CONSTITUTIONAL FORM OF OBESITY

**Introduction**

Obesity acquires the status of non-infection pandemic disease for the last 40 years. According to WHO worldwide obesity has nearly tripled since 1975. In 2016 more than 1.9 billion adults 18 years and older were overweight. Out of these people over 650 million were obese. 39% of adults aged 18 years and older were overweight in 2016 and 13% were obese [15]. There are many well-known obesity-related diseases such as insulin resistance, type 2 diabetes mellitus, and cardiovascular disease and other. Obesity can induce the development of heart stroke, arterial hypertension, cancer, diseases of musculoskeletal system and diseases of periodontal tissues.

There is periodontal and systemic immune response of overweight hosts to periodontitis. The most relevant linker is systemic inflammation and impaired immune response by which obesity might trigger aberrant periodontal inflammation and exacerbated alveolar bone loss [8]. Through test carried out on laboratory mice with induced obesity researchers explore significant decrease of alveolar bone level and increase of periodontal osteoclast, leukocyte, and macrophage number in obese mice with periodontitis compared with normal weight mice with induced periodontitis [16]. In periodontal diseases of

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monosodium glutamate-induced obesity rats activation of oxidative stress and nitrosative stress alteration and de-
polymerization of main connective tissues biopolymers were detected compared with rats without obesity [1].

There is a significant association between variety of body mass index (BMI) and waist-hip ratio (WHR) used in the assessment of body composition as indicators of obesity and risk of body fat distribution have an influence on the quality of life for aged individuals [9]. In young adults abdominal obesity is associated with poorer scores of emotional, school and psychosocial abilities and total life quality scores [12]. Due to mentioned above facts, overweight and obesity are not only medical, but global social problems needed to be tackled.

The mechanism of pathological changes development in periodontal tissues are not clear enough and it needs to be studied in depth in order to provide such group of patients with effective etiological and pathogenetic therapy.

The aim of research. The aim of our research was to explore the structure of oral cavity pathology in patients with diverse values of BMI in order to detect diseases comorbid with overweight in oral cavity.

Materials and methods

We conducted standard clinical examination of oral cavity in 154 young patients (18-21 years old) – all of them were students of the Ukrainian Medical Stoma-
tological Academy. All participants were informed about using of their personal information in the material of re-
search and signed a written agreement for further exami-
nation. Index assessment of oral status entails the de-
termination of caries intensity by DMFT index [11], esti-
mation of oral hygiene (Green-Vermillion index) [5], periodontal tissues (index Rateitchak) [14], CPI (complex periodontal index) (Leus) [3], PBI (Saxer and Muhlemann)[14] and Winkel Tongue Coating index (WTc) [7]. For all examined patients periodontogramma was completed. Periodontal diagnose made due to M.F. Danilevsky classification [3], alteration in oral mucosa and lips diseases were classified according to P.T. Maksymenko [10], occlusion pathology was estimated with classification by L.P. Grigoryeva [6].

In all patients, we determine the values of anthropo-
metrical parameters: body mass, height, waist and hip measures and hand dynamometry. Severity of obesity was estimated with WHO classification of obesity due to body mass index Ketle (BMI). Values of BMI were the criteria for group distribution: 1) patients with normal weight (BMI – 18,5 – 24,99 kg/cm²) n=31; 2) patients with overweight (BMI - 25 – 29,99 kg/cm²) n=49; 3) patients with the first degree obesity (BMI - 30 – 34,99 kg/cm²) n=34; 4) patients with the second degree obesity (BMI - 35 – 39,99 kg/cm²) n=40.

Inclusion and exclusion criteria. Inclusion criteria were patients of both gender aged from 18 to 21. Ukrainian origins, presence of constitutional or acquired forms of obesity in those who were obese.

The exclusion criteria were pregnant or lactating women; patients with endocrine forms of obesity; patients of non-Ukrainian race; presence of non-removable orthodontic appliances.

Statistical methods. SPSS 11.5 software was used for statistical analysis and data were presented as mean ± standard deviation (X ± s). Intra-group comparisons were conducted with a paired-sample t test, and the analysis of the correlation between the indicators was performed by Pearson’s correlation analysis. P < 0.05 was considered statistically significant.

Results and discussion

The average students of BMI in the first group of pa-
tients was 22,3 ± 0,2 kg/cm², in the second group – 27,84±0,2 kg/cm², in the 3rd group – 32,3 ± 0,38 kg/cm², in the fourth group – 38,54 ± 0,84 kg/cm². Among the exam-
inated students in the first group 64,5% were residents of large cities, 35,5% were residents of villages and small cities, the second group – 40,8% and 59,2%, the third group – 64,7% and 35,3%, the fourth - 60% and 40% re-
spectively.

Most of the examined with the first and the second degree of obesity severity were female. In the third group, the percentage of women was 76,5%, in the 4th – 55,0%, the ratio between obesity prevalence in women and men in the 1st and 2nd groups was almost the same. Our obtaining data about the prevalence of obesity among people of different sexes is confirmed with the re-
results of some epidemiological studies [4].

According to WHO, one of the criteria of metabolic syndrome is waist value 102 cm and higher for men and 88 cm for women. The excess of these measurements found in 76,5% of the patients of the third group and in 100% of the patients in the fourth group. The average value of waist and hip in patients of the first group was 75,67±1,45 cm and 98,33±1,42 cm, respectively, in per-
sons of the 2nd group – 83,3 ± 1,85 cm and 103 ± 2,25 cm, the third one group – 91,82±1,92 cm and 114,58±1,3, cm, in the fourth group – 108,23±2,3 cm and 121,95±2,24 cm, respectively. One of the criteria for abdominal obesity is a waist-hip ratio, for men it is ≤1,0, for women ≤0,85[4]. According to anthropometric data only 6,2% patients in the second group had abdominal obesity, in the third group - 11,77% and 30% in the 4th group had abdominal obesity.

In 32,5% out of all examined patients we observed the presence of allergy mostly to medicines and food products. Prevalence of allergy was the highest in pa-
tients with the second degree of obesity up to 40% with prevalence of polyvalent allergy. The presence of allergic reactions in persons with normal body mass was about 22,5%, in persons with overweight (second group) an al-
lergic anamnesis was complicated in 32,6% of patients, allergic reactions on food products were predominant in both groups. In the group with the 1st degree of obesity the presence of allergic reactions was found in 26,5%.

The majority of obese students had aggravated with heredity (Table 1) or there were numerous exogenous factors such as unhealthy lifestyle, lack of food culture in the family and disturbance in diet behavior as evidenced by the higher prevalence of obesity among the parents of patients with obesity. In the fourth group in 35% of pa-
tients both parents suffered from obesity and in 75% one of the parents was obese. In the third group, the preva-
lence of obesity in both parents was up to 29,41% and one of the parents was obese in 55,88%. The prevalence of obesity in parents of examined students in the first and the second group is shown in Table 1. about 15% of par-
teons of patients with the first and the second degree of obesity had Type 2 diabetes mellitus, which is signifi-
cantly higher than in patients with normal body weight and overweight. The prevalence of cardiovascular sys-
tem diseases and atopic diseases in the parents of ex-
mained patients had no definite liaison with the presence of obesity in examined individuals.
The parameters of hand dynamometry were as follows: in the first group among men - 47,5 ± 2,2 H, among women - 25,63 ± 1,23 H, in the second group - men - 49,95 ± 2,29 H, women - 29,23 ± 2,1H, in the third group - men 52,5 ± 2,4H, women - 25,84 ± 1,7H, in the fourth group - men 47,7 ± 2,4H, women 26,22 ± 1,56H.

The presence of papular and pustular skin rash was detected in 32,26% of students with normal BMI, in 48,1% - in the first group, 43% in the second group, 53% in the third group and 60% in the fourth group.

The prevalence of bad habits (smoking) was noted in 29% of people with normal weight, their age of smoking was 2,4 ± 0,54 years, the number of cigarettes per day was 5,4 ± 0,8 sig/day. In the third group, the percentage of smokers was 32,6%, in the second group - 43%, in the first group, 53% in the fourth group, 28,6% in the second group made checking-up at dentist once a year, 47,1% in the third group and 25% in the fourth group visit. Not regularly (with a presence of acute pain) to the dentist went 13% patients with normal BMI, 14,3% in the second group, 11,7% patients of the third group.

The prevalence of caries in examined groups was on average 97,4%, which corresponds to the results of a number of researchers. The intensity of the carious process in the investigated groups is given in Table 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>Decay</th>
<th>Missing</th>
<th>Filled</th>
<th>Mean DMFT</th>
</tr>
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<tbody>
<tr>
<td>IBM 18,5-24,99 kg/cm²</td>
<td>2,66±0,37</td>
<td>0,14±0,05</td>
<td>3,12±0,3</td>
<td>5,88±0,67</td>
</tr>
<tr>
<td>IBM 25-29,99 kg/cm²</td>
<td>3,35±0,4</td>
<td>0,24±0,11</td>
<td>3,24±0,49</td>
<td>6,84±0,58</td>
</tr>
<tr>
<td>IBM 30 – 34,99 kg/cm²</td>
<td>2,71±0,59</td>
<td>0,53±0,2</td>
<td>3,88±0,88</td>
<td>7,11±1,07</td>
</tr>
<tr>
<td>IBM 35 – 39,99 kg/cm²</td>
<td>4,25±0,85</td>
<td>0,14±0,06</td>
<td>1,6±0,42</td>
<td>5,96±0,84</td>
</tr>
<tr>
<td>Total</td>
<td>3,47±0,33</td>
<td>0,26±0,08</td>
<td>3,01±0,35</td>
<td>6,74±0,43</td>
</tr>
</tbody>
</table>

Note: p<0.05 - the level of significance is obtained when comparing groups of patients with normal weight and overweight patients;

p<0.01 - the level of significance is obtained when comparing groups patients with normal weight and patients with the first degree obesity;

p<0.001 - the level of significance is obtained when comparing groups patients with normal weight and patients with the second degree obesity;

p<0.001 - the level of significance is obtained when comparing groups of overweight patients and patients with the first degree obesity;

p<0.01 - the level of significance is obtained when comparing groups of overweight patients and patients with the second degree obesity;

p<0.05 - the level of significance is obtained when comparing groups patients with the first degree obesity and patients with the second degree obesity.

The prevalence of malocclusion was found in 48,1% patients in the first group, 43% in the second group, 53% in the third group and 60% in the fourth group.

Anomalies of soft tissues development in oral cavity (truncated frenulum of the tongue, small vestibulum of mouth) were found in 6,45% students in the first group,
12.24% of the second group, 11.76% of the third group and 10% in the fourth group.

The prevalence of periodontal diseases was up to 74%, chronic generalized catarrhal gingivitis and chronic localized catarrhal gingivitis were predominant forms of diseases. Chronic generalized periodontitis was diagnosed only in 4.55% of all cases (all - representatives of the third and the fourth group). The prevalence of periodontal disease with BMI is shown in Fig. 1. The frequency of pathological lesions in periodontal tissues increased with the rise of the BMI value, as well as the prevalence of generalized forms of periodontal diseases.

The prevalence of mouth diseases was up to 24.49%, as well as the presence of unhealed aphthous stomatitis with a high frequency of chronic recurrent aphthous stomatitis up to - 40%, which is evidenced by the presence of undiagnosed enterocolitis according to [2].

Index assessment of periodontal status is presented in Table 3.

![Fig. 1. Prevalence of generalized and localized forms of periodontal diseases among youth with diverse BMI values, is shown in percentage.](image)

<table>
<thead>
<tr>
<th>Index</th>
<th>Group (BMI)</th>
<th>18.5-24.99 kg/cm²</th>
<th>25-29.99 kg/cm²</th>
<th>30-34.99 kg/cm²</th>
<th>35-39.99 kg/cm²</th>
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<tr>
<td></td>
<td></td>
<td>(n=31)</td>
<td>(n=49)</td>
<td>(n=34)</td>
<td>(n=40)</td>
</tr>
<tr>
<td>OHI</td>
<td></td>
<td>0.54±0.11</td>
<td>1.34±0.07</td>
<td>1.42±0.12</td>
<td>1.4±0.11</td>
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<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>API, %</td>
<td></td>
<td>16.53±2.3</td>
<td>11.4±3.2</td>
<td>6.67±1.2</td>
<td>10.7±3.1</td>
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<tr>
<td></td>
<td>p&gt;0.05</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
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<tr>
<td>PMA, %</td>
<td></td>
<td>6.1±1.5</td>
<td>10.3±1.3</td>
<td>14.7±1.64</td>
<td>16.8±1.5</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.05</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>CPI (Leus)</td>
<td></td>
<td>1.38±0.15</td>
<td>1.52±0.11</td>
<td>1.7±0.1</td>
<td>1.66±0.15</td>
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<tr>
<td></td>
<td>p&gt;0.05</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>PBI, %</td>
<td></td>
<td>6.4±0.9</td>
<td>15.6±2.4</td>
<td>15.7±2.3</td>
<td>22.9±2.6</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td>p&gt;0.05</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
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<tr>
<td>WTC index</td>
<td></td>
<td>3.0±0.32</td>
<td>3.29±0.35</td>
<td>3.65±0.66</td>
<td>3.5±0.47</td>
</tr>
<tr>
<td></td>
<td>p&gt;0.05</td>
<td>p&gt;0.05</td>
<td>p&gt;0.05</td>
<td>p&gt;0.05</td>
<td>p&gt;0.05</td>
</tr>
</tbody>
</table>

Note: p<0.05 - the level of significance is obtained when comparing groups of patients with normal weight and overweight patients;

Conclusions

Thus, there is a significant prevalence of obesity among young females compared with male gender. The vast majority of all obese patients with BMI >30 kg/cm² in 62.2% cases were residents of large cities. In our opinion the fact is caused by a particular lifestyle - hypodynamia, irregular diet and the presence of strong social risk factors for the development of emotional stress compared with residents of rural area. It has been determined that the majority of patients with BMI >30 kg/cm² have a heavy family heredity, in 66.2% cases one parent of
obese students had obesity and 32.43% patients have both parents with obesity that is significantly higher compared with persons with normal BMI and overweight. All patients had aggravated allergic history, the presence of allergic reactions was detected in 32.5% of all students, the highest prevalence was in individuals with BMI 35-40 kg/cm² - 40%. Papular and postular skin rash was detected in the 3rd and the 4th group in 2 and 2.3 times frequently than in patients with normal BMI.

There is a high prevalence of periodontal diseases about 74% and carious lesions of teeth - 97.4% among young people despite the age and contingent of examined patients - medical students. This indicates the absence of effective primary and secondary prevention measures of dental pathology on the state, group and individual levels.

We did not find any link between the intensity of the carious process and the BMI. Although the highest value of the component of the DMFT-D index (non-filling carious cavities) was in the fourth group up to - 4.25 ± 0.85 which, in our opinion, indicates that there is no motivation in the dental health care in patients with the 2 degree of obesity. The prevalence of mucous lesions was the highest in persons with the 2 degree of obesity - 25%, with a domination of chronic recurrent aphthous stomatitis, which indicates the presence of digestive system organs disease in this group of individuals. The tongue hygiene indicator was clearly correlated with the value of BMI of patients. The tongue was the most coated in individuals with the second degree of obesity. Coating on the tongue is a sign of a presence of digestive system pathology in this group of individuals.

The prevalence conclusion was the highest in individuals of the fourth group, and was up to 60%. In the structure of morbidity, chronic generalized catarrhal gingivitis was prevalent - 44.8%; the share of chronic generalized periodontitis was 4.55%, all individuals of the 3rd and the 4th groups. We found a direct correlation between the prevalence of periodontal disease and the BMI in patients, as well as the increase of percentage of generalized forms of periodontal diseases. The values of oral hygienic indexes were poor in all examined groups, but their values were slightly lower in patients with normal BMI than in those with overweight and obesity. The prevalence of inflammatory changes in the gums was higher in persons of the 3th and the 4th groups PMA =14,5±1.8 and 16,8±1.5%, respectively. All persons with overweight and obesity had a mild degree of lesions in periodontal tissues with a CPI> 1,5, compared with individuals with normal weight where the CPI value was 0.5±0.11. Inflammatory processes in the gums were the most intense in patients with the second degree of obesity, where the PBI was 22,9±2.8%, that is by 1,5 times higher than in the second and third group and by 4 times higher than in the first group.

In our opinion, the development of inflammatory changes in the gums in patients with the second degree of obesity is not caused by local factors. The key role in development of inflammation process is systemic - proinflammatory adipocytocins that are secreted into blood by adipose tissue in excess. We would like to sum up that systemic factors play a crucial role in the development of periodontal tissues alteration in obese individuals, because there is no significance between local factors in all group of individuals where dental deposits quantity was the same. Overweight leads to the disturbance of compensatory and adaptive processes in the whole body by forming chronic systemic mild inflammation in the body.

According to the results of the study, the presence of the first and the second degree of obesity should be considered as a risk factor triggering periodontal tissues diseases. For persons with BMI >30 kg/cm² with periodontal disease measures for the secondary prevention of inflammatory and inflammatory dystrophic periodontal diseases should be carried out and in persons without periodontal disease against the background of obesity, measures of primary prevention should be done.

References