The patterns of some Inflammatory Cytokine, C-Reactive Protein and Troponin-T pre and post recovery stage of Moderate Exercise.

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Name of the Author:

Ehiaghe F. Alfred[1,2] * and Digban A. Kester [1]

[1]Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University, Okada, Nigeria

[2]Department of Hematology and Immunohematology, College of Health Sciences, Igbinedion University, Okada, Nigeria

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ABSTRACT

This study was designed to provide additional information on the roles and levels of some cytokines (interleukin-1β, interleukin-10), C-reactive protein, absolute white blood cells, red blood cell indices, Creatine kinase-MB and Troponin T circulating amongst Nigerian undergraduates' pre and three hours post recovery stage of moderate exercise. A total of 77 healthy young undergraduates of Igbinedion University,Okada with an average age of 25.3 ± 4 years and body mass index of 26.7± 1.5(Kg/m^2) participated fully in the randomized pre and post experimental study. The subjects took part in an endurance exercise by playing football for fifteen minutes. Hematological parameters were estimated using Sysmex® Automated Hematology Analyzer whereas; IL-1β, IL-10, CRP, TT, and CK-MB were estimated using enzyme-linked immunosorbent assay methods. The levels of IL-1β, IL-10, CRP and Troponin-T were significantly elevated at three hour post exercise stage when compared with pre stage while the levels of TLC, AGC, ALC, MCH, MCV, MCHC and CK-MB shows no significant difference at three hour post exercise when compared with pre exercise stage. It may be concluded that moderate exercise enhances the immunological responses during the three hours post recovery stage of moderate exercise but should be performed with caution to prevent over-activation of IL-1β and CRP which are potent stimulators of the hypothalamic-pituitary-adrenal axis.

KEYWORDS :

Moderate exercise, post-exercise stress, IL-1β, IL-10, CRP

1. INTRODUCTION

Physical exercise is important for maintaining physical fitness and can contribute positively to maintaining a healthy weight, muscle strengthening, promoting physiological well-being and strengthening of the immune system (Stampfer *et al*., 2000; Hu *et al*., 2001; Gosker and Schol, 2008). Moderate exercise has been associated with a 29% decreased incidence of upper respiratory tract infections (URTI) (Geddes, 2007). Developing research has demonstrated that many of the benefits of exercise are mediated through the release of myokines which promote the growth of new tissue and reduces the risk of developing inflammatory diseases (Pedersen, 2013). Moderate exercise boosts the immune system by increasing the level of interferon gamma in blood circulation (Lewis, 2008; Ueda *et al*., 2009; Ehiaghe *et al*., 2016). It has also been reported that acute exercise significantly increase the levels of absolute lymphocyte count, absolute neutrophils count, C-reactive protein and malondialdehyde concentration in young male undergraduate which are needed to maintain cellular homeostasis (Ehiaghe *et al*., 2017). Currently, there is paucity of information on the levels of pro-inflammatory cytokines (interleukin-1β), anti-inflammatory cytokine (interleukin-10), red blood cell indices, Creatine kinase-MB, Troponin T circulating amongst Nigerian undergraduates' pre and three hours post recovery stage of moderate exercise. This study was designed to provide additional information on the roles and levels of some cytokines (interleukin-1β, interleukin-10), C-reactive protein, absolute white blood cells, red blood cell indices, Creatine kinase-MB and Troponin T circulating amongst Nigerian undergraduates' pre and three hours post recovery stage of moderate exercise. This will add to the existing level of information on moderate exercises which are beneficial.

II. MATERIALS AND METHODS

2.1 Subjects

A total of 77 healthy young undergraduates of Igbinedion University,Okada with an average age of 25.3 ± 4 years and body mass index of 26.7± 1.5(Kg/m^2) participated fully in the randomized pre and post experimental study. The subjects who meant the inclusion criteria (healthy young undergraduates within the ages of 18 and 25) were encouraged to eat balance diet two hours prior to the moderate exercise and avoid any strenuous activity during the course of the research. Upon arrival at the venue of the research, their height (H) and weight (W) was measured and recorded and they were allowed to rest for at least ten minutes. Patient consent was obtained from the subjects before sample collection and ethical approval was obtained from Institution Ethical Review Committee before the commencement of the study. Pre venous blood samples (10ml) were collected from the medial cubital vein using vacutainer and needle from each of the subjects shared equally into ethylene diamine tetra acetic acid containers and plain containers. The subjects took part in an endurance exercise by playing football for fifteen minutes as described by Adedapo *et al*., (2009).

2.2 Three hours post exercise blood samples collection and measurement of biochemical indices

Ten (10ml) of venous blood sample were collected from the medial cubital vein using vacutainer and needle from each of the subjects shared equally into ethylene diamine tetra acetic acid containers and plain containers. The blood samples collected in EDTA were used for hematological parameters using Sysmex® Automated Hematology Analyzer as previously described by Ehiaghe *et al*., (2016). The levels of IL-1β and IL-10 were determined using enzyme-linked immunosorbent assay methods as described by Khalid *et al*., (2016). Serum CRP was determined using enzyme-linked immunosorbent assay method as described by Digban and Ehiaghe, (2017) while the levels of Creatine kinase-MB, Troponin T were determined using enzyme-linked immunosorbent assay methods as described by Ehiaghe *et al*., (2017).

2.3 Statistical analysis

All numerical results were analyzed with unpaired Student t-Test using SPSS version 20.0 statistical program. P values < 0.05 were considered significant.

III. RESULTS

Table 1 and Table 2 shows the levels (mean ± SD) of (interleukin-1β, interleukin-10), C-reactive protein, absolute white blood cells, red blood cell indices, Creatine kinase-MB and Troponin-T of the exercised subjects at pre and three hours post exercise stages. The levels of IL-1β, IL-10, CRP and Troponin-T were significantly elevated at three hour post exercise stage when compared with pre stage while the levels of TLC, AGC, ALC, MCH, MCV, MCHC and CK-MB shows no significant difference at three hour post exercise when compared with pre exercise stage (Tables 1and 2)

Table 1: Levels (mean ± SD) of Interleukin-1β (pg/m), Interleukin-10 (pg/ml), C-reactive protein (mg/L), Total leukocyte count (Cells/µl), Absolute granulocyte count (Cells/µl) and Absolute lymphocyte count (Cells/µl) in subjects that engaged in moderate exercise

Time intervals	Interleukin-1β	Interleukin-10	C-reactive protein	Total leukocyte count	Absolute granulocyte count	Absolute lymphocyte count
PE	0.03 ± 0.05	0.03 ± 0.05	1.24 ± 0.36	4.4 ± 1.15	2.6 ± 0.84	1.72 ± 1.01
3-HPE	5.87 ± 0.77	4.68 ± 2.43	21.23 ± 1.76	4.5 ± 1.17	2.6 ± 1.07	2.51 ± 0.80
P value	0.006*	0.001*	0.009*	0.987(ns)	0.338(ns)	0.415(ns)

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ns = non significant * = significant PE = Pre-Exercise 3HPE = 3 Hours post exercise

Table 2: Levels (mean ± SD) of MCV (fl), MCH (pg/cell), MCHC (g/dl), Creatine kinase MB (ng/ml), Troponin-T (pg/ml) in subjects that engaged in moderate exercise

Time intervals	MCV	MCH	MCHC	Creatine kinase	Troponin-T
P E	80.0 ± 6.8	27.3 ± 2.9	32.4 ± 1.1	48.8 ± 3.8	0.40 ± 0.01
3HPE	85.6 ± 2.6	28.1 ± 1.6	32.8 ± 1.6	57.7 ± 2.7	31.6 ± 2.60
P value	0.06(ns)	0.228(ns)	0.312(ns)	0.800(ns)	0.008*

ns = non significant * = significant PE = Pre-Exercise 3HPE = 3 Hours post exercise

IV. DISCUSSION

This study was designed to provide additional information on the roles and levels of some cytokines (interleukin-1β, interleukin-10), C-reactive protein, absolute white blood cells, red blood cell indices, Creatine kinase-MB and Troponin T circulating amongst Nigerian undergraduates' pre and three hours post recovery stage of moderate exercise. The study revealed that moderate exercise enhances the release of both interleukin-1β and interleukin-10, thus, indicating that moderate exercise enhances the immunological responses during the three hours post recovery stage of the exercise bout. It is also possible that the elevated level of CRP observed in the post recovery stage of the exercise are mediated by the increased level of interleukin-1β which is known to stimulate the release of CRP from the hepatic cell during stress response (Table 1). Khalid *et al*., (2016) reported that exercise has a positive effect of the levels of pro-inflammatory cytokine such as IL-1 and TNF-α. Also, Shehard *et al*., (1994) opined that endurance exercise causes an increase in plasma levels of interleukin-1, possibly as a response to the increased mechanical stress associated with muscle contraction. The significant expression of interleukin 10 at three hours post recovery stage of the moderate exercise might be an indication that there is an effective control of the immune responses to stress within these periods. Bente, (2006) and Rodrigo *et al.,* (2012) reported that post exercise stress enhances the up-regulation of interleukin-10 genes which in turn inhibits the production of IL-1, TNF-α and IFN-γ in attempt to regain cellular homeostasis during muscle contractions. Stenberg *et al*., (2000) opined that humans respond to post exercise stress by activating cytokine producing cells to induce the production of cytokine genes such as tumor necrosis factor alpha, interferon gamma; it simultaneously releases interleukin-10 to effectively control immune response to stress during the moderate exercise bout. However, other work demonstrated that interleukin-10 levels are elevated during strenuous exercise (Ostrowski *et al*., 2000). Although Peake *et al*., (2005) reported that exercise induced muscle fatigue can up-regulate interleukin-10 genes. It has been observed that 30 minutes' walk increases the level of interleukin-10 genes in young male students (Nieman *et al*., 2005).

The possible mechanism of the up-regulation of the pro (IL-1) and anti-inflammatory (IL-10) cytokines observed in this study could be linked to adenosine triphosphate depletion, accumulation of adenosine diphosphate, and adenosine monophosphate due to consumption of adenosine triphosphate by the exercising muscles (Vamshi,2012).

The study also revealed that the levels of TLC, AGC, ALC, MCV, MCH, MCHC and CK-MB shows no significant difference three hours post recovery stage of the moderate exercise (Tables 1 and 2), indicating a restored cellular homeostasis as the subjects feel relief of the stress induced by the exercise bout. Similar finding had been reported by Ehiaghe *et al*., (2017), who reported no significant difference in the levels of white blood cell count in the four hours and twenty-four hours post recovery stage of acute exercise. Furthermore, the levels of TT was significantly elevated three hours post recovery stage of moderate exercise (Table 2), suggesting an increased mechanical stress during muscle contraction. Thus, it can be extrapolated that too much exercise without adequate rest can increase the chance of cardiovascular problem. Adedapo *et al*., (2009) opined that the reduction in the level of ATP increases cellular permeability due to increased muscle contraction. Also, Ehiaghe *et al*., (2017) reported an elevated level of CK-MB and TT in the one hours post exercise recovery stage of acute exercise amongst young male undergraduates in Nnewi.

V. CONCLUSION

It was evident from this study that moderate exercise significantly elevates the levels of IL-1β, IL-10, CRP and TT but do not significantly affect the levels of TLC, ALC, AGC, MCV, MCH, MCHC and CK-MB three hours post recovery stage of moderate exercise. It may be concluded that moderate exercise enhances the immunological responses during the three hours post recovery stage of moderate exercise but should be performed with caution to prevent over-activation of IL-1β and CRP which are potent stimulators of the hypothalamic-pituitary-adrenal axis.

VI. COMPETING INTERESTS

The authors declare that they have no competing interests.

VII. AUTHORS' CONTRIBUTIONS

Author EFA designed the study and performed the statistical analysis. Authors KAD and EFA conducted and managed the laboratory analysis. All authors read and approved the final manuscript.

VIII. ACKNOWLEDGEMENTS

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Corresponding author :

Ehiaghe F. Alfred *

Department of Medical Laboratory Science, College of Health Sciences, Igbinedion University, Okada, Nigeria. Email: fredleo2547 [at]yahoo.com