INTRODUCTION
The oral cavity has a multi-component system of protection against environmental pathogenic factors. Apparently, the homeostasis of the oral cavity is determined by many factors, but, first of all, by the functional activity of the salivary glands, contributing to both the presence of dental pathology and somatic human health in general [1].

Saliva, which is the product of secretion of the salivary glands, is crucial in keeping the normal state of tissues and organs of the oral cavity. Functions of saliva are diverse [2]. It has been found that quantitative and qualitative changes in saliva greatly determine the resistance of teeth to dental caries [3].

The problem of alcoholism is considered to be relevant worldwide, and more than half of them refuse to contact medical professionals for assistance [4, 5]. Salivary glands of almost all patients with alcohol abuse showed marked acinar hyperplasia, dilated ducts, granular and adipose dystrophy of the ductal epithelium. In some cases minor swelling and stromal fibrosis was detected [6].

The state of the segments of the microvasculature, especially exchange one, has a significant effect on the organs’ functions. The results of it’s research can be objectified by morphometric method.

Materials and methods: 45 albino rats were involved into study. Intact group (n=5) animals were administered with NaCl isotonic solution 4 times a day directly into the stomach. Experimental group (n=40) animals were administered with 40° ethanol 4 times a day directly into the stomach. Animals were sacrificed on 5, 9, 12 and 30 days by overdose of thiopental anesthesia. Lobules of submandibular glands were embedded into epon-812 according to standard procedure.

Results: On day 5 of the experiment the outer diameter of the capillary wall significantly reduced (4,91±0,02 µm), that is 19,5 % less than the values in controls (р<0,05). On day 9 of the experiment it was 15,2 % lower than the value of control group (р>0,05). On day 30 of the experiment the outer capillary diameter was 8 % lower compared to controls (р<0,05).

Conclusions: The early observation showed vasodilatation, confirmed by the constriction of the outer diameter and lumen diameter, accompanied by the thickening of the vascular wall under the influence of chronic ethanol intoxication. The indices did not come to normal values by the 30-th day of the experiment.

KEY WORDS: rats, salivary glands, capillaries, ethanol intoxication
THE AIM
The paper was aimed at the determining the dynamics of changes in metric indices of the exchange segment of microvasculature of rats’ submandibular glands in normal conditions and in chronic ethanol intoxication.

MATERIALS AND METHODS
45 outbred albino rats were involved into study. Intact group (n=5) animals were administered with NaCl isotonic solution 4 times a day directly into the stomach. Experimental group (n=40) animals were administered with 12 mg/kg 40° ethanol 4 times a day directly into the stomach [9].

The animals were sacrificed under 25 mg/kg thiopental anesthesia overdose in compliance with the scheduled time periods (on day 5, 9, 12 and 30). Lobules of submandibular glands were embedded into epon-812 according to standard procedure [10]. Semi-thin sections were stained with polychrome stain.

The average values of the outer diameter and diameter of capillary lumen were measured using the microscope with digital Biorex - 3 microphotohead with software, adapted to studies of such type. The thickness of the vascular wall was calculated according to the formula:

\[ T_{vw} = D_o - D_i / 2, \]

where \( D_o \) is the outer diameter of the capillary wall, \( D_i \) is the inner diameter of the capillary wall, \( T_{vw} \) is the thickness of the vascular wall of capillaries.

Statistical processing of the morphometric data has been carried out using the Microsoft Excel [11].

Animal housing and experiments on them have been
carried out in compliance with the “General Ethic Rules for Conducting Experiments on Animals”, adopted by the I National Congress on Bioethics and the requirements of international principles of the “European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes” [12].

RESULTS AND DISCUSSION

The morphometric study has established that the average values of the outer diameter of the capillary wall of the lobules of submandibular gland was 6,10±0,05 µm; the inner diameter was 4,16±0,02 µm. The thickness of the vascular wall of capillaries was 0,92 µm (Table I).

On day 5 of the experiment the outer diameter of the capillary wall significantly reduced (4,91±0,02 µm), that is 19,5 % less than the values in controls (р<0,05); similarly, the diameter of the capillary lumen reduced by 12,5 % (Fig.1). Its average values were 3,64±0,02 µm, red blood cells in the lumens were deformed. The thickness of vascular wall was reduced by 30,4 % (0,64 µm) (Table I).

On day 9 of the experiment the outer diameter of capillaries was enlarged by 5,3 % (5,17±0,01 µm) compared to day 5; however, it was 15,2 % lower than the value of control group (р>0,05). The lumen diameter was 3,80±0,02 µm, that was 4,4 % higher the values on day 5 of the experiment but was 8,7 % lower compared to controls (р>0,05). Similarly, the thickness of vascular wall was tending to change. It was 6,3 % higher compared to day 5 of the experiment and 26,1 % (0,68 µm) lower compared to controls (Table I).

On day 12 of the experiment the outer diameter of capillaries was 5,34±0,03 µm, that was 3,3 % higher the values of the day 9 of the experiment, but was 12,5 % lower compared to controls (р<0,05). The average values of the lumen diameter were 3,87±0,01 µm, that was 1,8 % higher the values of the previous time period of experiment, but was 6,7 % lower the values of controls (р<0,05). The thickness of the vascular wall was 8,8 % higher compared to day 9 of the experiment and 19,6 % lower compared to controls (р<0,05) with the average values of 0,74 µm (Table I).

On day 30 of the experiment the outer capillary diameter of the lobules of submandibular gland was 5,61±0,01 µm, that was 5,1 % higher the values of day 12 of the experiment but 8 % lower compared to controls (р<0,05). The inner capillary diameter was 3,1 % (3,99±0,02 µm) higher the values of the previous time period of experiment, that was 4,1 % lower the values of controls; loose placement of blood corpuscles was detected in the lumens (Fig.2). The thickness of the vascular wall was 9,5 % higher compared to day 12 and significantly 12 % lower compared to controls (р<0,05) with the average values of 0,81 µm (Table I).

The findings of our previous studies have shown the spasm of arterioles in the lobules of the rat's submandibular glands at the early stages of intoxication with ethanol, which is confirmed by the thinning of the vascular wall by 41,8 %. At the ninth day of the experiment, dilatation, manifested by the significant enlargement of the outer diameter and the diameter of the lumen was noted, as well as thinning of the vascular wall. The rates did not come to normal by the thirtieth day of the experiment [14].

Thus, the established changes in the exchange segment of the microvasculature are caused by the blood flow decrease from dilated arterioles on the one hand, and hyperhydration of the amorphous component of the intercellular substance of the connective tissue of the stroma of the rats’ submandibular gland lobules on the other hand, at the early stages of the experiment. The findings of our study are in concordance with the findings of other researchers [1, 7], who studied the effect of ethanol and 1% methacrylic ester on the mucous membrane of the masticatory type. However, the authors established a more pronounced reaction of the exchange segment of the microvasculature of the glandular zone of hard palate and gums of rats due to direct exposure of the irritating factor to the surface. The submandibular glands are mediated indirectly by the bloodstream and, to a small extent, retrograde ethanol penetration through the duct system of the glands. The above reduces the manifestations of microcirculation disorders by an average of 10%.

CONCLUSIONS

The morphometric study has established that chronic ethanol intoxication affects the exchange segment of the microvasculature of the lobules of submandibular gland.

<table>
<thead>
<tr>
<th>Capillaries</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>D_o</td>
<td>D_l</td>
<td>T_{VW}</td>
</tr>
<tr>
<td>Control</td>
<td>6,10±0,05</td>
<td>4,16±0,02</td>
<td>0,92</td>
</tr>
<tr>
<td>day 5</td>
<td>4,91±0,02</td>
<td>3,64±0,02</td>
<td>0,64</td>
</tr>
<tr>
<td>day 9</td>
<td>5,17±0,01</td>
<td>3,80±0,02</td>
<td>0,68</td>
</tr>
<tr>
<td>day 12</td>
<td>5,34±0,03</td>
<td>3,87±0,01</td>
<td>0,74</td>
</tr>
<tr>
<td>day 30</td>
<td>5,61±0,01</td>
<td>3,99±0,02</td>
<td>0,81</td>
</tr>
</tbody>
</table>

Note: * - р < 0,05 compared with controls; ** - р <0,05 compared with experimental group.
The early observation showed vasodilatation, confirmed by the constriction of the outer diameter and lumen diameter, accompanied by the thickening of the vascular wall. From day 9 of the experiment the metric values were tending to restore.

The indices did not come to normal values by the 30-th day of the experiment.

REFERENCES

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Authors’ contributions:
According to the order of the Authorship.

Conflict of interest:
The Authors declare no conflict of interest.

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