DOI 10.29254/2077-4214-2018-4-1-146-213-215
UDC 616.315+616.311:59.08

Yeroshenko G. A., Tymoshenko Yu. V.

ALTERED EXPRESSION OF CARBOHYDRATE DETERMINANTS OF THE MUCOUS MEMBRANE OF THE GLANDULAR ZONE OF THE HARD PALATE IN EXPERIMENTAL HYPOSALIVATION

Ukrainian Medical Stomatological Academy (Poltava)

gala_umsa@ukr.net

Publication relation to planned scientific research projects. The paper has been written within the research scientific work, entitled "Experimental and morphological study of the effect of transplantants of cryopreserved placenta and other exogenic factors on the morphofunctional state of several internal organs"; State registration number 0113U006185.

Introduction. The minor salivary glands ensure moisturizing of the oral mucosa at rest. However, the influence of various factors can lead to reduced secretory activity of the salivary glands, i.e., hyposalivation that is clinically manifested by xerostomia, developed under the influence of endogenous or exogenous factors. The common cause of exogenous xerostomia is the use of removable dentures with 90% contact to hard palate mucosa and direct irritating action of the denture residual monomer, i.e., methacrylate.

The method of lectin sounding is more effective than the traditional methods for determining carbohydrate determinants due to its sensitivity and selectivity for detecting the above molecular structures. The varying complexity of the carbohydrate structures on the cell surface is the ligands for binding with lectins, thus affecting the processes of the functioning of cells, tissues and organs [1,2,3,4].

Purpose. The purpose of the paper was to define the degree of expression of carbohydrate determinants of the mucous membrane of the glandular zone of the hard palate for Concanavalin A mannose-specific lectin in the intact group of animals in experimental hyposalivation.

Methods and Materials. Outbred albino rats were involved into study. 5 animals were assigned into the control group and 10 animals were assigned into study group. Xerostomia was simulated by the exposure of rat oral mucosa to methacrylate 1% during 30 days [5,6,7]. The animals were killed on day 14 and 30 under thiopental anesthesia overdose. The specimens were processed using the standard sets of "Lectinotest" laboratory (Lviv) in 1:50 lectin dilution [8]. Semi-quantitative method was used for visualization of the reaction with lectin conjugates in the Biorex – 3 BM-500 microscope immersion magnification [9].

Results and Discussion. Sounding of intact rats' hard palate mucosa with Concanavalin A (Con A) mannose-specific lectin showed the strong conjugation with receptors of horny scales **(fig. 1).**

Cells of the stratum granulosum, stratum spinosum and stratum basale, as well as basal membrane showed weak response.

The intensity of marking of the components of lamina propria was weak and the elastic arteriole membranes showed negative reaction. Macrophages, lymphocytes and mastocytes showed weak, moderate and strong expression, respectively.

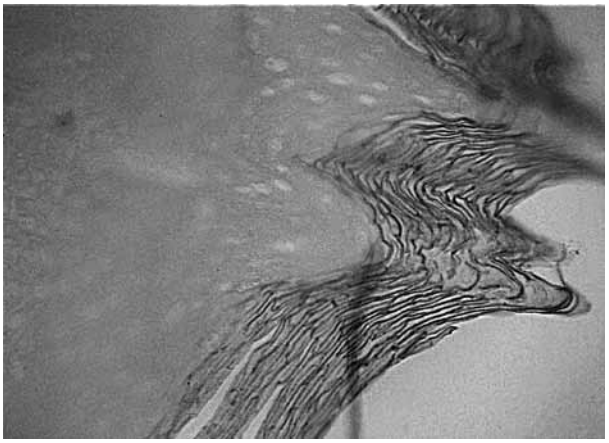

Fig. 1. Very strong expression of Concanavalin A mannose-specific lectin on the horny scales of the epithelial plate in the glandular zone of the intact rat hard palate. ConA marking. Magnification: 40X objective lens; 10X ocular lens.

The relation of the structural components of the intact rats' palatine glands to αD-mannose was weak in the epithelial cells of the acini, namely, the cytoplasm, basal membrane and basal plasmalemma.

The intensity of marking of the surface and cytoplasm of myoepitheliocytes was very strong **(fig. 2).**

Myoepitheliocytes of the excretory ducts showed strong relation to αD-mannose. Expression of the receptors of the cytoplasm, basal membrane and basal plasmalemma of the ductal epithelial cells was weak.

Before day 14 of the experiment the intensity of the biding of receptors of horny scales with Concanavalin A lectin was persistent, strong. Expression of the receptors on the cells of the stratum granulosum, stratum spinosum and stratum basale, as well as basal membrane was stable weak.

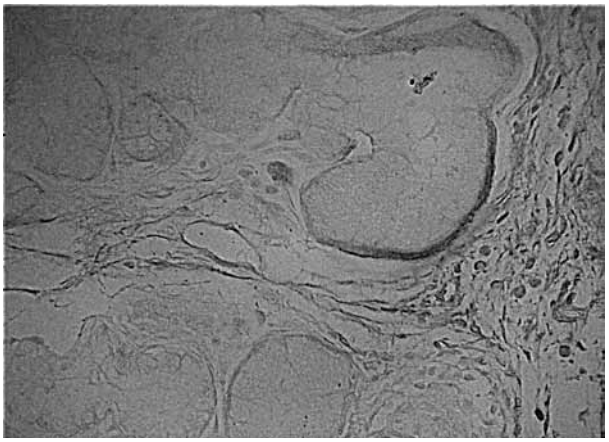

Fig. 2. Moderate expression of Concanavalin A mannose-specific lectin on the collagen fibers and strong expression on the myoepitheliocytes of the acini of salivary glands of the glandular zone in the intact rat. ConA marking; Magnification: 100X objective lens; 10X ocular lens.

Fig. 3. Enhancement to very strong expression of Concanavalin A mannose-specific lectin on the collagen fibers, fibroblasts and macrophages in the lamina propria of the glandular zone of the rat hard palate on day 14 of the experiment. ConA marking; Magnification: 100X objective lens; 10X ocular lens.

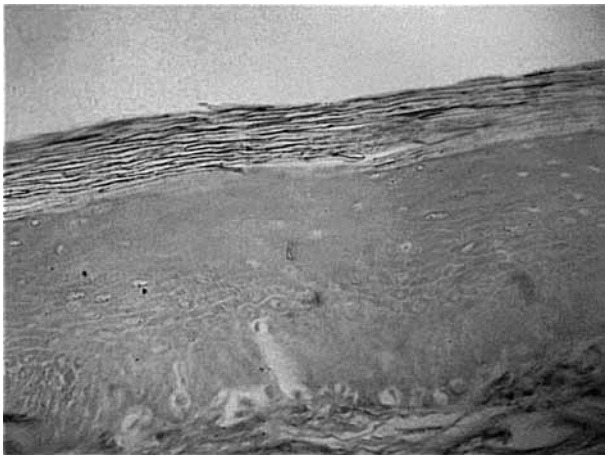

Fig. 4. Moderate expression of the Concanavalin A mannose-specific lectin on the horny scales of the epithelial plate in the glandular zone of the rat hard palate on day 30 of the experiment. ConA marking; Magnification: 100X objective lens; 10X ocular lens.

Study of the specificity of the binding of the components of the lamina propria revealed the enhanced expression of the receptors to αD-mannose on the fibroblasts and strong expression on the collagen fibers. The response of the vascular wall components remained weak, with the exception of the increased strong binding with receptors on the basal membrane. The relation of the receptors to αD-mannose of macrophages, mastocytes and lymphocytes increased to very strong, strong and weak, respectively, decreasing to negative.

On day 14 of the experiment moderate expression of receptors to ConA on the basal membrane of the acini was detected **(fig. 3).**

Response of the basal plasmalemma and cytoplasm remained persistent very weak. Expression of Concanavalin A mannose-specific lectin on the myoepitheliocytes of the acini decreased from very strong to weak.

Similar changes have been established in the structural components of the excretory ducts of the rat palatine glands on day 14 in administration of methacrylate 1 %.

On day 30 of the experiment the response of the horny scales in the epithelial plate of the glandular zone of the intact rats' hard palate mucosa changed from very strong to moderate on day 14 **(fig. 4).**

Keratinocytes of the stratum granulosum, stratum spinosum and stratum basale, as well as basal membrane maintained weak marking intensity. The lamina propria showed moderate expression (weak expression in the intact group of animals) of the receptors to peanut lectin on the cytoplasm of the fibroblasts.

The degree of binding with vascular endothelial has changed from weak to moderate. The negative reaction of the elastic membrane of arterioles was unchanged. Among the migrant cells of the connective tissue only the mastocytes showed weak expression of the receptors, whilst lymphocytes and macrophages showed no response.

On day 30 of the experiment the acini of the palatine glands showed sustained moderate intensity in exposure of carbohydrate determinants to Concanavalin A lectin on the basal membrane (weak in the intact group and moderate on day 14 of the experiment) and myoepitheliocytes (very strong in the intact group and moderate on day 14 of the experiment), plasmalemma (strong in the intact group, very strong on day 14 of the experiment). The expression of receptors to Con A lectin on the plasmalemma and in the cytoplasm of the acinar epithelial cells was stable weak throughout the experiment. Identification of the specificity of binding of Concanavalin A mannose-specific lectin with receptors of structural components of the excretory ducts of the palatine glands revealed moderate reaction of the basal membrane and myoepitheliocytes (very strong in the intact rats and moderate on day 14 of the experiment) on day 30 of the experiment. Throughout the experiment the cytoplasm of the epithelial cells and basal plasmalemma showed weak marking.

Conclusion. Sounding of the hard palate mucosa with Concanavalin A mannose-specific lectin in experimental hyposalivation has established the increase in expression of carbohydrate determinants on the fibroblasts and collagen fibers of the lamina propria and enhanced intensity of vascular basal membrane binding, caused by hyperhydration of the amorphous substance. Decreased intensity of the exposure of the migrant cells of the connective tissue indicates the stress of the local immunity to irritating action of methacrylate. Myoepitheliocytes of the acini and ductal system of the minor salivary glands showed decreased expression of the carbohydrate determinants, caused by the reduced secretory activity of the glandular cells.

Prospects for further research. In the future, the lectin profile of the mucous membrane of the rats' hard palate to the sialospecific lectins is planned.

References

1. Antonyuk RV, Lucik OD. Lektinogistohimichne doslidzhennya tovstoi kishki lyudini v normi ta pri neoplastichnih procesah z vikoristannyam lektiniv, specifichnih do T-antigenu ta N-acetillaktozaminu. Svit medicini ta biologii. 2015;4(53):5-18. [in Ukrainian].
2. Villalobo A, Nogales-Conzalez A, Galius HJ. A guide to signaling pathways connecting protein-glycan interaction with the emerging versatile effector functionality of mammalian lectins. Trends Glycosci. Glycotechnol. 2006;18:1-37.
3. Vasil'chuk NG, Kushch OG. Osoblivosti rozpodilu receptoriv do lektiniv arahisu ta ikri okunya v kapsuli mediastenal'nogo limfatichnogo vuzla. Svit medicini ta biologii. 2015;4(53):15-8. [in Ukrainian].

4. Bilash SM, Eroshenko GA, Pokotilo PB. Lektinohimichna harakteristika vuglevodnih determinant shlunku pri vvedenni kriokonservovanoi placenti na tli gostrogo eksperimntal'nogo zapalennya. Svit medicini ta biologii. 2013;1(36):94-9. [in Ukrainian].
5. Babij RI. Korekciya funkcional'noi aktivnosti slinnih zaloz pri zubnomu protezuvanni hvorih z giposalivacieyu [disertaciya]. Odessa; 2008. 143 s. [in Ukrainian].
6. European Science Foundation. Use of animals in research: European Science Foundation Policy briefing. Banda E, secretary general ESF. 2000 Sept;9:1-6.
7. Obshchie ehticheskie principy raboty s ehksperimental'nymi zhivotnymi pri provedenii medicinskih i biologicheskih issledovanij: Nacional'nij kongres z bioetiki; 2001 Veres 17-20; Kiyv. Zhurn. AMN Ukrayni. 2001;7(4):814-6. [in Russian].
8. Lucik AD, Detyuk EC, Lucik MD. Lektiny v gistohimii. L'vov: Vishcha shkola; 1989. 144 s. [in Russian].
9. Yeroshenko GA, Timoshenko YuV, Kazakova KS, Yeroshenko AI. Lectinochemical characteristics of rat normal masticatory oral mucosa. In: Fundamental and Applied Studies in the Modern World: Proceedings of the XV International Academic Congress; 2016 Sept 6-8; UK, Oxford. 2016;XV:207-11.

ЗМІНИ ЕКСПРЕСІЇ ВУГЛЕВОДНИХ ДЕТЕРМІНАНТ СЛИЗОВОЇ ОБОЛОНКИ ЗАЛОЗИСТОЇ ЗОНИ ТВЕРДОГО ПІДНЕБІННЯ ЗА УМОВ ЕКСПЕРИМЕНТАЛЬНОЇ ГІПОСАЛІВАЦІЇ

Єрошенко Г. А., Тимошенко Ю. В.

Резюме. Зволоження слизової оболонки порожнини рота в стані спокою забезпечується секретом малих слинних залоз. Однак, вплив різноманітних чинників може призводить до зниження секреторної активності слинних залоз – гіпосалівації. Зондування слизової оболонки твердого піднебіння маннозоспецифічним лектином конканаваліну А при експериментальній гіпосалівації визначило збільшення експресії вуглеводних детермінант збоку фібробластів та колагенових волокон власної пластинки та збільшення інтенсивності зв'язування базальної мембрани судин що обумовлено гіпергідратацією аморфної речовини. Зменшення інтенсивності експонування мігрантних клітин сполучної тканини свідчать про напруженість локального імунітету на подразливу дію ефіру метакрилової кислоти. З боку міоепітеліоцитів кінцевих відділів та протокової системи малих слинних залоз відзначається зменшення експресії вуглеводних детермінант, що обумовлено зменшенням секреторної активності гландулоцитів.

Ключові слова: слизова оболонка, тверде піднебіння, гіпосалівація, лектини.

ИЗМЕНЕНИЯ ЭКСПРЕССИИ УГЛЕВОДНЫХ ДЕТЕРМИНАНТ СЛИЗИСТОЙ ОБОЛОЧКИ ЖЕЛЕЗИСТОЙ ЗОНЫ ТВЕРДОГО НЕБА ПРИ ЭКСПЕРИМЕНТАЛЬНОЙ ГИПОСАЛИВАЦИИ

Ерошенко Г. А., Тимошенко Ю. В.

Резюме. Увлажнение слизистой оболочки полости рта в состоянии покоя обеспечивается секретом малых слюнных желез. Однако, влияние различных факторов может приводить к снижению секреторной активности слюнных желез – гипосаливации. Зондирование слизистой оболочки твердого неба маннозоспецифическим лектином конканавалина А при экспериментальной гипосаливации определило увеличение экспрессии углеводных детерминант со стороны фибробластов и коллагеновых волокон собственной пластинки и увеличение интенсивности связывания базальной мембраны сосудов, что обусловлено гипергидратацией аморфного вещества. Уменьшение интенсивности экспонирования мигрантных клеток соединительной ткани свидетельствуют о напряженности локального иммунитета на раздражающее действие эфира метакриловой кислоты. Со стороны миоэпителиоцитов концевых отделов и протоковой системы малых слюнных желез отмечается уменьшение экспрессии углеводных детерминант, что обусловлено уменьшением секреторной активности гландулоцитов.

Ключевые слова: слизистая оболочка, твердое небо, гипосаливация, лектины.

ALTERED EXPRESSION OF CARBOHYDRATE DETERMINANTS OF THE MUCOUS MEMBRANE OF THE GLANDULAR ZONE OF THE HARD PALATE IN EXPERIMENTAL HYPOSALIVATION

Yeroshenko G. A., Tymoshenko Yu. V.

Abstract. Moisturizing the oral mucosa in a state of rest is provided by the secret of small salivary glands. However, the influence of various factors may lead to a decrease in secretory activity of the salivary glands – hyposalivation. The probing of the mucous membrane of the hard palate with mannosospecific lectin concanavalin A during experimental hyposalivation determined an increase in the expression of carbohydrate determinants from the side of fibroblasts and collagen fibers of the own plate and an increase in the binding of the vascular basement membrane due to hyperhydration of the amorphous substance. The decrease in the intensity of the exposure of the migrative cells of the connective tissue indicates the tension of local immunity to the irritant action of the ether of methacrylic acid. On the part of the myoepithelial cells of the terminal organs and the duct system of the small salivary glands there is a decrease in the expression of carbohydrate determinants, which is due to a decrease in secretory activity of glandulocytes.

Key words: mucous membrane, hard palate, hyposalivation, lectins.

Рецензент – проф. Білаш С. М.
Стаття надійшла 22.09.2018 року