

## ORIGINAL ARTICLE

# PROGNOSTIC CRITERIA OF EXCESSIVE BODY WEIGHT DEVELOPMENT AMONG SCHOOLCHILDREN BY THE RESULTS OF ANAMNESTIC SURVEY

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**ABSTRACT****The aim:** To elaborate prognostic criteria to assess the risk of excessive body weight development among schoolchildren on the basis of hereditary and behavioral predictors.**Materials and methods:** 90 parents of school age children were interviewed by means of the social study method.**Results:** Hereditary status (1 and 2 congeniality degree to type 2 diabetes mellitus, arterial hypertension, excessive body weight, cases of myocardial infarction and/or stroke available among relatives) and behavioral characteristics (peculiarities of diet and physical activity of a child) were studied among school age children. The risks promoting development of an excessive body weight under conditions of hereditary and behavioral factors were assessed. The prognostic matrix elaborated enables to predict development of an excessive body weight of a child under a comprehensive effect of unfavorable hereditary and behavioral characteristics with a high accuracy (AUC = 0,88, Std. Dev. = 0,0451).**Conclusions:** The method elaborated enables to find children with the risk of an excessive body weight development and introduce individualized prophylaxis measures in order to prevent development of obesity and diseases associated with an excessive body weight.**KEY WORDS:** children, excessive body weight, risk factors, prognostication

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**INTRODUCTION**

Nowadays assessment of factors, variable by their nature and origin, influencing upon health, and prognostication of development of diseases among population have become more significant within the system of public health care. Obesity in childhood has an irreversible effect on the human health, causes unfavorable medical, social and economic consequences [1-3]. Important measures in order to solve this issue include investigation of hereditary risk factors promoting development of an excessive body weight among children and unfavorable behavioral family characteristics, organization of their registration and prevention applying health-improving technologies [4]. In order to assess hereditary and unfavorable behavioral risk factors promoting development of an excessive body weight and obesity among children within the frame of introducing medical-social monitoring of obesity among schoolchildren, anamnestic survey of parents is elaborated and introduced into health care institutions included into the program of preventive examinations of children.

**THE AIM**

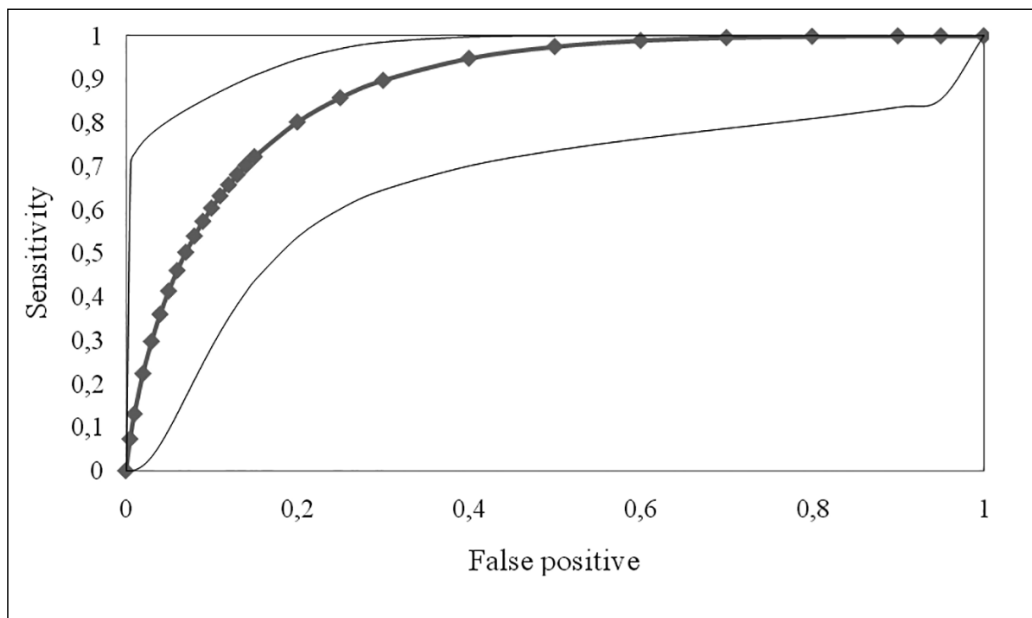
The aim – elaborate prognostic criteria to assess the risk of excessive body weight development among schoolchildren on the basis of hereditary and behavioral predictors.

**MATERIALS AND METHODS**

The study was conducted among 90 respondents, parents of children who were consulted by a district pediatrician with the purpose to undergo annual preventive medical examination of their children. Heredity, dietary anamnesis and peculiarities of physical activity of children were studied by means of the social study method – the survey of questionnaire – substantiated on the basis of the Clinical Practice Guideline developed by the European Society of Endocrinology «Pediatric Obesity – Assessment, Treatment and Prevention», Styne Dennis M. et al., [5] and the results of the WHO collaborative cross-national study «Health behaviour in school-aged children (HBSC) study», Inchley Jo [6]. The questionnaire was simple to use. It did not take much time to fill it in. The survey was conducted during preliminary consulting when parents wrote an informed consent concerning medical examination of their children.

The questionnaires obtained were sorted out into two groups: I group – 75 questionnaires from the parents whose children had an excessive body weight (body mass index within 85-97 percentiles for a corresponding age and sex) and obesity (body mass index more than 97 percentiles for a corresponding age and sex), II group – 15 questionnaires from the parents whose children had normal body weight (body mass index within 5-85 percentiles for a corresponding age and sex).

Statistical significance of value differences between the groups of comparison was determined by means of Fisher transformation  $p_{\varphi}$  applying the computer program Statistica 10 StatSoft.



**Fig. 1.** ROC-curve to predict development of an excessive body weight among schoolchildren

**Table I.** Risk factors promoting development of an excessive body weight among schoolchildren

Characteristics	Groups of observation		P <sub>φ</sub>	OR; 95% CI
	I, %	II, %		
Compromised heredity with T2D	46,7	13,3	0,002	6,7; 1,4–31,5
Compromised heredity with AH	37,3	13,3	0,017	4,6; 0,97–21,5
Compromised heredity with MI/S	26,7	13,3	> 0,05	2,8; 0,6–13,2
Relatives of 1 and 2 degree of relationship with EBW/O	81,3	26,7	< 0,001	15,3; 4,3–54,3
Intake of chips, fast food, sweet drinks more than 3-4 times a week	88,0	66,7	0,032	3,7; 1,02–13,2
Intake of vegetable less than twice a week	34,7	6,7	0,004	7,4; 1,0–59,7
Intake of fruits less than twice a week	26,7	6,7	0,024	5,1; 0,6–41,3
Intake of meat products less than twice a week	24,0	6,7	0,039	4,4; 0,5–34,0
Intake of fish products less than twice a week	56,0	26,7	0,016	3,5; 1,02–12,0
Sitting at an electronic appliance over 3 hours every day	33,3	13,3	0,045	3,25; 0,7–15,5
Physical activity less than 0,5 hours a day	86,7	60,0	0,014	4,3; 1,3–14,8

Confidence intervals for these values assumed as 95% were calculated with boundary risk of error less than 5% ( $p < 0,05$ ). Probability of development of an excessive body weight of a child under conditions of anamnestic aggravation and unfavorable behavioral characteristics was assessed according to the odds ratio indices [7].

Prognostic matrices were developed by Bayes' method by means of normalizing intensive indicators and calculation of in-

tegrated indices. Normalized intensive indicator was calculated according to the formula:  $N = f/I$ , where  $f$  – sign frequency and/or characteristic frequency in the group of comparison (intensive indicator, %),  $I$  – normalization index (sign frequency and/or characteristic frequency according to the results of the study in both groups, %). Integrated index was calculated according to the formula:  $I = N \times OR$ ,  $N$  – normalized intensive indicator,  $OR$  – odds ratio. The prognostic table included the signs with

**Table II.** Prognostic matrix for a comprehensive assessment of risk promoting development of an excessive body weight among schoolchildren

Characteristics	Index for normalization	Normalized intensive indicator		Integrated index	
		I	II	min.	max.
Compromised heredity with T2D	40,7	1,15	0,33	2,2	7,7
Compromised heredity with AH	33,0	1,13	0,4	1,8	5,2
Relatives of 1 and 2 degree of relationship with EBW/O	71,4	1,14	0,37	5,7	17,4
Intake of chips, fast food, sweet drinks more than 3-4 times a week	83,5	1,1	0,8	3,0	4,1
Intake of vegetable less than twice a week	29,7	1,2	0,2	1,5	8,9
Intake of fish products less than twice a week	50,5	1,1	0,5	1,8	3,9
Physical activity less than 0,5 hours a day	81,3	1,1	0,7	3,0	4,7
Calculated index of risk: minimal and maximal				19	51,9

significant odds ratio indices which were determined by 95% odds ratio values. Prognostic value of the effect of hereditary aggravation and unfavorable behavior promoting development of an excessive body weight in children was assessed by the AUC balanced accuracy with interpretation of the result obtained by the AUC expert interval scale (Winham et al., 2010, Swets, 1988).

## RESULTS

Investigation of hereditary characteristics demonstrated that 75 (83,3%) children had compromised anamnesis concerning development of an excessive body weight – relatives of 1 and 2 degree of relationship with type 2 diabetes mellitus (T2D), arterial hypertension (AH), an excessive body weight and/or obesity (EBW/O), cases of myocardial infarction and/or stroke (MI/S). At the moment of conducting the survey 15 children did not have compromised family anamnesis. The majority of them (66,7%) had normal body mass index for their age and sex. Occurrence of unfavorable hereditary and behavioral characteristics found concerning development of an excessive body weight and risks promoting it are presented in Table I.

Hereditary compromised myocardial infarction and/or stroke were excluded from a comprehensive assessment of risks promoting development of an excessive body weight of schoolchildren among biological characteristics essential for the construction of a prognostic matrix. Among behavioral factors we have chosen characteristics possessing a reliable probability and value concerning development of an excessive body weight of a child: excessive intake of chips, fast food, and sweet drinks, insufficient intake of fish and vegetables, low physical activity. The prognostic matrix including hereditary and behavioral risk factors promoting development of an excessive body weight and/or obesity among schoolchildren is presented in Table II.

The matrix includes all the biological and behavioral risk factors chosen for prognostication with the values of calculated indices, that is, indices to perform normalization, normalized intensive indicators and integrated indices. The range of the risk values by a complex of factors was determined according to the integral indices.

Thus, the value of a minimal risk promoting development of an excessive body weight of a pupil is the sum of minimal integrated indices:  $2,2 + 1,8 + 5,7 + 3,0 + 1,5 + 1,8 + 3,0 = 19$ . The maximal value of the prognostic risk is 51,9. The range of risk (19–51,9) was determined on the basis of the prognostic matrix (19–51,9), which enabled to identify the interval values: low risk (19–29,9), average risk (30–40,9), high risk (41–51,9). The quality of the prognostic assessment was checked by means of ROC-curve (Fig 1.).

Sensitivity of risk assessment of an excessive body weight among schoolchildren under conditions of integrated index of a combined unfavorable effect of hereditary and behavioral risk factors more than 30,0 is 82,9%, specificity – 77,8%. The square under the curve 0,88 (Std. Dev. AUC = 0,0451) is indicative of a high quality of the prognostication method.

## DISCUSSION

Our results obtained coincide with the results of other modern researches which confirm that child's physical activity depends on a complicated relationship of the genetic background with family behavioral and dietary stereotypes, environmental factors, as well as exposition and intensity of a comprehensive unfavorable effect of these factors on the child's organism [8, 9].

According to our data hereditary susceptibility to the development of an excessive body weight of a child is of the greatest value among biological factors (odds ratio = 15,3; 95%CI: 4,3–54,3). The international study on pediatric obesity, the lifestyle and environment (Lifestyle and the Environment – ISCOLE) determined that in the families where parents have an excessive body weight a percentage of children with an excessive weight is 84,1%. The scientists recommend learning the family status while following the state of health and development of a child [10].

In the process of family socialization a child assimilates a certain lifestyle including an unfavorable one consisting of unhealthy diet and low physical activity, which results in the development of an excessive body weight [11, 12]. The intake of chips, fast food and sweet drinks more than 3-4 times a week were found to be the most common behavioral factors. The percentage of such children was 83,5%. Fast food is confirmed to be characterized by low dietary value, very high content of fats and saturated fatty acids, which excess in the diet results in

increasing the body weight. Sugar intake increases energy but decreases dietary value of food.

Physical activity increases energy loss. Excessive food and sedentary lifestyle promote development of an excessive body weight considerably. Sedentary life is associated with longer time passed away in front of electronic appliances (TV sets, computers, video game devices etc.), reduced time when a child is outdoors or goes in for sport [13]. In our study the percentage of children with sedentary lifestyle was 81,3% (their physical activity was less than 0,5 hour a day). Practically every third child (29,7%) was sitting in front of the computer and/or TV set over 3 hours a day.

The introduced anamnestic questionnaire within the frame of the program of medical-social monitoring of obesity among schoolchildren on the level of our multidisciplinary health care institution in the future will allow longitudinal observation of the results of medical practice in this area. Detection of obesity predictors among children will promote timely organization of measures on prevention, formation of parents' approval of a well-balanced diet of their children, and changing family stereotype to a healthy lifestyle.

## CONCLUSIONS

The elaborated technique to predict development of an excessive body weight of children allows a general practitioner who gives primary medical aid by means of a simple method to find children with different degree of risk promoting development of obesity and/or an excessive body weight. Individual prognostication can be used as a screening test during annual preventive medical examinations of children receiving a substantiated prognosis of an excessive body weight development. By means of the individual prognostication individualized prophylaxis measures can be developed concerning prevention of obesity development and other diseases associated with an excessive body weight.

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## Conflict of interest:

The Authors declare no conflict of interest.

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