DIFFERENCE IN THE DISTRIBUTION OF SELECTED BLOOD VARIABLES AMONG ATHLETES DURING A COMPETITION PERIOD

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ABSTRACT

Exercise is known to cause considerable changes in leucocyte counts and functions. The aim of the present study was to investigate the effect of exercise on leukocyte counts in athletes of different sporting codes during the competition time of the season.

Forty-two university athletes voluntarily participated in the study, rugby players, male soccer players, female soccer players and female netball players. Blood samples were collected and analysis for whole blood count was done in Lancet laboratory, Richards Bay, RSA. Data were analyzed using unpaired t-test for treatment independent samples.

It is noteworthy to point out the higher levels of leucocytes in the netball players than in female soccer players (6.8 ± 1.24 X 10^9/L and 6.11 ± 1.28 X 10^9/L respectively). The lymphocyte levels were also higher in the netball players than in female soccer players (2.60 ± 0.58 X10^9/L and 2.16 ± 0.49 X10^9/L respectively). There were also higher levels of leucocytes in the male soccer players compared to the male rugby players (6.26 ± 1.97X10^9/L and 5.46 ± 0.99 X10^9/L respectively). The lymphocyte levels were higher in the soccer players than in the rugby players (2.17 ± 0.36 X10^9/L and 1.85 ± 0.32 X10^9/L respectively), but the differences were not significant at $p< 0.05$.

The changes in leucocytes could be a result (among other things) of the removal of dead cells related to exercise stress and trauma. It was expected, considering the levels of physical contact, that the leucocyte counts and the lymphocytes in particular were going to be higher among female netball players and male soccer players. The athletes' results for the measured blood parameters were within the health norms. These findings could be related to the less intensive training protocols and lower levels of physical contact and stress in players from the students teams compared to the professional players.

***Key words**: athletes, exercise stress, leucocytes, lymphocytes.*

INTRODUCTION

Training of athletes is intended to ensure that athletes reach their peak condition and produce performance which ensures that they succeed during competition. There is a complex relationship between training and competition. There are, therefore, processes which can be used to monitor how athletes respond to training. There are a number of procedures which are used by coaches and sports scientists to monitor how athletes respond to both training during preparation for competition and during the competition period itself. A number of biochemical markers are being used to monitor fitness and fatigue of athletes (Coutts & Cormack, 2014). Muscle damage has been detected through blood markers and enzymes such as creatine kinase (CK) (Clarkson et al., 2005; Yamin et al., 2007). Myoglobin, troponin, urea, uric acid and ammonia have also been used as biomarkers of muscle damage (Kirwan et al., 1990). The hormone cortisol from saliva has been used as a marker and has been shown to be elevated soon after competition (Elloumi et al., 2003; Haneish et al., 2007). Elloumi et al., 2003 have also re-

ported the use of the hormone testosterone as an exercise marker. White blood cells and platelets increase following exercise, hence are biomarkers of oxidative stress (Djarova et al., 2010), and may be useful for a clinician to better assess and evaluate the benefits of training and/ or supplementation programs (Banfi et al., 2006). It is established that exercise of elevated intensity compromises the immune system leaving athletes susceptible to illnesses (Allgrove et al., 2012). Leucocytes and cytokines have been used as possible markers of compromised immune system due to exercise (Mackinnon 1997; Gleeson & Walsh 2012).

Exercise is known to cause considerable changes in leucocyte counts and functions. The aim of the present study was to investigate the effect of exercise on leukocyte and lymphocyte counts in athletes of different sporting codes during the competition time of the season.

METHODOLOGY

Forty-two (n=42) active university athletes voluntarily participated in the study; the participants' ages were 21.76±3.24. They were all students recruited from the University of Zululand as follows: rugby players (n=9), male soccer players (n=17), female soccer players (n=9) and female netball players (n=7). They had regular training sessions of two hours or more with a frequency of five to six times a week. They also took part in the inter university games. The net ball and male soccer players were also involved in club competitions of the UThungulu District in the Kwa-Zulu Natal province. As part of their obligation in the clubs and university games, they played competitive matches during the weekends. All participants participated in the study on a voluntary basis. The objectives of the study were explained to them and the possible risks of participating in the study were clearly elucidated, after which written consent was obtained from each one of the participants. A medical professional sought information on any diseases they might have had before, their present health status and any medication which they could have been taking. The following constituted the exclusion criteria; current infection, history of chronic disease use of antibiotics, herbal, antioxidant and steroids containing supplements. The study protocols were conducted in accordance with the Helsinki Declaration for the Ethical Treatment of Human Subjects and were evaluated and approved by the ethics committee of the Faculty of Science and Agriculture at the University of Zululand.

Blood samples were collected and blood analysis for whole blood count was done in Lancet laboratory, Richards Bay, RSA. Data were analysed using unpaired t-test for treatment of independent samples.

RESULTS

It is noteworthy to point out the higher levels of leucocytes in the netball players than in female soccer players (6.8 ± 1.24 X 10^9/L and 6.11 ± 1.28 X 10^9/L respectively). The lymphocyte levels were also higher in the netball players than in female soccer players (2.60 ± 0.58 X10^9/L and 2.16 ± 0.49 X10^9/L respectively). There were also higher levels of leucocytes in the male soccer players compared to male rugby players (6.26 ± 1.97X10^9/L and 5.46 ± 0.99 X10^9/L respectively). The lymphocyte levels were higher in the soccer players than in the rugby players (2.17 ± 0.36 X10^9/L and 1.85 ± 0.32 X10^9/L respectively), but the differences were however not significant at $p< 0.05$. When looking at the results of the four groups collectively, the netball players had the highest levels of both leucocyte and lymphocyte counts. They were followed by the male soccer players, and then the female soccer players, the male rugby players had the lowest counts for both the leucocytes and lymphocytes.

Table 1. *Athletes' lymphocyte and leucocyte blood counts*

Athletes	Lymphocytes X 10^9/L	Leucocytes X 10^9/L
Male soccer (n=17)	2.17±0.3	6.26±1.92
Male Rugby (n=9)	1.85±0.32	5.46±0.99
Female Netball (n=7)	2.60±0.58	6.80±1.24
Female soccer (n=9)	2.16±0.49	6.11±1.28

DISCUSSION

Soccer is the most popular and widely played sport among blacks in South Africa especially among men (Hammond 2011; Fredrick and Llewellyn 2016). It is also much more popular among blacks than Rugby; as a result, the University of Zululand which has a predominantly black student population has a soccer league within the university itself where students' teams from within the same university compete against each other. The best students from the same teams form a university select team which competes in the local district league and the inter university competitions. Compared to their rugby counter parts the male soccer players are exposed to more competitions. There is only one rugby team in the university and therefore the rugby players do not have a local university league within the university and the district, because of that they only wait for the national inter universities rugby tournament. In the interim they play occasional friendly matches. The rugby players are therefore not exposed to the usual extensive exercise, training and competition stress as is the norm with regular rugby league players. In comparison to their soccer counterparts in the university they are subjected to less stress which may cause rise in the leucocytes and lymphocytes. The changes in leucocytes could be a result (among other things) of the removal of dead cells related to exercise stress and trauma especially due to contact impact during play. It was expected, considering the higher levels of physical contact in rugby generally than in soccer, that the leucocyte counts and the lymphocytes counts were going to be higher among the male rugby players compared to their male soccer counterparts. It would appear however that the rugby players' counts of the two blood parameters were lower than that of the male soccer players due to the very low levels of competition compared to their male soccer counter parts who had more competitions, as discussed above.

With regards to females' netball is a relatively more popular sport among women compared to female soccer (Fabrizio, 2005). Just like the university male soccer players the netball athletes had more tournaments in the local district than their female soccer counterparts. It would appear therefore that the netball players experienced great workloads during the competition season than their female soccer counter parts resulting in them registering high levels of both leucocytes and lymphocytes. The relatively higher levels of leucocytes and lymphocytes in male soccer and female netball players reflect what has been obtained in other studies which show an increase of constituents of leucocytes such as the insulin-like growth factor 1 (IGF-1) which have a regulatory role in the immune response for muscle repair (Fragala et al., 2014). High competition physical exercise stress was seen to induce oxidative stress and activation of leucocytes

in adolescents in fairly the same way as seen in individuals in our study who were also adolescents (Santos-Silvaa et al., 2001). Lymphocytes and their subsets have also been known to increase with exercise (Hong et al., 2004).

CONCLUSIONS

The athletes' results for the measured blood parameters were within the health norms. These findings could be related to the less intensive training protocols and lower levels of physical contact and stress in players from the students' teams compared to the professional players. The method used with the two blood parameters can always be used with other methods of monitoring athletes' response to training to increase the reliability of the athletes' assessment process.

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