The Effect of Therapeutic Exercises and Fish Oil in Treatment of Muscle Tear

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Abstract: The aim of this study is to identify the role of therapeutic exercises and fish oil in treatment of muscle tear. 12 soccer players affected with minor injuries to the hamstring, they were divided to two groups, therapeutic exercises and therapeutic exercises plus Omega-3 treatment (3 capsules) daily with a dose of 1000 mg fish oil). The sample age was between 16-22 yrs. Biochemical variables: CK, LDH, T. protein, urea, creatinine, potassium and cortisol before and after treatment were determined, isotonic leg muscle strength was also performed before and after treatment, also healing tine was detected. Results indicated a reduction in biochemical variables in the two groups and a further reduction after exercise plus fish oil treatment. Muscle strength increased after treatment in both groups. In conclusion, the use of fish oil plus exercise by soccer players significantly reduces serum concentrations of T-protein and protein metabolism, and decreased potassium and cortisol levels associated with muscle damage and increased muscle strength in both groups, healing time was in favor of the two groups.
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Key words: Therapeutic exercises, fish oil, biochemical variables, muscle tear, muscle strength.

1. Introduction

As a result of changes in functional status of some organs of the body, which arise in the sport after a break in training for a while and back again, often and never cannot prevent the occurrence of any injury; injuries in most sports are minor injuries 90%, medium muscle injuries 9% and severe muscle injuries 1% (1). She added that growth factors play an essential role in the process of healing of muscle.

Therapeutic exercises best known as one of the efficient complex methods in treatment of different injuries, as it helps healing of injured tissues and get rid of swelling and prevent bleeding and restoration of injured muscles to their function in the least possible time (2).

Strenuous physical exercise commonly results in muscle injury, especially when that exercise is intense, prolonged and includes an important eccentric component (3). Individuals may subjectively perceive the muscle damage approximately 24h after exercise (4). The initiating event may be related to high specific tensions produced by the muscle, which results in shearing of the myofibrils and disturbances in the metabolic milieu such as a reduction in PH or increased temperature (5).

Muscle fibers contain proteolytic enzymes, which after injury, are released and initiate the degradation of lipid and protein structures in the injured cell (6).

The rapid break down of damaged muscle fibers and connective tissue is accompanied by the diffusion of intracellular components into the interstitium and plasma. Many of these substances including prostaglandins, heat shock protein, chemokines and free radicals, attract neutrophils and monocytes(7). Also increased serum creatine kinase and muscle ultra structural changes (8). The strenuous exercise is accompanied by a sequential increase in circulating pro-inflammatory and inflammation response cytokines such as tumor necrosis factor alpha (TNF), interleukin-1 (IL-1), IL-6 andIL-1 receptor antagonist (IL-1-ra). These alterations contribute to the pathogenic tissue changes observed during competition(9).

It is possible that preventing the immune disturbance following competitive sport might limit tissue damage. In clinical trials, the ability of analgesics and anti-inflammatory agents to decrease muscle injury when administered at the onset of detectable soreness is unclear.

Fish oils can be used in the treatments of rheumatoid arthritis through reducing the inflammatory mediators (leukotrienes) which potentiate and aggravate the inflammatory process that occurs in this disease (10). Use of parentral solutions with a high concentration of w-3 PUFAs has been associated with decreased infections and improved the in vitro immunological indices in patients (11). Eicosanoids derived from linoleic (w-3 fatty acids) are associated with less inflammation and immuno suppression(12).

The research objectives was:

To identify the role of fish oil treatment in the process of treatment of muscle injury in comparison with therapeutic exercises.

Identify biochemicals indices of muscle damage.

Identify healing time in therapeutic exercise and fish oil plus therapeutic exercise groups.

2. Methodology:

Method:

The researcher used the experimental method for its suitability to the research objective by using two groups: The first therapeutic exercises and the second therapeutic exercises plus Omega-3 treatment

Sample of the study :

15 Soccer players affected with first degree tear to the thigh muscle (hamstring) chosen under the vision of specialist, they were divided to two groups : Group (1) therapeutic exercises, Group (2)therapeutic exercises plusOmega-3 treatment (3 capsules daily dose 1000 mg fish oil). Aged between16-22 yrs.3 players were dismissed due to irregularity in program application. The sample was selected according to the following :

Soccer players subjected to complete medical examination.

Soccer players registered in the first grade muscle tear.

There was no other injuries except that of hamstring.

All the injuries were diagnosed by a specialist.

The injuries of the two legs were dismissed.

Table (1): Statistical analysis of the two groups in some anthropometric variable using Mann Whitney (μ)

Variables	**Group (1) Mean ± SD**	**Group (2) Mean ± SD**	**Sig.**
Age (yrs)	17.50 ± 2.6	16.9 ± 2.4	NS
Height (cm)	169.4 ± 7.3	172.3 ± 6.5	NS
Weight (kg)	67.4 ± 5.4	69.5 ± 5.1	NS
CK (iu/L.)	483±50	491±461*	NS
LDH (iu/L.)	381±29	374±31	NS
Total protein (g.dl)	7.8±0.5	7.9±0.6	NS
Urea (mg/dl)	41.1±5.1	39.9±5.2	NS
Creatinine (mg/dl)	1.17±0.1	1.21±0.1	NS
Potassium (me/L.)	4.12±0.01	4.2±0.04	NS
Cortisol (μg/dl)	22.1±3.2	23.2±2.5	NS
Isotonic leg muscle strength (k)	79.2±7.1	78.4±5.9	NS

SD = Standard deviation group (1) Exercise $P < 0.05$ group (2) Exercise + Fish oil

Study steps:

A-The main study:

Soccer players affected with first grade tear to the thigh muscle (hamstring) were selected. Aged between16-22 years. The pre- study measurement was performed individually in different periods from Thursday 16 June 2011to Saturday 30 July 2011. The sample of the study subjected to medical examination and serum samples were selected after 8-12 hour fasting.

The players were divided to two groups(6 individual each),the first group subjected to therapeutic exercises only and the second group used therapeutic exercises plus fish oil treatment. The study was performed under supervision of specialist in the period from Saturday 18 June to thursday 1st September 2011.

The post study measurements were performed individually according to the termination of each player program as done in the pre-study measurements.

B-Study variables measurement:

Serum samples were collected in the laboratory by specialist during rest and after fasting for 8-12 hours in the morning(9 am) for thr pre &the post study variables measurement individually.

Muscle strength was evaluated on the injured leg using dynamometer

Biochemicals indices of muscle damage.

Creatine kinase (CK), lactate dehydrogenase, urea, creatinine, total protein were measured before and after treatment, using spectrophotometry analyser, as for cortisol using Eliza technique and flame photometer for potassium measurement.

C-Therapeutic Program :

The therapeutic exercise program was designed after several references and scientific studies, and through analysis of previous programs and after the suggestion of specialist in physical education and physical therapy and specialists in sport medicine reaching the view that :

Therapeutic exercises will be exerted in 3 phases, one week each.

Time table for the execution of the program 3 weeks, 4times aweek, this will be (12) exercises unit with duration of 45 min each.

The players were in negative rest in the first stage of the program and in positive rest during the second and third phases.

As for fish oil administration:

The participants of group (2) were given 3 fish oil capsules every day for 3 weeks.

D-Statistical Analysis:

Non-parametric tests were used throughout due to the reduced size of the groups and because of their

non-normal distribution. Differences between the therapeutic exercises and therapeutic exercises plus fish oil treatment were compared by the Mann-Whitney U-test. Comparisons of pre and post treatment biological parameters within groups were made using the Wilcoxon rank sum matched pair test. Statistical significance was set at $P < 0.05$.

3. Results

Table (2) indicated that CK, LDH, Total protein, Potassium and Isotonic leg muscle strength were significantly changed while Urea, Creatinine and Cortisol were non significantly changed.

Table(3) indicated that CK, LDH, Total protein, Potassium, Cortisol and Isotonic leg muscle strength were significantly changed while Urea, Creatinine were non significantly changed

The therapeutic exercises and therapeutic exercises plus fish oil groups (g1, g2) did not differ significantly in their baseline physical characteristics (Table 1).

Table (2,3,4) shows the biochemical indices of protein metabolism and muscle injury together with cortisol and potassium, before and after therapeutic exercises and therapeutic exercises plus fish oil treatment. After 3 weeks of treatment, both urea and creatinine concentration of both group did not differ significantly. In contrast, in both groups, significant reductions in all biochemical markers and healing time and increase in muscle strength (CK, LDH, total protein, potassium and cortisol), the reductions was obvious in case of the therapeutic exercises plus fish oil treatment. All values shown in table (2,3.4) are the mean difference between the concentrations of the biochemical parameters before and after the treatment period of 3 weeks. Significance difference between the two groups $P< 0.05$.

Table (2): Concentrations of biochemical variables before and after therapeutic exercises.

Variables	Group (1) Mean ± SD		Sig.
	B.	A.	
CK (iu/L.)	483±50	332±32	S
LDH (iu/L.)	381±29	359±24	S
Total protein (g.dl)	7.8±0.5	7.3±0.4	S
Urea (mg/dl)	41.1±5.1	39.2±4.6	NS
Creatinine (mg/dl)	1.17±0.1	1.22±0.2	NS
Potassium (me/L.)	4.12±0.01	3.8±0.03	S
Cortisol (µg/dl)	22.1±3.2	21.2±4.1	NS
Isotonicleg muscle strength (k)	79.2±7.1	86.2±6.1	S
Healing time (days)		14.5±1.5	

*Sig. Differences between the two group $P< 0.05$ CK= creatine kinase LDH= Lactate dehydrogenase.

Table (3): Concentrations of biochemical variables before and after therapeutic exercises and therapeutic exercises plus fish oil administrations.

Variables	Group (2) Mean ± SD		Sig.
	B.	A.	
CK (iu/L.)	491±461	318±25**	S
LDH (iu/L.)	374±31	312±25*	S
Total protein (g.dl)	7.9±0.6	7.2±0.3*	S
Urea (mg/dl)	39.9±5.2	37.6±4.8**	NS
Creatinine (mg/dl)	1.21±0.1	1.19±0.2	NS
Potassium (me/L.)	4.2±0.04	3.6±0.04*	S
Cortisol (µg/dl)	23.2±2.5	20.5±2.3*	S
Isotonic leg muscle strength (k)	78.4±5.9	89.3±6.5*	S
Healing time (days)		12.3±1.1	

*Sig. Differences between the two group $P< 0.05$ CK= creatine kinase LDH= Lactate dehydrogenase.

Table (4): Concentrations of biochemical variables before and after therapeutic exercises and therapeutic exercises plus fish oil administrations.

Variables	B.	A.	B.	A.	Sig.
	Group (1) Mean ± SD		Group (2) Mean ± SD		
CK (iu/L.)	483±50	332±32	491±461	318±25**	S
LDH (iu/L.)	381±29	359±24	374±31	312±25*	S
Total protein (g.dl)	7.8±0.5	7.3±0.4	7.9±0.6	7.2±0.3*	S
Urea (mg/dl)	41.1±5.1	39.2±4.6	39.9±5.2	37.6±4.8**	NS
Creatinine (mg/dl)	1.17±0.1	1.22±0.2	1.21±0.1	1.19±0.2	NS
Potassium (me/L.)	4.12±0.01	3.8±0.03	4.2±0.04	3.6±0.04*	S
Cortisol (µg/dl)	22.1±3.2	21.2±4.1	23.2±2.5	20.5±2.3*	S
Isotonic leg muscle strength (k)	79.2±7.1	86.2±6.1	78.4±5.9	89.3±6.5*	S
Healing time (days)		14.5±1.5		12.3±1.1	S

*Sig. Differences between the two group P< 0.05 CK= creatine kinase LDH= Lactate dehydrogenase.

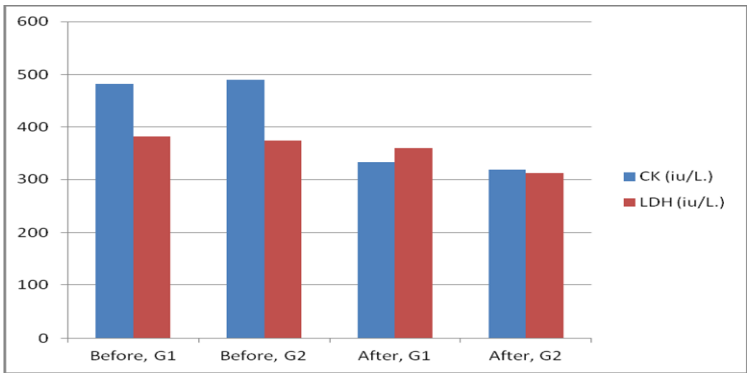

Figure (1) Concentrations of CK and LDH before and after therapeutic exercises

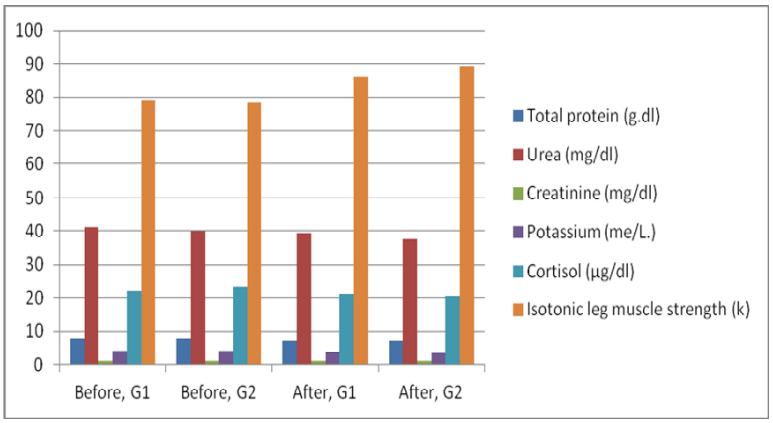

Figure (2) Concentrations of other biochemical variables before and after therapeutic exercises.

4. Discussion

The results of this study show that therapeutic exercises alone or together with addition of fish oil improved muscle injury and prevent raised concentrations of biochemical markers of muscle damage. Table (2,3,4) indicated that Biochemical markers were reduced after both therapeutic exercise alone, also in addition to fish oil.(13) suggested that acute inflammatory process may be the underlying mechanism of exercise induced muscle damage. (8) added that raised muscle protein concentration and structural damage to subcellular components are pivotal markers of exercise induced injury. Skeletal muscle damage is commonly estimated by measuring the concentration of muscle proteins creatinekinase, lactate dehydrogenase and total protein. (14).

The results of the study are in agreement with those of (15), (16) and (17) that therapeutic exercise

programs may lead to increased muscle force and help to prevent recurrency in the future.

The decreased CK in post exercise program compared to pre-program estimation may indicate that CK change CP + ADP to ATP + C and that CK concentration is high in muscle and the heart and it is a marker of muscle injury (18) (19) stated, that in normal condition CK is found in small quantity in the blood, but due to physical effort, the enzyme activity increased is case of muscle injury.

Chronically stressed skeletal muscle (injury) shows a normalities in the expression of lactate dehydrogenase enzyme (3). However, small changes in lactate dehydrogenase are non-specific and currently are only minimally helpful in the diagnosis of muscle fibre injury.

In the present study, exercise plus fish oil administration indicated that total protein associated with tissue damage significantly inhibited which mean the conservation of muscle fibres for more building, this is in agreement with the data reported by (3).

The conservatory action of muscle fibres help in reduction healing process time in case of therapeutic exercise plus fish oil treatment compared with therapeutic exercises only (Table 4).

The healing process of the muscle to the recovery of injury undergoes three stages:

The stage of atrophy and inflammation of the muscle immediately after the injury.

The stage of the reconfiguration of the fibrous tissue.

The stage of reorganization of fibroblast formed (1).

(20) reported that EPA administration preserve cytoskeleton proteins (Myosin, actinin 4), proteins involved in RNA metabolism. The large portion of identified proteins belongs to the so-called housekeeping proteins such as cytoskeletal protein.

EPA administration in addition to therapeutic exercise induced a lower cortisol level compared to therapeutic exercise only, Table (4), which indicates that EPA administration suppress stress. (21) added that ACTH and cortisol values increase in various abnormal conditions, as cortisol inhibits fibroblastic activity, decrease local swelling and block the systemic effects of bacterial toxins. The decreased local inflammatory reaction is due to inhibition of phospholipase, and leukotrienes decrease, as it is powerful mediator of inflammation.

(22) stated that the ability of skeletal muscle to regenerate is owed to a population of myogenic stem cells called satellite cells. These adults stem cells are situated under the basal lamina of myofibers and contribute 2-4% of the nuclei in adult skeletal muscles (23) (24).

Satellite cells are typically quiescent in adult muscles but can be activated in response to muscle injury and disease. Depending on the magnitude of tissue trauma, these cells may divide minimally to repair subtle damage within individual myofibers or produce a larger progeny pool that forms new myofibers in cases of overt muscle trauma (25) (26), satellite cells meet the functional definition of what stem cells are, as they have the ability to self-renew, in addition to producing differentiating progeny (27) (28).

Table (4) indicated a significant differences in potassium concentration before and after the program of the two groups, as potassium decreased. (29) showed that potassium assists sodium in regulation the involuntary movement of muscles during sport activity, also regulates osmotic pressure and balance the power to practice physical activities (30) stated that potassium is one of biggest ions in the cell and is distributed inside body fluids and tissues it is found in vegetables and the body needs (4 grams) of potassium daily. (21) added that potassium has an important role in pain sensation as its name is (P) factor, pain factor.

The researcher showed that the cause of the decrease in potassium can return to the influence of rehabilitation exercises program, principally, which led to improvement of function of affected muscles and enforce the active muscle of he foot, added to that the healing of destroyed tissues and absorption of the infiltrations, which led to edema and decreased the pressure induced inside the muscle and this was reflected on decreased sensation of pain and elevation of efficiency of the body in toleration of pain in the injured place.

Isotonic muscle strength increased significantly after therapeutic exercises and therapeutic exercises plus fish oil administration (Table 4). This was in accordance with (31) who found a positive effect after a vibration program. The gain in muscle strength reported in the results might be due to effect of therapeutic exercise which increased the action of motor units through activation of muscle spindles and polysynaptic pathway.

Conclusions

According to the study aims and sample, the following could be concluded: Therapeutic exercises induced a reduction of all parameters. Fish oil plus therapeutic exercises induced a further reduce of biochemical parameter associated with muscle damage. The muscle strength increase in both groups specially the 2nd group but it is statistically insignificant.

Recommendations

-Using fish oil plus therapeutic exercises improve muscle tear and healing of injured tissues.

-Performing similar studies on larger samples and different ages.

- Performing further studies on second and third grades muscular tear and different tissues.

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