

Evaluation of plasma levels of interleukin 6 and iron status of basketball players in Madonna University, Elele, Rivers State, Nigeria

Evaluación de los niveles plasmáticos de interleucina 6 y del estado del hierro de los jugadores de baloncesto de la Universidad de Madonna, Elele, Estado de los Ríos, Nigeria

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Abstract

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

Methods: A total number of 80 subjects were recruited for the study, comprising of 40 subjects before playing basketball (20 males and 20 females) and 40 subjects after playing basketball (20 males, 20 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 $p < 0.05$.

Results: A significant increase ($p=0.002$) was found in interleukin 6 (IL-6) after playing basketball compared to before playing basketball and no significant change (0.276) in iron after playing basketball compared to before playing basketball respectively. It was also observed that there was no significant increase ($p=0.115$) in interleukin 6 (IL-6) of males compared to females and no significant change in iron ($p=0.770$) of males compared to females respectively. There was no significant increase ($p=0.115$) in interleukin 6 (IL-6) of basketball players aged 15 to 25 years compared to basketball players aged 26 to 35 years and no significant change in iron ($p=0.770$) of basketball players aged 15 to 25 years compared to volleyball players aged 26 to 35 years respectively.

Conclusions: The study showed increase in interleukin 6 (IL-6) of the basketball 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 basketball game.

Key words: Interleukin 6 (IL-6), Iron, basketball, sports, inflammation.

Resumen

Objetivo: El estudio se realizó para determinar los niveles de interleucina 6 (IL-6) y el estado del hierro de los jugadores de baloncesto de la Universidad Madonna, Elele, Estado de Rivers, Nigeria.

Material y métodos: Se reclutó un total de 80 sujetos para el estudio, que comprendía 40 sujetos antes de jugar al baloncesto (20 hombres y 20 mujeres) y 40 sujetos después de jugar al baloncesto (20 hombres y 20 mujeres) de la Universidad Madonna de Nigeria, Campus de Elele, Estado de Rivers, Nigeria. Los datos obtenidos en el estudio se presentaron en forma de media \pm DE en tablas y se analizaron mediante la prueba t de student para datos paramétricos utilizando el SPSS versión 20. El nivel de significación se fijó en $p < 0,05$.

Resultados: Se encontró un aumento significativo ($p=0,002$) en la interleucina 6 (IL-6) después de jugar al baloncesto en comparación con antes de jugar al baloncesto y ningún cambio significativo (0,276) en el hierro después de jugar al baloncesto en comparación con antes de jugar al baloncesto respectivamente. También se observó que no hubo un aumento significativo ($p=0,115$) en la interleucina 6 (IL-6) de los hombres en comparación con las mujeres y ningún cambio significativo en el hierro ($p=0,770$) de los hombres en comparación con las mujeres respectivamente. No hubo un aumento significativo ($p=0,115$) en la interleucina 6 (IL-6) de los jugadores de baloncesto de 15 a 25 años en comparación con los jugadores de baloncesto de 26 a 35 años y ningún cambio significativo en el hierro ($p=0,770$) de los jugadores de baloncesto de 15 a 25 años en comparación con los jugadores de voleibol de 26 a 35 años respectivamente.

Conclusiones: El estudio mostró un aumento de la interleucina 6 (IL-6) de las jugadoras de baloncesto después de jugar en comparación con el nivel anterior al juego, lo que demuestra que la actividad física aumenta el nivel de interleucina 6, pero no tiene ningún efecto sobre el nivel de hierro después del juego de baloncesto.

Palabras clave: Interleucina 6 (IL-6), hierro, baloncesto, deporte, inflamación.

Introduction

Exercise reduces the strain on muscles to perform contractions¹. Muscles adapted to exercise by secreting interleukin-6 into the bloodstream. Interleukin-6 is a myokine important for muscle adaptation in sports, especially basketball². It is involved in regulating inflammation, protein synthesis, lipid deposition, metabolism, and muscle building. Interleukin-6 was also associated with iron deposition, including ferritin, hepcidin and hemoglobin³. Interleukin-6 is a pro-inflammatory cytokine that can be increased after exercise⁴. Higher levels of interleukin-6 are associated with a stronger inflammatory response to exercise, such as soccer, which affects the whole body⁵. Interleukin-6 stimulates the synthesis of hepcidin, resulting in elevated blood levels of hepcidin during inflammation^{6,7}. Reported by Cullen et al. the effect of exercise intensity and volume on interleukin-6 response was found to be increased in the high intensity group compared to the low intensity group⁸. Interleukin 6 (IL-6) is a cytokine involved in specific antigenic immune and acute inflammatory responses⁹. It is produced in a variety of cell types and acts in numerous tissues¹⁰. IL-6 plays an important role in defense responses and has pleiotropic properties that can determine multiple phenotypic traits^{10,11}. Contraction of skeletal muscle is the stimulus for its release. Therefore, it is produced, expressed and released by muscle and is considered a myokine due to its paracrine and endocrine effects^{12,13}. Reducing carbohydrate availability during exercise helps maintain serum glucose levels during exercise, thus stimulating IL-6 release¹³.

IL-6 is an important marker. This is because its increased concentration is associated with increased concentrations of acute-phase inflammatory proteins such as C-reactive protein 14, the risk of cardiovascular events, and rupture processes¹⁵.

Hepcidin plays a key role of ferroportin opening and iron transport via membrane regulation¹⁶. Hepcidin inhibits ferroportin opening so that iron fail to export across membrane of erythrocyte and macrophage¹⁷.

The role of heme and non-heme iron in biological function and locomotion has been elucidated by human and animal studies, and several classic reviews have been published^{18,19} and updated. However, because of the strong association between the ability to sustain submaximal exercise for prolonged periods and the activity of iron-dependent oxidase, endurance performance at reduced exercise intensity is more closely related to tissue iron concentrations. The study was done to determine the levels of interleukin 6 (IL-6) and iron status of basketball players in Madonna University, Elele, Rivers State, Nigeria

Materials and methods

Study Design

The project is a cross-sectional study involving subjects recruited from basketball players of Madonna University Nigeria, Elele Campus. The subjects encompass males and females football players 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.

Study area

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

Study population

A total number of 80 subjects were recruited for the study, comprising of 40 subjects before playing basketball (20 males and 20 females) and 40 subjects after playing basketball (20 males, 20 females) from Madonna University Nigeria, Elele Campus, Rivers State, Nigeria. They all gave consent to participate in this study.

Inclusion criteria

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

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.

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.

Ethical consideration

The approval for the study was obtained from the Department of Medical Laboratory Science, Madonna University Nigeria, Elele Campus, Rivers State and written consent obtained from the subjects before commencement of the study.

Laboratory Investigations

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

Procedure

1. 100µL standard or sample 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.

Statistical analysis

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 $p < 0.05$.

Results

Table I showed that there was significant increase ($p=0.002$) in interleukin 6 (IL-6) after playing basketball (24.20 ± 6.52 pg/ml) compared to before playing basketball (9.44 ± 2.77 pg/ml) and no significant change (0.276) in iron after playing basketball (107.16 ± 24.68 pg/ml) compared to before playing basketball (92.04 ± 15.12 ug/dl) respectively.

Table I: Mean \pm SD values of interleukin 6 (IL-6) and Iron status of the subjects before and after playing basketball.

Parameters	Before	After	t-value	P-value
IL-6 (pg/ml)	9.44 \pm 2.77	24.20 \pm 6.52	-4.658	0.002*
Iron (ug/dl)	92.04 \pm 15.12	107.16 \pm 24.68	-1.168	0.276

Table II showed that there was no significant increase ($p=0.115$) in interleukin 6 (IL-6) of males (18.59 ± 0.50 pg/ml) compared to females (27.95 ± 5.69 pg/ml) and no significant change in iron ($p=0.770$) of males (102.25 ± 26.94 pg/ml) compared to females (110.43 ± 28.55 ug/dl) respectively.

Table II: Mean \pm SD values of interleukin 6 (IL-6) and Iron status of basketball players based on sex.

Parameters	Male	Female	t-value	P-value
IL-6 (pg/ml)	18.59 \pm 0.50	27.95 \pm 5.69	-2.204	0.115
Iron (ug/dl)	102.25 \pm 26.94	110.43 \pm 28.55	-0.320	0.770

Table III showed that there was no significant increase ($p=0.115$) in interleukin 6 (IL-6) of basketball players aged 15-25 Years (18.59 ± 0.50 pg/ml) compared to volleyball players aged 26-35 Years (27.95 ± 5.69 pg/ml) and no significant change in iron ($p=0.770$) of volleyball players aged 15-25 Years (102.25 ± 26.94 ug/dl) compared to volleyball players aged 26-35 Years (110.43 ± 28.55 ug/dl) respectively.

Table III: Mean \pm SD values of interleukin 6 (IL-6) and Iron status of basketball players based on age brackets.

Parameters	15-25 Years	26-35 Years	t-value	P-value
IL-6 (pg/ml)	18.59 \pm 0.50	27.95 \pm 5.69	-2.204	0.115
Iron (ug/dl)	102.25 \pm 26.94	110.43 \pm 28.55	-0.320	0.770

Discussion

The results of **table I** showed that there was increase in interleukin 6 (IL-6) after playing basketball compared to before playing basketball and no significant change in iron after playing basketball compared to before playing basketball.

Table II showed that there was no significant increase in interleukin 6 (IL-6) of males compared to females and no significant change in iron of males compared to females. The study showed increase in interleukin 6 (IL-6) of basketball players after playing that was statistically significant. It is also known that sports enhance plasma levels of some cytokines²¹. Several studies demonstrated that tedious games like basketball 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^{22,23}. It has been shown that physical activity such as exercises help 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 concentrations²⁴, studies of subjects exercising intensively reported conflicting results. Some authors reporting increase²⁵ and others no changes²⁶ 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 volleyball players after playing. Thus, it has been demonstrated that plasma concentrations of IL-6 increases up to more than 100-fold during prolonged muscular exercise²⁷. The augmented IL-6 plasma concentrations following football was associated with muscle damage in an earlier study²⁷, 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 se²⁷. **Table III** showed that there was no significant increase in interleukin 6 (IL-6) of volleyball players on age groups.

Conclusion

The study showed increase in interleukin 6 (IL-6) of the basketball 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 basketball game.

Recommendations

The levels of interleukin 6 should be monitored as accelerated increase of it will cause severe inflammatory

leading to tissue injury, unregulated immunological response and cardiovascular disease. Interleukin 6 should be monitored along with acute proteins and regulated in the players for their total fitness which will enhance their lifespan and productivity.

Conflict of interest

None

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