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Personalized Approach to Early Detection and Prevention of Overweight in Young People

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Abstract: The article presents the results of studying taste perception thresholds phenylthiocarbamide (FTC) in medical students in order to predict the genetic predisposition of their obesity and the nature of its course. Testing to the FTC, based on the method of Harris and Kalmus (1949), conducted in 339 healthy young people aged from 17 to 29 years. Subjects offered strips of filter paper soaked in solutions of various concentrations of FTC, starting with the lowest dilution to a clear sense of bitter taste. The study found that among people who suffer from excessive and obese, almost twice as likely to occur non-testery compared with healthy people. To recognize the bitter taste phenylthiocarbamide examined patients required significantly more concentrated solutions of the FTC. The observed statistically significant differences in the characteristics of perceptual sensitivity thresholds to allow the FTC to use this test to identify genetic predisposition to obesity.
Keywords: students, obesity, genetic predisposition.

Introduction

Increasing life expectancy has led to an increase in the global burden of non-communicable diseases, which are the main cause of morbidity and mortality in the world. In this regard, in most developed countries more and more attention is paid to preventive personalized medicine, which is based in the individual management of health and body reserves in view of its genetic, physiologic, biochemical, metabolic or other individual characteristics.

The prospects of such an approach cannot be overestimated. Based on modern genetics achievements of molecular biology and bioengineering, it enables the use of high technologies (such as genetic testing, the study of biomarker molecules, etc.). Not only to identify the pathological processes in the pre-clinical stage of the disease, but also on the basis of an analysis of the data to predict a predisposition to certain diseases. However, the vast majority of chronic diseases (with the exception of monogenic) develop, provided the combination of genetic predisposition and environmental influences. Therefore, many genetic risks can never be realized over the life of the patient with the timely adoption of targeted measures aimed at preventing the disease.

It has long been recognized that genetics plays a key role in shaping the constitutional peculiarities of the organism. Genetic predisposition to excessive accumulation of body fat and obesity runs in families and is a multifactorial disease. To date more than 250 studied the role of genes in the development of obesity: leptin mutations in genes, leptin receptor, hormone convertase 1 precursor, proopiomelanocortin, melanocortin-4 receptor, and SIM 1. These studies help understand the molecular mechanisms that regulate energy balance in humans. However, genotyping at loci associated with impaired fat metabolism, at the level of primary health care is irrational from an economic point of view. Therefore, a search for markers of genetic susceptibility to obesity, the use of which would be low-cost, fast and efficient for screening the population surveys in order to identify individuals at high risk for developing the disease.

In genetic studies, widely used test of taste sensitivity to phenylthiocarbamide (FTC). Aleli TAS2R38 gene whose chief locus located on chromosome 7q35-36, while the additional - on chromosome 16p (Drayna, 2003; Adler, 2000; Reed, 2000) and a configuration control G-protein receptors are expressed in the language of the gastrointestinal tract and central nervous systems (Wu, 2002; Hao, 2008), and define the inherited ability or inability to feeling the bitter taste of the FTC and the related class of compounds.

Sensitivity to the FTC study non-invasive, does not require significant financial cost, is fast and allows a short time to obtain information about the state of the genotype of the subject.

Therefore, the establishment of the sensitivity of the status of the association to the FTC with a hereditary predisposition to obesity in young people and the clinical features of disease would be possible to organize screening

events in order to select the contingent for the primary prevention programs, as well as forecast for already developed the disease and assist in the selection of treatment tactics. In this context, the aim of the research was to study the genetic characteristics of obesity in young people in order to predict the predisposition of its development and trends.

Materials And Methods

The basis of determining the sensitivity of the method was taken to phenylthiocarbamide, developed in 1949 by Harris and Kalmus. In 100 ml of distilled water was dissolved FTC mass weighed 260 mg. It turns out the starting solution (dilution 0), each subsequent dilution is reduced by half. Thus, we used a series of 14 dilutions in progression FTC 2.6 g per 1 liter of distilled water with the presentation of the subject in order from the smallest value of n (0,08 mg / l) until a clear sense of bitterness. The subject is asked to put on the area of the tongue strip of filter paper that has been soaked in a solution of a known concentration of FTC, thus determining their individual ability or inability to feel the bitter taste of the FTC: FTC + or FTK-.

Each trial began with the use of the solution with the lowest concentration of the drug phenylthiocarbamide. In the case where the subjects confirmed that taste feel to verify their sensations they were asked to make one more sample (next to increase concentration). Upon confirmation of a positive result, the fixed number of previous breeding.

For this study were selected 339 healthy people aged between 17 and 29 years enrolled in VSMU residents of the Central Black Earth region of Russia.

Results

data distribution sensitivity analysis to the FTC in the group of healthy subjects “Non-testers” are 54 people (42,5%), “testers” – 73 persons (57.5%), while “absolute non-testers” are 7% of the surveyed – 51 people (40.1%), and hypersensitive to the MTF (conscious of the bitter taste in dilutions from 10 to 14) are 22 persons (17.3%). With an average level of sensitivity in the group corresponding to the threshold value “testers”, men have a higher threshold of sensitivity to the FTC, in they feel the taste of the FTC in higher concentrations compared with women with the level difference is statistically significant – table 1.

Table 1. *Average thresholds of sensitivity to the FTC in a group of clinically healthy persons based on gender*

Gender	Sensitivity average value to the FTC
Men (n = 42)	3.8 ± 0.5
Women (n = 85)	6.2 ± 0.4 *
In the total sample (n = 127)	5.4 ± 0.4

** - p = 0.001 compared to men*

These comparative analysis of anthropometric indices in the group of healthy persons showed that the «non-testers» differ significantly large values of height and weight in comparison with the «testers», and there was a trend to higher values of body mass index from the «non-testers», although the difference in this indicator between subgroups did not reach a statistically significant level – table 2.

Table 2. *Mean values of anthropometric parameters of clinically healthy individuals, depending on the sensitivity of the status to the FTC*

Indicators	Health n = 127	Healthy “testers” n = 73	Healthy “non-testers” n = 54
Height (cm)	170.81 ± 0.79	169.38 ± 0.92	172.74 ± 1.33 *
Weight (kg)	63.81 ± 1.18	60.66 ± 1.20	68.06 ± 2.12 *
BMI (kg / m2)	21.75 ± 0.30	21.06 ± 0.31	22.69 ± 0.55

** - p <0.05*

Comparative analysis of the frequency of overweight and obesity in a group of healthy persons showed that overweight is more common among subjects «non-testers» in comparison with «testers», 1 degree of obesity was noted only among the «non-testers.» Obesity Cases 2 and 3 degrees among clinically healthy individuals revealed was not – table 3.

Table 3. *The frequency of overweight and obesity in a group of healthy subjects, depending on the sensitivity to the status of the MTF*

Disease	Healthy n = 127		Healthy "testers" n = 73		Healthy "non-testers" n = 54	
	Abs. (Pers.)	Rel. (%)	Abs. (Pers.)	Rel. (%)	Abs. (Pers.)	Rel.(%)
Overweight	16	12.6	5	6.8	11	20.3
Obesity1 degree	4	3.1	0	0	4	7.4

Results of the analysis of obesity anthropometric parameters are shown in table 4.

Table 4. *Anthropometric parameters of obese patients*

Indicator	Obese patients n = 51	Obese patients "testers" n = 27	Obese patients "non-testers" n = 24
Height (cm)	167.2 ± 1.2	167.4 ± 1.7	167.0 ± 1.8
Weight (kg)	77.9 ± 2.3	76.3 ± 2.6	79.6 ± 4.0
BMI (kg / m2)	28.7 ± 0.8	27.3 ± 0.9	30.2 ± 1.4 *

** - p <0-05 as compared to the «testers»*

As can be seen from the data, the average BMI «non-testers» corresponds to obesity I degree and higher than for «testers» and the average value in the total group of patients with obesity, relevant overweight.

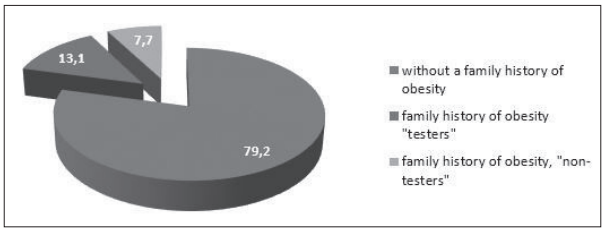
Analysis of the frequency of excess weight in obese patients according to table 5 also confirms a high prevalence of overweight in "testers" and the highest number of patients with obesity 1 degree among the "non-testers." Please note that the obesity grade 3 patients identified only among the "non-testers."

Table 5. *Obesity and overweight rate in obese patients, depending on the sensitivity of the status to the FTC*

Disease	Patients with obesity n = 51		Patients with obesity "testers" n = 27		Patients with obesity "non-testers" n = 24	
	Abs. (Pers.)	Rel. (%)	Abs. (Pers.)	Rel. (%)	Abs. (Pers.)	Rel.(%)
Overweight	16	31.4	11	40.7	5	20.8
Obesity 1 degree	8	7.4	6	15.7	2	25.0
Obesity 2 degree	6	11.8	3	11.1	3	12.5
Obesity 3 degree	2	3.9	0	0	2	8.3

In the analysis of the relation "testers" and "non-testers" in the study groups (Fig. 1) found that their distribution in the group of healthy corresponds to the literature data for Caucasian individuals with predominance of "testers" of "non-testers." And in the group of obese patients observed distribution of inversion: the share of "non-sensitive" exceeds the percentage taste the FTC. Thus, it can be assumed that the status of insensitivity to FTC risk associated with obesity. In the study of family history in patients who are obese, being overweight and obesity in first-degree relative was found in 27 cases (20.8%), 10 of them are "testers" and 17 "non-testers." The percentage of patients with a family history of obesity, is shown in Figure 1.

Fig. 1. *Prevalence of family history of obesity in a group of obese patients, depending on the sensitivity of the status to the FTC*



From the data presented in the figure can be seen that among patients with a family history of obesity, the proportion of "non-testers" almost twice as high as "testers".

Comorbidities of patients in the group with obesity were observed in 70% of cases (36). The structure and the frequency of occurrence of comorbidity presented in – tab. 6.

Table 6. *The frequency of co-morbidities in obese patients*

Disease	Patients with obesity n = 51		Patients with obesity "testers" n = 27		Patients with obesity "non-testers" n = 24	
	Abs. (pers.)	Rel. (%)	Abs. (pers.)	Rel. (%)	Abs. (pers.)	Rel. (%)
Hypertensive heart disease	23	45	10	37	13	54
Diabetes mellitus type 2	5	9.8	3	11.1	2	8.3
CHD angina FC 1-2 June	6	12	3	11.1	3	12.5
Chronic pancreatitis	2	4	1	3.7	1	4.1
Chronic cholecystitis	2	4	1	3.7	1	4.1
Urolithiasis, pyelonephritis	4	7.8	4	15	0	0
Osteoarthritis	2	4	1	3.7	1	4.1

As can be seen from the data, the subgroup "testers" and "non-testers" comorbidity comparable in frequency, but all cases of urolithiasis and pyelonephritis account only the "testers", and hypertensive disease is slightly more common in "non-testers."

These subjective assessment of the overall health of the patient, the effect of existing conditions in the physical, mental capacity, ability for social interaction and the overall level of mental health in accordance with the SF-36 questionnaire are presented in tab. 7.

Table 7. *Quality of life parameters on the SF-36 in patients with obesity*

Index (Score)	Obese patients n = 51	Patients with obesity "testers" n = 27	Obese patients "non-testers" n = 24
GH	45.21 ± 1.74	41.67 ± 2.50	49.21 ± 2.17 *
PF	30.39 ± 3.52	31.67 ± 4.21	28.96 ± 5.88
RP	14.70 ± 4.44	14.81 ± 6.15	14.58 ± 6.54
RE	26.21 ± 5.71	19.85 ± 6.73	33.37 ± 9.41
SF	42.41 ± 1.82	42.85 ± 2.33	41.92 ± 2.89
BP	80.02 ± 4.17	79.67 ± 5.63	80.42 ± 6.32
VT	42.65 ± 2.29	42.96 ± 2.56	42.29 ± 4.00
MH	54.58 ± 2.47	54.81 ± 3.08	54.33 ± 4.01

** - $p < 0.05$*

As can be seen from the data, significant differences between the subgroups of «testers» and «non-testers» on the scale of quality of life questionnaire SF-36 is also not revealed, except the indicator of GH, which characterizes the general level of health. Using this parameter «non-testers» show a higher score indicating a better state of health.

Conclusion

Taste sensitivity test to the FTC is an affordable and quick way to diagnose a predisposition to excessive accumulation of body fat in young adults, which can be used at the level of primary health care to identify individuals increased risk of developing obesity to develop individual prevention programs. The study also taste sensitivity to FTC can help in predicting the course of the disease and the effect of traditional therapy.

The practical implementation of research results is not only medical, but also social and economic importance, since the use to create an effective model of forecasting and early diagnosis of obesity in young people, will prevent development of the disease and its associated conditions, reduce morbidity, healthcare costs for treatment and maintenance this category of the population, improve the quality of life of patients and maintain the ability to work.

The results can be used in medical practice for current and future planning cross-sectoral, sectoral and regional youth health programs based on the rational allocation of health care resources, as well as the justification of the investment policy in the social sphere and in health care.

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