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Evaluation of hematuria in Iranian boxers and runners

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Abstract

To evaluate the incidence of hematuria (blood in the urine) in boxers and runners after the competition in the respective field. In this study 50 boxers having participated in the national championship or the Fajr International Tournament winning their way up to semi-finals with a mean age of 24.5+/-3 years, mean height of 172+/-15 cm and mean of weight 74.5+/-22 kg and 25 sprinters (100-400 m) with a mean age of 22.5 +/- 3 years, mean height of 169+/-6 cm and mean weight of 76+/-6 kg and 25 endurance runners (over 3000 m) with a mean age of 23.7+/- 2 years, mean height of 178+/-8 cm and 71.5+/- 6 kg, all participating in academic competitions and the Clubs Championship League, were selected as samples. Urine samples collected from subjects were evaluated using full urine analysis method (macroscopic using a tape and microscopic). In case the test result was positive and there was blood detected in the urine of any of samples, they were given rest for 72 hours and then the tests were repeated to differentiate cases of sports hematuria from pathological hematuria. These findings were evaluated using Excel and SPSS software and descriptive statistics and chi-squared method. The results showed that 27 of the boxers participating in this study have represented macroscopic and microscopic hematuria, but after a 72-hour rest, only four of them showed blood in the urine, and thus the likelihood of any pathological lesions in the kidney and urinary tract. Among the endurance runners in the first group test results indicate that there were 18 cases that tested positive for hematuria while in the retest this number reduced to five and among the sprinters in the first tats, there were 16 subjects with blood in the urine, next test, however, indicated two cases of hematuria. This study showed that 54% of boxers had a significant amount of blood in their urine which was seen more as hemoglobin which is a sign of successive blows and incidence of trauma to their bodies. After 72 hours rest, 8% of them still had signs of hematuria. 72% of long-distance runners in the first test had hematuria, but it was reduced to 20% after rest; and in sprinters 64% in the first test and only 8% had hematuria in the second test.

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Introduction

Hematuria or blood in the urine is normal something usual as the presence of 2-1 erythrocytes in a microscopic field of urine specimen is not considered a pathological symptom. The normal level of red blood cells in the urinary excretion is up to 2 million red blood cells per day. (Neviackas *et al.*, 1981) Hematuria is defined as the presence of 2 to 5 red blood cells per high-magnification microscopic field. (Clarkson, 2007).

Hematuria or the presence of blood in the urine of persons in a single urinalysis is a common problem that may be associated with menstruation in women, viral infection, allergies, exercises and mild injuries and trauma in either sex (Neviackas *et al.,* 1981; Kraus *et al.,* 1988).

Those who in 3 urinalyses in a row have more than 3 red blood cells in the urine, or more than 100 blood cells are observed in their urine at one test, should be classified as those with constant hematuria but studies indicate that only in 9.1% out of 1000 cases, there may be individuals with important urologic or renal lesions (Hochberg *et al.,* 2002).

Abarbanel, Bennett, Lask and co-workers found that the transition from rest to intense exercise can cause pathological changes in several organs, especially the urinary tract. Hematuria (macroscopic and microscopic) is one of the most common changes arising after physical activity. This phenomenon may occur in non-contact sports such as rowing, jogging or swimming or in high-impact sports such as or boxing and soccer or in other athletic activities. The underlying cause can be strikes and traumatic or non-traumatic. Trauma to the urinary tract or bladder due to repeated contact or pressure on the bladder posterior wall on the base of the bladder can cause vessel rupture and bleeding in urine (Castenfors, 1997; Cianflocco, 1992). Previous studies have shown that athletes, especially those with flexion and extension movements in the hip joint suffer hematuria more likely than others (Miller *et al.,* 1988).

A method of distinguishing sports or non-pathological hematuria from pathological hematuria is urine test repeated after 48-72 hours of active rest (Lindermann *et al.,* 1978; Jones *et al.,* 1997). Presence of blood in urine after rest can increase the possibility of pathological lesions and such athletes are required to seek further medical care (Cianflocco *et al.,* 1992).

In physical activities that entail repeated blows to the body and in fact moderate to severe trauma, there is the possibility of blood in the urine, except that the blood in urine of those who suffer from a trauma is hemoglobin; the proposed mechanism for the onset of hematuria in athletes, especially endurance runners and swimmers is the empty bladder and the abrasion of its layers against posterior trigone and consequently the incidence of microscopic bleeding in the bladder (Abarbanel *et al.,* 1990; Cesare *et al.,* 2005). Thus the evacuation of bladder at the beginning of exercise which is something quite normal and failure to discharge sufficient amount of urine produced by the kidneys, which is likely due to body dehydration or lack of knowledge of coaches and athletes as to how to consume water 1 hour before practice or competition could be considered one of the most significant causes of hematuria among athletes (Castenfors, 1997; Jones, 1997).

Most of the reports are related to the runner's hematuria; however, hematuria has been reported among hockey players, endurance skiers, boxers and cyclists. Studies show that 20% to 90% of marathon runners represent traces of blood in the urine after competition which may be visible and macroscopic or non-visible and microscopic (Hooshang *et al.,* 2007).

If hematuria is severe and sustained several injuries could be inflicted upon the kidneys. Most cases of hematuria associated with exercise do not result in serious injuries.

Exercise-induced hematuria differs from other conditions such as the presence of myoglobin

resulting in red or discolored urine and is known as March hemoglobinuria. In these two conditions there occurs secretion of hemoglobin and myoglobin and not all erythrocytes. Sports hematuria usually has a benign and self-control period, however, urinary tract diseases must be carefully examined (Parish, 1958).

There has been little research in Iran in to incidence of hematuria in athletes but a lot of research has been done in other countries. Some previous studies in the middle distance runners have examined the incidence and prevalence of hematuria. These runners were examined during competition and training season with the goal of determining what intensity or distance of running could tends to cause hematuria. 71% of the samples had hematuria. There were 32 cases of severe hematuria. Although 90% of runners had experienced hematuria at least once after physical activity, in runners with activity of more than 110% VO_2 max over 60-1500m and 1500-3000m distances, the highest prevalence of hematuria was seen after exercise, in all cases hematuria disappeared after 72 hours (Can[a], 2001; Kraus *et al.,* 1988).

Data of another study showed that hematuria would occur in both intense and prolonged running (Can[b], 2001). Falsty, Burke, Frederick and Ratring - 1983 as well Miller, Patte and Burgess - 1988, Portman - Matthew and De Planne - 1996 argue that positive result of urine test and occurrence of hematuria can be caused by exercise intensity and incidence of acidosis or reduced availability of sufficient blood to the kidneys. Injury or trauma to the bladder or kidneys and/or continued movement of legs in runners found by Blackluck - 1977 can also be among other causes of hematuria in athletes (Blacklock, 1977).

Miller et al report repeated blows against soles and Blackluck indicated that bladder trauma as the most common causes of hematuria in 10,000-meter runners (Blacklock, 1977; Miller *et al.,* 1988). Ichner - 1990 believes that the quantity of red blood cells in the urine depends on the total distance run by runners so hematuria can also be caused by increasing exercise. This was discovered through a general review by Jones and Venuehouse in 1997. (Jones *et al.,* 2001; Mercieri *et al.,* 2002).

Given the results of this research and the impact of hematuria on athletes' health it seems necessary to study the rate of hematuria in Iranian athletes and to determine its prevalence with view to identification of its causes as well as prevention.

This study aims in the first place to investigate the prevalence of hematuria (sporting and pathological) in 100 Iranian athletes and then to determine the case where there was the possibility of being pathological and medical care would be needed by repeating urine test after 72 hours of rest in subjects whose first tests were positive, They have.

Materials and methods

Subjects

The study population included all Iranian players in the two fields of boxing and track and field practicing in the national team, clubs and collegiate tournaments. The subjects of this study consist of 50 of the national teams boxers in the national championships and the International Fajr Cup in the semi-finals and finals and 25 endurance and cross country off-road (over 3000 meters) runners and 25 sprinters (100-400 m) who had been selected and briefed purposely after due coordination with the respective federations and coaches to form statistical samples. The reason why boxers were chosen as part of a research samples was the risk of injury from punch shots on their bodies on the one hand and the possibility of losing body weight by some others and to get rid of this lurking variable those boxers under weight control or weight loss were excluded. The choice of speed and endurance runners was aimed at examining the implied impact of distances traveled as well as running intensity and speed on the incidence of hematuria in them.

Methodology

This is a descriptive research with a scientific-comparative approach. It aims to study varying levels of hematuria or presence of more than 2 red blood cells in a microscopic field in the urine of Iranian athletes. The subjects were asked to cooperate with

sample takers after the semi-final and final matches in boxing competition at the club and college tournaments regardless of the results of their matches, and after completion of recovery and 5 to 10 minutes rest, deliver in presence of project partners at least 10 cubic centimeters of their urine in a sterile container.

Demographic characteristics of each sample were listed on the container labels and then the samples were transported to pathology lab in the fridge. Full urinalysis was performed using Reagent strips for urine test analysis and microscopic examination was also performed and the results were collected by researchers and associates. The subject with hematuria symptoms were advised to rest for at least 72 hours. The rest meant avoiding exercise, running and long walks, but doing everyday tasks was allowed for them. After 72 hours the subjects were again given urine tests. Urine samples were collected for laboratory analysis of blood in urine. Those without blood in urine in the second test, subjects were deemed healthy and thus represented sports hematuria, but those with hematuria again and after 72 hours of rest were identified as those with persistent and pathological hematuria and were referred to specialized centers for further laboratory examinations and medical care. In order to analyze statistically and explain the findings of this research taking into consideration its nature and to determine the degree of difference in hematuria in athletes descriptive statistics was used and to compare the results from the two stages of tests chi-square was used at a confidence level of $P<0.05$. Spss, Excel were the applications used in this study.

According to the initial results of the tests 27 boxers had hematuria while the endurance runners with 18 cases and sprinters with 16 cases of hematuria represented higher frequency than the boxers. In the second test following 72 hours of rest there were 4 among the boxers; 5 among endurance runners and 2 sprinters with hematuria. The frequency and percentages of the results are reflected in Tables 2 and 3.

Statistical analysis of this study which was done using comparison of means in unpaired statistical groups revealed that hematuria incidence is significantly ($P<0.05$) higher in endurance runners and sprinters groups than that of boxers. However, comparison of mean incidence of hematuria in the first tests despite the difference between the two groups of sprinters and endurance is not statistically significant. Comparison of positive hematuria in the first tests and after 72 hours of rest in each of the three groups and using the paired means test is significant. Comparison of mean positive cases of hematuria between sprinters and endurance runners in the second stage is significant with $P<0.05$. There was no significant difference between boxers and sprinters because despite 0.01 difference in the results it can not be considered significant, whereas the difference between the average positive hematuria in boxers and the endurance runners in the second stage tests was significant with $P<0.05$.

Discussion and conclusion

The results show a very high incidence of hematuria in Iranian athletes for which a variety of reasons can be considered due to differences in the type of physical activity in boxing and running. Full analysis of the urine of boxing samples revealed microscopic bleeding and very large number hemoglobin in their urine which differs from type and the percentage of incidence and prevalence hematuria in runners and these differences represent a major factor of the degree and type of hematuria in different sports and each must be examined. The prevalence rates of hematuria in endurance runners 72%, sprinters 64% and boxers 54% reflects indicate the impact the type of physical activities on causing the problem, while in the repeated tests performed on the subjects again there are the endurance runners with 27.7%, sprinters with 12/5% and boxers represent the last place with 13.5% which again indicate the obvious and significant differences between types of physical activity and the risk of pathological injuries to athletes.

Table 1. Demographic characteristics of the samples.

Sport name	Number of Subject	Height (cm)	Weight (kg)	Age (year)
Boxing	50	172 ± 15.5	74.5 ± 22	24.5 ± 3.9
Endurance Running	25	178 ± 8.3	72.5 ± 6.5	23.7 ± 2.2
Sprint	25	169 ± 6.5	76 ± 6.2	22.5 ± 3.1

Table 2. Results of the first Test (Immediately after the contest).

Sport name	Number	Positive Samples	Percent
Boxing	50	27	54%
Endurance	25	18	72%
Sprint	25	16	64%

Table 3. Results of the second test (after 72 hours of rest).

Sport name	Number	Positive Samples	Percent
Boxing	27	4	13.5%
Endurance	18	5	27.7%
Sprint	16	2	12.5%

The 27 positive tests out of 50 boxers in the first test indicates the high incidence and prevalence of hematuria in athletes in this high-impact sport during who suffer hemolytic during training or competition due to undergoing severe and moderate and recurrent blows and trauma. The findings are similar to those of Abarbanel and Benet who believe that the inflicted trauma or blows to the body, especially to the urinary tract and kidneys could cause hematuria (Abarbanel *et al.,* 1990). But in this research the only sign that guide the researcher and the associates to the main cause of incidence of hematuria in boxers which is probably the occurrence of traumatic injuries resulting from the blows, was a large number of hemoglobin in the urine. In 18 of 27 cases who were positive in the first test, the presence of large amounts of hemoglobin was indicative of inflicting blows to the bodies of the boxers as a main reason for the incidence of hematuria. While in runners the numbers were respectively 3 out of 18 in endurance runners and 4 out of 16 in sprinters. These findings are in agreement with the results of Miller et al who consider repeated blows inflicted on their feet to be the main cause hematuria incidence in runners, although the etiologic study of these phenomena, requires more accurate tests and clinical studies (Miller *et al.,* 1988; Jacobs *et al.,* 1986; Weight *et al.,* 1992). Given the existing yet insignificant differences between the positive samples in endurance runners with 18 cases and sprinters with 16 cases, these results are consistent with the findings of another researcher who showed in controlled and laboratory studies that the risk of hematuria is identical in both sprinters and endurance runners (Bergstein *et al.,* 2005; Parekh *et al.,* 2002). Nevertheless the results can not be associated with the findings of other researchers believes that the volume of red blood cells in the urine of runners has a positive and significant correlation with the total distance the run. Because Ithese studies focus on training sessions, but this study was conducted during a single contest and in fact the sprinter was examined after warming up and running quickly for a short distance. After 72 hours of rest samples with urinary blood in the first test, went again through full urinalysis. Of 27 boxers, 4 samples again had amounts of blood in the urine. Sharp decline in the number of subjects with hematuria indicates that healthy samples no urinary blood had been suffering from sports hematuria caused by the trauma which is consistent with the findings of Sigel

et al obtained about marathon runners (Siegel *et al.,* 1979). Despite differences in the nature of sports, the mechanism proposed by Miller et al for sports hematuria in marathon and ultra marathon runners arguing that in addition abrasion of empty layers of bladder or in fact the repeated minor trauma to the bladder caused by the feet striking frequently against the ground, is the main reason the incidence of hematuria in runner which is similar to the likely mechanism of hematuria in boxers and is based on the average trauma (Miller *et al.,* 1988). The researchers examined 50 marathon runners before the race, immediately after the competition and 3 days after the competition. All were healthy before the race, after the race, 18% of them had severe hematuria and again after 3 days rest they were all diagnosed healthy. The results of this study, however, cannot be compared exactly with the results of these researchers. Because most frequent type of sports hematuria in boxers was severe hemolysis which is associated with blows inflicted upon the body.

In endurance runners, 5 suffered from hematuria after the rest and required further medical studies. This represents 20% of the total subjects that is 25 and calculated against the 18 positives of the first test that is 18; they would represent 27.7% of subjects with initial hematuria and this is indicative of very high prevalence.

The result is not consistent with the findings of Jones et al conducted on 100 subjects from runners of different distances and despite a 90% incidence of hematuria in some groups of runners, after 72 hours of rest, no subject had urinary blood (Jones *et al.,* 2001). The main reason why about 20% of subjects are categorized as medically discussable pathological hematuria can be ascribed to type of footgear worn, the track, climatic conditions in addition to environmental factors and the manner of water intake by Iranian runners. The study of the researcher and associates showed that during the 10,000 m race, some Iranian runners did not drink water even once. Mild traumatic injuries to the sole in all long distance runners or moderate injury against the runners' feet in short and medium distance runners can be considered similar. The major factor that can explain the gross 0% difference or absence of hematuria after resting in foreign runners and 20% hematuria in the subject Iranian runners after 72 hours of rest in this study is probably the manner of consumption of water before, during and after the competition that requires careful rethinking by Iranian coaches and runners. In particular, the presence of casts in the urine samples of these runners can be a factor for the occurrence of mild renal failures or injuries in their renal tubules. In sprinters the rate is only 2 or 8% compared to the entire 25 samples or 12.5% of 16 subjects with primary hematuria. This gross difference can be attributed to less frequent mild sole trauma and/or probably to intake of adequate amounts of water, because sprinters rest after having run a short distance and may drink water to reduce their increased body temperature but endurance runners thinking that drinking water could cause them to stop or slow down do not drink water over long distances. The nature of hematuria in endurance runner and sprinters also differed; the higher hemoglobin in sprinters than endurance runners and also higher amount of cast in endurance runners than in sprinters can well support the fact that the intensity of strikes against the sole in sprinters is the main cause of hematuria in them, while running long distances with empty bladder and body dehydration can be the main cause of hematuria in endurance runners. As the researcher has studies hematuria in athletes for the first time in Iran and has not investigated their conditions before training and/or competition, this study can be regarded as an all-inclusive one; it is however an introductory one which requires further pursuit and completion. All the same, hematuria in the Iranian athletes representing the subjects of this study appears to highly prevalent and this can threaten their health particularly given that distinguishing between sports hematuria and pathologic hematuria and identification of its causes and consequences will probably be helpful to athletes and coaches and will prevent to some extent the spread of this syndrome.

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