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Research Article

**CATECHOLAMINE EXCRETION IN INDIVIDUALS  
ENGAGED IN EXTREME SPORTS****A.V. Izosimova\*, I.H. Vakhitov, T.L. Zefirov**Institute of Engineering, **Kazan Federal University**, 18 Kremlyovskaya street  
Kazan 420008, Russian Federation, Russia**Abstract:**

*The specific features of the excretion of catecholamines in parachutists at various stages of preparation for and after performing the jump have been studied. It was revealed that the beginners engaged in parachuting, i.e. parachutists inexperienced in jumps react with a significant release of epinephrine and cortisol before boarding during the jump. At the same time, the excretion of norepinephrine in these athletes under the same conditions does not change significantly in comparison with the initial data. Mass class parachutists, i.e. athletes having a certain experience in jumping during preparation for and in the process of the jump react with a significant release of epinephrine, cortisol and norepinephrine. At the same time, these athletes had significantly higher level of excreted norepinephrine than adrenaline and cortisol. Highly skilled parachutists (masters of sports and masters of sports of the international class) react with a significant release of only norepinephrine during the preparation for and performance of the jump. Consequently, the excretion of catecholamines in sportsmen regularly engaged in parachuting depends on the level of athletes' qualification. The higher the level of training of parachutists is, the less changes occur in the values of excretion of catecholamines.*

**Keywords:** *parachutists, systematic training, level of training, excretion, epinephrine, norepinephrine, cortisol.***Corresponding author:****A.V. Izosimova**Institute of Engineering,  
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## INTRODUCTION:

Parachuting has become the most popular type of sport in recent years. Parachuting engages a significant number of young people (high school age children, students and adults). It should be noted that the parachute sport specifies specific requirements for the sportsmen. Parachutists are usually not subject to any heavy muscular exercise. During the training, they do not perform heavy exercise, as in the case of other types of cyclic and acyclic sports. However, in preparation for the jump (starting from packing the parachute and ending with boarding on an aircraft), during the performance of the jump (when the human body experiences large positive overload in the process of free fall) and at landing, the sportsmen's body undergoes significant changes. Parachuting also requires to have certain psychological abilities. Parachuting has a different specificity as compared to the "land" sports [1, 2]. The main difference is in the impact of stress factors on the parachutist's body during jump, such as atmospheric pressure drops, acceleration, overload, motion sickness, etc. This type of sport imposes significant, specific requirements for the growing organism [2]. Most researchers in stressful situations draw attention to the level of released catecholamines. The level of excretion of catecholamines is one of the indicators of adaptive features of the organism to stressful situations [3, 5].

According to researchers, long-term parachuting causes significant changes in the activity of various organs and systems [1, 3, 4]. In this case, the specific features of the excretion of catecholamines in parachutists during systematic training in parachute jumps remain understudied.

**Objective** of this research was to study the excretion of catecholamines in athletes regularly going in for parachuting sport.

### Research tasks:

1. To study the excretion of catecholamines in athletes of various qualifications at various stages of preparation for a jump.
2. To analyze the excretion of catecholamines in parachutists after performing a parachute jump.

## RESEARCH METHODS:

Our experiments were conducted at the airport "Kurkachi", located near Kazan. The studies involved 65 athletes ranging from beginners to the masters of sports of international class. The beginners were young men participating in military field training at the paratroop club. This field training is held annually within the framework of military-patriotic work and organized by the Ministry of Youth, Sports and Tourism of the Republic of Tatarstan and the Republican sports and patriotic center "Patriot" together with the Russian Defense Sports and Techniques Organization (ROSTO) (Voluntary Association for Assistance to Army, Air Force and Navy) of the

Republic of Tatarstan. These guys had little experience in jumping with a parachute.

The competitive sportsmen, masters of sports and masters of sports of international class were the athletes participating in competitions in parachute jumping in the Russian championship.

Quantitative determination of epinephrine, norepinephrine and cortisol in the urine was performed by HPLC with electrochemical detection (chromatograph Shimadzu LC-20AD with an electrochemical detector ECD DECADE II).

## RESEARCH RESULTS AND THEIR ANALYSIS

According to our data, the greatest changes in epinephrine values of the adolescents were recorded before boarding the aircraft and after landing. At the same time, the epinephrine values after the jump with a parachute were significantly higher (Table 1). An increase in epinephrine in adolescents after landing exceeded twofold the excretion of epinephrine before boarding the aircraft. Thus, beginners taking up parachuting, i.e. athletes aged 16-17 years inexperienced in parachute jumping react with a significant epinephrine excretion before boarding the aircraft (preparation for the jump) and during the jump itself.

Qualified parachutists (class 1, 2, 3) react with less epinephrine excretion than beginners. At the same time, of the dischargers, the epinephrine values in the experiences parachutists after the jump were significantly higher than those in the beginners. Thus, the values of epinephrine in beginners and experienced parachutists after the jump were  $38.7 \pm 1.7$   $\mu\text{g/day}$  and  $48.0 \pm 1.9$   $\mu\text{g/day}$ , respectively. The epinephrine excretion in professional parachutists, i.e. masters of sports and masters of sports of the international class, does not change as compared with the initial data before boarding the aircraft and after landing. Thus, it can be argued that as the level of the parachutist's training increases, the values of epinephrine excretion before and after the jump decrease significantly as compared with the initial data. The least reaction of epinephrine excretion before and after the jump was in the masters of sports of international class. Whereas the athletes lacking the experience in jumping had epinephrine values reaching their maximum already before boarding the aircraft ( $37.7 \pm 1.3$   $\mu\text{g/day}$ ) and remaining at this high level after the jump ( $38.7 \pm 1.7$   $\mu\text{g/day}$ ). At the same time, mass class athletes and masters of sports had significant increase in epinephrine values only after the jump.

We also analyzed the values of norepinephrine in urine. As a result of our research, as the training level of parachutists increases, the release of norepinephrine before boarding the aircraft and after the jump increases too. At the same time, the most pronounced increase in norepinephrine excretion was observed in the qualified

parachutists, where the values of norepinephrine before boarding the aircraft and after landing were  $53.4 \pm 1.9$   $\mu\text{g/day}$  and  $40.7 \pm 1.9$   $\mu\text{g/day}$ , respectively. The values of norepinephrine in masters of sports and masters of sports of international class before boarding the aircraft and after the jump were  $47.4 \pm 1.1$   $\mu\text{g/day}$  and  $36.5 \pm 1.7$   $\mu\text{g/day}$ . Beginners taking up parachuting, i.e. athletes aged 16-17 years, had the values of norepinephrine before boarding the aircraft and after the jump equal to  $27.5 \pm 1.7$   $\mu\text{g/day}$  and  $18.9 \pm 1.7$   $\mu\text{g/day}$ , respectively. Comparing the amount of excreted epinephrine and norepinephrine at various stages of preparation for a jump in athletes of different training level, we revealed the following features:

- Beginners taking up parachuting, i.e. athletes inexperienced in parachute jumping, have the greatest changes in epinephrine excretion before boarding the aircraft and after landing. The values of epinephrine after the jump with a parachute were significantly higher. For example, if the epinephrine values before boarding the aircraft increased 2.0 times in comparison with the initial data, then during the jump they increased 2.1 times. At the same time, the values of norepinephrine before boarding the aircraft and after the jump do not reliably change in comparison with the initial data. Therefore, beginners taking up parachuting, i.e. athletes aged 16-17 years, react with a significant adrenaline excretion before boarding the aircraft and during the jump itself. While the values of norepinephrine do not change significantly.

- Qualified parachutists react with a greater release of norepinephrine than epinephrine before boarding the aircraft and during the jump itself. For example, if before boarding the aircraft the epinephrine values of these athletes increased 1.9 times as compared with the initial data, then the values of norepinephrine increased 2.4 times.

- The epinephrine excretion in professional parachutists, i.e. masters of sports and masters of sports of the international class, does not change as compared with the initial data before boarding the aircraft and after landing. The values of norepinephrine before boarding the aircraft and during the jump increase 1.9 and 1.5 times, respectively.

Thus, it can be argued that as the level of parachutists' training increases, the body of athletes reacts more with the excretion of norepinephrine to stimuli, such as boarding the aircraft and the jumping itself. While athletes taking up parachute sport react more with the release of epinephrine.

Analysis of the cortisol values of parachutists at various stages of preparation for the jump and during the jump itself showed certain specific features. Significant changes in the cortisol values are observed in qualified parachutists. These athletes had significantly higher level of cortisol before boarding the aircraft and after the jump, as compared with all the surveyed groups of parachutists. The values of cortisol reached their maximum values - 34-38  $\mu\text{g/day}$ . The level of cortisol excretion in the beginners was also high before boarding the aircraft and immediately after the jump. However, in comparison with qualified parachutists, the beginners had a bit lower values of cortisol (28-30  $\mu\text{g/day}$ ).

The cortisol values in masters of sports and masters of sports of the international class did not change significantly before boarding the aircraft and after landing as compared with the initial data, and remained at the level of nearly 17-18  $\mu\text{g/day}$ . Therefore, the greatest changes in the values of cortisol before boarding the aircraft and after the jump are observed in the qualified parachutists. (Table 1).

**Table 1: Changes in epinephrine (E), norepinephrine (NE) and cortisol excretion in parachutists.**

Test group	n (qty)	Age	In the morning, on the day of jump ( $\mu\text{g/day}$ )			Before boarding the aircraft ( $\mu\text{g/day}$ )			After the jump ( $\mu\text{g/day}$ )		
			E epinephrine	NE norepinephrine	C cortisol	E epinephrine	NE norepinephrine	C cortisol	E epinephrine	NE norepinephrine	C cortisol
Beginners	17	16-17	17.7 $\pm 1.4$	24.5 $\pm 1.8$	19.9 $\pm 1.9$	35.7 $\pm 1.3^*$	27.5 $\pm 1.7$	28.5 $\pm 2.1^*$	38.7 $\pm 1.7$	18.9 $\pm 1.7^*$	31.4 $\pm 2.3$
Qualified parachutists	21	20-22	15.4 $\pm 1.7$	21.7 $\pm 2.1$	21.4 $\pm 1.8$	29.7 $\pm 1.9^*$	53.4 $\pm 1.9^*$	34.7 $\pm 1.7^*$	48.0 $\pm 1.9^*$	40.7 $\pm 1.9^*$	38.4 $\pm 2.1$
Masters of sports, masters of sports of international qualification	27	24-35	14.3 $\pm 1.5$	23.9 $\pm 1.7$	17.7 $\pm 2.1$	18.7 $\pm 1.5$	47.4 $\pm 1.1^*$	19.6 $\pm 1.9$	16.7 $\pm 2.4$	36.5 $\pm 1.7^*$	18.5 $\pm 1.7$

\* – Reliable data as compared with the previous values ( $P \leq 0.05$ )

**CONCLUSION:**

Many researchers in stressful situations point to the need to study the level of excretion of catecholamines [1, 3, 5]. The level of excretion of catecholamines is one of the indicators of adaptive features of the organism to stressful situations. In our studies, we analyzed the content of adrenaline, norepinephrine and cortisol in the urine.

Studying the features of excretion of catecholamines in parachutists of various qualifications and at various stages of preparation for the jump and after it, we revealed certain peculiarities. For example, beginners, i.e. athletes aged 16-17 years, have increased epinephrine levels by 2.0 and 2.1 times before boarding the aircraft and during the jump as compared with the original data. The values of cortisol also increase by 1.4 and 1.5 times. At the same time, the values of norepinephrine do not substantially change in comparison with the initial data. Consequently, inexperienced parachutists react with a significant excretion of epinephrine and cortisol before boarding the aircraft and during the jump itself. In this case, the excretion of epinephrine is significantly higher than of cortisol. The release of norepinephrine under these conditions does not change significantly in comparison with the initial data.

The level of epinephrine in qualified parachutists before boarding the aircraft rises 1.9 times, which is somewhat lower than that of beginners. However, during the jump itself, the epinephrine values of these athletes increase 3.1 times as compared to the initial data, which is significantly higher than that of the beginners. The qualified parachutists, therefore, have significant increase in the epinephrine excretion during the jump itself. The release of cortisol in these athletes is also significantly higher as compared with the beginners. For example, if the beginners had increase in cortisol level before and during the jump by 1.4 and 1.5 times as compared with the initial data, then the qualified athletes had increase in the same hormone by 1.6 and 1.7 times, respectively. Here it should be noted that the qualified parachutists during the preparation for the jump and during the jump itself had significantly higher level of excreted norepinephrine than that in the beginners. If the qualified parachutists had increase in the values of norepinephrine during boarding the aircraft by 2.4 times in comparison with the initial data, then the beginners showed no significant changes in the values of norepinephrine. Consequently, the qualified parachutists react to physiological stimuli, such as preparation for the jump and the jump itself, with a significant increase in the released epinephrine, cortisol and norepinephrine. In this case, the release of norepinephrine was significantly higher than of epinephrine and cortisol. Therefore, when the values of epinephrine and cortisol during the

preparation for the jump increase by 1.9 and 1.7 times, the values of cortisol increase by 2.4 times.

Masters of sports and masters of sports of international class in parachuting showed no significant changes in the excretion of epinephrine and cortisol during boarding the aircraft and during the jump itself, as compared with the initial data. At the same time, the values of norepinephrine increased 1.9 and 1.5 times, respectively. Therefore, the highly qualified parachutists react with a significant release of norepinephrine during the preparation for the jump and during the jump itself. Consequently, the excretion of catecholamines in parachutists depends on the level of athletes' qualification. The higher the level of training of parachutists is, the less changes occur in the values of excretion of catecholamines.

**SUMMARY:**

1. The excretion of catecholamines in sportsmen regularly engaged in parachuting depends on the level of athletes' training. The higher the level of training of parachutists is, the less changes occur in the values of excretion of catecholamines.
2. The beginners taking up parachuting have the highest levels of excreted epinephrine and cortisol during the preparation for the jump and after jumping, while the level of norepinephrine excretion does not change significantly.
3. The highly qualified parachutists react with a significant release of norepinephrine only during the preparation for the jump and during the jump itself.

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