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Effect of Sodium Chloride on Morphology Self-Organization of Saliva During Their Dehydratation

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Abstract
Background:
Biological fluids perform a wide range of vital functions of the vital activity of the human body. During the transition of a biological fluid to a solid phase, crystalline structures are formed to the morphotype which represents an integral picture of the interaction of its molecular and atomic composition in the liquid phase. At the same time, the complete loss of water by the test drop leads to the formation on the surface of a glass slide of the facies – the film, "a thin section of highly mobile non-cellular tissue, on which a pattern of mutual action of biological fluid elements is fixed". In the process of self-organization during wedge-shaped or marginal dehydration of biological fluids, the specific structures of its molecules form local structures of the supramolecular level, which are available for visual analysis. Studying the processes of structuring bioliquids samples and their mixtures with solutions of its individual components (salts, proteins) allows optimizing its capabilities and developing a new methodological approach to studying the morphological analysis of biofluids and allows developing criteria and diagnostic algorithms, identifying markers of various physiological states of the human body, which determines their relevance. *The purpose of the research:* to research the peculiarities of the process of structurization of a drying drop of saliva of healthy people during their phase transition from a liquid to a solid state, as well as the effect on them of the amount of crystallization initiators – sodium chloride of physiological concentration.

Methods:
In our studies, we used the technique proposed by Zakharova, Yanov, and Shabalyn, based on morphological research, including determining the total structuring time, the length of the structuring front path during wedge-shaped dehydration of a biological fluid, and as an integral criterion for evaluating the process, the structuration rate determined by the formula $\upsilon = \Delta V/\Delta t$, where ΔV is the Amount of lost evaporation of a liquid in the process of liquid separation; Δt is the time required for evaporation of a certain amount of biological fluid, corresponding to the evaporation of free water. The method of wedge-shaped dehydration is as follows: a non-fat glass slide, located strictly horizontally, is applied a drop of the test liquid in a volume of 0.02 ml. The diameter of the drop is 5-7 mm. Then the drop is dried at a temperature of 20-25° C and with a minimum humidity of the surrounding air. When drying the drop is kept motionless. The drying pattern of the drop is observed continuously using an optical microscope at a magnification of from three to ten, respectively, and recorded using an integrated digital video camera. Entering images into a computer is carried out through a standard USB interface. The magnification of the microscope is selected so that the entire surface of the drop is placed in the field of view. The depth of field does not exceed 0.2 mm, which made it possible to consistently visualize the flow patterns near the free surface of the drop. A microscope with samples is placed in an isolated room to reduce the effects of air convection currents.
The objects of the research. We studied the dynamic parameters of the drying process of a drop of samples of biological fluid on a standard slide using the wedge-shaped dehydration method: The temporal and concentration characteristics of the formation of self-organizing morphology of model samples – drops of biofluid consisting of saliva and sodium chloride (physiological concentration (0.9%) were studied in different volume ratios, namely: saliva; 0.5 sputum + 0.5 NaCl; 0.25 saliva + 0.75 NaCl; 0.75 saliva + 0.25 NaCl and only NaCl solution.

Results:
In the process of wedge-shaped dehydration of biological fluid, the formation of structures of the solid phase occurs according to the laws of self-organization. At the same time, the drying process of a biological fluid goes through specific stages, in the direction from the periphery to the center of the drop, after which certain structures are formed. The main key stages of the formation of the structures of the solid phase of biological fluids are the formation of the main pattern of the facies during the evaporation of free water, including: the formation on the periphery of a drop of an annular film of a dried protein in the peripheral edge zone; cracking of the dried drop with the formation of arcade edge structures and radial cracks with the advent of sectors; the formation of transverse cracks with the formation of separate; the formation of the final pattern of the facies during the evaporation of bound water.

Conclusions:
It has been established that, in the presence of wedge-shaped dehydration of salt, as owners of more powerful osmotic forces, it is crystallized in the central zone of a drop of biological fluid, and the protein components form the peripheral amorphous zone.

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