

THE EFFECTS OF OMEGA-3 INTAKE ON DELAYED ONSET MUSCLE SORNESS IN NON-ATHLET MEN

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Annotation. Delayed onset muscle soreness (DOMS) is classified as a muscle strain that presents with tenderness and stiffness one to two days after exercise. At present there are multiple proposed methods for treating DOMS, including anti-inflammatory medication, stretching, homeopathy, L-carnitine, rest and light exercise. The purpose of this study was to investigation of the effects of omega-3 intake on delayed onset muscle soreness in non-athlete men. 20 healthy subjects (age: 20.5±1.8 years) participated as subjects in this study. Subjects were randomly divided into two groups (experimental and control). In the experimental group, subjects consume daily 2000 mg of omega-3; 2 times per day for 1 month before and 48 hours after perform leg press exercise with eccentric pattern. Similarly, the c was taking in the control group. The results showed significant decrease in severity of DOMS (CK and LDH levels and decreased knee's range of motion) in experimental group in comparison with control group ($p<0.05$). As a result of our study it is suggested that the use of omega-3 supplement can effectively reduce DOMS caused by eccentric exercise.

Keywords: Omega-3, Delayed onset muscle soreness, Leg press, eccentric.

Introduction.

Delayed onset muscle soreness (DOMS) is classified as a type I muscle strain that presents with tenderness and stiffness one to two days after exercise or unaccustomed movement [4, 23, 29]. DOMS and muscle damage are common self-limiting, training related conditions that can result in loss of muscle force and significant pain [8, 29]. At present there are multiple proposed methods for treating DOMS, including cryotherapy, anti-inflammatory medication, stretching, hyperbaric oxygen, homeopathy, ultrasound, L-carnitine, rest, light exercise and electromagnetic shields [29].

However, to date an effective treatment for DOMS has not been established. Unaccustomed exercise typically causes muscle soreness, which usually begins within 24 hours and peaks within 48 hours after exercise. Eccentric exercise, which occurs when a skeletal muscle lengthens as it produces force, provides a common exercise mode to induce muscle damage [7].

Omega-3 fatty acids are essential in the human diet, as there is no mechanism in humans for producing these fats from other substances. Omega-3 fatty acids serve as precursors to prostaglandins, which are powerful hormone-like substances that reduce inflammation and improve blood flow [9, 19].

There are several investigations dealing with the effects of different methods on reducing DOMS signs and symptoms. Jouris et al (2011) investigated the omega-3 fatty acids supplementation on the inflammatory response to eccentric strength exercise. They reported that omega-3 supplementation decreases soreness, as a marker of inflammation, after eccentric exercise. Based on these findings, omega-3 supplementation could provide benefits by minimizing post-exercise soreness and thereby facilitate exercise training in individuals ranging from athletes undergoing heavy conditioning to sedentary subjects or patients who are starting exercise programs or medical treatments such as physical therapy or cardiac rehabilitation [19]. Pumpa et al (2001) studied the effects of Lyprinol on delayed onset muscle soreness and muscle damage in well trained athletes. They reported that after 2 months ingestion of Lyprinol at the recommended dosage (200mg/day) and a demanding eccentric exercise intervention, Lyprinol did not convincingly affect DOMS and indicators of muscle damage [29]. Burnley et al (2010) investigated the impact of protein supplements on muscle recovery after exercise-induced muscle soreness. They indicated that protein or carbohydrate supplement after exercise that caused mild muscle damage did not facilitate muscle recovery in adequately nourished, healthy young men [7].

Yet, omega-3 has not been used as a treatment for DOMS and research background does not exist in this topic, especially in the area of sports science. Also, the existing drugs because of side effects may not have good effects. In addition, anti-inflammatory effects of omega-3 have been investigated in some researches. Therefore the purpose of this study was to investigation of the effects of omega-3 intake on delayed onset muscle soreness in non-athlete men.

Methods.

Subjects.

Among the 40 volunteers participating in research, based on physician and health questionnaire, 20 subjects that were healthy and without previous history of certain diseases and participated as subjects in this study. Subjects were randomly divided into two groups (experimental and control).

Drug intake methods.

After determining the group in a double blind design, subjects in the experimental and control groups consume daily 2000 mg of omega-3 (Viva Omega-3 Fish Oil, made in Canada) or the same amount of placebo 2 times per day

for 1 month before and 48 hours after perform leg press exercise with eccentric pattern. To control annoying and confounding factors, all subjects were asked to use any drugs during the study. Subjects' diet was controlled by a food frequency questionnaire (FFQ).

Eccentric exercise method.

Leg press exercise was performed at 75% of one-repetition maximum (1RM). Exercise consisted of 4 sets of 20 repetitions with 180 seconds interval rest between sets (Figure1). Eccentric quadriceps contractions occurred during flexion of knee joint and return to starting position.



Figure 1. Eccentric exercise by Leg press machine

Measurement of the maximal isotonic voluntary contractile strength.

The maximal isotonic voluntary contractile strength of quadriceps measured by Leg press machine and Brazinsky formula:

$$1RM = \text{weight (kg)} \times (1.0278 - (0.0278 \times \text{repetition}))$$

Swelling test.

Swelling was measured with a metric plastic tape-measure. Circumferential measurements were taken of leg with the subject in the prone position (middle thigh circumference). The distance from this circumferential measurement to the popliteal crease was recorded. This was done so that measurements could be taken at the same sites during subsequent visits and a measurement at the corresponding anatomical site on the opposite leg could be taken for comparison [31].

Knee joint angle.

ROM of the knee joint angle was evaluated by measuring the knee angle in flexion position using a goniometer [30].

Level of perceived muscle pain.

The soreness scale used is a Talag soreness scale used by the most recent research on the effects of O3FA on muscle soreness [37].

Measurement of LDH and CK levels.

To determine the levels of blood serum creatine kinase (CK) and lactate dehydrogenase (LDH), 5 ml blood was drawn from antecubital vein and transferred immediately to the lab for assessing CK and LDH analysis. Then, CK and LDH levels were determined using special kits (Pars Azmoon, made in Iran) with AutoAnalyzer (Hitachi, made in Japan).

Statistical Methods.

All descriptive data are expressed as means \pm SD. Data were analyzed using ANOVA with repeated measure to compare the mean of each variable between two groups. Statistical analysis was conducted using SPSS 16.0 for Windows.

Results

Subjects' data are presented in Table 1.

Table 1. Subjects' descriptive data

Group	Age (years)	Height (cm)	Weight (kg)	Body fat (%)
experimental	22.5 \pm 1.2	174.5 \pm 5.2	71.1 \pm 6.1	15.68 \pm 7.21
Control	23.6 \pm 1.4	175.5 \pm 4.7	71.4 \pm 9.1	16.21 \pm 9.1

The results showed that there is no significant difference in the maximal isotonic voluntary contractile strength of quadriceps between experimental and control groups. But, significant differences were observed between two groups immediately, 48 and 72 hours after exercise (Table 2). There were no significant differences between two groups in middle thigh circumference at baseline and immediate after exercise levels. But, there were significant differences between two groups in middle thigh circumference 24, 48 and 72 hours after eccentric exercise (Table 2).

There were no significant differences between two groups in range motion of knee joint at baseline, immediately and 24 hours after eccentric exercise. But, significant differences were observed between control and experimental groups at 48 and 72 hours after exercise (Table 2). Also, there were no significant differences in perceived pain between

two groups at baseline and immediately after exercise. But, significant differences were observed between two groups at 24, 48 and 72 hours after eccentric exercise (Table 2).

Table 2. Results of isotonic strength, inflammation, Knee joint angle and perceived muscle pain of subjects

variable		Baseline	P	Immediately after exercise	P	24h after exercise	P	48h after exercise	P	72h after exercise	P
Isotonic strength	Omega-3	178.3±4.7	0.27	-	-	175.7±6.59	*0.01	178.45±4.9	*0.00	178.70±4.63	*0.00
	control	181.5±7.6		-		157.5±20.3		150.9±17.3		147.90±19.9	
Middle thigh circumference	Omega-3	51.95±2.8	0.89	53.63±3.08	0.76	52.0±2.72	*0.03	51.95±2.80	*0.01	51.90±2.91	*0.00
	control	51.55±3.65		54.51±3.25		53.4±3.48		53.83±3.71		53.65±3.79	
knee joint angle	Omega-3	51.44±3.33	0.79	53.45±3.60	0.94	51.5±3.19	0.11	51.44±3.33	*0.15	51.37±3.40	*0.02
	control	51.03±3.61		53.33±3.40		53.9±3.19		55.28±3.02		54.85±2.86	
perceived muscle pain	Omega-3	-	0.72	1.80±1.54	0.25	4±0.51	*0.00	0.000±0.000	*0.00	0.000±0.000	*0.00
	control	-		2.60±1.50		4.50±0.84		4.90±0.56		3.10±1.19	
	control	-		4.60±1.26		6.2±1.47		7.00±1.15		6.30±0.823	

* Differences are significant at the 0.05 level.

There were no significant difference between two groups in CPK levels at baseline and 24 hours after eccentric exercise. But, there were significant differences between two groups at 48 and 72 hours after exercise (Table 3). Also, no significant differences were founded between two groups in LDH levels at baseline and 24 hours after exercise. But, there were significant difference in LDH levels at 48 and 72 hours after exercise (Table 3).

Table 3. CPK and LDH levels

Variable		Baseline	P	24h after exercise	P	48h after exercise	P	72h after exercise	P
CPK	Omega-3	186.5±139.17	0.94	427.70±107.81	0.52	406.20±83.11	*0.00	186.5±134.24	*0.000
	control	190.10±73.26		503.6±106.58		569.1±128.29		535.4±139.82	
LDH	Omega-3	297.1±50.47	0.92	540.90±95.79	0.46	5.18.20±88.60	*0.01	292.6±46.5	*0.000
	control	294.90±48.78		582.7±122.31		651.90±124.68		577.6±129.78	

* Differences are significant at the 0.05 level.

Discussion.

This research is the first study in the field of omega-3 supplements to control and prevent delayed onset muscle soreness. The result of perception of pain in the present research is not in agreement with Stone (2002), Williams (2007) and Donnelly (1998) [35, 44, 13]. This difference may be due to the lower amount of muscle damage and differences in the organs and gastrointestinal absorption of omega-3 in this study. Almekinders (1999) and Tartibian et al (2009) also reported similar results with investigated the effect of naproxen on perceived pain intensity after eccentric exercise [2, 37].

The results showed that middle thigh circumference as an index of inflammation was increased immediate and 24 hours after exercise, but was not statistically significant. This increase continued in control group at 48 and 72 hours after exercise and significant differences was observed between two groups.

The results of present study showed that the range of motion of the knee joint, showed no significant difference immediately and 24 hours after exercise. However, 48 and 72 hours after exercise, no significant differences were

observed between the two groups. However, in this period decreased range of motion in the knee joint in experimental group was less than the control group.

This result is not in agreement with Lenn et al (2002), Stone et al (2002), Barlas et al (2000) and Tokmakidis et al (2003) [21, 5, 39]. This can be attributed to less muscle damage and anti-inflammatory properties of omega-3 in present study.

Also, based on the results, it was observed that creatine kinase levels in both groups during 24 hours were elevated after the delayed onset muscle soreness. However, this increment in the experimental group was slightly lower than the control group. Also, creatine kinase in experimental group was decreased at 48 and 72 hours after exercise and this difference was statistically significant after 72 hours. This result could indicate the potential effect of omega-3 supplementation in reduce exercise-induced muscle damage.

The results of creatin kinase after exercise in contrast to baseline levels, is not in agreement with White et al (2008), Lenn et al (2002) and Sunita et al (2010) [43, 21, 36]. This result is maybe due to differences in type and dose of drugs and methods of exercise.

In summary, the results of this study showed that taking 2000 mg of Omega-3 per day has beneficial effects on controlling and reducing symptoms of delayed onset muscle soreness. However, more research should be done to identify the mechanisms of the drug action and influence dosages on delayed onset muscle soreness.

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