

Dosed physical activity effect over metabolic saliva status in untrained men

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Abstract:

The simple and verified methods for diagnosing the state of metabolic status in a person performing physical activity development and testing remains an urgent problem. *Purpose:* to study the effect of regular aerobic physical activity on untrained men's crystallogenic properties of saliva. *Materials and methods.* Description of the metabolic status of the body was carried out using the method of analysis of saliva crystallographic fractions. Biological material was collected from men attending physical education classes on the basis of a sports and recreation complex. Saliva was taken twice – before and after 6 months of doing sports. The subjects' age ranged from 40 to 60 years. The project participants had no acute and chronic pathology, as well as contraindications to physical education and sports. The subjects were not professional athletes. The crystallogenic activity of saliva was evaluated using a number of quantitative criteria included in the methodology of classical crystalloscopy. *Results.* Significant changes in the crystalloscopic pattern were recorded in comparison with the baseline level. A marked decrease in the destruction of facies, an increase in the number of complex crystalline elements, regular faults appearance, etc. were found. The revealed shifts in the crystallogenic activity of saliva may indicate the optimization of the component composition and physical-chemical properties of this biological fluid under the graduated exercise influence. *Conclusions.* The results obtained in the research project can be used in the practice of physical education and sports to diagnose the state of physical fitness and in planning the training process.

Key Words: Physical activity, physical training, Crystalloscopic patterns (facies), saliva diagnostics, physical loading.

Introduction

It is known that regular dosed aerobic physical training can improve the state of the metabolic system of the body (Kolokoltsev et al., 2021; Moghetti et al., 2016; Kolomiets et al., 2017). An important role is played by the selection of the optimal training regime for people of different ages with different levels of physical capabilities and health (Lucas de Albuquerque Freire et al., 2020; Chiriac Paul Bogdan et al., 2021).

The rate of metabolic processes in the body is one of the main indicators of human physiological health. In this regard, correction of oxidative stress in the antioxidant system is possible through the use of personalized physical training (Amap et al., 2018; Tummala et al., 2018; Vahdatahar et al., 2021). At the moment, there are a small number of research works that consider the peculiarities of people's engaged in physical culture the metabolic profile (Nobari et al., 2021). Most often, to assess the metabolic potential, researchers consider biochemical blood parameters (Siti Baitul Mukarromah et al., 2021) and hormonal status (Saad et al., 2020; Foretic et al., 2020). However, the presented assessment methods are invasive and insufficiently indicative. In this regard, it is of great interest to create and develop innovative diagnostic technologies of body fluids allowing monitoring the metabolic status of people engaged in physical training on a regular basis (Lindsey et al., 2017). In this case, one of the research methods may be the crystalloscopic method of studying the metabolic status (Jordanishvili, 2019). Salivadiagnostics has been proposed, which makes it possible to study various parameters of mixed saliva (Papakostas et al., 2011; Hayes et al., 2015; Rutherford-Markvik et al., 2017; Vakhdatakhar et al., 2021).

The study of the physico-chemical characteristics of the biological media crystallization in the human body is used to assess its potential (Jordanishvili, 2019; Martusevich et al., 2022). Using the methods of classical

crystalloscopy used in the evaluation of saliva, it is possible to obtain sufficiently informative data on the state of the human body (Kokornachik et al., 2021; Martusevich et al., 2022). Thus, salivadiagnostics is a more convenient alternative way of testing the effect of physical activity on the parameters of oxidative stress, metabolic shifts, etc. (Marconi et al., 2007; Reneker et al., 2018; Vahdatahar et al., 2021). In our previous scientific papers, the phenomenon of crystallogenesis of professional athletes' saliva was considered in detail, but for the most complete dynamic analysis of the transformational abilities of the biocrystallome of the body, additional studies concerning people of different ages who are not athletes but perform regular physical activity are necessary (Martusevich et al., 2021, 2022).

Purpose. Studying the effect of regular aerobic physical activity on untrained men's crystallogenic properties of saliva.

Material & methods

The research project involved 46 men aged 40 to 60 (48.7 ± 1.9), who had no contraindications for performing physical activities. For 6 months 3 times a week for 2 hours men performed aerobic exercise on the basis of sports facilities. Prior to the research project, all men did not perform regular training loads. Salivary fluid was examined twice: at the beginning and at the end of the project. Before taking saliva, patients washed their mouth twice with distilled water, after which they spat into clean, dry test tubes. The research did not include individuals who had oral diseases.

The crystallogenic activity of men's saliva was studied in the laboratory by classical crystalloscopy by drying 100 ml of biological fluid on a slide under standard conditions (temperature – 20-22°C, humidity – 35-50%). The results of dehydration structuring were analyzed by microscopy at low magnification (x60) 24 hours after applying saliva to the slide. Crystalloscopic patterns (facies) were recorded in the form of photographic images obtained using a built-in camera in a Levenhuk microscope. The following parameters were used as criteria for evaluating crystalloscopic facies: crystallizability (Cr), degree of facies destruction (FDD), structural index (SI) and the severity of the marginal zone (MZ), which indicates the presence of protein in the biological fluid. The integral facies index (FIP) was calculated by summing the values of the presented characteristics, which gives an overall assessment of the crystallogenic properties of saliva (Martusevich et al., 2021, 2022).

All men gave written consent to participate in the research, which does not contradict the principles of the Helsinki Declaration of 2008 in the field of biomedical observations.

The methods of variational statistics in the Statistica 6.1 software package were used. According to the nature of the distribution of the trait, the Kraskal-Wallace H-criterion was used to assess the statistical significance of the differences.

Results

In 6 months after the start of the research project, it was found that the regular performance of dosed physical activity by men had a significant impact on the crystallogenic properties of saliva. A significant quantitative parameter characterizing the ability of a biological fluid to dehydration structuring is the crystallizability index, which indicates the density of crystalline elements in the facies, Figure 1.

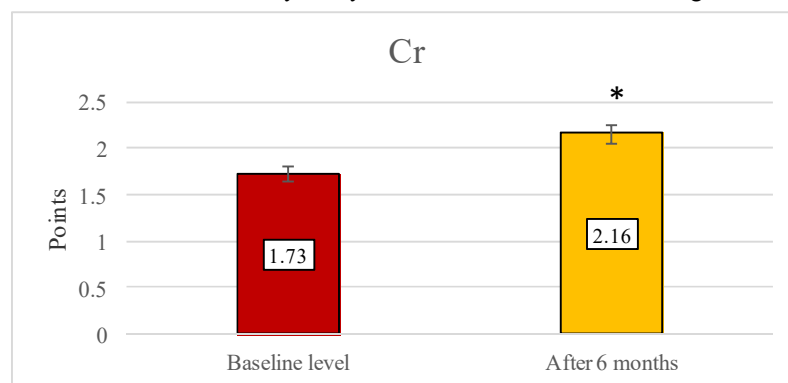


Fig. 1. Dynamics of crystallizability in facias of saliva specimens before and after 6-month individual physical exercises (* - differences to baseline level are statically valued, $p < 0.05$)

It was revealed that after a six-month cycle of physical activity, the indicator under consideration increases by 24.9% relative to the initial level (from 1.73 to 2.16 points), $p < 0.05$. It indicates an increase in the crystallogenic potential of the men's in the formed group saliva.

The second semi-quantitative criterion of the crystallogenic activity of biological fluid, which characterizes the complexity of the structure of the elements of the dried microslide, is the saliva structural index, Figure 2.

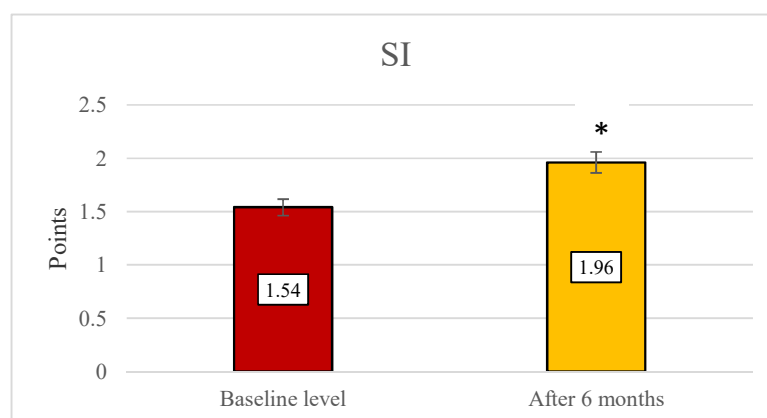


Fig. 2. Dynamics of structure index in facias of saliva specimens before and after 6-month individual physical exercises (* - differences to baseline level are statically valued, $p < 0.05$)

It was found that the involvement of initially untrained people in a cycle of 6-month regular training contributes to an increase in the structural index by 27.3% compared to the value of the indicator that took place before the start of the dosed physical activity course, $p < 0.05$. It should be noted that this trend is associated with changes in crystallizability in saliva facies induced by the general factor under consideration. In general, shifts in crystallizability and the structural index indicate a significant increase in the crystallogenic potential of the biological fluid under study, which, in our opinion, can be regarded as positive changes.

It was revealed that conducting a long course of aerobic physical training has a beneficial effect on the degree of facies destruction, significantly reducing it by 42.4% (from 1.68 to 1.18 points), $p < 0.05$, Figure 3.

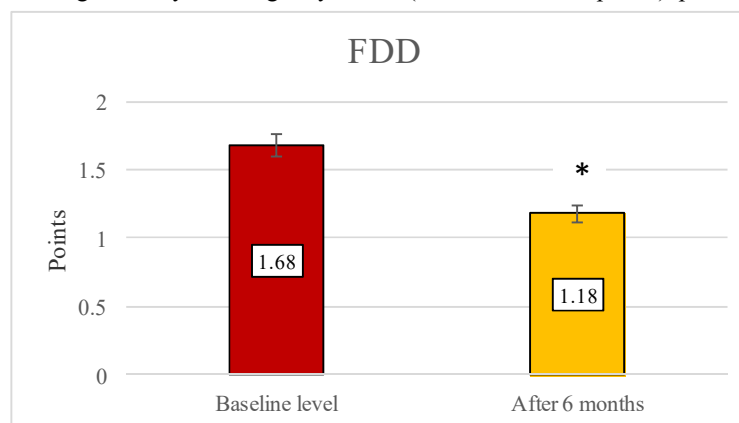


Fig. 3. Dynamics of facia destruction degree in driedsaliva specimens before and after 6-month individual physical exercises (* - differences to baseline level are statically valued, $p < 0.05$)

The main measurable indicator of the crystallogenic activity of saliva samples is the severity of the dried microslides' marginal zone, indirectly indicating the state of the biological medium proteome, Figure 4.

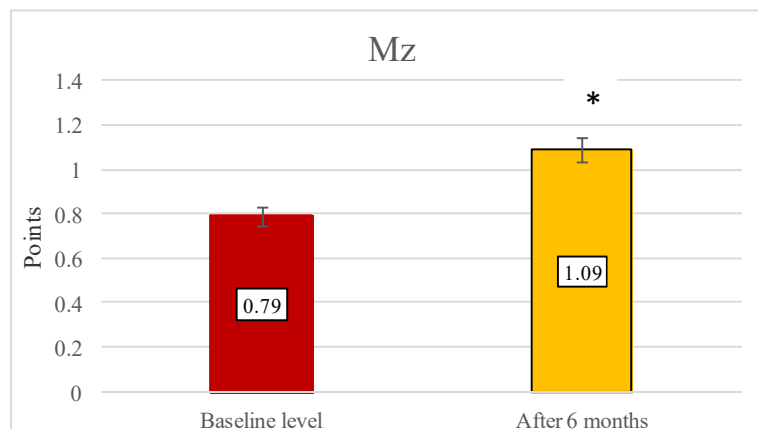


Fig. 4. Dynamics of clarity of marginal zone in facias of saliva specimens before and after 6-month individual physical exercises (* - differences to baseline level are statically valued, $p < 0.05$)

It was found that after the completion of a six-month regular physical training cycle, there was an expansion of the marginal zone radius by 38.0% (from 0.79 to 1.09 points), $p < 0.05$, which indicates an increase in the relative number of proteins of the individuals' in the formed group native structure and conformation in the samples of the biological fluid. Consequently, such shifts in crystallogenic activity can be considered as positive.

To obtain integral information about the examined persons' crystallogenic activity of saliva, we calculated the integral facies index, which integrates the contribution of all the above-mentioned main evaluation indicators, Figure 5.

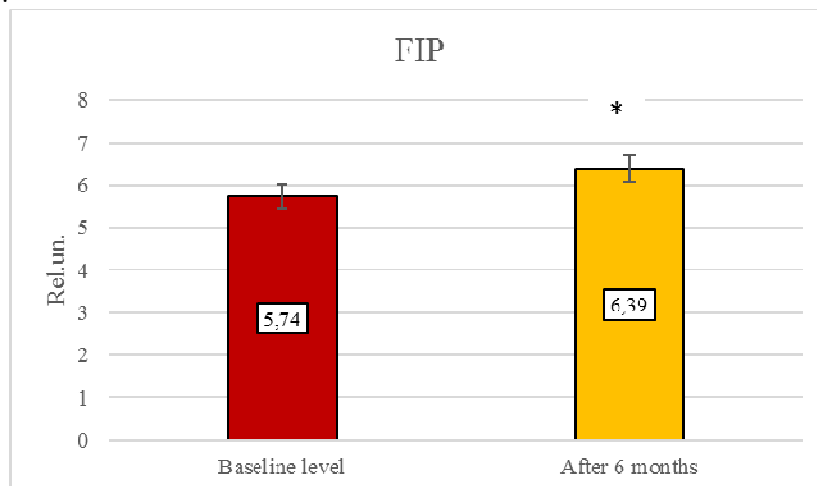


Fig. 5. Dynamics of facia integral parameter in dried saliva specimens before and after 6-month individual physical exercises (* - differences to baseline level are statically valued, $p < 0.05$)

According to its calculation structure, the increase in this indicator shows the optimization of the component composition and physical-chemical properties of the biological fluid, while the decrease indicates negative metabolic shifts in it. It was found that at the end of the 6-month period of physical training, there is a statistically significant increase in the level of the integral facies index in dried saliva microslides by 11.3% relative to the initial values, $p < 0.05$, which indicates a positive effect of the selected physical activity regime on the functional and metabolic status of men in the formed group.

Dicussion

It is known that oxidative metabolism, being a universal acceptor of a wide range of endogenous and exogenous influences (Reneker, 2018), reacts sensitively to changes in the motor activity mode of an individual (Moggetti et al., 2016). At the same time, the intensity, duration and type of physical activity directly determine the result of this modulating influence (Papacosta, & Nassis, 2011). If the physiological limits of metabolic adaptation are reached in response to physical loading, manifestations of oxidative stress are formed and progressed in biological fluids and tissues – an uncompensated imbalance in the intensity of free radical processes and the capabilities of enzyme and non-enzyme antioxidant systems (Kolomiets et al., 2017; Margonis et al., 2007). These metabolic disturbances are transmitted through histohematic barriers, being transported, among other things, into mixed saliva, which leads to significant shifts in its composition and physical-chemical parameters (Hayes et al., 2015; Lindsay et al., 2017). One of the methods of integral evaluation of the latter is biocrystalloscopic analysis (Kokornaczyk et al., 2021; Martusevich et al., 2022), which was used by us in this research.

The methodology of the biocrystalline test made it possible to monitor the saliva composition of men who started regular physical training for the first time and completed a course lasting 6 months. The obtained results indicated a positive effect of training loads on the crystallogenic activity of the biological fluid under consideration, which included an increase in its crystallogenic ability (according to the dynamics of crystallizability and the structural index), a decrease in the degree of facies destruction and an increase in the proportion of protein macromolecules that retained their native structure and conformation. It is consistent with the data on metabolic rearrangements in saliva observed in our previous research works performed in professional athletes (Martusevich et al., 2021; Martusevich et al., 2022) and the results of other authors (Jordanishvili, 2019).

We have previously shown that the integral facies index is the most universal, integrally characterizes the balance of the component composition of the biological fluid by mineral and organic compounds, the local microenvironment of salt crystallogenesis, etc. From these positions, shifts in the degree of destruction of saliva facies associated with the appearance of regular physical training in men lead to optimization of the organic-mineral composition of the biological fluid relative to the initial human condition. Our data confirm the results of other researchers' observations concerning positive changes in the crystallogenic properties of salivary fluid

under the influence of physical activity (Hayes et al., 2015; Lindsay et al., 2017). Knowledge of the regularities of the changes dynamics in saliva crystallizability can be used in physical culture and sports practice to diagnose the state of physical fitness of various population groups and to assess the educational and training process in persons engaged in physical culture or sports.

Conclusions

Analysis of the high-stakes research results of the salivary fluid crystallogenic properties under the influence of aerobic exercise after 6 months in untrained men indicates significant changes in the metabolic state of saliva. At the end of the research project, an increase in the crystallogenic potential of the oral fluid by 24.9%, a pronounced decrease in the destruction of facies by 42.4%, an expansion of the radius of the marginal zone by 38.0%, the appearance of regular fractures, an increase in the level of the integral facies index in dried saliva microslides by 11.3%, relative to the initial values. The revealed shifts in the crystallogenic activity of saliva may indicate the optimization of the component composition and physical-chemical properties of this biological fluid under the influence of dosed aerobic exercise.

The results obtained can be used in physical culture and sports practice as a method of diagnosing the level of persons' performing physical activity physical fitness.

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Conflicts of interest. The authors declare no conflict of interest.

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