. There were no probable modifications of waist/hip ratio during the treatment. Normalization of blood pressure after 6 months of treatment was achieved in 8 (53.3%) patients and a significant decrease in blood pressure - in 4 (26.7%) patients. In 3 (20.0%) patients blood pressure didn't change. GFR normalized in 2 (13.3%) persons, decreased - in 13 (86.7%) patients after treatment. The level of β_2-mg decreased in 13 (86.7%) patients, did not change - in 2 (13.3%) patients. Similar changes found in the analysis of β_2-mg / Kr urine ratio: normalization of the ratio - in 1 (6.7%) patients, reduction of this parameter - in 10 (66.7%) patients, this ratio has not changed - in 4 (26, 6%) patients. There were significant improvement in carbohydrate metabolism and HOMA-IR, lowering leptin levels in this group of patients. In parallel with weight loss fasting insulin levels decreased from 28.6 [24.2; 32.6] to 26.5 [22.1; 32.1] mcMO / ml ($p <0.01$), decreased initially elevated HOMA-IR indexes from 6.2 [4.7, 8.2] to 5.5 [4.4, 7.4] ($p <0.01$), decreased elevated levels of fasting glucose from 4 8 [4.4; 5.6] to 4.5 [4.1, 5.5] mmol / L ($p <0.01$), decreased elevated glucose levels after carbohydrate loading from 5.8 [5 6; 7.6] to 5.6 [5.5, 7.6] mg / dL ($p <0.05$) and leptin levels from 33.7 [25.6; 53.1] to 32.0 [22.4; 46.8] ng / ml ($p <0.01$) in patients with abdominal obesity and hypertension. Similar changes observed in the analysis of lipid abnormalities: decreased total cholesterol from 4.9 [4.2, 5.5] to 4.6 [4.0, 5.2] mmol / L ($p <0.01$) and LDL from 3.4 [2.3, 3.8] to 3.0 [2.2, 3.4] mmol / L ($p <0.01$).

During the treatment there was no probable ($p<0,05$) modifications TG, HDL-C and IA. Reducing averages HOMA-IR for 0.7 and weight for 5.0 kg led to a reduction in SBP average for 4 mm Hg and DBP for 2 mm Hg, GFR for 10.2 ml / min, β2-mg - 0.1 mg / 24 h. and β2-mg / cr urine ratio - 0.1 mg / g. Dynamics of anthropometric parameters, leptin levels, insulin resistance, carbohydrate and lipid metabolism showed positive changes of kidney function similar group №1 in patients with abdominal obesity and hypertension against the background of diet and dosed physical activity. Our results confirmed the literature. According to literature data weight loss improves renal function with a reduction in proteinuria, glomerular hyperfiltration and inflammation, and improves control blood glucose levels in people with or without obvious renal failure.

Conclusions. The necessity diet and physical activity was substantiated in patients with abdominal obesity and renal dysfunction depending on the degree of obesity, metabolic characteristics, levels of IR. Diet and physical activity in patients with abdominal obesity and early renal damage are an effective way of prevention or correction renal dysfunction and associated metabolic changes. The research laboratory parameters of kidney function in patients with abdominal obesity and renal dysfunction have great importance for the diagnostic assessment of the impact diet and physical activity on the development and progression of early stages of renal damage.

Key words: abdominal obesity, renal dysfunction, diet, physical activity.

1. Introductions

The basic principle of a comprehensive treatment program is the prevalence of abdominal obesity energy consumption of the energy value of food. The modern treatment concept of obesity based on tactics of gradual weight loss - 0.5-1 kg / week, stabilization and maintenance of achieved body weight with a mandatory reduction the impact of risk factors for complications and improve the quality of life. Current guidelines complied by WHO, National Institutes of Health and the North American Association for the Study of Obesity recommend a comprehensive program includes body weight control, based on nonmedical methods. It is sustainable hypocaloric food based on individual dietary habits, lifestyle, age, increasing physical activity for background correction stereotypes feeding behavior, the formation of healthy lifestyles. According to the literature the physician‘s recommendations relative to healthy lifestyles and prevention of cardiovascular diseases receive only 10% of patients.

Weight loss in patients with chronic kidney disease (CKD) is a matter not only and not so much the weight loss, but also reduce elevated levels of insulin resistance (IR). Despite irrational nutrition, especially consumption of large amounts of saturated fats and carbohydrates, which plays a decisive role in the development of obesity, modified diet usually can’t achieve a real reduction of increased body mass and decrease associated with it metabolic disorders due to low patient adherence. High protein diets, common in the United States and Europe, should not be used in patients with impaired renal function due to non-enzymatic proteins of glycolysis in renal tubules. Recommendations for changes in diet in individuals with obesity continues to be based primarily on reducing the total number of calories consumed with the number of vegetable products.

Exercise increases energy costs, promote lipolysis, improve the function of the cardiovascular system. Lifestyle dosed with physical activity and restriction of caloric intake enhances the effectiveness of drugs used to treat obesity [1-5].

2. Object: to evaluate the impact of diet and dosed physical exercises on clinical and laboratory parameters of initial renal dysfunction in patients with abdominal obesity with or without arterial hypertension (AH).

3. Materials and Methods

The effectiveness of diet and physical activity was studied in 46 patients with abdominal obesity and initial manifestations of renal damage with or without arterial hypertension.

Criteria for forming groups:

1) Abdominal obesity 1-3 degree in anthropometric indicators (BMI, waist circumference, waist/hip ratio).
2) Moderate insulin resistance.
3) The presence of renal dysfunction’s parameters.

The first group’s data are shown below. The average age of patients with abdominal obesity without arterial hypertension was 24,0±1,4 years, men were 14 (45.2%), women - 17 (54.8%). Average BMI was equal 33.1 [31.0; 37.4] kg / m^2. The group consisted of patients with abdominal obesity without hypertension who were assigned diet and dosed exercises. This group included patients with or without disturbances of carbohydrate and lipid metabolism, able of accomplishing exercise and diet.

The second group’s data are shown below. The average age of patients with abdominal obesity and arterial hypertension 1 degree was 33,0±1,6 years; men were 5 (33.3%), women - 10 (66.7%). Blood pressure (BP) was between 140-152/86-96 mm Hg., average BMI - 32.1 [31.0; 33.8] kg / m^2. Diet and exercises were assigned similar to the first group. All patients adhere recommendations.

Diet was calculated on the basis of basal energy balance (BEB). We used the Harris – Benedict formula:

Men BEB (kcal) = 66,47 + 13,75W + 5,0 H-6,77 A;

Women BEB (kcal) = 65,51 + 9,56 W + 1,85 H - 4,67 A,

where: W = weight (kg), H = height (cm), A = age (years).

Then the resulting value BEB multiply for 1,3 - ratio of exercise. Physical activity offered daily from 20 to 40 minutes once or twice a day [4].

In addition to using general methods of clinical research conducted anthropometry, electrocardiography, ultrasound of the kidneys, determination of GFR using 24-hour urine collection without adjustment for body surface area, immunoreactive insulin, carbohydrate and lipid metabolism, level of leptin in plasma; urine albumin, urine protein, urine β_2-microglobulin, insulin resistance index - HOMA-IR, urine albumin / urine creatinine ratio, urine protein / urine creatinine ratio, urine β_2-microglobulin / urine creatinine ratio.

Statistical analysis of the research results carried out by methods of variation statistics implemented a standard application package "Statistica 6.1, Serial AGAR 909E415822FA" and "Microsoft Excel". Data were presented as median (Me) and borders interquartile interval [25%; 75%] when describing quantitative signs. Quality signs were defined as minimum and maximum for each parameter in absolute numbers and percentages. The level of significance was considered significant at $p<0,05$.

4. Results

In the first group initial data and dynamics of anthropometry and blood pressure levels, which changed after the treatment represented in Table 1. Significant reduction ($p<0.001$) of body weight from 97.0 [87.5, 106.0] to 92.0 [84.0, 100.0] kg, BMI from 33.1 [31.0; 37.4] to 31.2 [29.7, 35.9] kg / m^2 and other anthropometric parameters were observed in 100% of cases under the influence of diet and physical activity. The levels of SBP and DBP were within normal limits and did not change significantly.

Table 1: The dynamics of anthropometry and blood pressure in patients with abdominal obesity without hypertension under the influence of diet and dosed physical exercises (n = 31)

Parameter	Before treatment	After treatment
Body weight, kg	97,0 [87,5;106,0]	92,0 [84,0;100,0]*
Waist circumference, см	105,0 [98,0;110,0]	100,0 [96,0;106,0]*
Waist/hip circumference ratio	0,92 [0,9;1,0]	0,9 [0,87;1,0]*
BMI, kg / m2[2]	33,1 [31,0;37,4]	31,2 [29,7;35,9]*
SBP, mmHg	120,0 [118,0;120,0]	120,0 [116,0;120,0]#
DBP, mmHg	70,0 [70,0;80,0]	70,0 [70,0;76,0]#

Notes: * - p <0.001; # - p> 0,05.

The evaluation of kidney function parameters is shown in Table 2. Weight loss of 5.0 kg led to a significant decrease (p<0.01) in GFR an average of 1.9 mL / min, β2-mg - 0.6 mg / 24 h. and urine β2-mg / urine Kr ratio - 0.4 mg / g (tabl.2).

Table 2: The assessment of kidney function in patients with abdominal obesity without hypertension under the influence of diet and dosed physical exercises (n = 31)

Parameter	Before treatment	After treatment
GFR, mL / min	163,0 [142,4;186,7]	149,2 [127,3;171,6]*
β_2- mg, mg /24 H.	1,6 [0,8;3,5]	1,5 [0,6;3,2]**
β_2- mg / Kr urine ratio, mg / g	1,6 [0,8;3,5]	1,0 [0,6;2,3]*

Notes: * - p <0.001; ** - p <0.05.

Leptin levels significantly (p<0.01) reduced in this group of patients. Carbohydrate and lipid metabolism improved in parallel with the decrease in body weight. According to the table 3 level of total cholesterol decreased from 5.3 [4.5, 6.1] to 4.9 [4.2, 5.8] mmol / L, LDL - from 3.4 [2.9, 4.5] to 3.2 [2.5, 4.1] mmol / L, fasting insulin levels - from 31.0 [27.7, 38.6] to 29.1 [22.3, 39.4] mcMO / ml, index HOMA-IR - 7.2 [5.9, 10.2] to 6.5 [4.7, 9.1], fasting glucose level - from 5.2 [4.6, 6, 2] to 5.1 [4.5, 5.9] mmol / L, glucose after carbohydrate test - from 6.9 [5.6, 7.5] to 6.5 [5.5, 7.5] mmol / L. Diet and dosed exercises did not affect for TG, HDL and AI. Diet and dosed exercises have no contraindications, except for changes in the general food and mode of motor activity (tabl.3).

Table 3: The dynamics of the lipids and carbohydrates metabolism, insulin resistance in patients with abdominal obesity without hypertension under the influence of diet and dosed exercises (n = 31)

Parameter	Before treatment	After treatment
Fasting glucose, mmol / L	5,2 [4,6;6,2]	5,1 [4,5;5,9]**
Glucose after carbohydrate test, mmol / L	6,9 [5,6;7,5]	6,5 [5,5;7,5]*
Insulin, mcMO / ml	31,0 [27,7;38,6]	29,1 [22,3;39,4]*
HOMA-IR	7,2 [5,9;10,2]	6,5 [4,7;9,1]*
Total cholesterol, mmol / L	5,3 [4,5;6,1]	4,9 [4,2;5,8]*
TG, mmol / L	1,2 [0,8;1,8]	1,1 [0,8;1,7]#
HDL, mmol / L	1,2 [1,1;1,3]	1,2 [1,1;1,3]#
LDL, mmol / L	3,4 [2,9;4,5]	3,2 [2,5;4,1]**
AI	3,7 [2,7;4,9]	3,1 [2,5;4,0]*
Leptin, ng / mL	33,7 [25,6;53,1]	32,0 [22,4;46,8]*

Notes: * -p <0.001; ** - p <0.01; # - p> 0,05.

In the second group weight loss and waist circumference were observed in 100% of cases, influenced by diet and physical activity. BMI significantly reduced from 32.1 [31.0; 33.8] to 31.6 [29.7; 32.5] kg / m^2, waist circumference decreased from 102.0 [96.0; 115.0] to 95 [92.0, 112.0] cm, weight - from 95.0 [83.0; 106.0] to 90.0 [80.0; 100.0] kg under the influence of diet and physical activity. Consequently, the dynamics of body mass and waist circumference in this group was similar group 1. There was no probable modifications of waist/hip ratio during the treatment. Normalization of blood pressure after 6 months of treatment was achieved in 8 (53.3%) patients and a significant decrease in blood pressure - in 4 (26.7%) patients. In 3 (20.0%) patients blood pressure didn't change (tabl.4).

Table 4: The dynamics of anthropometry and blood pressure in patients with abdominal obesity and hypertension under the influence of diet and dosed physical exercises (n = 15)

Parameter	Before treatment	After treatment
Body weight, kg	95,0 [83,0;106,0]	90,0 [80,0;100,0]*
Waist circumference, см	102,0 [96,0;115,0]	95,0 [92,0;112,0]*
Waist/hip circumference ratio	0,91 [0,87;0,95]	0,9 [0,87;0,95]#
BMI, kg / m2[2]	32,1 [31,0;33,8]	31,6 [29,7;32,5]*
SBP, mmHg	142,0 [140,0;146,0]	138,0 [136,0;144,0]**
DBP, mmHg	90,0 [90,0;92,0]	88,0 [86,0;88,0]**

Notes: * - p<0,001; ** - p<0,01; # - p>0,05.

GFR normalized in 2 (13.3%) persons, decreased - in 13 (86.7%) patients after treatment. The level of β_2-mg decreased in 13 (86.7%) patients, did not change - in 2 (13.3%) patients. Similar changes found in the analysis of β_2-mg / Kr urine ratio: normalization of the ratio - in 1 (6.7%) patients, reduction of this parameter - in 10 (66.7%) patients, this ratio has not changed - in 4 (26, 6%) patients (tabl.5).

Table 5: The assessment of kidney function in patients with abdominal obesity and hypertension under the influence of diet and dosed physical exercises (n = 15)

Parameter	Before treatment	After treatment
GFR, mL / min	143,6 [125,6;168,5]	133,4 [121,3;147,0]**
β_2- mg, mg /24 H.	0,9 [0,6;1,8]	0,8 [0,5;1,4]*
β_2- mg / Kr urine ratio, mg / g	0,7 [0,4;1,4]	0,6 [0,4;1,2]*

Notes: * - p<0,001; ** - p<0,05.

Research results of lipid and carbohydrate metabolism, HOMA-IR, hormones insulin and leptin levels, represented in Table 6. There were significant improvement in carbohydrate metabolism and HOMA-IR, lowering leptin levels in this group of patients.

In parallel with weight loss fasting insulin levels decreased from 28.6 [24.2; 32.6] to 26.5 [22.1; 32.1] mcMO / ml (p <0.01), decreased initially elevated HOMA-IR indexes from 6.2 [4.7, 8.2] to 5.5 [4.4, 7.4] (p <0.01), decreased elevated levels of fasting glucose from 4 8 [4.4; 5.6] to 4.5 [4.1, 5.5] mmol / L (p <0.01), decreased elevated glucose levels after carbohydrate loading from 5.8 [5 6; 7.6] to 5.6 [5.5, 7.6] mg / dL (p <0.05) and leptin levels from 33.7 [25.6; 53.1] to 32.0 [22.4; 46.8] ng / ml (p <0.01) in patients with abdominal obesity and hypertension (tabl.6).

Table 6: The dynamics of the lipids and carbohydrates metabolism, insulin resistance in patients with abdominal obesity and hypertension under the influence of diet and dosed exercises (n = 15)

Parameter	Before treatment	After treatment
Fasting glucose, mmol / L	4,8[(4,4;5,6]	4,5 [4,1;5,5]*
Glucose after carbohydrate loading, mmol / L	5,8 [5,6;7,6]	5,6 [5,5;7,6]**
Insulin, mcMO / ml	28,6 [24,2;32,6]	26,5 [22,1;32,1]*
HOMA-IR	6,2 [4,7;8,2]	5,5 [4,4;7,4]*
Total cholesterol, mmol / L	4,9 [4,2;5,5]	4,6 [4,0;5,2]*
TG, mmol / L	0,9 [0,8;1,4]	0,9 [0,8;1,2]#
HDL, mmol / L	1,2 [1,1;1,3]	1,2 [1,2;1,3]#
LDL mmol / L	3,4 [2,3;3,8]	3,0 [2,2;3,4]*
AI	3,3 [2,2;3,6]	2,8 [2,1;3,3]#
Leptin, ng / mL	33,7 [25,6;53,1]	32,0 [22,4;46,8]*

Notes: *-p<0,01; ** - p<0,05; #- p>0,05.

Similar changes observed in the analysis of lipid abnormalities: decreased total cholesterol from 4.9 [4.2, 5.5] to 4.6 [4.0, 5.2] mmol / L ($p < 0.01$) and LDL from 3.4 [2.3, 3.8] to 3.0 [2.2, 3.4] mmol / L ($p < 0.01$). During the treatment there was no probable ($p<0,05$) modifications TG, HDL-C and IA (tabl.6).

Reducing averages HOMA-IR for 0.7 and weight for 5.0 kg led to a reduction in SBP average for 4 mm Hg and DBP for 2 mm Hg, GFR for 10.2 ml / min, β2-mg - 0.1 mg / 24 h. and β2-mg / cr urine ratio - 0.1 mg / g.

Dynamics of anthropometric parameters, leptin levels, insulin resistance, carbohydrate and lipid metabolism showed positive changes of kidney function similar group №1 in patients with abdominal obesity and hypertension against the background of diet and dosed physical activity.

Our results confirmed the literature. According to literature data weight loss improves renal function with a reduction in proteinuria, glomerular hyperfiltration and inflammation, and improves control blood glucose levels in people with or without obvious renal failure.

5. Conclusions

1. The necessity diet and physical activity was substantiated in patients with abdominal obesity and renal dysfunction depending on the degree of obesity, metabolic characteristics, levels of IR.
2. Diet and physical activity in patients with abdominal obesity and early renal damage are an effective way of prevention or correction renal dysfunction and associated metabolic changes.
3. The research laboratory parameters of kidney function in patients with abdominal obesity and renal dysfunction have great importance for the diagnostic assessment of the impact diet and physical activity on the development and progression of early stages of renal damage.

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