

# Structural and functional characteristics of stress resistance in sports amid coronavirus disease 2019 pandemic

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The aim of this study was to carry out a comparative analysis of the effectiveness of coping strategies among female track-and-field students of the first-third study years with different aggressiveness levels on the back of the coronavirus disease 2019-provoked self-isolation. The total sample of respondents comprised 360 female students majoring in Physical Education and Sports. All of them were enrolled in an online survey using the Anxiety, Frustration, Aggressiveness, and Rigidity methodology and Coping Orientation to Problems Experienced inventory. The study revealed that first-year students with high levels of aggressiveness focused on emotions and their expression under stress more often than first-years with moderate aggressiveness levels. Similarly, an increased concentration on negative emotions display was inherent to respondents of the second study year. The transition from the first to the third study year was marked with consolidation and strength-

ening of negative coping strategies used by female track-and-field athletes. This represents one of the central reasons for the deterioration of their psycho-emotional state during the quarantine. The most widely applied stress response tactics of female students of all 3 study years were associated with positive thinking, active coping, and planning ( $P \leq 0.05$  with other coping strategies). Resort to psychoactive substances was noted less frequently ( $P \leq 0.01$  with other strategies). As for the emotional component, increased attention to emotions' expression and seeking of instrumental and emotional support were also chosen relatively often. The problematic issue needs further investigation in order to analyze whether stressful conditions persist or have decreased.


**Keywords:** Aggressiveness, Athletes, Coping strategies, COVID-19, Self-isolation

## INTRODUCTION

As is well known, stress is a result of two central stimulants: changes in physiological processes and changes in the psyche (Bryce et al., 2019). Initially, the body's response to stress has a protective effect when it adapts to drastically changed conditions (Stranges et al., 2012). By resisting a stressful situation, the body overcomes it and adapts to new circumstances. As such, a stressful situation does not necessarily entail any negative consequences. Short-term stress usually facilitates attention concentration, improves cogni-

tive processes, raises endurance, and contributes to a better manifestation of other characteristics of physical strength (Clemente-Suárez et al., 2020). Negative effects can only be expected in the case of long-term stressful impact since the body simply becomes "worn-out" (McKenzie, 2012; Samaranayake et al., 2014). From this it follows that the main prerequisite for successful adaptation is for the stress not to exceed the adaptive potential of the organism.

An ongoing global pandemic of coronavirus disease 2019 (COVID-19) that has been frightening the world for the last 2 years has completely changed the way we live. Its dreadful consequenc-

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es have led a growing number of people to experience stress, depression, and anxiety (Zhai et al., 2020). To a large extent, these feelings are caused by severe quarantine restrictions – distance learning, reduced contacts, inability to go outside without a good reason, and forced self-isolation (Clemente-Suárez et al., 2020).

As indicated in a wide range of scientific sources, athletes are among the most vulnerable to stressful situations groups of people. Constant mental pressure related to professional activity may provoke certain behavioral shifts, in particular, disorganization (Zhai et al., 2020). Such behavior is especially unfavorable for team sports. As a rule, athletes experience stresses associated with upcoming competitions. The strength of this stress effect is largely connected with individual characteristics of one's psyche, sociability level, and intensity of physiological processes (Ghrouz et al., 2019).

When it comes to the body's response to stress, the endocrine system is the first line of defense against its physiological effects. However, as has been previously reported in the literature, its reaction (pain, fear, fatigue, etc.) does not have a pronounced dependence on the stress type (Saleh et al., 2017). The intensive work of the endocrine system provokes the release of numerous hormones, first of all, steroids starting a sequential chain in the cardiovascular system (increase in heart rate, pulse), in the respiratory system (increase in the rate of breathing), and in the general kinematics of movements, which become then less accurate and efficient (Cui et al., 2021). At the level of the psyche, this is accompanied by worsened control over one's conduct, expressed in more complicated concentration and less adequate decisions (Fuentes-García et al., 2020).

A thorough literature review shows that there are two types of stress in terms of duration. The first type covers stress factors with a short-term impact. They are associated with the feeling of fear that may arise before a meeting with a strong competitor or performing a difficult or traumatic exercise, fear of injury while doing the exercise, fear of inability to hold the maximum pace of the exercise, and fear of defeat. The second group consists of long-term stress factors. They refer to the same fear of failure but are rather associated with team interaction (e.g., in motorsport), fatigue stemming from the monotonous and long performance of strenuous exercises, and various rivalry and competitive activity aspects (Litwick-Kaminska and Izdebski, 2016). Apart from the already mentioned long-term stress factors, the COVID-19 has provoked the emergence of several new of them. First and foremost, this relates to isolation. During the pandemic outbreak, it has become the dominant stress-forming factor affecting the mental stability of

athletes worldwide (Reardon et al., 2020). The reason for this is that competitions, if held, are now taking place exceptionally without fans and spectators. On top of this, the ban on attending public events has extended to sports training, which, in the face of a severe lockdown, became possible only at home, thereby complicating athletes' lives and careers.

To date, there have been several extensive studies on stress resistance of athletes in the context of COVID-19. Thus, a joint 2020 investigation involving specialists from Russia, Spain, Lithuania, Romania, Poland, Slovakia, Iran, and Indonesia, analyzed strategies for coping with stress during the pandemic (Makarowski et al., 2020). While before the outbreak, this research enrolled 781 athletes, in the very its midst, their number grew to already 1,032 individuals, some of whom (396 people) were engaged in martial arts. In sum, this work revealed that ways of coping with pandemic stress differ across males and females. Hence, the dominant strategy for men was reported as self-blame, whereas women preferred the tactics of avoidance. At the same time, it turned out that martial arts athletes showed less stress during the pandemic compared to its onset. Despite somehow differing results obtained for both sexes, gender differences did not affect the denial or acceptance of the fact of a pandemic, the use of stress-reducing psychoactive substances, or emotional release significantly.

Similar research was conducted in 2,020 among 57 professionals taking part in preparation for the Olympics and 54 students of physical education studying by correspondence (Szczypińska et al., 2021). It was found that both categories of respondents coped with stress using cognitive and behavioral survival tactics. In the meantime, the gender factor turned out to be less critical than the strategy used to overcome stress, whereas the consistency of planning and specific actions were regarded as the main factors ensuring success in sports.

Not less fruitful was a study based on an online survey of 526 French elite athletes (Pété et al., 2022). Its authors investigated the levels of stress (anxiety, depression) as well as the strategies to counteract them in isolation. They found that athletes tend to use four ways to overcome the difficulties associated with quarantine. Some coped with problems (including mental ones) on their own, some used a strategy of interest, others, on the contrary, avoided any news about the pandemic, and the rest took an active social position. In sum, as reported by the study authors, the least stress-resistant group was represented by respondents taken the strategy of avoidance – they reported high levels of anxiety and an inability to cope with mental problems.

Given the data above, one can state with certainty that the

COVID-19 pandemic has severe implications for the majority of athletes, both from mental and career perspectives (Tayech et al., 2020). Despite extensive research on gender differences among young sports performers (students majoring in Physical Education and Sports) in terms of pandemic perception, the dependence between their age and mental health is still covered scantily (Mehrsafar et al., 2020). At the same time, such studies are deemed necessary since students of physical education specialties represent the elite of the future sport, and it is crucial to have an idea of the state of their psyche and ways of coping with stress in extreme conditions. Precisely this represents the subject of the present work. Research authors suggest that students may use different strategies to deal with the effects of stress depending on the aggressiveness level.

The ultimate goal of this study is to carry out a comparative analysis of the effectiveness of coping strategies in physical culture and sports female students with different aggressiveness levels amid the COVID-19-related self-isolation. Its fulfillment presupposes the achievement of the following objectives: (a) Determine the levels of aggressiveness among female students of different study years and possible variations in them during self-isolation. (b) Reveal what coping strategies are used by female students in stress conditions. (c) Compare the changes in the coping strategies chosen by the female students of different study years.

## MATERIALS AND METHODS

### Research materials

The study was conducted in Kazakhstan at the height of the COVID-19 in April–May 2020. The research was conducted in the conditions of the pandemic, in particular at its initial stage, when people did not understand how to function and implement the educational process, so their mental state was under stress. In such a manner, the stress associated with the preparation for exams was superimposed on the anxiety connected with the pandemic as the training was carried out remotely. The overall investigation was based on one of the physical culture universities in Almaty, the name of which was not disclosed for confidentiality purposes. The total research sample comprised 360 students of the first, second, and third study years, 120 students each. The average age of respondents was  $17.8 \pm 0.3$ ,  $18.6 \pm 0.4$ , and  $19.7 \pm 0.2$  years, respectively.

### Research design

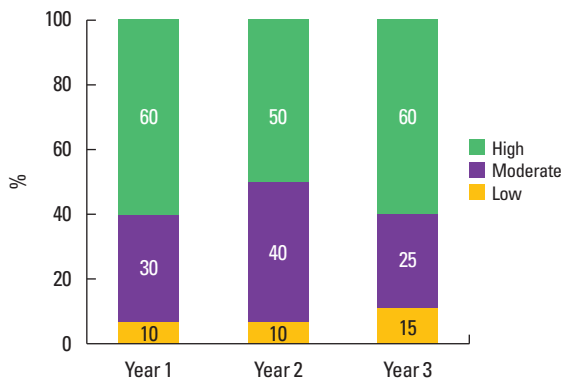
The paper did not aim to study the gender aspect as far as this issue is already studied to a sufficient degree, including in works

related to the effect of self-isolation on the mental health of male athletes (see Introduction). Since the problematic issue of the influence of self-isolation on the mental health of male athletes has already been sufficiently investigated in the works of other scientists, only female athletes were selected for the sample. Therefore, the sample of this research included only female respondents. All of them studied in the same specialty (Physical Education and Sports, Track-and-Field Athletics). The focus on one specialty was provoked by the fact that representatives of diverse sports fields, as shown by the example of athletes involved in martial arts, can react differently to pandemics and self-isolation. Hence, it was possible to obtain adequate results on a large sample, in our case, for the area of track-and-field.

### Research methods

All data collection was carried out remotely by polling through Google Forms. In case of the necessity to clarify any responses, communication was carried out via videoconferences on Skype. Within the present work, coping strategies were understood as conscious and unconscious manifestations designed to regulate the emotional processes of a particular individual. Basically, they are divided into internal (solving an internal problem, i.e., stress itself) and external ones (solving emotional experiences associated with stress) (Lazarus, 2006).

With the intention of finding out which strategies of counteracting stress among female students with different levels of aggressiveness are the most successful, the following approaches were used. The integrated Anxiety, Frustration, Aggressiveness, and Rigidity (AFAR) methodology was applied to measure how strongly the respondents' intrapsychic processes proceed and thus determine their aggressiveness and anxiety levels. All assessments were carried out according to the methodology's recommendations and scales. Apart from the AFAR, the study benefited from a Coping Orientation to Problems Experienced (COPE) inventory. This self-report questionnaire was used to evaluate the stress management degree. Its advantage over other analogs lies in the ability to outline not only coping strategies but also personal styles used for this purpose. In the present study, all the data obtained from this questionnaire were located on the abscissa axis in the form of the following factors: F1 - Positive thinking and the subsequent personality growth, F2 - Mental disengagement, F3 - Increased attention to emotions' expression, F4 - Seeking instrumental support, F5 - Active coping, F6 - Denial, F7 - Increased religiosity, F8 - Humor, F9 - Behavioral disengagement, F10 - Self-control by restraint, F11 - Seeking emotional support, F12 - Use of psy-



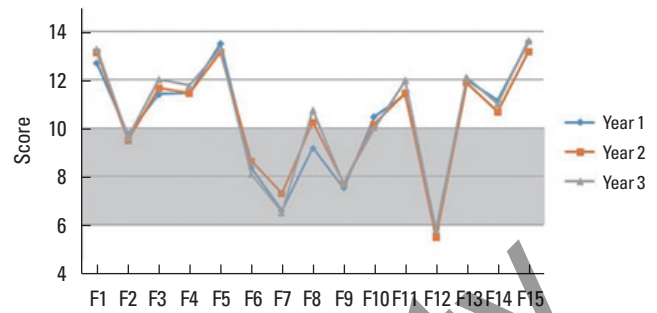
**Fig. 1.** Aggressiveness of female students during self-isolation (in %).

choactive substances (primarily sedatives), F13 - Acceptance, F14 - Suppression of competing activities, F15 - Planning.

According to the results of testing for aggressiveness, three groups of students were identified for each study year (Fig. 1). Fig. 1 shows that among all female students examined, groups with moderate and high aggressiveness levels prevailed ( $P \leq 0.01$  with low-aggressiveness groups of each of the study years). The group with low-aggressiveness levels was the least numerous and constituted from 10% to 15% of all respondents of one study year. In this regard, further analysis was carried out exclusively among female students with moderate and high aggressiveness levels. Another reason for excluding female students with a low level of aggressiveness from the analysis was that they keep in touch with society, family, friends, and, of course, with their personalities effectively. All these points made it possible to move female students with a low level of aggressiveness from the risk group.

### Ethical issues

The study complied with all international ethics and moral standards. It was fully anonymous and confidential, so the names of the participants and university were not disclosed. What is more, the process of conducting research was approved at a meeting of the Ethics Committee of Abai Kazakh National Pedagogical University (Protocol No. 6 of 13.10.2021). Informed consent was signed by participants. The examination enrolled only those respondents who gave oral and written consent to participate. Written consent was obtained in the form of a scanned document copy received by one of the authors by email. In the absence of written consent, the individual was not considered a research participant. Since the participants of the experiment were students who had reached the age of majority, they could sign the agreement to participate in the experiment themselves. Guardians or parents signed



**Fig. 2.** Strategies to cope with self-isolation caused stress used by physical culture and sports female students of first-third study years (the gray area corresponds to the norm). Hereinafter, for F denotation, see Materials and methods. F1 - positive thinking and the subsequent personality growth, F2 - mental disengagement, F3 - increased attention to emotions' expression, F4 - seeking instrumental support, F5 - active coping, F6 - denial, F7 - increased religiosity, F8 - humor, F9 - behavioral disengagement, F10 - self-control by restraint, F11 - seeking emotional support, F12 - use of psychoactive substances (primarily sedatives), F13 - acceptance, F14 - suppression of competing activities, F15 - planning.

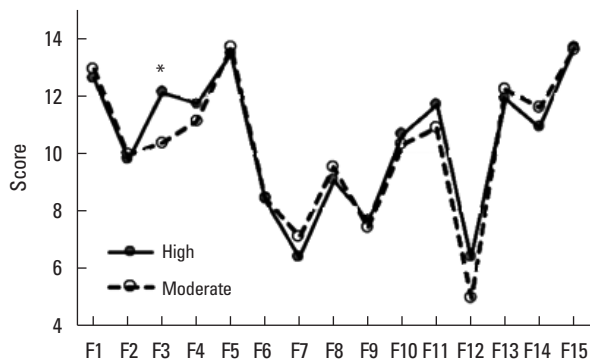
the agreement instead of students only if they were under 18 years of age.

### Statistical analysis

Statistical analysis was carried out by means of Statistica v. 7.0 (StatSoft ver. 7.0, StatSoft Inc., Tulsa, OK, USA). For this, the arithmetic mean and standard error were calculated. Since the data obtained did not correspond to the normal distribution, the nonparametric Mann-Whitney  $U$ -test was used. The least significant was considered the value of  $P \leq 0.05$ . Graphical presentation of research results was done in Microsoft Excel 2016 (Microsoft Inc., Redmond, WA, USA). Reliability of the questionnaire and questions for checking internal consistency is measured using Cronbach alpha and equals 0.93.

## RESULTS

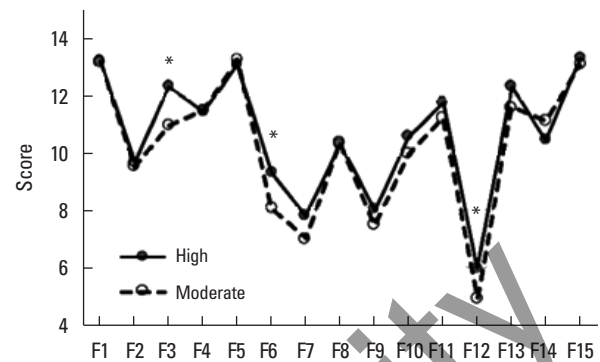
The analysis of the behavior models of female students in terms of the preferred stress coping strategies did not expose significant variations (Fig. 2). Nevertheless, it was possible to establish the main preferred strategies common to all 3 years of study. The most frequently chosen strategies by female students of all study years were F1, F5, and F15 ( $P \leq 0.05$  with other stress coping tactics). The least frequently chosen option was F12 ( $P \leq 0.01$  with other tactics). As for the emotional component, responses F3–4, F11 were also quite common. The appeal to the passive defense was reflected in the acceptance of the conditions dictated during the



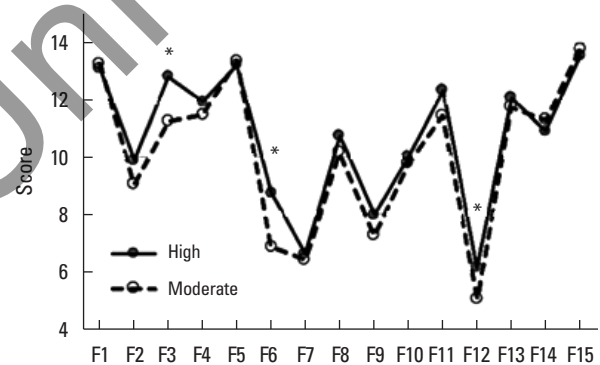
**Fig. 3.** Strategies to cope with self-isolation caused stress used by first-year physical culture and sports female students with different aggressiveness levels (significant differences are marked with an asterisk). F1 - positive thinking and the subsequent personality growth, F2 - mental disengagement, F3 - increased attention to emotions' expression, F4 - seeking instrumental support, F5 - active coping, F6 - denial, F7 - increased religiosity, F8 - humor, F9 - behavioral disengagement, F10 - self-control by restraint, F11 - seeking emotional support, F12 - use of psychoactive substances (primarily sedatives), F13 - acceptance, F14 - suppression of competing activities, F15 - planning.

tense situation created by the pandemic. On the other hand, the choice of this strategy could also be provoked by a relatively calm perception of crisis conditions. Comparison of the ways to cope with stress used by first-years unveiled their formal similarity with the generally used ones indicated in Fig. 2. Nevertheless, several differences were also revealed. Thus, first-year students with a high level of aggressiveness were significantly more often concentrated on emotions, as well as expressed them under stress, if compared with the group of respondents with moderate aggressiveness ( $Z = 679, P \leq 0.002, \alpha = 0.93$ ) (Fig. 3). Apparently, this is primarily associated with the excess of negative emotional reactions, which hardly ever lead to a positive outcome and more often contribute to the deterioration of the mental state of respondents.

By the end of the second study year, the list of top coping strategies somehow changed (Fig. 4). As shown by the conducted analysis, second-year female students with higher aggressiveness indicators are characterized by a more frequent focus on negative emotions and their severity (F3) than respondents with moderate aggressiveness ( $Z = 2,112, P = 0.005, \alpha = 0.93$ ). Not less interesting is the fact that the number of choices of F6 and F12 strategy options increased substantially as contrasted with the first-year respondents ( $Z = 2,122, P = 0.015, \alpha = 0.93$ ;  $Z = 2,244, P = 0.009, \alpha = 0.93$ ). The data collected for the third year of training in a physical culture demonstrate that female students with a high level of aggressiveness not only preserve but strengthen the stress-coping strategies already present (Fig. 5). As evidenced in the figure above, the F3 usage increases even more than ever before ( $Z =$



**Fig. 4.** Strategies to cope with self-isolation caused stress used by second-year physical culture and sports female students with different aggressiveness levels (significant differences are marked with an asterisk). F1 - positive thinking and the subsequent personality growth, F2 - mental disengagement, F3 - increased attention to emotions' expression, F4 - seeking instrumental support, F5 - active coping, F6 - denial, F7 - increased religiosity, F8 - humor, F9 - behavioral disengagement, F10 - self-control by restraint, F11 - seeking emotional support, F12 - use of psychoactive substances (primarily sedatives), F13 - acceptance, F14 - suppression of competing activities, F15 - planning.



**Fig. 5.** Strategies to cope with self-isolation caused stress used by third-year physical culture and sports female students with different aggressiveness levels (significant differences are marked with an asterisk). F1 - positive thinking and the subsequent personality growth, F2 - mental disengagement, F3 - increased attention to emotions' expression, F4 - seeking instrumental support, F5 - active coping, F6 - denial, F7 - increased religiosity, F8 - humor, F9 - behavioral disengagement, F10 - self-control by restraint, F11 - seeking emotional support, F12 - use of psychoactive substances (primarily sedatives), F13 - acceptance, F14 - suppression of competing activities, F15 - planning.

$1,566, P = 0.003, \alpha = 0.93$ ), which implies that this strategy further degrades mental health outcomes. Variants such as F6 ( $Z = 1,319, P = 0.002, \alpha = 0.93$ ) are chosen by third-years far more often than by second-years with similar levels of aggressiveness. In addition, a growing trend can be noticed in the use of psychoactive drugs (F12,  $Z = 1,788, P = 0.016, \alpha = 0.93$ ).

On that account, it can be confidently inferred that with time not only the consolidation of negative coping strategies occurs but

also their strengthening due to the addition of new tactics. In sum, this fact worsens the psycho-emotional state of female track-and-field athletes against the quarantine and self-isolation backdrop. The above conclusion particularly applies to female students with high aggressiveness levels and therefore entails that controlling aggressiveness, including in athletes, is of the utmost importance for overcoming stress.

## DISCUSSION

It is quite common that, when it comes to coping strategies, factors working at the individual level (mental or emotional ones) are taken into account on a first-priority basis (Pillay et al., 2020). As was shown in the present study using the example of isolation caused by the COVID-19 pandemic, not less significant role in shaping coping strategies can also be played by the situation itself. Long-term stressors can have a critical weight in shaping mental health problems. This is especially true of socially vulnerable groups of the population and people with health limitations (Begović, 2020). Notwithstanding that most athletes are in good health and shape due to their specialization, as some studies have shown, even a physically healthy (or practically healthy) person under the influence of COVID-19-related restrictions can have mental problems already 2-3 months after the quarantine onset. Therefore, research related to the impact of the pandemic on the mental health of athletes is of great relevance, especially in the light of the upcoming Olympics 2021.

According to the obtained findings, the conditions of self-isolation led to the formation of severe stress among respondents, mainly associated with communication only with close ones or through social networks and a completely unusual way of life and study. This facilitated the activation of various coping strategies, which determined the reactions of female students at the behavioral level. As evidenced by the examination outcomes, respondents' physical activity decreased dramatically as at home it is far from always possible to create conditions corresponding to a gym, and high-level training becomes less accessible. This fact also plays a part in the formation of a stressful situation. As a result, two processes superimposed on each other: on the one hand, negative coping strategies that intensified among third-year students, whereas, on the other, a notable drop in the number and quality of training sessions, which also affected their self-esteem. All this resulted in the fact that the sensitivity to stress has risen sharply.

Equally important is the fact that this research identified specific factors able to promote the dominance of negative coping strategies

over constructive ones, which, of course, contributes to the development of stress and a deterioration in the state of the psyche. These factors are largely consonant with similar studies on stress in different groups of respondents during the COVID-19 pandemic and incorporate the indicators of gender, age (in our case, these are different study years), as well as the degree of aggressiveness (Blakelock et al., 2019; Kuśnierz et al., 2020; Pillay et al., 2020).

In sum, it was found that first-years are characterized by tolerance towards their peers, adherence to established stereotypes and rules, as well as not clearly expressed motivation for the educational process. In the event of the development of these lines of behavior against the background of frustration processes, there is a manifestation of more aggressive reactions characteristic of track-and-field athletes of the second and third study years. This can be seen from the data obtained. While the strategy of increased attention to emotions' expression (F3) prevailed among the first-years, by the end of the second year of training, the tactics of avoiding the tense situation by denying (F6) as well as by using psychoactive substances (not only sedatives but also nicotine and alcohol) came to the fore. By the third study year, these tendencies only intensified. The obtained results corroborate with those received for individuals of non-sports specialties, i.e., within the framework of COPE, the general trend persists for all young people (Tomczak et al., 2013). In a similar fashion, for medical students, there is a predominance of overwork, compensation, and distraction (Eisenbarth, 2019). Overall, researchers believe that the prevalence of aggressiveness and emotions' relaxation and suppressing tactics are primarily associated with the poorly developed psycho-emotional sphere of students of this age. Eventually, in the case of increased aggressiveness, maladaptive changes in the personality architecture should be expected. The rise in aggressiveness leads to the inherent proneness to conflict. Thus, in the event of a pandemic, one should expect a combination of oppositely directed behaviors, including in athletes, e.g., humor and aggressiveness (that is, a sarcastic attitude towards others).

In our opinion, a decrease in aggressiveness can be achieved by improving constructive coping strategies associated primarily with self-improvement and attention switching (to reduce fatigue and focus on negative emotions). Similar studies certainly need to be continued. Their major directions are seen in studying senior female students' aggressiveness amid COVID-19 and then comparing the collected data with that for young males. Besides, not less advantageous will also be works on stress resistance of athletes of other specialties.

During the COVID-19 pandemic, the world has witnessed a unique event – all types of education, including physical, switched to distance learning. In this regard, the levels of students' aggressiveness have grown remarkably, and the higher the study year, the higher its level was recorded. The outlined research findings allow arguing that it was precisely the aggressiveness that became the reason for the choice of nonconstructive coping strategies by the students of physical culture specialties. These include the appeal to emotions, escape from reality, and the use of psychoactive substances. Among female students with a low level of aggressiveness, a constructive approach dominated. It incorporated planning, a sense of time as a given opportunity for self-improvement, and acceptance of the existing situation. The consequence of such a fundamental transformation in the educational process and the lack of the possibility of full-fledged training is an increase in aggressiveness and shift in corresponding coping strategies. Such long-term changes in the psyche may well end in a drop in the level of professionalism, sports results, and sports career success. Respondents of all 3 study years examined showed a preference for strategies F1, F5, and F15 (they got 13, 13.5, and 13.8 points, respectively). The minimum was scored by tactics F7 (6.4 points) and F12 (5.9 points). Even though F7 and F12 coping strategies were in the normal zone, F1, F5, and F15 exceeded them substantially.

It follows from this that when conducting this kind of research, it is necessary to pay attention to the level of aggressiveness and measures to reduce it since aggressiveness is a trigger mechanism for the formation and consolidation of negative coping strategies that give rise to increased stress and the formation of mental abnormalities during the COVID-19 pandemic, including among athletes.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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