

Research Article

The Effect of One Bout High Intensity Interval Exercise (HIIE) On Serum Levels of Decorin And IGF-I In Active Young Men

Mina Daliran¹, Lida Moradi*¹, Mohammad Ali Azarbayjani ²

1. Department of Physical Education and Sports Sciences, North Tehran Branch, Islamic Azad University, Tehran, Iran

2. Department of Exercise Physiology, Central Tehran Branch, Islamic Azad University, Tehran, Iran

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Abstract

Background: Some researchers attributed the positive effects of exercise training on secretion of different myokines from skeletal muscles. Acute exercise lead to changes in gene expression and phosphorylation that stimulates muscular adaptation. However, one bout exercise isn't adequate to change muscle phenotype and phenotypic adaptation to training consists of aggregation stimulation of one bout exercise sessions Decorin is new discovered myokine that its changes in response to exercise such as high intensity interval exercise (HIIE) is unknown. It seems that Decorin has effects on skeletal muscle hypertrophy. Therefore, the aim of present study was investigated the effect of one bout high intensity interval exercise (HIIE) on serum levels of decorin and IGF-I in active young male.

Materials and Methods: For this purpose, 10 active young males with mean age of 25.4 ± 2.36 voluntary participated in this study. The subjects took part in HIIE protocol in 10 am and after 3 hours. HIIE protocol consisted of four minutes' intervals with 90-95 percent of maximum heart rate that between each interval, 3-minute active recovery with 60-70 percent of maximum heart rate performed. The subjects heart rate during HIIE protocol was monitored by polar belt. Blood samples were collected immediately after exercise, subsequently IGF-I and decorin levels were measured by ELISA method. In order to data analyzed, SPSS software version 24 and paired t test were used and significantly level was considered $p < 0.05$.

Results: The results indicated that decorin and IGF-I increased significantly after exercise ($p \leq 0/05$).

Conclusion: It seems that some HIIT-induced adaptations partly are related to increase in decorin levels.

*Corresponding author: Lida Moradi

Address: Department of Physical Education and Sports Sciences, North Tehran Branch, Islamic Azad University, Tehran, Iran

Tell: +982177009800 Email: moradi.lida@gmail.com

L M: 0000-0002-4012-6199



1. Introduction

About 30% of adults in all of the world have sedentary life style. This life style is related to some disorders like obesity, type 2 diabetes, hypertension, coronary heart disease and other health problems. So, physical fitness parameters are in concern in scientific and clinical centers because of their importance in health (1). World Health Organization (WHO) and other international organizations have suggested 150 min physical activity program with medium intensity or 75 min physical activity with high intensity per week in order to get health benefits from exercise. However, many of people don't have activity at this level and one the main problems to participate in physical activity programs is lack of time. Thus, many of researchers suggest participation in High Intensity Interval Training (HIIT), that consists of intervals with 10 sec to 4 min with intensity above 85% maximal heart rate and it can be a proper solution to time lack(2). The main advantages of participating in HIIT program are: we can do them in a short period, they don't need to equipment and they are joyful. In comparison with traditional endurance training HIIT has greater cardiometabolic effects in less time. These findings are reported in healthy and obese people (3). Acute exercise lead to changes in gene expression and phosphorylation that stimulates muscular adaptation. However, one bout exercise isn't adequate to change muscle phenotype and phenotypic adaptation to training consists of aggregation stimulation of one bout exercise sessions (4).

Many researches have been reported that skeletal muscle can secrete peptides during physical activity that they named these myokines and it seems that myokines attribute in many of positive effects of exercise. According to this, we can define myokines as proteins with small molecules that are secreted by stimulated muscle. These skeletal muscle derived factors can be induced with muscle(5). Different types of myokines are identified. At first, transgenic expression of PGC1- α in skeletal muscle as a key regulatory factor lead to identification of Irisin and Meteorin-like factor as a myokines that regulated with physical activity and both of them are associated with stimulation of energy usage and brown adipose tissue in rats. Primary findings in human subjects reported secretion of IL-6, IL-8, IL-10, IL-15 from skeletal muscle. On the other hand, researchers observe increasing in gene expression and level of proteins like ANGPTL4¹, BDNF, CTGF¹, Cyr61¹ and Fractalkine in skeletal muscle after acute physical activity. Decorin is other myokine that regulated with physical activity and play a key role in proliferation of human skeletal muscle cells (6). Decorin (NM-133507) is an extracellular proteoglycan and consist of 359 amino acids that can be found in many tissues (7). It is a core protein consist on 10 sequence full of leucine in central domain and has a glycosaminoglycan domain on amino terminus (8). Today, Decorin recognized as a multi-functional and multi directional signaling molecule and not only controls tumor growth and activity but also has many functions as: inflammatory responses and Keratinocyte function (9).

Studies show that Decorin moderates growth factors function, tyrosine kinase receptors, angiogenesis, tissue deformation, bacterial infection and cardiovascular disease (10). Researchers reported that Decorin can increase proliferation and differentiation of myogenic cells via inhibit myostatin. Therefore, Decorin was suggested as a new molecule in myostatin pathway. Myostatin and Decorin are produced concurrent by skeletal muscle. On the other hand, it seems that Decorin can increase Follistatin activity and all of them supported the key role of Decorin on muscle growth and hypertrophy and prevent of muscle atrophy (11). Decorin expresses and secretes due to muscle contraction and its circulatory levels increase after acute physical exercise in human. Furthermore, its expression increases in skeletal muscle of human and rats after training. Over expression of Decorin is related to increase of muscle hypertrophy and at the same time ubiquitin ligases (MURF-1 and Atrogin-1) that involve in atrophy path ways down regulates (12). Decorin attach to IGF-IR and limit endothelial cells apoptosis (13).

IGF-1 is an anabolic growth factor that stimulates skeletal protein synthesis, proliferation and differentiation of satellite cells. IGF-1 has antiapoptotic effects on muscle cells, suppresses proteolysis and inhibits ubiquitin-proteasome pathways (14). IGF-1 is an unique because it has receptor on all of cells and tissues (15). Despite this, Decorine roles and effect of different exercise programs on its circulatory levels don't determine and information about its relation with IGF-1 isn't clear. Thus in this research we investigated the effect of one bout HIIE on serum level of Decorin and IGF-1 in active young men.

2. Materials and Methods

This study was a semi- experimental research and it's design was group with pretest and post test. Subjects were active young men that 10 person selected based on inclusion criteria. Inclusion criteria were: sexuality (man), age between 22-30, activity about 3 sessions per week in 6 months, don't have any cardiovascular disease, do not use supplements in next 6 months, have ability to perform program, normal weight.

Exclusion criteria was: can't complete exercise protocol.

At the first day subject received information about project and signed consent letter, then they familiar with exercise protocol. We want them to don't have any heavy activity 48 hours before protocol. They attempted in 10 a.m. and they had their last meal 3 hours before. At first anthropometric measurements were done. Palsma samples collected before and after protocol. Subjects warmed up about 10 min before program.

Exercise protocol

The high intensity interval exercise (HIIE) exercise protocol consisted of 4 interval with 4 min duration and 90-95% of maximal heart rate intensity. The rest between intervals was 3 min active rest with 60-70% maximal heart rate intensity. Subjects heart rate during activity monitored with polar heart rate monitor and HIIE protocol performed on treadmill.

Samples and data collection: plasma samples collected before and after exercise protocol. Chemiluminescent Immunoassay (CLIA) is being used to measure plasma level of IGF-1 and Decorin levels measured with ELIZA method.

Statistics: Shapiro-wilk test was used to evaluate normal distribution of data and then paired sample t_test was used to find differences between pre test and post test. All data analysis were done with SPSS version 24.

3. Results

Subjects descriptive characteristics was shown in table1. Decorin and IGF-1 levels in pretest and post test were shown on table2.

Table 1: subjects demographic data

variable	mean±SD
Age(year)	25.4±2.36
Weight(kg)	74.4±7.66
Height(cm)	173.3±9.75

Table 2: changes in Decorin and IGF-1 in pretest and post test

Variable	pretest	Posttest	Changes percent
Decorin(ng.ml)	2.18±0.77	3.11±0.94	+42.66
IGF-1(ng.ml)	182.4±56.95	191.1±65.31	+4.76

Table 3: paired sample t-test results

	Changes mean	SD	t	df	p-value
Decorin	0.929	1.01443	-2.896	9	0.018*
IGF-1	8.7	9.847	-2.794	9	0.021*

Data analysis show that plasma levels of decoroin had significant changes after one bout exercise ($t=-2.896$, $df=9$, $P<0.05$). IGF-1 changes after exercise were significant too ($t=-2.794$, $df=9$, $P<0.05$).

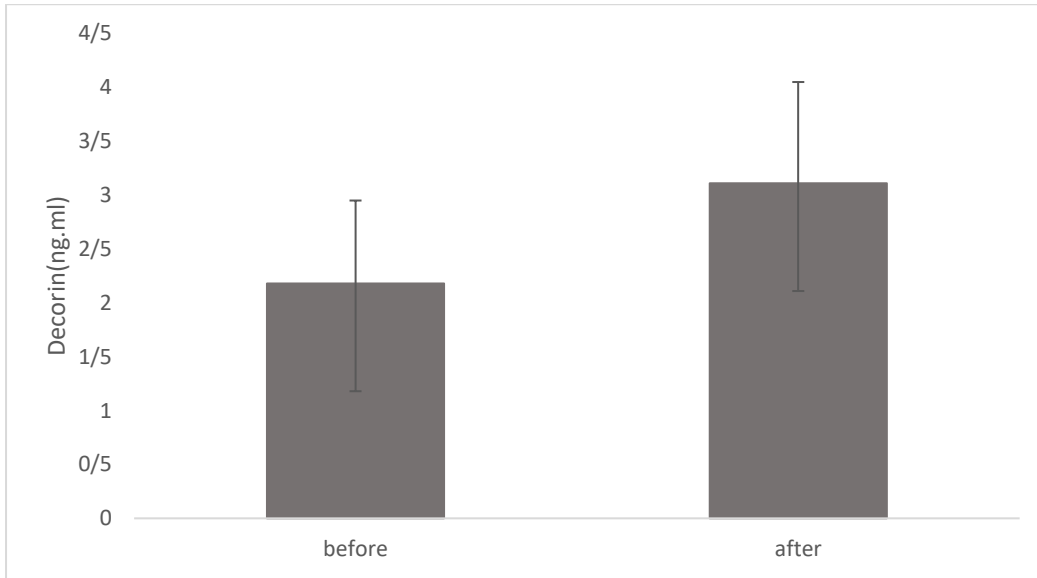


Chart 1: Decorin changes

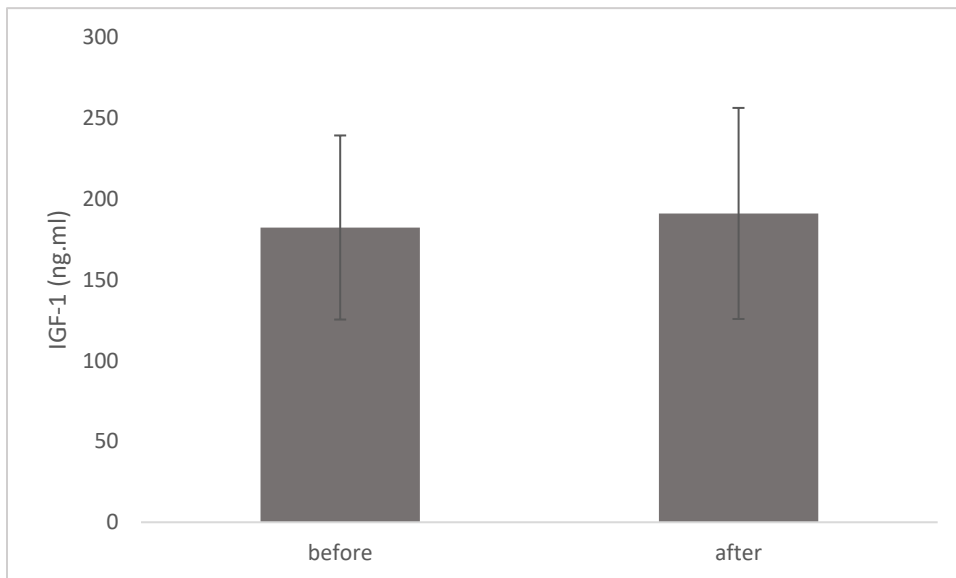


Chart 2: IGF-1 changes

4. Discussion

Our results show that Decorin increased significantly immediately after HIIE ($P=0.018$) and IGF-1 increased after exercise session significantly too ($P=0.021$). Based on this results, it seems that some of adaptations to HIIT maybe be related to Decorin changes. Kanzleiter et al. (2014) showed that muscular transcription of Decorin increased after one bout exercise and it associated with increased plasma levels of decorin (12). Although, it seems that acute exercise session can increase Decorin the effect of training is unknown. On the other hand, sampling time is a important factore, because Decorin levels decrease to primary levels about one hour after exercise. Also, exercise intensity and duration have main effect on Decorin responses. Researchers suggested that Decorin has effect on muscle hypertrophy but their underline mechanisms are unknown(19).

Meckel et al.(2011) reported increasing in IGF-1 levels after one bout exercise (19) but in other researches increase in IGF-1 was not significant. The response of IGF-1 to one bout exercise depends on many factors like: exercise protocol, exercise duration and intensity, subjects' physical fitness in base line, sexuality and others. Exercise recruitments systemic IGF-1 from liver and local IGF-1 from muscle. Growth hormone is a main stimulator for production of IGF-1 in liver, but this process needs a long time(21). Findings showed that increase of IGF-1 after exercise is independent to GH and it seems that relates to muscular IGF-1 (21).

Δ. Conclusion

Our finding showed that one bout HIIE increased Decorin and IGF-1 significantly. Due to this findings it seems that Decorin can effect on hypertrophy process after exercise.

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Author contributions

Conceptualization: L.M., M.D.; Methodology: M.A., M.D.; Software: L.M.; Validation: M.A., M.D.; Formal analysis: M.A., M.D.; Investigation: M.A., M.D.; Resources: M.D., L.M., M.A.; Data curation: M.A., M.D.; Writing - original draft: L.M., M.D.; Writing - review & editing: M.A., L.M.; Visualization: M.D., M.A.; Supervision: M.A.; Project administration: M.D.; Funding acquisition: L.M., M.A.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval the research was conducted with regard to the ethical principles

Informed consent Informed consent was obtained from all participants.

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