The Effect of Exercise on Total blood count, Phagocytic Activity and Immunoglobulin's levels

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Abstract

Present work included the study of cellular and humoral immune response in athletes before and after running on treadmill. Results of cellular immune response related with differential white blood cell count indicated an increasing in mean number of neutrophils after exercise in comparison with their number before exercise but it is not significant, whearas the eosinophils and basophils did not show any significant differences in their numbers between the two intervals of study (before and after exercise). Also there is a significant elevation in numbers of monocytes after an exercise in comparison with athletes before an exercise and control group.

The study also indicated that there is non significant increasing in lymphocytes after an exercise when compared with their number before an exercise. Moreover results of total white blood cell count indicated that there is an increasing in their numbers in athletes after an exercise.

Other indicator of cellular immune response is the presence of an elevation in phagocytic activity of PMNs after an exercise in comparison with their activity before an exercise.

In relation with results of humoral immune response, present results demonstrated the significant increasing in IgM and IgA in athletes after an exercise while IgG donot revealed any significant differences in their level among the studied groups.

Introduction :

In recent years considerable interest has been directed to the effects of exercise on immune function. As demonstrated in animal experiments (1&2), moderate exercise appears to stimulate the immune system. However, several studies indicated that intense training increases susceptibility to illness. These illness range from persistant colds, sore throats to flu-like illnesses and post-viral fatigue syndrome (3).

Also, there is a rather evidence indicated that exercise is a life style that offers some protection against malignancy (4). It has become clear that moderate exercise stimulates the immune system and may be somewhat responsible for exercise related reduction in illness. However, strenuous exercise induces

immunosuppression in the recovery period in athletes (5 &6).

Moreover, Regular exercise has been reported to have a several favorable effects on physiological, psychological and immunological functions (7 ; 8 and 9).

In present work it has been tried to through a sight on the effect of an exercise related with running on treadmill on immunoglobulines level and phagocytic activity of polymorphonuclear cells before and after exercise in comparison with control group.

Materials and Methods:

Twenty student from first class in Basrah college of sports were performed an exercise related with running on treadmill for 15 minute with a speed of 12 Km/hr and 20 healthy age-matched sedentary or control group were enrolled in this study.

Sample collections:

Blood samples (5 ml) were taken once from sports student (before and after exercise) and from control group, then the samples separated as a follows:

1. (1 ml) put in EDTA (ethylin diamin tetra-acetic acid) tube for total and differential white blood cells count.

2. (2 ml) put in heparin tube for measuring the phagocytic activity of poly morphnuclear cells by chemiluminescence.

3. The remaining (2 ml) of blood were centrifuged for serum collection and measuring immunoglobulines (IgG, IgM, IgA) concentration.

Methods of cellular immune response determination

Total WBCs count:

Total WBCs count were done according to (10).

Chemiluminescence for PMNs phagocytic activity:

Chemiluminescence was done by preparing the chemiluminescence solution CL preparing by dissolving 0.01 gm of lucigenin in 5ml of Dimethyl Sulfonyl Oxide (DMSO). Then 12 ml of CL solution put it in a container for 100 second.

For measuring the CL, same amount of CL solution and blood put it in a photomultiplier tube (PMT) and then read by chemiluminescence reader which present in physics department of Basrah Education college.

Methods of humoral immune response:

Immunoglobulines concentration were measured by using LTA kit form Italy.The levels of IgG, IgA and IgM were determined according to kit information

and then the final concentration were determined in mg/dl for each group of present study.

Statistical analysis:

The data were analyzed with ANOVA test (11).

Results:

The results of differential WBC count revealed that there is a non significant ($p< 0.06$) increasing in neutrophils after exercise (14.450) in comparison with their numbers before exercise (36.550) whearas there is a significant increasing in neutrophils in control group in comparable with those after exercise table (1).

Recent data didn't show any significant differences in mean concentration of eosinophil and basophil between athletes before (7.6, 10.050) and after (7.050, 8.750) exercise. But the two previous cells showed significant increasing in athletes after exercise when compared with control group (3.990, 1.000) respectively table (1).

Results also revealed a significant elevation($p< 0.05$) in number of monocyte after exercise (11.850) more than those before exercise (7.900) there is also a significant differences between the number of monocyte after exercise (11.850) and control group (5.850). Table (1).

Lymphocytes were increased after exercise (35.300) but without any significant differences with the athletes before exercise (33.550) Table (1).

In relation with total WBCs count present results indicated a significant ($p<0.003$) elevation in total WBCs count after exercise (7575) in comparison with althetes before exercise and also with the control group (6030) table (2).

Our data demonstrated that there is a high phagocytic activity of PMN after an exercise (90523) when compared with their activity before exercise (72013) table (3).

The IgG Levels after 15 minute of exercise (1810.5) mg/dl didn't show any statistical differences with their levels before exercise (1375.5) mg/dl. Whearas IgM and IgA levels after exercise (276.93, 417.2) were respectively found to be statistically higher ($p< 0.0001$) than that before exercise (161.18, 197.8) respectively table (4).

Table (1): Mean levels of WBCs in athletes(before and after) exercise and in control group.

Group	Number	Neutrophil	Eosinophil	Basophil	Monocyte	Lymphocyte
1.Athletes						
Before	20	36.550 ±9.070	7.600 ±3.705	10.050 ±4.110	7.900 ±4.404	33.550 ±5.633
After	20	41.450 ±7.251	7.050 ±2.564	8.750 ±4.789	11.850 ±4.115	35.300 ±5.939
2.Control	20	56.60 ±0.000	3.900 ±0.000	1.000 ±0.000	5.850 ±0.000	33.700 ±0.000

Table (2): Total white blood cells in an athletes (before and after exercise) and control group.

Group	Number	Mean	SD±
1.Atthletes			
a. Before	20	6235	1260
b. After	20	7575	1390
2. Control	20	6030	503

Table (3): Phagocytic activity of PMN in an athletes (before and after exercise) and control group.

Group	Number	Mean arbitrary unit	SD±
1.Athletes			
a. Before	20	72013	±23802
b.After	20	90523	±17386
2.Control	20	98815	±5298

Table (4): Immunoglobulines (IgG,IgM and IgA) levels in athletic (before and after exercise) and control group.

Group	Number	IgG	IgM	IgA
1.Athletic				
a. before	20	1375.5±806.6	161.18±89.45	197.8±113.3
b.After	20	1810.5±724.4	276.93±90.45	417.2±240.7
2.Control	20	1392.7±796.9	189.68±43.33	171.9±75.8

Discussion:

In relation to exercise the results revealed that there is an increasing in neutrophile after exercise because these cells are part of the innate immune system, and are essential for host defense (6), So when pronounced physical activity like acute-long-term exercise were done there is an a prolonged neutrocytosis occur (12). Different reports showing that exercise triggers a series of changes in neutrophil population. Increased expression of the cell adhesion molecules after exercise may contribute to neutrophile extravasations into damaged tissue, including skeletal muscle (6).

The elevation of lymphocytes and total WBCs which recorded in recent work was in agreement with (13). The increased lymphocytes concentration is due to recruitment of all lymphocytes subpopulations to the blood (14) and (15).

(16) and (17) also indicated that exercise increases the number of lymphocytes in the circulation by acting as a lymphocytic B2-adrenergic agonist. Cortisol on the other hand blocks the entry of lymphocytes which would otherwise lead to strong neutrophilia in the circulation there by facilitating the passage of lymphocytes from the lymphoid compartments.

The results related with the lymphocytes and neutrophils which indicated recently may be due to that the mechanisms underlying exercise associated with immune changes are multifactorial and include neuroendocrinological factors such as adrenaline (epinephrine) noradrenaline (nor-epinephrine), growth hormone and Cortisol (14) and (18). As these hormones increases during exercise and return to origin values shortly after, but they also seems to exert effects on lymphocytes and neutrophils during the recovery period.

With regard to the chemiluminescence our data revealed that there is an increasing in neutrophil function after exercise in comparison with control group that mean there is an indication for phagocytosis process which may reflecting an inflammatory response due to substance released from injured muscle cells (15), on the other hand (19) reported that neutrophil function suppressed in althetes, but this has not been a consistent finding and may depend on the severity of

training. Reduced bactericidal activity of neutrophils has also been observed, but otherwise the effect of exercise on neutrophil function is quite variable (20).

In this study IgG don't increased significantly after exercise and this result is in agreement with (21) whom showed clinically normal serum immunoglobulin in marathon runners. IgM elevated significantly in recent work and the same result was reported by (22) and (23) whom indicated that IgM was increased by 7.2% one hour into three hour run at marathon pace. One explanation that has been proposed for the increases in certain antibodies after exercise is that non-systemic immunoglobulins are flushed out of secondary lymph storage site and/or enter the circulation because increased lymphatic flow (23). Another reason for IgM elevation may be that the stress is one of the stimulating factors of immune system and physical activity can result in stress, which leads to changes in the system (24). While (25) showed that IgM was reduced significantly 24 hours (2.3%) after the ultra-marathon. The diversity of results may reflect finding that enhancement or reduction of immune response depends on the intensity of exercise and the duration of rest between exercise session (6).

IgA also increased significantly in recent work and this result is similar with result of (26) when indicated an elevation of IgG, IgA, IgM immediately after exercise in wrestlers and sedentary controls .And this acute increase in IgA and IgM levels may suggest that plasma volume changes appear to largely explain the immunoglobulin increasing following maximal exercise (27). While poortmans has reasoned that immediately following maximal exercise, contributions of immunoglobulins from rapid exchangeable extravascular plasma protein pools may occur.

The study of (25) suggests that serum immunoglobulins response observed after an ultramarathon represents an enhanced antibody response. Isotype switching or a secondary response may regulate this response. The rapid upregulation of such a response probably afforded protection against pathogens and could help account for the maintenance of the wellbeing of the runners.

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الخلاصة

شمل العمل الحالي دراسة الاستجابة المناعية الخلوية والخلطية في الرياضيين قبل وبعد الركض على شريط الجهد. وقد أكدت نتائج الاستجابة المناعية الخلوية والمتعلقة بحساب العد التفريقي لكريات الدم البيضاء حصول زيادة في معدل أعداد الخلايا العدلة بعد أداء التمرين مقارنة مع أعدادها قبل التمرين لكنها غير معنوية. أما بالنسبة للخلايا الحمضة والقعدة فلم يظهر أي فارق معنوي في أعدادها بين فترتي الدراسة (قبل وبعد أداء التمرين) لكن لوحظ ارتفاعاً معنوياً في أعداد الخلايا الوحيدة النواة بعد أداء التمرين مقارنة مع الرياضيين قبل أداء التمرين والسيطرة.

كما أكدت الدراسة حدوث زيادة في الخلايا اللمفية بعد أداء التمرين لكنها غير معنوية مقارنة بأعدادها قبل أداء التمرين. فضلاً عن ذلك فقد أوضحت نتائج العد الكلي لكريات الدم البيض حدوث زيادة فيه في الرياضيين بعد أداء التمرين.

ومن مؤشرات الاستجابة المناعية الخلوية هو حصول زيادة في القابلية البلعمية للخلايا المتعددة الانوية بعد أداء التمرين مقارنة بفعاليتها بعد أداء التمرين. وفيما يتعلق بنتائج الاستجابة المناعية الخلطية فقد أوضحت النتائج حدوث زيادة معنوية في IgM وIgA في الرياضيين بعد أداء التمرين، اما IgG فلم تشير النتائج الى اي فارق معنوي في قيمته بين المجاميع المدروسة.