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## Dietary solutions for prevention of pancreatic involvement in adolescents with metabolic syndrome

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### Abstract

In this paper, we've described clinical and laboratory data concerning metabolic syndrome in adolescents with and without involvement of the pancreas. Also, dietary recommendations for prevention of pancreatic involvement in adolescents with metabolic syndrome were studied and illustrated. A hundred patients were thoroughly examined, among them 50 - with involvement of the pancreas and 50- without involvement. Our studies revealed the following as risk factors of pancreatic involvement: irregular acceptance of meals not more than 2 times daily (63.3%), overfeeding (58.0%).

**Keywords:** Adolescents, metabolic syndrome, diet, prevention, risk factors.

### 1. Introduction

Combined metabolic pathology with involvement of digestive organs is a matter of grave importance in current pediatric science <sup>[1, 2]</sup>. The prevalence in adolescents is unknown and requires further studies <sup>[3, 4]</sup>. Various dietary postulations have been put forward for this case but so far haven't proven to be as effective <sup>[5]</sup>.

Following the cascade of events that take place between ingestion and digestion of food products, the huge role of the pancreas in patients with metabolic syndrome and pancreatic involvement can't go unnoticed <sup>[6]</sup>. Recent research has proven that ingesting a low fat diet may help reduce the symptoms associated with this combined pathology, because this will decrease the amount of enzymes needed to digest meals <sup>[7]</sup>. We offered our patients a diet rich in protein, antioxidants and vitamins. Some research works have been able to prove the efficacy of antioxidants or omega-3-unriched acids. It is also a proven fact that high fiber-content food products i.e fruits, vegetables, lean meats (like fish, skinless poultry, eggs), and cereals are seen to improve the quality of life in 85% of the patients with metabolic syndrome and pancreatic involvement <sup>[7]</sup>.

**1.1 The purpose of study:** To deduce and prove the impact of a specific dietary regime on metabolic syndrome patients with pancreatic involvement.

### 2. Material and Methods

We have examined 50 children (62.5%) of patients with metabolic syndrome and pancreatic involvement and 30 (37.5%) of them with only metabolic syndrome as a comparative group.

Design of investigation included anamnesis and physical assessment (weight, height, abdominal circumference and BMI, blood pressure monitoring). For evaluation of risk factors, we have used the Dietary Questionnaire of Scottish Collaborative Group Food Frequency Questionnaire version C2 "Diet questionnaire for children" (University of Aberdeen, 2006). Lab studies include: level of low density cholesterol, glycolised hemoglobin, BMI, and fasting glucose level (reagents done by High Technology Inc., USA, apparatus Bio Chem SA). Sonography of pancreas was done with Phillips apparatus (depth of the placement of the indicator was within 12-14 cm).

Dietary recommendations for these patients include: regular consumption of food products and beverages without "light" sugar from 4 to 5 times daily, which do contain enough fibers and rough cellulose. Also we prescribed green products rich in antioxidants (like spinach) in salads or soups. For patients, holiday meals would include: dairy products (not fatty meat and fish); porridges with low glycemic index; cow or sheep cheese, herbal tea with honey or slice of sugar. Lightly boiled vegetables in salads and soups are preferable at this time.

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Also before going to bed, despite activity level, child received natural yoghurt with low caloric index followed by water with spoon of honey. Sometimes dried fruits like plums and raisins were given.

During physical exercises, we recommended diet with normal or increased caloric index, increased amount of the proteins and a limited amount of the carbohydrates. Vitamins of the group B and C were also given.

In our prescriptions we avoided cabbage-containing dishes, fresh and squashed juices, raw vegetables and fried meat or/and fish. We also increased the amount of the animal proteins in our diet (up to 60-70%) because of lack of inhibitors of the proteases. Such a diet could stimulate reparative processes in the pancreas. Our diet was also enriched with microelements, most especially potassium and calcium. Statistic data was done according to STATISTICA 6.0. on a personal computer.

### 3. Results and Discussion

From the anamnesis of the examined patients, a good number of children with metabolic syndrome had an altered feeding pattern. For instance, overfeeding was more common in first group of children in comparison to the second one (58.0% and 33.3%,  $p<0.05$ ). Irregular acceptance of meal (2 times daily) was higher in second group of patients than in first (63.3% and 36.7%,  $p<0.05$ ). Unbalanced feeding because of lack of protein and other essentials took place in both cases (56.0% and 50.0%,  $p=0.05$ ).

The family anamnesis didn't prove to be of significant importance except in the first group where the amount of obese relatives in the family was higher (78.0% and 53.3%,  $p<0.05$ ).

Physical assessment was conducted due to international requirements (table 1).

**Table 1:** Anthropometric indexes in children with metabolic syndrome, n=80 (M±m)

Index/units	Patients with metabolic syndrome and pancreatic involvement, n=50	Patients with metabolic syndrome alone, n=50
Height/cm	165.0±0.5	178.0±0.2
Weight/kg	75.0±0.5	80.0±0.2
Abdominal circumference/cm	80.1±0.5	65.2±0.5
Proved difference	$p<0.05$	$p<0.05$

Looking at data represented above, we can make the following conclusions: Patients with metabolic syndrome and pancreatic involvement manifest with higher abdominal circumference than patients without such involvement. Weight of the patients is higher from predicted values in both groups, but tendency to worsening of clinical picture was seen in first group of patients

with a higher BMI.

BMI was higher in adolescents with pancreatic involvement rather than without it (95.0±0.5 and 88.1±0.1,  $p<0.05$ ).

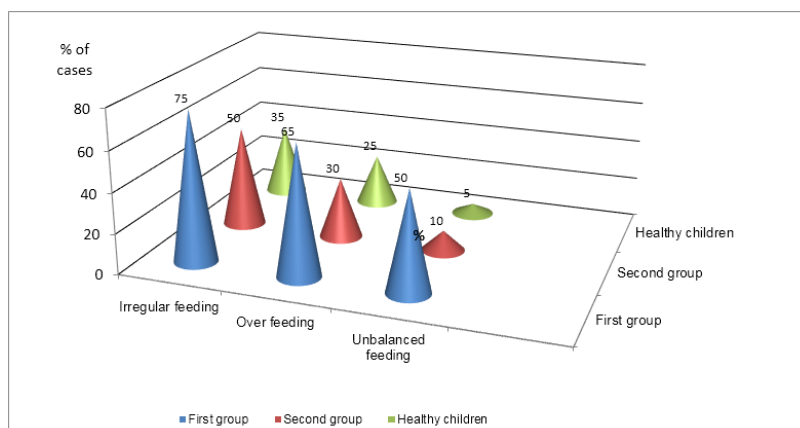
Blood pressure measured by Holter monitoring was carried out in both groups and is presented in the table 2.

**Table 2:** Blood pressure monitoring in children with metabolic syndrome, n=80 (M±m)

Index/amount of patients	Patients with metabolic syndrome and pancreatic involvement, n=50	Patients with metabolic syndrome alone, n=50
Pre-hypertension stage, n=10	145.0± 0.1	135.5± 0.2
Mild arterial hypertension, n=20	155.0±0.2	145.0±0.3
Moderate, n=10	170.0±0.1	150.0± 0.2
Severe, n=10	186.0± 0.3	172.0± 0.2
Difference	$p<0.05$	$p<0.05$

From our observation, blood pressure varied for the whole day but prevalence of mild arterial hypertension stage was seen in both groups (20.0 %). By the purpose of the questionnaire, we

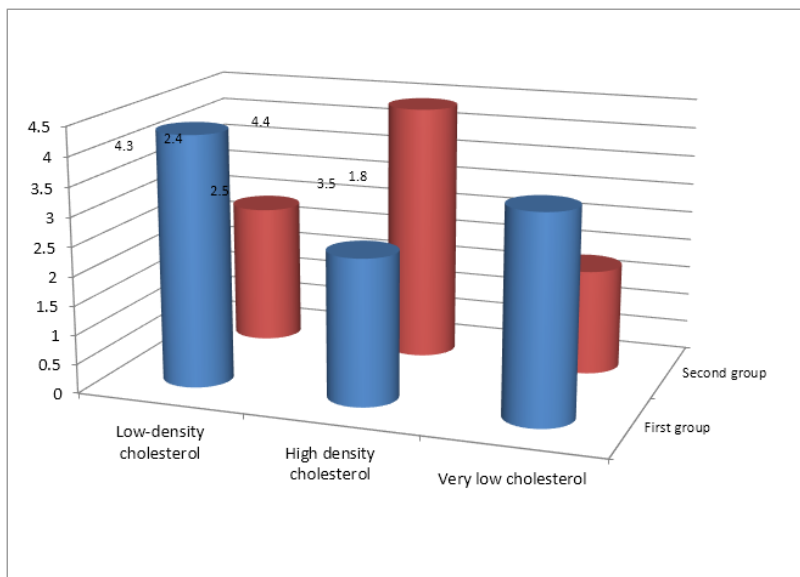
have found several groups of factors which may be responsible for pancreatic involvement in adolescents with metabolic syndrome (figure 1).



**Fig 1:** Risk factors for pancreatic involvement of metabolic syndrome, n=100

Following the presented data we have found significant risk factors for pancreatic involvement in metabolic syndrome like irregular feeding, over-feeding and unbalanced feeding.

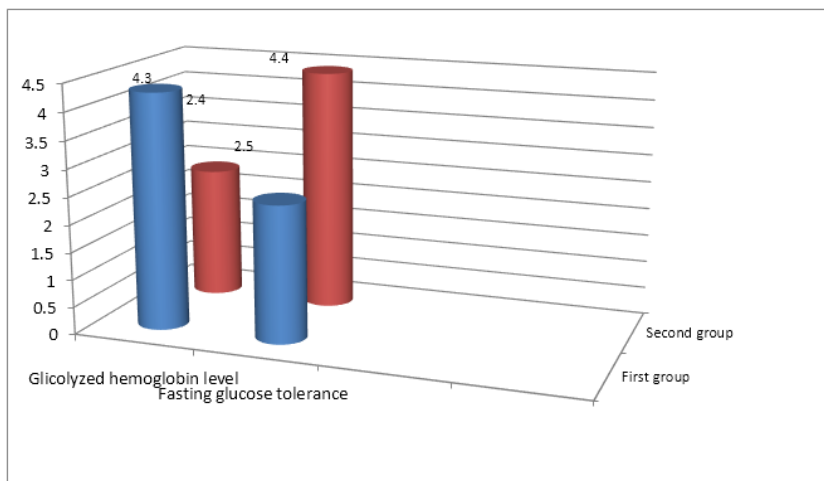
Laboratory data also revealed early signs of pancreatic involvement in patients with metabolic syndrome (figure 2)



**Fig 2:** Lipid metabolism in patients with metabolic syndrome with and without pancreatic involvement, n=100

According to received data we could make a conclusion about violations of lipid metabolism in patients with and without pancreatic involvement. Dyslipidemia was more common in

first group of patients, but level of high density cholesterol still remained higher in second group.



**Fig 3:** Condition of carbohydrate metabolism in patients with metabolic syndrome and without pancreatic involvement, n=100

Presented data revealed higher levels of the fasting glucose level and glycolised hemoglobin in first group of patients. This emphasized the need for more focused and detailed prescriptions and recommendations for such children who

manifested with pancreatic involvement. Sonography data revealed edema of pancreatic head or tail. More details in table 3.

**Table 3:** Sonographic data in patients with metabolic syndrome with and without pancreatic involvement, n=10

Index	First group/%	Second group/%	Difference
Edema of pancreatic head	30 (60.0)	11 (36.6)	p<0.05
Edema of pancreatic tale	25 (50.0)	10 (33.3)	p<0.05
Edema of the whole pancreas	10 (20.0)	8 (26.7)	p=0.05
Echo-positive triangle-like admixtures in structure of the pancreas	24 (48.0)	5 (16.7)	p<0.05

As we can see, significant difference between echographic pictures in both groups of patients with metabolic syndrome is not seen. Hence further studies on this case are required.

#### 4. Conclusion

1. Metabolic syndrome is often accompanied with involvement of the pancreas and has certain clinical and laboratory features.
2. Diet plays a very significant role in the establishment of pancreatic features because it helps to decrease the risk of its impairment and determines prognosis.

#### 5. Further studies

To improve treatment according to results

Listed above and to produce a list of follow-up diet recommendations for the patients with combined pathology.

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