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Functional Features of the Digestive System in Retired Athletes

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Abstract--- *According to many researchers, the abrupt cessation of motor activity in athletes can be considered as a stress factor for the body, which accordingly leads to disorganization and disruption of all functional systems. The paper presents the results of a study on functioning of the retired wrestlers' digestive system and discusses the findings concerning the digestive conveyor functioning in a state of muscle rest in former wrestlers as compared to their peers who are not engaged in sports activities. Our research materials show that the retired athletes' digestive system functioning is characterized by severe inhibition of gastric acid juice secretion in basal secretion, as well as acid-forming and enzyme excretory functions in basal and stimulated digestive tract secretion. These factors result in a decrease in proteolysis. The peak drop in reactivity and the level of total proteolytic activity in former athletes is most likely caused by a decrease in the level of physical activities. It was revealed that the stage of finishing with a sports career or as we call it "post-sport ontogeny" can be referred to as a critical period of the former athlete's life from the standpoint of the digestive system functioning, which manifests itself in the inhibition of the main indicators of the gastric glands. Undoubtedly, the presented results of this series of studies require further research, since the period of the subsequent lifestyle of former athletes is quite long.*

Keywords--- *Ex-athletes, Sports Career-ending Stage, Digestive System, Indicators of Gastric Secretion.*

I. INTRODUCTION

At the present stage of world sports development, characterized by ever-increasing training volumes and intensity, sometimes on the verge of an athlete's capabilities, the issues of identifying the state of functioning of various body systems and restoring performance as a result of the mobilization of morpho-functional adaptive capabilities are the researchers' primary task in the field of natural sciences (1, 2, 3).

In particular, the issues of functioning of the digestive glands of current athletes are of theoretical and practical interest; solution of these issues can affect the process of adaptive alterations in the body to the systematic effects of physical activities and help develop a balanced diet (4, 5, 6, 7, 8, 9).

However, the experimental data of almost all studies on the presented problem cover the "sport ontogeny" stage and only in a few works the researchers emphasize the importance of considering the issues and various complications that arise in highly qualified athletes after ending their sports career, that is, at the "post-sport ontogeny" stage (10). Proceeding from the above, the following **hypothesis** was put forward in our study: it was assumed that the study of the peculiarities of the ex-wrestlers' digestive system functioning will reveal significant

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differences in comparison to the digestive tract activity in adult males who were previously not professionally engaged in any sport.

The purpose of this research was to study the features of the digestive system functioning in retired wrestlers and adult men who previously were not professionally engaged in any kind of sports activity.

To achieve the purpose of our research, we considered the following tasks:

1. To study the absolute and relative indicators of the volume of basal and stimulated gastric secretions in retired wrestlers and in adult males previously not professionally engaged in any sport in a comparative aspect.
2. To study the absolute and relative indicators of the HCl discharge per hour in basal and stimulated gastric secretions in retired wrestlers, and in adult males who were not professionally engaged in any kind of sporting activity in a comparative aspect.
3. To study the absolute and relative indicators of the pepsinogen discharge per hour in basal and stimulated gastric secretions in retired wrestlers, and in adult men previously not professionally engaged in any kind of sports activity in a comparative aspect.
4. To study the absolute and relative indicators of the total proteolytic activity of basal and stimulated gastric secretions in retired wrestlers, and in adult males who were not professionally engaged in any kind of sports activity in a comparative aspect.

II. LITERATURE REVIEW

Unfortunately, according to many scholars, sports gastroenterology is still one of the least studied types of age-related gastroenterology of the ascending ontogenesis period.

But it is precisely the digestive tract that plays a particularly important role in replenishing and distributing the energy and plastic losses of the athlete's body in the process of adaptive alterations in response to muscle load (11, 12, 13, 14, 15, 16, 17).

Long lasting studies of the influence of sports on the athletes' digestive system indicators indisputably present evidence of close dependence of the digestive conveyor functions on the level of motor activity.

Findings of Russian scholars in the field of age-related sports gastroenterology show that as a result of motor activity bidirectional shifts can be observed in the secretory function of the active athletes' digestive tract:

- Hyperfunction – in long-distance runners, cyclists, and skiers;
- Hypofunction – in wrestlers and boxers.

The direction and level of the occurring shifts in the secretory function (according to the same authors) depend on the kind of sports, sports qualifications, training experience and the age of the sportsmen (4, 10, 11, 18, 19).

The results of the studies on functioning of the digestive conveyor in wrestlers over the entire period of their training and competitive activities (that is, the sport ontogeny stage) indicate a tendency toward hypofunction of the gastric glands, which is considered to be a derivative of reduced gastric reactivity to nerve and submaximal chemical

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stimuli. In turn, the response of the digestive glands to muscle load can be considered a variable that is available for correction.

The origin of reduced reactivity and hypofunction of wrestlers' digestive glands is influenced by many components related to the specifics of the training and competitive activities of judo wrestlers. These include: working in an anaerobic power mode, a large proportion of static stresses and efforts in the presence of pain sense modality, intense water-salt metabolism (associated with weight loss) and, as a result, specific endocrine shifts.

In all the above studies, active athletes of various sports specializations and qualifications, as well as of different ages, are represented as trial subjects.

However, recently many researchers have emphasized the need to consider various problems that arise for high-class athletes who finished with their sports career. This period is seen as a crisis in the lives of athletes, for many years leading a "Spartan" lifestyle associated with the strict sports regimen, social status, and so on.

Carrier ending in sports changes their usual way of life and can have the most serious and drastic consequences for a person. Ex-athletes are experiencing serious difficulties in adapting to unfamiliar real life and quite often cannot find suitable activities for themselves.

In Russian publications on the psychology of sports, many problems are considered related to the selection of methods for psychological assistance, the creation of psychological and pedagogical conditions for social adaptation for ex-athletes, and so on (20, 21, 22).

Despite the relevance of this problem, there has been very little research on this topic, and this problem has not been sufficiently addressed in sports literature.

As for the issues of the functioning of the athlete's body systems at the career-ending stage, there are practically no fundamental studies in this area.

However, in the body of an athlete who, for a sufficiently long sports career, was able to adapt to maximum muscle loads, alterations occur in various functional systems of the body: the metabolic processes and the activity of cardiovascular and respiratory systems are improved; functioning of the endocrine apparatus is stabilized, and so on.

In other words, the more adapted the system to the effects of stress (in this case, the muscle load is a stress factor), the less changes occur in its activity (3, 23, 24). In particular, the major part of studies is devoted to the impact of continuous muscle load on the functional state of the digestive tract, which manifests itself as a stress factor. As a result, the indicators of the gastric secretory apparatus and endocrine shifts are corrected.

A sharp cessation of muscle loads can also be considered as another stress factor for the body, which accordingly leads to disorganization and disruption of all functional systems: severe alterations may be suffered by the musculoskeletal system, cardiovascular, endocrine, digestive systems of ex-athletes that were accustomed to function in conditions of a serious muscular activity.

Despite the relevance, the issues concerning the impact of cessation of wrestlers' training and competitive activity on the digestive system indicators have not been studied in fact. Stating the above, it becomes quite relevant

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to study the functioning of the gastric glands in athletes after their sports career-ending, that is, in the post-sport ontogeny period (25, 26).

III. MATERIALS AND METHODS

Based on the tasks set in our study, we selected two groups of trial subjects as a cohort.

Group No. 1 was composed of 18 wrestlers aged 25-30 years, who ceased their training activities, and by this time already had sports categories ranging from a candidate master of sports to master of sports.

Group No. 2 was considered by us as a control one and consisted of 16 adult men aged 25-30 years who had previously not been professionally engaged in any kind of sports activity.

The study was conducted in the format of the Ethics Committee requirements – all subjects took part in the study with their written voluntary consent.

To study the functional state of the digestive glands, we used the method of fractional gastric intubation as one of the most acceptable physiological methods for studying the secretory activity of the gastrointestinal tract. The intubation was conducted in our study in the resting state.

The gastric glands were irritated (stimulated) with a 10% broth of cabbage juice in a volume of 200 ml, which in its composition is similar to the foods used in everyday life and, in turn, is an effective stimulator of the neurohumoral production phase.

In our study, the following indicators of gastric secretion at rest were considered: the volume of gastric juice, the hydrochloric acid discharge per hour, the pepsinogen discharge per hour and proteolysis – total proteolytic activity (TPA). All these parameters were studied in the basal and stimulated phases of secretion.

We examined all the data in both absolute and relative terms, that is, in equivalent to a kilogram of the athletes' body weight. Such a recalculation is necessary to compare the absolute and relative indicators of the data, since the significance level of the compared results increases.

IV. RESULTS

This series of trials involved ex-wrestlers and untrained volunteers.

As a result of the analysis of the findings, we can state that when comparing the absolute indices of gastric secretion in ex- wrestlers and the control group subjects, significant differences are observed ($p < 0.01$-0.05).

The data obtained give us reason to believe that the production of gastric glands in ex-athletes continues to proceed as a hypofunction. All four digestive gland indicators considered by us in the Group 1 subjects have lower values as compared to the indicators of the control group subjects (Group 2).

V. DISCUSSION

Analyzing the results obtained, it can be noted that in the former athletes the absolute indices of the basal gastric secretion volume (47.27 ± 3.15 ml) significantly ($p<0.05$) differ and are almost by 2.5 times lower than the same indicator (103.76 ± 8.81 ml) in the individuals not going in for sports. These results once again confirm that the

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production of gastric glands in terms of basal secretion continues to proceed as a hypofunction. A completely different picture is observed when analyzing the indicator of stimulated gastric secretion volume. In this case, the results of the former athletes (97.30±9.45 ml) and the representatives of the control group (106.58 ± 8.25 ml) did not significantly differ from each other ($p>0.05$).

The response of the indicator of the gastric juice volume in stimulated secretion to a submaximal stimulator in ex-wrestlers approaches the same indicator in individuals who do not engage in sports.

In our opinion, this type of adaptation of the gastric glands is most likely explained by the specifics of wrestling as a kind of sports activity.

Analyzing the results obtained in terms of acid formation, we observe a continuing tendency to hypofunction of the digestive glands in the retired wrestlers.

The rates of HCl discharge per hour in basal gastric secretion (127.54±10.13 mg/h) and HCl discharge per hour in stimulated secretion of the control group subjects (168.91±14.1 mg/h) are significantly higher ($p<0.01$) than the same indicators for ex-wrestlers (9.83±0.78 mg/h and 44.51±3.31 mg/h, respectively).

It should be noted that there is the largest shift in the direction of inhibition (by more than 10 times) in the indicator of basal acid formation in former athletes as compared to the control group subjects.

When analyzing the enzyme excretory function of the digestive tract conveyor, it can be seen that the pepsinogen discharge per hour in the basal gastric secretion in the former athletes (4.13±0.31 mg/h) is by 7.5 times lower as compared to their peers who are not engaged in any sport (31.37±2.11 mg/h) and this difference is significant at ($p<0.01$).

The enzymatic excretory function in terms of the pepsinogen discharge per hour in the stimulated secretion is also significantly lower in ex-athletes (15.33±0.12) than in the control group subjects (29.01±2.02 mg/h) at $p<0.05$.

However, in this case, the response of this indicator to a submaximal stimulus is slightly calmer and only by 1.7 times lower than the same indicator in people who are not engaged in sports.

Considering the TPA, it is observed that in former athletes, the absolute values significantly ($p<0.01$) differ from the results in persons who do not go in for sports. Moreover, both in the basal (4.44±0.57 mg/h) and in the stimulated secretion (8.35±0.84 mg/h), the proteolysis rate is approximately by 4-5 times lower in the former wrestlers compared to the control group subjects (21.93±0.74 mg/h and 36.22±0.91 mg /h, respectively).

When considering all of the above indicators of gastric secretion in relative terms, that is, in equivalent to a kilogram of the subjects' body weight in both groups compared, an increase in the significance of the compared indicators was noted (in many cases, up to $p<0.001$).

All of the aforesaid is more clearly demonstrated by our calculated indicators of the ex-athletes' gastric secretion, expressed as a percentage, in comparison to the similar indicators of the control group subjects (Figure 1).

If we take indicators of the gastric secretion of people who are not engaged in sports for 100% (the background value), the picture will look as follows.

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In the former athletes, indicators of the secret volume make up 49.5% of the background value in the basal secret and 90.4% of the background value in the stimulated secret;

- The HCl discharge per hour indicators make 7.7% of the background value in the basal secret and 26.5% of the background value in the stimulated secret, respectively;
- The pepsinogen discharge per hour indicators are 13.3% of the background value in the basal secret and 55.6% of the background value in the stimulated secret, respectively;
- The indicators of total proteolytic activity (TPA) make 20.2% of the background value in the basal secretion and 23.0% of the background value in the stimulated secretion, respectively.

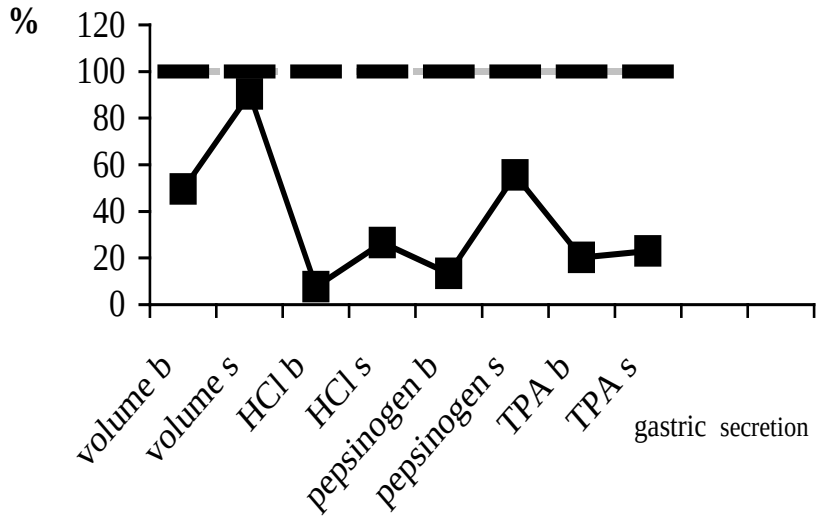

Figure 1: The Ex-athletes' Gastric Secretion Indicators, Expressed as a Percentage, as Compared to the Similar Indicators of the Control Group Subjects

Based on the data obtained, it can be stated that in athletes who ceased their training and competitive activity, we revealed a sharp secretion inhibition in the basal secret, and in the rate of the HCl and pepsinogen discharge per hour in the basal and stimulated secret. The total effect of these indicators, in turn, entailed a peak decrease in the total proteolytic activity of gastric juice.

VI. Conclusion

It is obvious from our findings that ex-athletes have the lowest reactivity of gastric secretion and, accordingly, the level of proteolysis. It should be noted that in this age range the reactivity of the gastric glands and the level of total proteolytic activity decrease in people who are not engaged in sports.

However, due to a smoother decrease, the digestive secretion indicators in individuals who do not go in for sports are significantly higher. The revealed peak drop in reactivity and the TPA level in the former athletes is a consequence of the cessation of training and competitive activity, that is, a sharp decrease in the level of muscle load.

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As a result of the studies, it is interesting to state the fact of the restoration of correlation between the indicators that were absent in and adolescence and early adulthood.

In particular, against the background of the sports career ending in former wrestlers the correlations between the subjects' body weight and the gastric secretion volume are restored ($r=+0.58 – +0.64$; $p<0.05$); between the body weight and the indicator of total proteolytic activity ($r=+0.49 – +0.50$; $p<0.05$).

In our opinion, this can be explained by the fact that former athletes ceased forcedly waste their weight in a steam bath due to the lack of competitive activities in their lives.

Thus, the career ending stage or as we call it "post-sport ontogeny" can be safely called a critical period in the former athlete's life from the standpoint of the digestive system functioning, which manifests itself in the inhibition of the main indicators of the gastric glands.

Undoubtedly, the presented results of this series of studies need further research, since the period of the subsequent lifestyle of the former athletes is quite long.

The revealed peak drop in reactivity and the level of total proteolytic activity in the ex-wrestlers suggests the necessary opportunity to integrate into the complex process of proteolysis using fairly simple means. These include adequate dosing of muscle load, adequate alternation of the number of thermal procedures when visiting a steam bath, and an adequate selection of the temperature regime in this case.

In general, our study prompts a simple truth to the sports educators and coaches: the successful fulfilment of tasks in their professional activities is impossible without reliance on scholars' research in the field of sports physiology, sports gastroenterology and sports medicine.

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