The Effect of Ritalin on the Concentration of Catecholamines and Blood Lactic Acid in Male Rats after an Exhaustive Session

Mohammad Esmaeil Afzalpour, Mohammadreza Yousefi, Keykhosrow Ahmadi, Mahnaz Omidi

1Associate professor, physical Education and sport Sciences Department, University of Birjand, Iran.
2Department of Physical Education and Sport Science, Ilam Branch, Islamic Azad University, Ilam, Iran
3Department of Physical Education, Ilam Branch, Islamic Azad University, Ilam, Iran

ABSTRACT

Background: Use of the Ritalin suggests that it is used to treat ADHD patients in order to increase catecholamine levels and increase thought and attention since decrease in catecholamine level is a major cause. Objective: Due to the increasing cases of drug abuse in the exercise and lack of awareness of the risks to athletes, the present study was conducted to investigate the effect of Ritalin on a male rat’s central nervous system (CNS) following a session of exhaustive activity. To do this, 60 male rats with a mean age of (3.5 months) and Weight (283 G), were divided into six groups: control group, training group without drug use, training group with 25% of the lethal dose 50 (LD50), training group with 50% of the LD50, training group with 75% of the LD50 and training group with full LD50. Each group according to their weight received the drug orally and after the effects appeared, they were put into the treadmill and run at a speed of 30 meters per minute until exhaustion. Following the exhaustion, the samples were taken out from the device and after anesthesia, the blood samples were taken from them. Results: Data was analyzed by ANOVA. Results showed that Ritalin increases the concentration of epinephrine (p=0.000), Norepinephrine (p=0.000), Dopamine (p=0.000) and lactic acid (p<0.000) Blood. Conclusion: On the whole, Ritalin accompanied by exercise increases the time of activity and postpone fatigue in the rats by increasing catecholamines and prevent their reabsorption.

INTRODUCTION

The notorious doping phenomenon and empowering drug abuse have inflicted the sports and in the recent years have been wronged the wholesome sports; negligent athletes are increasingly entrapped in these potential fatal complications. Sudden deaths in the sports fields are clear example of this bitter event as wrong information and attitude can be a great cause [1].

Using prohibited and restricted drugs and methods in order to enhance unauthorized artificial body fitness, is unethical and against fair play; not only can it be against the moral rules, but also it can compromise the athletes’ health seriously. Sports as constructive activity building personality and creative spirit, dedication, perseverance, persistence and self-discipline has its unique status [2, 3]. Results on the use of the Ritalin suggests that it is used to treat ADHD patients in order to increase catecholamine levels and increase thought and attention since decrease in catecholamine level is a major cause. There is no consensus regarding the effect of this drug on physical performance, but the research results show that the use of the drug in ADHD patients increases the focus, attention, planning and the ability to execute missions. Since the success of the athletic skills requires such factors, it is likely that Ritalin be effective in the sport activities [4].

In this regard, the results also showed that the use of Ritalin reduced the activities that involve speed and strength. Moreover, the drug increases resting heart beat rate and reduces the aerobic activity. Results also show that Ritalin can have positive effects on activities that may need attention, concentration, precision and organization and can have negative effects on aerobic activity, fast and explosive performances [5, 6, 7].

Athletes and coaches not knowing the risks and potentially fatal side effects of these drugs and the lack of scientific research conducted on animals in the country made researchers study the side effects on the rats. Therefore, the purpose of this research is to measure catecholamines and blood lactic acid of rats after
using stimulant Ritalin (methylphenidate) in different doses to advise athletes about the use of the material provided and the adverse effects of these drugs [8].

MATERIALS AND METHODS

Because of the restrictions on the use of human subjects in research due to the high doses of Ritalin and better control of experimental variables as well as the better study of independent variables, animals were used. The sample of this study consists of 60 male rats with a mean age of (3.5 months) and Weight (283 G). Experimental groups were divided into six groups:
1- control group,
2- training group with no drug treatment,
3- training group with 25% of the lethal dose 50 (LD50)
4- training group with 50% of the LD50
5- training group with 75% of the LD50
6- training group with full LD50.

Data for dependent were collected through post-test to measure dependent variables in this study and the effect of independent variables on the dependent variables in the experimental subjects were collected by the researchers.

To fulfill the objectives of the study each group according to their weight, received the drug orally and after the effects appeared, they were put into the treadmill and to run at a speed of 30 meters per minute until exhaustion. Following the exhaustion, the samples were taken out from the device and after anesthesia, the blood samples were taken from them to measure catecholamines and lactic acid.

SPSS software Versions 16 was used for data analysis. Than Kolmogorov-Smirnov test and Mauchly’s test were employed in order to determine the normality of data distribution and homogeneity of variances, respectively. It was determined that the research data are normal. Therefore, ANOVA test was used to investigate the significant changes in blood levels and Tukey follow-up test was used to examine the differences in the significance. Significance level was determined to be P < 0.05.

Results:

In order to test the hypothesis and compare catecholamine and lactic acid concentrations and duration of exercise in the control group, the training group, training with 25% LD50, training with 50% LD50, training with 75% LD50 and full-dose groups. one-way analysis of variance was used whose results are shown in graphs 1-5.

Graph 1: Epinephrine concentrations in groups (Ng/ml).
Graph 2: Norepinephrine concentration in groups (Ng/ml).

Graph 3: Dopamine concentration in groups (Ng/ml).

Graph 4: Lactic acid concentration (MilliMoles/liter).
According to the study, implementation of an exhaustive session with different doses of Ritalin made blood catecholamine concentrations rise in the rats and this is statistically significant. The results of the previous research on the subject confirm the results of this study [10, 11, 13, 14, 17, 20, 19, 9, 16].

The results obtained in this study indicate that Ritalin and other stimulant drugs of central nervous system stimulant delay fatigue, so that the athlete performs dangerously beyond their normal capacity; often athletes are unaware of the inability of the blood circulation and are brought to dangerous situations; this lack of information brings complications including cardiovascular collapse, high blood pressure responses, the risk of orthopedic injury, seizure, coma, stroke and at ultimately death [20].

The results of the performed analysis showed that the groups that have used Ritalin stimulant drugs, had a higher concentrations of catecholamines and lactic acid in the blood compared to the control group.

Comparing the groups who received the drug, with the exercise group not having received the drug, concentration of catecholamine and blood lactate were several times more than the exercise group. Results of the previous research confirmed this.

For the endurance athletes, the stimulant drugs being the leading doping agents, postpone fatigue and increase alertness and aggressive mode and a state of defiance. Martial athletes and boxers use the drug to multiply the violence against opponents. Despite increased lactic acid in the blood, stimulants cause athletes to continue their training long without fatigue sensation.

From other mechanisms of stimulant drug is that they can make subjects hurt themselves and others; in this research treated subjects were caged by the rest of the samples who were not receiving medication. the appearance of the drug manifestations after 15 to 30 minutes demonstrated by attacking and biting and injuring other animals; after this, they immediately were taken out of their cage and were placed in a separate cage and this time they turned out to bite and hurt themselves; of course this occurred in the communities with high doses from 50% LD50 to the full LD50. Subjects with 50% LD AND 75% LD were exhausted later, respectively.

It should be noted that the highest amount of blood were obtained from the control group who did not have any activity and the lowest levels, respectively, from the full dose LD50and the practice group.

Comparing the practice group activities with those of other groups that had received the drug, there was a high time difference; so it can be concluded that in the athletes using CNS stimulant drugs, the mechanism of action of drugs mimicking sympathetic stimulation (transmitting neural Neurons substrate) are indirectly causing the nerve to stimulate adrenergic, noradrenergic, dopaminergic, and by this to free epinephrine, norepinephrine and dopamine in synapses more than normal and remain with high concentration in there.

Stimuli stimulate the release of catecholamines at nerve endings and prevent their reabsorption into the nerve endings vesicles. This makes them concentrate several times more than normal in the spot. Moreover, stimuli prevent the release of monoamino oxidase and catechol-o-methyl transferase, two enzymes that can quickly destroy the nerve and the external environment; metabolism of catecholamines may lead to increased concentrations of them.

The stimuli increase the catecholamines in the cell environment; catecholamines are secreted into the blood and affect the alpha and beta receptors in the heart so that the heart rate goes up too much and cause the calcium pump in heart to fail and eventually makes the athlete suffer from tetanus or cardiac arrest.

Using stimulant drugs to enhance artificial body power is likely to cause irreversible side effects and athletes may lose their lives; or in the long run causes complications such as mental and physical drug
dependence, groundless illusions, neurological disorders, aggression, depression, myocardial infarction and stroke and... [18].

General conclusion:
Using nervous system stimulant drugs increases catecholamine concentrations and blood lactic acid. More, these drugs inhibit the aforementioned enzymes and prevent their re-absorption. These factors made subjects continue to operate for a long time without fatigue. This continuation can bring about serious dangers or even death.

REFERENCES