26. Malkhazova S.M., Mironova V.A., Kotova T.V., Shartova N.V., Orlov D.S. Natural-focal diseases: mapping experience in Russia, International Journal of Health Geographics, 2014, Vol. 13, p. 21, doi: 10.1186/1476-072X-13-21.

27. Storch A., Vladimirtsev V.A., Tumani H., Wellinghausen N., Haas A., Krivoshapkin V.G., Ludolph A.C. Viliuisk encephalomyelitis in Northeastern Siberia is not caused by *Borrelia burgdorferi* infection, Neurological Sciences, 2008, Vol. 29, No 1, pp.11-14.

28. Eldin C. Mélenotte C. Mediannikov O. Ghigo E. Million M. Edouard S. Mege J.L. Maurin M. Raoult D. From Q fever to Coxiella burnetii infection: a paradigm change. Clinical Microbiology Reviews, 2017, Vol. 30, No 1, pp. 115-190.

29. Tokarevich N.K., Freilykhma O.A., Titova N.M., Zheltakova I.R., Ribakova N.A., Vorobeychikov E.V. Anthropogenic effects on changing Q fever epidemiology in Russia, Annals of the New York Academy of Science, 2006, Vol. 1078, No 1, pp. 120-123.

30. Brunetti E., Kern P., Vuitton D.A.,Writing Panel for the WHO-IWGE. Expert consensus for the diagnosis and treatment of cystic and alveolar echinococcosis in humans, Acta Tropica, 2010, Vol.114, No 1, pp. 1-16.

31. Liance M., Janin V., Bresson-Hadni S., Vuitton D.A., Houin R., Piarroux R. Immunodiagnosis of *Echinococcus* infections: confirmatory testing and species differentiation by a new commercial western blot, Journal of Clinical Microbiology, 2000, Vol. 38, pp. 3718-3721.

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IMPACT OF MEDICAL AND SOCIAL FACTORS ON OBESITY IN PRESCHOOL CHILDREN IN THE NORTH OF VIETNAM: A CASE-CONTROL STUDY

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Obesity in children increases the risk of overweight and obesity in adults and leads to several complications, both physical and mental, which put a strain on public health. A case-control study of 360 obese children and 786 normal children (according to WHO 2006 criteria) as a control group helped to elucidate the influence of medical and social factors on the development of childhood obesity. Univariate regression analysis showed the following risk factors: overweight/obesity of the father with OR = 5.1 (95% CI: 3.8 – 6.9): mother's overweight/obesity with OR = 6.1 (95% CI: 3.8 – 9.7); stress during pregnancy of mother with OR = 1.5 (95% CI: 1.1 – 2.1); excessive weight gain of mother during pregnancy (≥ 12 kg) with OR = 1.75 (95% CI: 1.3 – 2.3). Risk factors related to nutrition and physical activities were found: fast eating speed with OR = 2.1 (95% CI: 1.2 – 3.9); soft drinks with OR = 1.6 (95% CI: 1.1 – 2.3); time for TV watching if ≥ 2 hours per day with OR = 4.7 (95% CI: 3.4 – 6.5) or during 1 – 2 hours per day OR = 2.6 (95% CI: 1.9 – 3.5), respectively. Multivariate regression analysis identified the most significant risk factors for obesity in children: BMI of the father and mother, time for TV watching per day and eating speed, with the further development of a formula for calculating the probability of obesity, which can be used in organizing a preventive program for obesity in children.

Keywords: children, obesity, social, feeding rate, BMI, risk factor, Vietnam.

Introduction. According to WHO, in 2019, about 38 million children under the age of 5 were overweight or obese and it is estimated that by 2030 almost a third of the world's population may be overweight or obese [1]. In the USA for 2017 - 2018 obesity was specified in 13.4% of children 2 - 5 years old; in 20.3% of children 6-11 years old and in 21.2% of children 12-19 years old [2]. In Russia, the number of children and overweight and obese children is also increasing over a ten-year period [3, 4]. In Vietnam, from 2000 to 2015, the proportion of overweight children more than quadrupled from 3.3% to 17.5% related to urbanization and food transitions [5]. Childhood obesity is becoming a global public health problem around the world.

Obesity in children increases the risk of adult overweight and obesity by 70 - 80%, accompanying a number of complications such as metabolic disorders, vascular – cardiac diseases, environmental diseases, diseases of the musculoskeletal system and psychological disorders [6]. Ethnic variations in prevalence of overweight and obesity between Kinh, Muong, Tay (as main ethnic groups in Vietnam) children under 5 years old [7] were identified in a study in 2019 suggested that childhood obesity depends on the genotype and the environmental factors. In Vietnamese children primary school was found the significant relationship between delivery method, birthweight, night sleep duration and *BDNF* Val66Met polymorphism to adiposes [8]. In a review, degree of dependence of obesity on susceptible genes may be different in various populations [9] but in general, childhood obesity more depends on a number of reversible cultural and environmental factors such as diet, physical activity, lifestyle... [10].

Identifying reversible medical and social risk factors for obesity in preschool children could stands the base for reducing the risk interventions on individual level and provide a rationale for developing an obesity prevention program from an early age on population level.

Methodology and materials. This study was conducted from 1/1/2019 to 31/12/2019 on 16175 children aged from 24 to 60 months old living in the north of Vietnam. Participants were chosen from various randomly selected kindergartens located in 6 north cities and provinces of Vietnam including Hanoi, Thanhhoa, Namdinh, Phutho, Caobang, Hoabinh, to ensure the representative characteristics for North Vietnam of sample.

Nutritional status as malnutrition, norm, overweight and obesity was classified according to the WHO 2006 criteria. Obesity was defined if the child had the

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Z-score weight/ height/ age ≥3SD. Sample were selected using matched pair case-control method, and sample size was calculated using program sourceforge.net with the power = 80%, anpha risk = 5%, OR = 2, ratio control/case = ½, and estimated prevalence of childhood obesity 6.1% [11], resulting in 311 case and 622 control. In fact, two groups of children were compiled: obesity (n = 360) and a control group (normal nutritional status: n = 786) with Z-score weight/ height/age in interval (-1; 1) and the "control" child would in the same class and the same gender with the "case" child for the purpose of clarifying the effect of independent factors on obesity.

The parents of the subjects were given a questionnaire to identify the main social factors, related to family lifestyle and its impacts to childhood obesity. The research method was an open comparative retrospective case - control. The inclusive criteria were children aged from 24 - 60 months old with the written consent of their parents. The exclusive criteria were children with obesity due to confirmed genetic and endocrine disorders; obesity related to medications (corticosteroid, antidepressant…); children with acute and chronic diseases and all cases without the written consent of the parents. This study used part of the data from the Vietnamese Ministry of Education and Training project "Building a Model to Predict the Risk of Obesity in Preschool Children Based on Selected Genes, Diet and Physical Activity Habits," Grant No. B2018-SPH-50. The study was approved by the Ethics Committee of the Medical Institute of the Northeastern Federal University. M.K. Ammosov on October 6, 2019.

The data were processed using Microsoft Excel and SPSS version 16.0. Qualitative variables are represented by the number (n) and shares (%), the comparison was made according to the X^2 criteria. Quantitative variables were tested for normal distribution and compared by Student's t-test/ Mann-Whitney test. Univariate and multivariate regression analysis was used to determine the effects of risk factors on obesity. A predictive model was created and then an R-curve with area under the curve was constructed with p-values <0.05 were considered statically significant from both sides.

Results and discussion

1. Participants' characteristics. The general characteristics of the students were indicated in Table 1. Two groups of obese children and normal nutritional status are identical in gender and age structure (p> 0.05). All anthropometric indicators (weight, height, Z-score of weight / age, height / age, weight / height / age and BMI / age) in children with obesity were much higher than the control group, including Z-score of weight / height / age and Z-score for BMI / age, respectively.

The similarity in sex and age of the two groups can be explained by the method of sample selection for case – control study.

2. The influence of medical and social factors. Various medical and social risk factors of obesity have been identified in children. The results were

Table 1

Main characteristics of students

Characteristics		Obese group (360)	Control group (786)	p
Gender	Boys	277 (76.9%)	569 (72.4%)	0.111*
	Girls	83 (23.1%)	217 (27.6%)	
Age groups	2 – 3 years old	22 (6.1%)	55 (7%)	0.792*
	3 – 4 years old	41 (11.4%)	95 (12.1%)	
	4 – 5 years old	297 (82.5%)	636 (80.9%)	
Anthropometric indices	Weight	24.3±3.9	16.3±2.6	<0.001**
	Height	105.2±7.8	102.4±6.8	<0.001**
	Z-score weight for age	2.77±0.92	-0.20±0.98	<0.001**
	Z-score height for age	0.29±1.21	-0.35±1.15	<0.001**
	Z-score weight for height for age	3.69±0.60	-0.01±0.92	<0.001**
	Z-score BMI for age	3.81±0.74	0.02±0.92	<0.001**

* p obtained from test χ2; ** p obtained from t-test.

Table 2

Several medical and social risk factors and their impacts on obesity in preschool children in North Vietnam

Risk factors		n (%)		Univariate analysis
		Obese group	Control group	OR (95% CI)
BMI of father	BMI <25	213 (59.2)	292 (88)	1
	BMI ≥25	147 (40.8)	94 (12)	**5.081 (3.760 – 6.865)**
BMI of mother	BMI <25	296 (82.2)	759 (96.6)	1
	BMI ≥25	92 (17.8)	27 (3.4)	**6.078 (3.801 – 9.719)**
Living place	Countryside	90 (25)	197 (25.1)	1
	Suburban	152 (42.2)	324 (41.2)	1.027 (0.749 – 1.407)
	Urban	118 (32.8)	265 (33.7)	0.975 (0.7 – 1.356)
Mother was stressed during pregnancy	No	276 (76.7)	654 (83.2)	1
	Yes	84 (23.3)	132 (16.8)	**1.508 (1.109 – 2.051)**
Weight gain of mother during pregnancy	10 – 12 kg	156 (43.3)	403 (51.3)	1
	Less than 10kg	41 (11.4)	101 (12.8)	1.005 (p=0.98)
	More than 12 kg	163 (45.3)	282 (35.9)	**1.75 (1.34 – 2.287)**
Birth method	Normal	131 (36.4)	248 (31.6)	1
	Caesarean section	229 (63.6)	538 (68.4)	0.806 (0.620 – 1.047)

ОШ – отношение шансов.

reported in Tables 2 and 3. A father and mother BMI ≥ 25, considered as overweight or obese, increases the risk of childhood obesity by 5 and 6 times. This is similar to the results of many studies around the world that have shown a link between parental BMI and the risk of obesity in children [12, 13]. Obesity is transmitted through generations due to the role of genetic predisposition, and the lifestyle of the family and the nutrition of children under 5 years old strongly depends on those of parents.

During pregnancy, the mother experienced stress or added weight dramatically (more than 12kg) also increases the risk of obesity in children by 50% and 75%, respectively. Research by Lampard [14] and Voerman [13] also showed this strong correlation, which can be explained by the fact that stress increases the mother's appetite, as well as the role of the first 1000 days (including the time during pregnancy) in programming the child's development. The method of birth in this study did not show an effect on obesity in children, similar other studies [15, 16]. In our study, the living place did not increase the risk of obesity, although the prevalence of obesity was increasing in rural areas nowadays, but there is still a gap in obesity among rural and urban residents in a separate health region [17].

The parental characteristics of preschool children have had a major impact on the risk of obesity. The data were shown in Table 3. A child drinking a lot of soft drinks or eating too fast (time per meal less than 20 minutes) can have the increased risk of obesity by 1.6 and 2.1 times, respectively. Our result is resemble a study on over 4000 children aged 9–10 years in Japan, which showed fast speed increased the risk of obesity by 1.5 times in comparison with children who eat normally [18]. It is possible that when children eat quickly, blood glucose levels rise rapidly, causing excessive insulin secretion and consistently insulin resistance in many cell types. Decreased insulin sensitivity leads to overeating and obesity.

The time children spend watching TV and the nature of children (hyperactivity, shyness) indicate the degree of physical activity of children. Consequently, if children are not active increases his risk of obesity by 1.5 or 1.8 times, depending on the frequency. On the contrary, if children are not shy, the risk of obesity decreases by 30 - 70%, depending on the regularity. According to a 2018 Gobadi study of 607 children aged 6 to 10, children who watched TV for more than 2 hours a day

Table 3

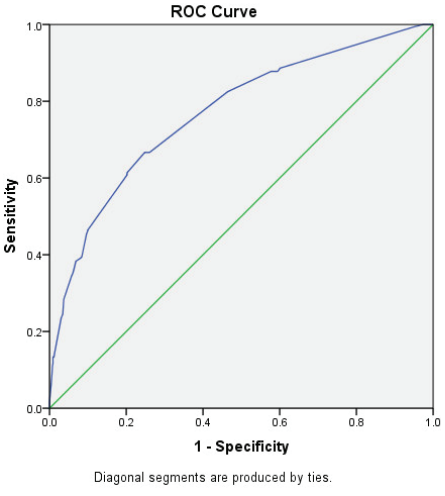
Influence of the characteristics of upbringing and the trait of children on the obesity in preschool children in the north of Vietnam

Risk factors		Univariate analysis	
		OR (95% CI)	p
Feeding children by desiration	No	1	0.073
	Yes	0.722 (0.506 – 1.031)	
Time for 1 meal	20 – 40min	1	
	<20 min	**2.128 (1.15 – 3.935)**	**0.016**
	>40 min	**0.307 (0.158 – 0.592)**	**0.001**
Soft drink	Little	**1**	**0.007**
	Much	**1.611 (1.140 – 2.278)**	
Time for TV watching /day	Less than <60 min	1	
	Medium (60 – 120 min)	**2.56 (1.881 – 3.484)**	**<0.001**
	Much (>120 min)	**4.663 (3.368 – 6.456)**	**<0.001**
Hyperactiveness	Regularly	**1**	
	Sometimes	**1.543 (1.061 – 2.243)**	**0.023**
	Never	**1.845 (1.331 -2.559)**	**<0.001**
Shyness	Regularly	**1**	
	Sometimes	**0.723 (0.553 – 0.944)**	**0.017**
	Never	**0.318 (0.109 – 0.928)**	**0.036**

Table 4

Risk factors of obesity in preschool children living in North Vietnam with coefficients in multivariate regression analysis

Risk factors		Coefficient	OR	p
Sex	Boys	-0.094	1	0.576
	Girls		0.91	
Age (months)		0.006	1.006	0.394
Stress in pregnancy	No		1	0.104
	Yes	0.307	1.36	
Weight gain during pregnancy	10-12 kg		1	
	< 10 kg	0.114	1.12	0.629
	> 12 kg	0.260	1.3	0.99
Time for 1 meal	Normal		1	
	<20 min	**0.946**	**2.6**	**<0.001**
	>40 min	**-1.194**	**0.3**	**0.001**
Soft drink	Little		1	**0.021**
	Much	**0.48**	**1.6**	
Time for TVwatching /day	Less		1	
	Medium	**1.079**	**2.9**	**<0.001**
	Much	**1.551**	**4.7**	**<0.001**
Overweight/obese mother		**1.191**	**3.3**	**<0.001**
Overweight/obese father		**1.394**	**4.0**	**<0.001**
Hyperactiveness	Regularly		1	
	Sometimes	0.058	1.059	0.747
	Never	-0.301	0.740	0.187
Shyness	Regularly		1	
	Sometimes	-0.320	0.726	0.056
	Never	-0.878	0.416	0.144



ROC Curve of predicting model for obesity in preschool children based on medical and social risk factors.

were 1.99 times more likely to become obese than those who watched TV for less than 2 hours a day. In addition to the fact that a lot of time spent by children in front of the TV reduces physical activity, but the influence of electronic devices on the risk of developing obesity has also been revealed. [19].

The time children spend watching TV and the nature of children (hyperactivity, shyness) indicate the degree of physical activity of children. Consequently, if children are not active increases his risk of obesity by 1.5 or 1.8 times, depending on the frequency. On the contrary, if children are not shy, the risk of obesity decreases by 30 - 70%, depending on the regularity. According to a 2018 Gobadi study of 607 children aged 6 to 10, children who watched TV for more than 2 hours a day were 1.99 times more likely to become obese than those who watched TV for less than 2 hours a day. In addition to the fact that a lot of time spent by children in front of the TV reduces physical activity, but the influence of electronic devices on the risk of developing obesity has also been revealed. [19].

3. Multivariate regression analysis risk factors of childhood obesity. Risk factors revealed by univariate regression analysis were put in a multivariate regression, including sex and age of children, the result was shown in Table 4.

Multivariate analysis revealed the following risk factors for obesity in preschool children in Vietnam: time per meal (less than 20 minutes increases the risk of obesity by 1.36 times, more than 40 minutes decreases the risk by 0.3 times); TV time (more than 60 minutes will increase the risk by 2.9 times, more than 120 minutes - 4.7 times); A father's BMI over 25 increases the risk by 4 times and an overweight/obese mother increases the risk by 3.3 times.

From the 4 above mentioned risk factors, it is possible to construct a prediction model with an area under the curve (0.769). This model with AUC = 769 showed high reliability and can be used in a preclinical setting to predict the risk of obesity in children, thereby warning young parents and educational institutions for preschool children. also take timely interventions to prevent early obesity.

Formula for predicting obesity in preschool children based on medical and social factors:

$P = e^y/(1+e^y)$

P – probability of obesity in children

e - Euler's number (≈2,718)

y= k1*βtime_for_1_meal+ k2*βtime_for_TV watching /day + 1,394*βBMI_father + 1,191*βBMI_mother - 2,089

k1= 0,946 if time for 1 meal less 20 min

k1=-1,194 if time for 1 meal more 40 min

k2= 1,079 if time for watching TV/day in 60 – 120 min

k2=1,551 if time for watching TV/day more than 120 min

For example: A child (code number 318402: BMI of father = 29,07; BMI of mother = 20,3; time for watching TV/day more than 120 min, time for 1 meal in 20 – 40 min, we can calculate y = (0+1.551+1.394+0)-2,089 = 0.856 => obese probability = 70.2%.

and in facts this boy, age 57.6 months, with a BMI / age z-score = 4.85, is obese.

This formula can be used easily in population studies related to childhood obesity.

The strengthens of this study were good design with large sample size calculated for case-control study with power > 80%. Addition, the statistical analysis approach with a probabilistic model constructed by multilevel analysis provided the effect sizes without bias. The limitation was almost all qualitative variates collected through questionnaire and retrospective method that could lead to some individual errors due to memories, that open up a new research direction with more quantitative studies in future.

4. Conclusions. The obesity of Vietnamese preschool children depends on various medical and social risk factors that are subject to possible changes. To reduce the risk of early obesity, the following measures should be taken: normalize the BMI of the father and mother, organize the correct diet for children, and limit a sedentary lifestyle. Enhancing physical activity and controlling nutrition is critical in preventing obesity in young children.

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Conflict of interest. The authors declare no conflicts of interest.

Reference

1. ВОЗ https://www.who.int/ru/news-room/fact-sheets/detail/obesity-and-overweight доступ в 10.06.2021

2. Безрукова Д.А., Богданьянц М.В., Акмаева Л.М., Трубина Е.В., Ожирение у детей: состояние проблемы // Астраханский медицинский журнал. – 2017 [Bezrukova DA, Bogdanyants MV, Akmaeva LM, Trubina EV, Obesity in children: the state of the problem. *Astrakhan medical journal*. – 2017 (In Russ).]

3. Коваленко Т.В. Особенности эпидемиологии ожирения у детей в Удмуртской республике // Материалы конгресса педиатров. - М., 2018. С. 137-138. [Kovalenko T.V. Osobennosti jepidemiologii ozhirenija u detej v Udmurtskoj respublike // Materialy kongressa pediatrov [Features of the epidemiology of obesity in children in the Udmurt Republic. *Materials of the Congress of Pediatricians*]. - M., 2018. P. 137-138 (In Russ).] https://www.elibrary.ru/item.asp?id=35196210

4. Суплотова Л.А. Динамика частоты избыточной массы тела и ожирения у детей младшего школьного возраста в Тюменском регионе/Л.А. Суплотова, С.А.С., О.Б. Макарова [и др.] // Ожирение и метаболизм.-2019.-16(1).-С.34-38 [Suplotova L.A. Dynamics of the frequency of overweight and obesity in primary school children in the Tyumen region / L.A. Suplotova, S. A. S., O.B. Makarova [et al.]. *Obesity and metabolism*. - 2019.-16 (1). - P.34-38 (In Russ).]

5. Fryar CD, C.M., Afful J. Prevalence of overweight, obesity, and severe obesity among , t.N. children and adolescents aged 2–19 years: United States, and H.E.-S. 2020.

6. Đỗ Thị Phương Hà, Lê Bạch Mai. Thực trạng thừa cân béo phì ở người trưởng thành giai đoạn 2011-2015. Chiến lược quốc gia dinh dưỡng giai đoạn 2011-2015. (2015).

7. Jensen MD, R.D., Apovian CM, et al, for the American College of Cardiology/American Heart Association Task Force on Practice Guidelines; Obesity Society. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *J Am Coll Cardiol*. 2014 ;63(25 Pt B):2985–3023. doi: 10.1016/j.jacc.2013.11.004.

8. Le TT, L.T., Do NK, Nadezhda VS, Andrej MG, Nguyen TTT, Nguyen TTM, Vu TT, Le TH, Nguyen TTL, Duong TAD. Ethnic Variations in Nutritional Status among Preschool Children in Northern Vietnam: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2019 Oct 23;16(21):4060. doi: 10.3390/ijerph16214060. PMID: 31652691; PMCID: PMC6862071.

9. Tuyet LT, N.B., Dao DTA, Hanh NTH, Tuyen LD, Binh TQ, Thuc VTM., The Brain-Derived Neurotrophic Factor Val66Met Polymorphism, Delivery Method, Birth Weight, and Night Sleep Duration as Determinants of Obesity in Vietnamese Children of Primary School Age. *Child Obes.* 2017 Oct;13(5):392-399. doi: 10.1089/chi.2017.0007.

Epub 2017 May 4. PMID: 28471701.
10. Vettori A, P.G., Paolini B, Del Ciondolo I, Bressan S, Dundar M, Kenanoğlu S, Unfer V, Bertelli M, Genetic background, nutrition and obesity: a review. *Eur Rev Med Pharmacol Sci*. Feb;23(4):1751-1761. doi: 10.26355/eurrev_201902_17137. PMID: 30840300., 2019
11. Do LM, T.T., Eriksson B, Petzold M, Nguyen CTK, Ascher H. Preschool overweight and obesity in urban and rural Vietnam: differences in prevalence and associated factors. *Global Health Action.* 2015;8:28615.
12. Ek A, S.K., Eli K, et al. Associations between Parental Concerns about Preschoolers' Weight and Eating and Parental Feeding Practices: Results from Analyses of the Child Eating Behavior Questionnaire, the Child Feeding Questionnaire, and the Lifestyle Behavior Checklist. *PLoS One*. 2016;11(1):e0147257-e0147257.
13. Voerman E, S.S., Patro Golab B, et al. Maternal body mass index, gestational weight gain, and the risk of overweight and obesity across childhood: An individual participant data meta-analysis. *PLoS Med.* 2019;16(2):e1002744.
14. Lampard AM, F.R., Davison KK. Maternal depression and childhood obesity: a systematic review. *Prev Med*. 2014;59:60-67.
15. Masukume G, K.A., Morton SMB, Baker PN, Kenny LC, McCarthy FP. Caesarean section delivery and childhood obesity in a British longitudinal cohort study. *PLoS One*. 2019;14(10):e0223856.
16. Masukume G, M.F., Baker PN, et al. Association between caesarean section delivery and obesity in childhood: a longitudinal cohort study in Ireland. BMJ Open. 2019;9(3):e025051.
17. Hill, J.L., You, W., & Zoellner, J. M. (2014). Disparities in obesity among rural and urban residents in a health disparate region. *BMC public health*, 14, 1051. https://doi.org/10.1186/1471-2458-14-1051.
18. Sonoda C, F.H., Kitamura M, et al. Associations among Obesity, Eating Speed, and Oral Health. *Obes Facts*. 2018;11(2):165-175.
19. Kenney EL, G.S.U.S.A.T., Computer, Videogame, Smartphone, and Tablet Use: Associations with Sugary Drinks, Sleep, Physical Activity, and Obesity. *J Pediatr.* 2017;182:144-149.

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CONTRIBUTION OF *IL12A*, *IL12B*, *IL13* AND *IL12RB2* GENE POLYMORPHISMS TO THE DEVELOPMENT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory lung disease affecting primarily distal respiratory pathways and lung parenchyma. An abnormal inflammatory response to inhaled harmful particles and tobacco smoke leads to airway remodeling and is thought to be a main mechanism of COPD development.

This study aimed to determine possible genetic association of *IL12A* (rs568408, rs2243115), *IL12B* (rs3212227), *IL13* (rs20541), *IL12RB2* (rs3762317) genes polymorphisms with COPD and studied the relationship between selected candidate genes variants with quantitative lung function parameters and smoking index in a Tatar population from Russia.

SNPs of *IL12A, IL12B, IL13, IL12RB2* genes were analyzed for association with COPD in cohort of 601 patients and 617 controls. SNPs were examined by the real-time polymerase chain reaction (PCR), with the use of TaqMan SNP discrimination assays.

As a result statistically significant associations with COPD in the study group under the biologically plausible assumption of additive genetic model were identified in *IL12A* (rs568408G>A) (P = 0.00001, OR = OR=2.07), *IL12A* (rs2243115T>G) (P = 0.00001, OR = 2.85), *IL13* (rs20541A>G) (P = 0.00001, OR = 1.58). A relationship between smoking index and *IL12A* (rs568408G>A) (P=0.027), *IL12A* (rs2243115T>G) (P=0.0038) was revealed. A significant genotype-dependent variation of Forced Vital Capacity was observed for *IL12A* (rs568408G>A) (P=0.045), *IL12A* (rs2243115T>G) (P=0.013) and *IL13* (rs20541A>G) (P =0.0051). Vital Capacity was affected by *IL12A* (rs2243115T>G) (P =0.0019).

Our data confirm the assumption about the essential role of genes responsible for the synthesis of α- and β-subunits of IL12, structural α-helices of IL13 to increased risk of COPD.

Keywords: chronic obstructive pulmonary disease, inflammation, interleukins 12 and 13.

Introduction. Chronic obstructive pulmonary disease (COPD) is a common chronic inflammatory disease that characterized by partly reversible airflow limitation, chronic inflammation, fibrosis of small airways, and destruction of lung parenchyma [15]. Today, the total number of people suffering from this disease is estimated at 251 million people, while COPD is the third most common cause of death in the world, which leads to a high demand for studies of the mechanisms of pathogenesis, new methods of therapy and early diagnosis of the disease [15]. An abnormal inflammatory response to inhaled harmful particles and tobacco smoke leads to airway remodeling and is thought to be a main mechanism of COPD development. In this case, the most important part of the mechanism of its development are inflammatory mediators, chemokines and interleukins, in particular IL12 and IL13 and their receptors [7,15].

IL-12 is a heterodimer consisting of protein α (IL-12p35) and β (IL-12p40)