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Cytomorphological assessment of buccal epithelium of the cheeks of children of some industrial cities of the Karaganda region

The article discusses changes in the buccal epithelium of the cheeks (BECh) based on the results of a survey of the child population of three industrial cities of the Karaganda region (Temirtau, Balkhash, Abay), methods of cytological analysis were used. Cytochemical methods were used for the early detection of functional changes in the nonspecific protection of the body from environmental factors. When conducting a research on the cytological status of buccal epithelium cells of children living in the studied areas, it was revealed that an increase in the number of cells with small-droplet inclusions in the cytoplasm of children of Temirtau and Balkhash was found. When comparing the results of investigation of child population (Temirtau, Balkhash, Abay), a decrease in the number of cells with small-droplet inclusions in the cytoplasm by 4 times and an increase in the number of cells with large-droplet inclusions in the cytoplasm for 78 %, with signs of karyorexis for 74 % was noted. The number of nuclear-free cells was reduced for 34 %, degenerated neutrophil leukocytes by 3.9 times. There is an increase in the amount of amitosis for 50 % and a decrease in the number of normal buccal cells for 71 %. The appearance of small and large inclusions in the cytoplasm of cells proves the effect of adverse environmental factors on the body of children living in industrial regions.

Keywords: buccal epithelium of the cheeks, child population, non-specific resistance of the organism.

Introduction

Indicators of the functional state of some body systems should be considered more informative than the incidence, when assessing the health status of the population. Thus, minimal changes in the quality indicators of buccal epithelial cells of the cheeks of children were noted at a pollution level approaching 3 MPCs, and at the same time they did not have significant changes in the incidence of allergic diseases and changes in immune reactivity [1–3]. Children, living in areas with unfavorable hygienic conditions, have lowered functional reserves of the body, and changes in their respiratory parameters prevail. Under the influence of adverse environmental factors (water, food, atmospheric air), subnormal changes in the body of children were recorded [4, 5].

Numerous studies and the results of cytomorphological indicators of the BECh of the child population [6–10] have shown prospects for scientific research in this area. The cytological state of the BECh reflects the state of the body, changing in dependence of the pollution of the production environment. Studies have shown that the epithelium of the mucous membranes of different degrees of differentiation, vary from different adverse effects and can be considered as a target for these effects [11, 12]. Non-invasive multi-organ micronucleus test on human exfoliating cells, including analysis of buccal epithelial cells, allows to verify the data, obtained from biological material, as well as to expand the amount of information about the existing adverse factors. In this case, the cheek mucosa is under the predominant influence of factors acting under inhalation effect [3, 13, 14].

Methodology

Based on this, a research work of children of primary classes of secondary schools in Temirtau, Balkhash and Abay of Karaganda region was conducted. In total 240 children at the age of 6–8 years were examined. Methods of cytological analysis of BECh with the help of MS-200 microscope (Austria, 2004) were used, Kolmogorov-Smirnov criterion was used to evaluate normality of data distribution. Arithmetic mean, variance, error, and 95 % confidence interval were calculated for quantitative variables with normal distribution. Differences between the groups were revealed with the help of methods of parametric statistics. Comparison and assessment of relative risks was performed using the value of $\chi 2$. Non-parametric criteria based on the one-factorial dispersive analysis based on Wilcoxon rank labels, the median test, and Spearman's rank correlation coefficient were used for the calculation [15–17]. The results of the deviation were compared with the physiological limits of fluctuation. When calculating the BECh values, 200 cells were analyzed, 300 cells were counted if many different anomalies were recorded. During the analysis, 75–98 normal epi-

thelial cells were taken as «normal». The number from 55 to 74 normal epithelial cells indicates an initial decrease in body resistance. A quantity from 15 to 54 and below indicates a decrease in body resistance. Incomplete phagocytosis (microbial digestion, cell residue) — reduced immunity, karyorrhexis indicates cell necrosis [9, 14].

Results and their discussion

When conducting a research on the cytological status of buccal epithelium cells of children living in the studied areas, it was found that in Temirtau and Balkhash children have the increased number of cells with droplets in the cytoplasm which is 0.47 and 1.90, accordingly. At the same time, the indicators of epithelial cells with large-droplet inclusions of children living in Temirtau are 2.1. This figure is lower for children living in the city of Balkhash and is 1.2.

It was found that the cytomorphological indicator of a cell with signs of karyorrhexis of children living in Temirtau is 1.7 times more than of children living in Balkhash, the same indicator is 1.7 times higher in the Balkhash group of children than in Abay. The number of degenerated neutrophilic leukocytes (DNL) of the Balkhash group of children is increased by 2.5 times, and of children of the Temirtau group is decreased relative to the group of children from the city of Abay. The number of normal buccal cells of the cheeks in both groups was reduced: the Balkhash group by 1.4 and the Temirtau group by 2.4 times. The percentage of microflora contamination (streptococci, staphylococcus) in the 2nd and 3rd groups was increased by 26 % and 2.8 times (Fig. 1–3).

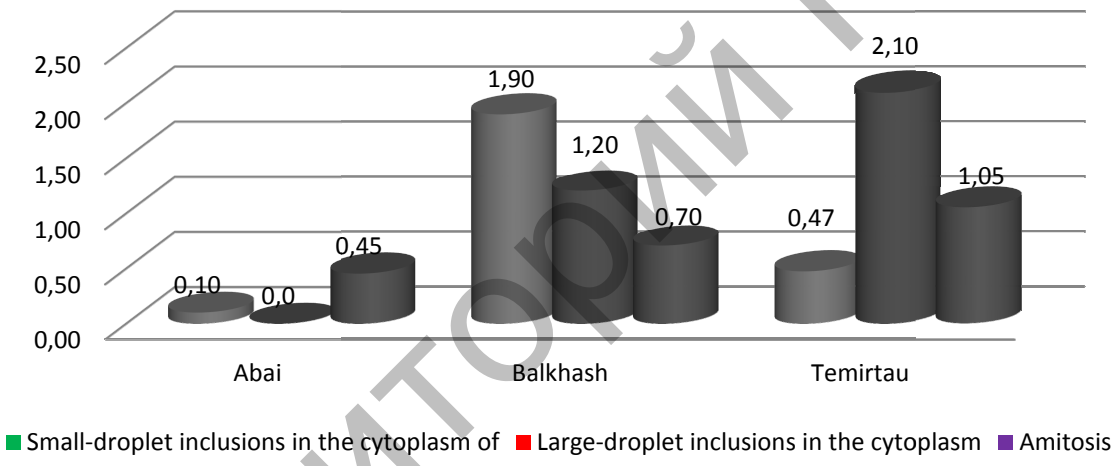

Figure 1. Cytomorphological parameters of BECh cells of the examined children of Karaganda region (%)

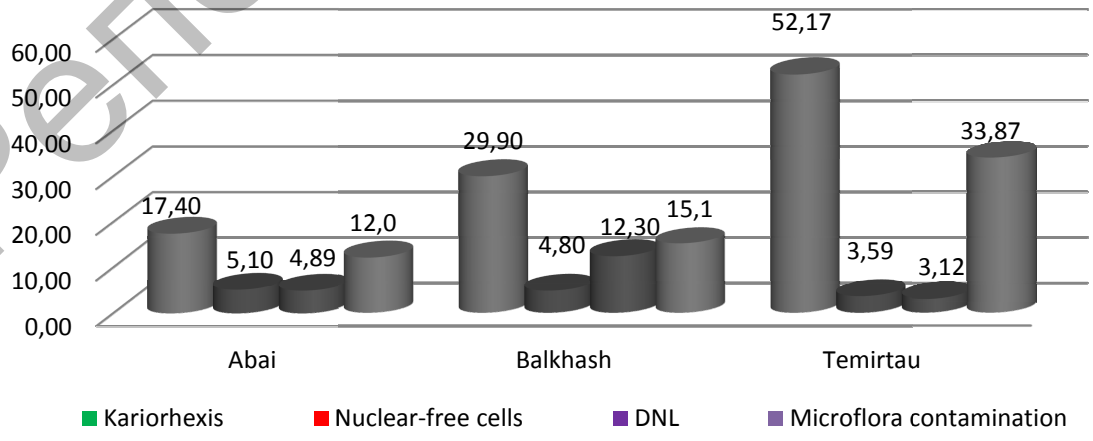

Figure 2. Cytomorphological parameters of BECh cells of the examined children of Karaganda region (%)

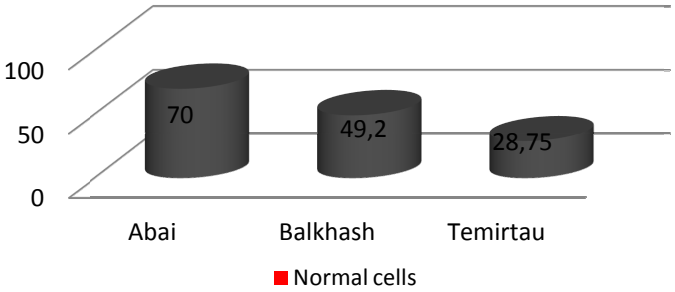

Figure 3. Cytomorphological parameters of BECh cells of the examined children of Karaganda region (Normal cells, %)

The functional status of buccal cells depends on the degree of their maturity, as in other epithelial cells. As part of the multilayer flat epithelium, buccal epithelial cells are at different stages of morphological and functional differentiation-from poorly differentiated precursors in the basal layer (they provide regeneration of the epithelium) to highly specialized cells, which while being differentiated are shifted to the surface layers, undergoing desquamation, some of them have signs of keratinization.

Differentiated, proliferative processes and functional parameters of mature cells are regulated by factors of local and central origin. It is not surprising that the state of buccal epithelial cells reflects the nature of destabilizing processes at the local and systemic levels [5, 12, 14, 18]. Changes in the differentiation of the epithelium, recorded morphologically (cell size, nature of nuclei and granules, signs of cytolysis) and electrokinetically (electrical mobility of nuclei), are proposed to be taken into account in screening assessment of health, stressful effects of harmful environmental factors, somatic pathology, biological age of a person.

The functional characteristics of epithelial cells also include such an important indicator as the ability for adhesive interactions with microorganisms. On this depends not only the nature of the microbial colonization of the epithelium and the state of local immunity, but also the homeostasis of the entire cellular community associated with the mucous membranes. Streptococci dominate in the obligate microflora of buccal cells. Their number is maximum in children under 10 years of age and is considered as one of the indicators of nonspecific resistance of the oral mucosa and «general health». The presence of less typical and atypical microorganisms for a given biotope reflects the weakening of colonization resistance, signaling destabilization processes, focused on the level of mucous membranes [18, 19].

A study of the buccal epithelium cells of the cheeks of the examined child population recorded a sixfold increase in the number of phagocytosed apoptotic (residual) bodies in all urban children. The number of cells with vacuolar dystrophy was above the norm in all examined urban children of Abay, Balkhash, Temirtau (Fig. 4).

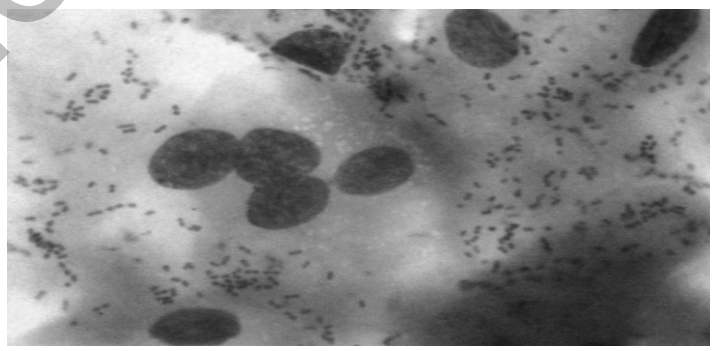

Figure 4. Buccal epithelium of the cheeks, a multinucleate cell with vacuolar dystrophy and high bacterial load. Mag. ×1600

The results showed that children living in the cities of Abay, Balkhash, Temirtau, despite the different place of residence, have catarrhal and atrophic rhinitis, because the buccal mucosa of the cheeks are the most

important biological barriers that prevent adverse and anthropogenic factors from entering the body. On the buccal epithelium of the cheeks the reparative process disorders were found, which affects their ability to interact adhesively with microorganisms constantly residing in the oral cavity, which leads to their accumulation. Inability to neutralize microorganisms indicates a disorder of local immunity [3, 6, 8]. Moreover, the buccal mucosa reflects the immune system of the entire digestive tract. Most of the nutrients enter the body through the gastrointestinal tract, the adequate functioning of which is ensured by normal microbiocenosis. [14, 18]. In the event of a change in microbiological associations, a negative change occurs in the processes of absorption, intestinal dysbiosis. Due to the toxic-dysmetabolic effects on the body, the formation of pathological processes is possible, which requires further in-depth study of the damaging effects of chemical factors. [12, 14, 19]. Malabsorption of essential trace elements occurs as a result of dismetabolic processes in the intestine, even with sufficient use of trace elements with food [12, 14]. Pediatricians note that prescribing iodine-containing drugs does not correct the iodine deficiency condition. This phenomenon is possible for any deficiency of trace elements (zinc, selenium). The revealed changes in the cytomorphological indices of the buccal epithelium make it possible to recommend non-invasive analyzes of the nasal epithelium, along with the buccal, to assess the effects of adverse environmental factors, especially to detect the inhalation effect of air pollutants.

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Қарағанды облысының кейбір өндірістік қалаларында тұратын балалардың ұртының буккальді эпителийін цитоморфологиялық бағалау

Мақалада зерттеу нәтижелері бойынша Қарағанды облысының үш өнеркәсіптік қалаларында (Теміртау, Балқаш, Абай) тұратын балалардың ұртының буккальді эпителийіндегі өзгерістер цитологиялық талдау әдісі арқылы қарастырылды. Цитохимиялық әдістер ағзаны қоршаған ортаның факторларынан қорғау мақсатында арнайы емес функционалдық өзгерістерді ерте анықтау үшін қолданылды. Зерттеу аудандарында тұратын балалар ұртының буккальді эпителий жасушаларының цитологиялық жағдайын зерттеу кезінде Теміртау мен Балқаштағы балалар цитоплазмадағы ұсақ тамшылы жасушалар санының артуын көрсетті. Балалардың буккальді эпителийін зерттеу нәтижелерін салыстыру кезінде (Теміртау, Балқаш, Абай) цитоплазмадағы кіші тамшы қосындылары бар жасушалар санының 4 есе азаюы және цитоплазмадағы қосарлы ірі тамшылардың қосындысы 78 %, кариорексис белгілері 74 % болатын жасушалардың санын көбеюі байқалды. Ядросыз жасушалардың саны 34 %-ға, нейтрофилді лейкоциттердің саны 3,9 есеге төмендеген. Амитоздың 50 %-ға өсуі және қалыпты буккальді жасушалардың саны 71 %-ға төмендеуі анықталды. Жасушалардың цитоплазмасында кіші және үлкен енулердің пайда болуы индустриалды аймақтарда тұратын балалардың ағзасына жағымсыз экологиялық факторлардың ықпалын растайды.

Кілт сөздер: ұрттың буккальді эпителийі, балалар популяциясы, ағзаның спецификалы емес резистенттілігі.

К.А. Нурлыбаева, А.М. Айткулов, М.А. Мукашева, А.Е. Старикова

Цитоморфологическая оценка буккального эпителия щек у детского населения некоторых промышленных городов Карагандинской области

В статье рассмотрены изменения в буккальном эпителии щек по результатам обследования детского населения трех промышленных городов Карагандинской области (городов Темиртау, Балхаша, Абая) с использованием методики цитологического анализа. Цитохимические методы были применены для раннего выявления функциональных изменений неспецифической защиты организма от факторов окружающей среды. При проведении исследований на цитологический статус клеток буккального эпителия щек у детей, проживающих в изучаемых районах, выявлено, что у детей гг. Темиртау и Балхаша обнаружено повышение количества клеток с мелкокапельными включениями в цитоплазме. При сравнении результатов исследования у детского населения (гг. Темиртау, Балхаша, Абая) отмечено снижение количества клеток с мелкокапельными включениями в цитоплазме в 4 раза и повышение количества клеток с крупнокапельными включениями в цитоплазме на 78 %, с признаками кариорексиса на 74 %. Число безъядерных клеток снижено на 34 %, дегенерированных нейтрофильных лейкоцитов — в 3,9 раза. Наблюдается повышение количества амитоза на 50 % и снижение количества нормальных буккальных клеток на 71 %. Появление мелких и крупных включений в цитоплазме клеток подтверждает воздействие неблагоприятных факторов окружающей среды на организм детей, проживающих в промышленных регионах.

Ключевые слова: буккальный эпителий щек, детское население, неспецифическая резистентность организма.

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