



Evaluation of Plasma Levels of Interleukin 6 and Iron Status of Football Players in a Nigerian University

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

To determine the levels of interleukin 6 (IL-6) and iron status of football players in Madonna University, Elele, Rivers State, Nigeria. A total number of 100 subjects were recruited for the study, comprising of 50 of football players before playing football (25 males and 25 females) and 50 of football players after playing football (25 males, 25 females) from Madonna University Nigeria, Elele Campus, Rivers State, Nigeria. The data obtained from the study were presented as Mean \pm SD in tables and analysed using student t-test for parametric data using SPSS version 20. The level of significance was set at $p < 0.05$. The results showed significant increase ($p = 0.004$) in interleukin 6 (IL-6) of football players after playing compared to it before playing and no significant change ($p = 0.505$) in the iron level of football players after playing compared to before playing respectively. The results also showed no significant change in interleukin 6 compared among football players based on gender and age groups and no significant change in the iron level of all

the subjects. The study showed increase in interleukin 6 (IL-6) of the football players after playing compared to the level before playing which shows that the physical activity increases the level of interleukin 6 and but has no effect on the iron level after football game.

Keywords: Interleukin 6; iron; football; exercise; students; university.

1. INTRODUCTION

It has been reported that in Physical exercise like football that there was a lower load to muscle to perform contraction [1]. Muscle adapted to physical load by secreting interleukin-6 into blood stream. Interleukin-6 is an important myokine for muscle adaptation during sports especially football [2]. It is responsible for inflammatory regulation, protein synthesis, lipid deposition, metabolism and muscle development. Interleukin-6 was also related to iron deposition involving ferritin, hepcidin and haemoglobin [3].

Interleukin-6 is a pro-inflammatory cytokine that can increase following physical exercise [4]. Higher level of interleukin-6 is linked to high response of inflammation due to physical exercise like in football which involves the entire body [5]. Interleukin-6 stimulates synthesis of hepcidin so that its level raised in the blood during inflammation [6,7]. It is reported by Cullen et al. [8] that the effect of exercise intensity and volume on the interleukin-6 response increases in the high intensity group compared to the low intensity group.

Interleukin 6 (IL-6) is a cytokine that plays a role in the specific antigen immune response and acute inflammatory response [9,10,11]. It is produced in several types of cells and can act in a large number of tissues [12]. IL-6 plays a crucial role in the defense response and has a pleiotropic characteristic that can determine more than one phenotypic characteristic [12,13]. When moderate to extreme intensity exercise (>85–90% of maximal heart rate) is performed, the IL-6 level in the blood circulation increases. Skeletal muscle contraction is the stimulus for its release; thus, it is considered a myokine as it is produced, expressed, and released by muscle and has paracrine and endocrine effects [14,15]. A reduction in the availability of carbohydrates for exercise stimulates the release of IL-6 as it can assist in the maintenance of serum glucose levels during exercise [15]. IL-6 is an important marker since an increase in its concentration is associated with an increase in the levels of

acute-phase inflammatory proteins, such as C-reactive protein [16], the risk of cardiovascular events, and the process of rupture [17].

Hepcidin plays a key role of ferroportin opening and iron transport via membrane regulation [18]. Hepcidin inhibits ferroportin opening so iron fail to export across membrane of erythrocyte and macrophage [19].

The role of haeme and nonhaeme iron in biological function and sports has been clarified via human and animal studies, and several classic reviews have been published [20,21] and updated [22]. Not surprisingly, haemoglobin iron, when lacking, can greatly affect sports through a reduction in oxygen transport to exercising muscle. Endurance performance at reduced exercise intensities, however, is more closely related to tissue iron concentrations because of the strong association between the ability to maintain prolonged submaximal exercise and the activity of iron-dependent oxidative enzymes.

The study was done to determine the levels of interleukin 6 (IL-6) and iron status of football players in Madonna University, Elele, Rivers State, Nigeria

2. MATERIALS AND METHODS

2.1 Study Design

The project is a cross-sectional study involving subjects recruited from football players of Madonna University Nigeria, Elele Campus. The subjects encompass males and females football players and apparently healthy individuals age and sex-matched as the controls. The study is a quantitative research to assess the levels of interleukin 6 and iron status of the football players among the students of the University.

2.2 Study Area

The research was carried out on football players in Madonna University Nigeria, Elele Campus, Rivers State, Nigeria. It is located in the South South part of Nigeria.

2.3 Study Population

A total number of 100 subjects were recruited for the study, comprising of 50 subjects before playing football (25 males and 25 females) and 50 subjects after playing football (25 males, 25 females) for the normal 90 minutes of football playing in Madonna University Nigeria, Elele Campus, Rivers State, Nigeria. They all gave consent to participate in this study.

2.3.1 Inclusion criteria

Students of Madonna University Nigeria, Elele Campus that are footballers without any sign of disease and apparently healthy individuals were selected for the study.

2.3.2 Exclusion criteria

Any Student of Madonna University Nigeria, Elele Campus that is sick or showed any sign of disease, pregnant, smoker, alcoholics or aged were excluded for the study.

2.3.3 Procurement of iron

A commercially prepared serum iron test kit product of BioSystems reagents and instruments company limited were used to assay the iron level.

2.4 Laboratory Investigations

Interleukin 6 (IL-6) determination using Elabscience (Catalog No: E-EL-H0102).

2.4.1 Procedure

1. 100µL standard or sample (plasma) was added to the wells and incubated for 90 min at 37°C
2. The liquid was discarded, immediately added 100µL Biotinylated Detection Ab working solution to each well and incubated for 60 min at 37°C.
3. The plate was aspirated and washed for 3 times

4. 100µL HRP conjugate working solution was added, incubated for 30 min at 37°C and aspirated and washed the plate for 5 times
5. 90µL Substrate Reagent was added and incubated for 15 min at 37°C
6. 50µL Stop Solution was added
7. The plate was read at 450nm immediately and the results calculated.

2.5 Statistical Analysis

The data obtained from the study were presented as Mean ± SD in tables and analysed using student t-test for parametric data using SPSS version 20. The level of significance was set at $p < 0.05$.

3. RESULTS

Table 1 showed significant increase ($p=0.004$) in interleukin 6 (IL-6) football players after playing (19.81 ± 3.60 pg/ml) compared to before playing (11.55 ± 2.28 pg/ml) and no significant change ($p=0.505$) in the iron level of football players after playing (93.23 ± 26.02 µg/dl) compared to before playing (82.70 ± 18.92 µg/dl) respectively.

Table 2 showed no significant change ($p=0.876$) in interleukin 6 (IL-6) of male football players (17.99 ± 2.43 pg/ml) compared to female football players (18.86 ± 6.53 pg/ml) and no significant change ($p=0.670$) in the iron level of male football players (95.20 ± 36.49 µg/dl) compared to female football players (81.95 ± 10.40 µg/dl) respectively.

Table 3 showed no significant change ($p=0.414$) in interleukin 6 (IL-6) of football players aged below 20 years (13.19 ± 4.36 pg/ml) compared to football players aged above 21- 30 years (18.86 ± 6.53 pg/ml) and no significant change ($p=0.823$) in the iron level of football players aged below 20 years (90.05 ± 43.77 µg/dl) compared to football players aged 21- 30 years (81.95 ± 10.40 µg/dl) respectively.

Table 1. Mean ± SD values of interleukin 6 (IL-6) and Iron status of the subjects before and after playing football

Parameters	Before Playing	After Playing	t-value	P-value
IL-6 (pg/ml)	11.55±2.28	19.81±3.60	4.291	0.004
Iron (µg/dl)	82.70±18.92	93.23±26.02	0.703	0.505

Table 2. Mean ± SD values of interleukin 6 (IL-6) and Iron status of the Football players based on sex

Parameters	Male	Female	t-value	P-value
IL-6 (pg/ml)	17.99±2.43	18.86±6.53	-0.177	0.876
Iron (µg/dl)	95.20±36.49	81.95±10.40	0.494	0.670

Table 3. Mean ± SD values of interleukin 6 (IL-6) and Iron status of the Football players based on age bracket

Parameters	Below 20 years	21-30 Years	t-value	P-value
IL-6 (pg/ml)	13.19±4.36	18.86±6.53	-1.021	0.414
Iron (µg/dl)	90.05±43.77	81.95±10.40	0.255	0.823

4. DISCUSSION

The study showed increase in interleukin 6 (IL-6) of football players after playing that was statistically significant. It is also known that muscular exercise enhances plasma levels of some cytokines [23]. Several studies demonstrated that strenuous exercise is accompanied by an increase in circulating pro-inflammatory responsive cytokines along with other bioactive stress molecules having some similarities with the response to sepsis and trauma [24,25]. It has been shown that physical activity such as exercises to the muscles increase the level of secretion and release of interleukin 6 from the muscles as well as from the lymphocytes. Despite the difficulties inherent in measuring plasma cytokines concentrations [26], studies of subjects exercising intensively reported conflicting results. Some authors reporting increase [27] and others no changes [28] in IL-6 production after strenuous exercise. The stress and oxidation may increase the inflammatory process that will raise the levels of interleukin 6 and regulate iron production through hepcidin regulation. This study also shows a significant increase in IL-6 concentrations for footballers after playing. Thus, it has been demonstrated that plasma concentrations of IL-6 increases up to more than 100-fold during prolonged muscular exercise [29]. The augmented IL-6 plasma concentrations following football was associated with muscle damage in an earlier study [30], but today it is very clear that exercise without any muscle damage also induces marked production of IL-6 and that IL-6 is produced as a direct consequence of contraction per se [31].

When interleukin 6 was compared among the males and females, there was no significant change. This shows that gender has no effect on

the levels of interleukin 6 as well as the iron status of footballers. Also, when interleukin 6 (IL-6) and iron were compared based on age groups such as below 20 years and 21-30 years of the footballers, there were no significant changes among the age groups.

5. CONCLUSION

The study showed increase in interleukin 6 (IL-6) of the football players after playing compared to the level before playing which shows that the physical activity increases the level of interleukin 6 and but has no effect on the iron level after football game.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The approval for the study was obtained from the Department of Medical Laboratory Science, Madonna University Nigeria, Elele Campus, Rivers State.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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