

Does Serum Adiponectin Levels Influence the Muscular Fitness in University Level Football Players?

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Abstract Adiponectin is known to be a recently debated hormone secreted from Adipose tissue. Many studies have revealed the varied effects of Adiponectin on obesity, type II diabetes mellitus, inflammation, cardiovascular disease and skeletal muscle etc., Not many studies have explored the connection between muscular fitness and Serum Adiponectin levels in the athletic population. The purpose of this study is to depict the connection between Serum Adiponectin levels and muscular fitness. We evaluated 29 male University level football players aged between 18 to 25 years. Anthropometric parameters like skin folds and girth measurements were taken. Overnight fasting 5ml venous blood sample was collected and analyzed to evaluate levels of Serum Adiponectin. Subjects then underwent muscular fitness tests such as Hand Grip Strength test, Broad Jump test and 1RM Leg Press test. Pearson correlation coefficient test was used to estimate the association of Serum Adiponectin levels with waist to hip ratio, muscle mass, hand grip strength, broad jump test score and 1RM leg press. Our results revealed a significant positive connection between levels of Serum Adiponectin and the muscular fitness parameters. A mild positive correlation between levels of Serum Adiponectin and Muscle mass was also observed. Thus Serum Adiponectin can be considered as one of the key determinants of Muscular Fitness in athletic population.

Keywords Serum Adiponectin, Muscular Fitness, Football

1. Introduction

Recently, few studies have identified naturally active protein called Adiponectin, secreted and expressed in mice and human adipose tissue, an endocrine organ [1, 2]. In addition to the adipocytes, cardiomyocytes, bone forming cells, pituitary cells and skeletal muscle also secretes it [3]. It prevents the development of type II Diabetes Mellitus, obesity and cardiovascular diseases [1]. Adiponectin exerts insulin-sensitizing effects in liver and skeletal muscle which are the vital tissues in glucose homeostasis [4]. It has also been assumed to be involved in the regulation of skeletal muscle growth [5].

Skeletal muscle plays a crucial role in determining whole-body insulin sensitivity and glucose disposal. Slow twitch (type I) fibers and fast twitch (type II) fibers differ in their contractile and metabolic characteristics. Type II fibers are nonreactive to insulin compared to type I fibers because they are predominantly oxidative and contain more

mitochondria. Higher type I slow twitch fibers is directly proportional to the whole body glucose uptake and muscle glucose transport. Decreased proportion of type I fiber exists in patients with insulin resistance.

To increase the mitochondrial biogenesis and induce calcium influx into myotubes, adiponectin infers results similar to exercise training. Recent reports in muscle specific Adipo R1 disruption in mice suppressed exercise mimetic effects which led to insulin resistance and decreased exercise endurance capacity. Since adiponectin and exercise provided similar metabolic effects, potential role of adiponectin in mediating the insulin sensitizing action of exercise are being explored [4].

Muscular fitness is one of the confounding factors of performance in football players. Assessing strength of correlation between muscular capacity and the serum adiponectin levels will benefit them to enhance their performance. This study was initiated to prove that serum levels of adiponectin may play a novel role in determining the level of muscular fitness.

Very few studies have investigated the relationship between muscular fitness and serum adiponectin levels in athletic population. Therefore, we intended to study the correlation between muscular fitness and serum adiponectin levels in Indian athletic population.

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2. Materials and Methods

2.1. Subjects

The study commenced after the approval from Institutional Ethics Committee of Sri Ramachandra Medical College & Research Institute. This study included 29 male university football players aged between 18 – 25 years who trained for minimum 10-15 hours per week. Exclusion criteria were any current medical illness or musculoskeletal injuries that prevented the individual from performing muscular fitness tests. Prior to the data collection, written informed consent was obtained and a medical examination was done to ascertain that the individual was fit to undergo the test.

2.2. Serum Adiponectin

After sterile precautions, a 5-mL overnight fasting venous blood sample was collected from the participants by venipuncture in the anti-cubital vein. The samples were stored in sterile blood collection tubes in refrigerated conditions (4° to 8°C), and then sent to an analytical laboratory for the Serum Adiponectin analysis. Serum Adiponectin level was analysed using 48 wells ELISA kit (Bioassay Technology Laboratory). Levels of serum adiponectin were expressed in mg/L.

2.3. Anthropometry

Body mass and height was measured in minimal outfit on SECA instrument with an accuracy of -0.02 kg. Skin fold thickness was measured to the nearest 0.2 mm, on the dominant side of the body, at the mid-thigh and calf, using Harpenden skin fold caliper. The girth measurements were taken from mid-thigh, calf and forearm. The muscle mass was calculated using Martin's equation which utilizes height, girth measurements such as mid-thigh, calf, forearm and also the skin fold measurements such as mid-thigh and calf [5].

Martin's equation:

$$\text{Muscle mass (g)} = H (0.0553\text{CTG}^2 + 0.0987\text{FG}^2 + 0.0331\text{CCG}^2) - 2445,$$

$$\text{CTG} = \text{TG} - \pi (\text{mid-thigh skin fold}/10)$$

$$\text{CCG} = \text{CG} - \pi (\text{calf skin fold}/10)$$

Where, H = Height, FG = forearm girth, CG = calf girth, CCG = corrected calf girth, TG = mid-thigh girth, CTG = corrected mid-thigh girth, π = Pi.

2.4. Handgrip Strength

After proper demonstration, handgrip strength (upper body isometric strength), was measured with a handgrip dynamometer, (T.K.K. 5001, Grip-A produced by Takei, Japan), adjusted by sex and hand size for each subject. The subjects were made to remain with their arm totally stretched crushing the dynamometer steadily and persistently for no less than 2 seconds. They performed the test twice alternating with both hands. A 90 sec period rest was given between trials. The handgrip score (kg) was calculated as the

average of the left and right hands and then expressed per kilogram of body.

2.5. Standing Long Jump

After appropriate warm up and demonstration, the subjects performed standing long jump test (lower body explosive strength) in an indoor wood floor. They were instructed to jump from the starting line and to push off vigorously and jump as far forward as possible landing on both feet. The best of three trials was selected. The standing long jump score was documented by the separation between the take-off line and the heel-mark.

2.6. 1 RM Leg Press

Prior to the testing, participants performed a familiarization session with the leg press resistance training equipment. 1RM is defined as the heaviest load; a participant could lift once with a proper lifting technique, without compensatory movements. The test was commenced after an adequate warm-up and stretching. The maximal strength test protocol included one set of 10 repetitions at a relatively light load followed by a gradual increase in load until 1RM was achieved. Throughout the test, the participant's rate of perceived exertion (RPE) was recorded using Borg scale.

2.7. Statistical Analysis

Data analysis was performed with the Statistical Package for Windows (Version 20 SPSS Inc., Chicago, IL). Descriptive data were presented as mean and standard deviation. Pearson correlation coefficient was used to evaluate the relationship of serum adiponectin levels with anthropometric variables and muscle fitness parameters.

3. Results

The descriptive statistics of study participants were shown in Table 1. Table 2 shows the output of Pearson correlation coefficient test, which reveals that there was a significant positive correlation between the levels of Serum Adiponectin and waist to hip ratio, hand grip strength, broad jump test and 1RM leg press. But only mild positive correlation exists between levels of serum adiponectin and muscle mass.

Table 1. Descriptive statistics of study participants (n=29)

Variables	Mean \pm SD
Age	19.56 \pm 1.97
Height (cm)	174.76 \pm 5.02
Weight (kg)	66.60 \pm 15.00
BMI (kg/m ²)	21.98 \pm 2.74
Waist to hip ratio	0.79 \pm 0.05
Muscle mass (kg)	34.55 \pm 6.82
Relative grip strength (ratio)	0.85 \pm 0.24
Broad jump test (m)	2.17 \pm 0.16
1 RM Leg press (kg)	88.00 \pm 25.58
Levels of adiponectin (mg/L)	8.72 \pm 3.32

Table 2. Correlation between serum levels of Adiponectin and anthropometric test scores

Variables	r Value	p Value
Muscle Mass	0.15	0.43
Waist To Hip Ratio	0.32	0.10
Relative Hand Grip Strength	.601**	0.01
Broad Jump Test	.393*	0.03
1RM Leg Press	.542**	0.002

* Significant at the level of p value ≤ 0.05 **Significant at the level of p value ≤ 0.01

4. Discussion

This correlational investigation endeavored at observing the relationship of serum adiponectin levels and muscular fitness in 29 College level football players. Our outcomes uncovered that there exists a moderate positive relationship between serum adiponectin levels and muscle mass. As opposed to our observation, a study done by Lubkowska et al in 95 healthy adults documented a negative relationship between serum adiponectin levels and lean body mass [6]. Few studies have stated that serum adiponectin levels negatively correlate with body mass index (BMI), waist hip ratio and body fat percentage [7]. But our study results did not confirm the same.

In a study done by Alice S. Ryan et. al., on 148 women aged 18 – 81 years with the BMI range of 17.2 – 44.3 g/m², showed that adiponectin concentration did not differ by age groups & there were significant age effects for BMI, %BF, visceral fat, subcutaneous abdominal fat [8]. In another study by Park KG et. al., 197 women grouped based on their visceral adipose tissue area; the visceral fat dominant group showed lower adiponectin levels than the subcutaneous fat dominant group. The adiponectin levels were inversely correlated with subcutaneous adipose tissue area & visceral adipose tissue area [9]. Body composition (BMI, fat mass, percentage of fat) has been earlier described to be negatively connected with serum adiponectin in Japanese people [10, 11], Indians [12], and Caucasians [12].

The present study states that levels of serum adiponectin strongly correlate with muscular fitness in university athletes. This may also be affected by other confounding factors such as type of diet, socioeconomic status and levels of physical activity. Only limited evidence exists supporting this relationship on a molecular level [13].

Agostinis Sobrinho et. al., evaluated the relationship between adiponectin levels and muscular fitness in adolescents, adjusting for a few potential confounders with 529 Portuguese young people aged 12-18 years. A Muscular Fitness score was computed as the mean of the handgrip strength and standing long jump standardized values by age and gender. And they observed an inverse association of serum adiponectin with muscular fitness score [14]. In another study conducted by Loncar et al., with 1259 elderly population in Japan recorded an increased levels of Serum Adiponectin in elderly heart failure patients with decreased

peripheral muscle mass and muscle strength [15]. In a study conducted on Japanese population, negative impact of increased serum adiponectin levels on physical function & health status of elderly population was documented [16].

There is no confirmatory evidence on the role of adiponectin on skeletal muscle strength. The pathways of adiponectin are still to be explored. Therefore, the casual relationship between the two factors could not be clearly demarcated by our findings.

Adipose and Non adipose tissues contribute to the serum levels of adiponectin. Role of skeletal muscle in determining the levels of serum adiponectin could not be clearly ascertained. Our sample size was smaller due to the limited funding. The current study could be extended to a larger study population with limitation of confounding factors such as physical activity status and dietary habits.

5. Conclusions

In opposition to our speculation, levels of serum adiponectin positively correlated with muscular fitness test scores in our study population. There exists mild positive relationship between serum adiponectin level and anthropometric measures. Thus adiponectin can be one of the factors which determine the muscular fitness. Further studies are warranted to depict the molecular basis of the above relationship.

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