

FLUORESCENCE SPECTROSCOPY USAGE POSSIBILITIES FOR THE LABORATORY RATS METABOLISM EVALUATION

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Tissue metabolic processes estimation and evaluation is a modern direction in the scientific research practice. For this purpose a fluorescence spectroscopy (FS) method was applied because of its high sensitivity and non-invasive diagnostics of the tissue oxygen metabolism [1-2]. The aim of the work was to find informative points (areas) on the rat skin for tissue oxygenation processes dynamics.

The research was conducted with the LAKK-M system usage (SPE “LAZMA” Ltd, Russia) with a measuring channel of FS at a wavelength of 532 nm. The points of the rat body were selected on the right thigh and at the base of the tail, because at these points the vessels are closest to the surface of the skin. Moreover, the mechanical interference of the optical probe from the movement and breathing of the rat and, as a result of preliminary studies, the noise on the fluorescence spectra are almost absent.

The work was made on 100-120 g Wistar rats (n=5) in according with the principles of good laboratory practice (GLP-GOST, 2014). The animals were held in quarantine for 2 weeks with temperature, humidity, bacterial contamination and day-night cycle control conditions. During the experiment, the rats were anesthetized with Zoletil 100 (Vibrac, France) in standard dosages. At the first stage, the fluorescence spectra were recorded for two hours with 10 min intervals. At the second stage, the following parameters were analyzed: the intensity of the fluorescence signal ($I_f(\lambda_f)$) at the fluorescence wavelength and the maximum intensity of the laser radiation ($I_{laser}(\lambda_e)$) scattered in the tissue. At the final stage, the transcutaneous index of substance fluorescence or simply the fluorescence index ($\eta(\lambda_f, \lambda_e)$) [3] were calculated for taking into account the different optical density of the tissues by means of normalization to the backscattered source signal.

As a result, the fluorescence intensity at the point on the thigh was 35.9 ± 12.6 a.u., at the base of the tail point – 74.7 ± 38.1 a.u. The fluorescence index at the point on the thigh was 0.36 ± 0.07 a.u., at the point at the base of the tail was 0.44 ± 0.1 a.u. The dynamics of these parameters are presented in Fig. 1.

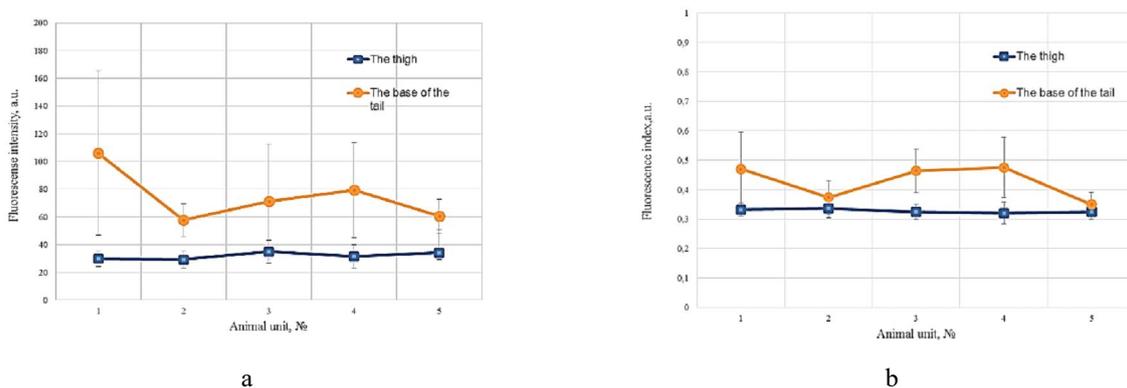


Fig.1: The dynamics of the fluorescence intensity (a) and the fluorescence index (b) for each animal unit

The range of parameters in the fluorescence intensity analysis at the point on the thigh was 14-30%, in the base of the tail – 20-58%; the range of the fluorescence index on the thigh it was 6-13%, at the point at the base of the tail – 12-27%. Thus, the evaluation of the parameters of the maximum intensity and the fluorescence index showed that the point on the thigh of the skin is optimal for the given tissue metabolic processes research using the FS method according to the scatter criterion (coefficient of variation).

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