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The Impact of Resistance Training on the Expression of TNF-α Protein in Fat of Diabetic Rats

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Abstract: Resistance training can increase muscle mass, strength and function of muscles in diabetics. TNF-α as an adipokines presented that its effects have been identified in relation to diabetes. This study aimed to determine the effects of resistance training on TNF-α protein expression in adipose tissue in normal and diabetic rats by STZ was created. A total of 40 rats were randomly divided into exercise diabetic groups and practice healthy and two diabetes and healthy control groups were divided. Diabetes injected with a single dose of STZ (55 mg per kg body weight, ip) was created and applied resistance training in 17 sessions and TNF-α protein expression level in fat tissue were measured by ELISA. After 17 sessions of resistance training group significant differences between TNF-α in the adipose tissue was observed. Exercise ($P < 0.01$) and diabetes ($P < 0.001$) were impacting the amount of TNF-α but there was no significant interaction between exercise and diabetes group. It seems that factors such as immunoregulatory, communication between myokines and used adipokines and intensity of exercise can be effective in the results.
Key words: TNF-α, resistance training, adipose tissue.

INTRODUCTION

Today, diabetes is controllable but incurable disease and continuous care to understand the nature and goals of diabetes treatment, resulting in more motivated patient to patient compliance with diet and continuous and long-term follow-up in implementing the goals of treatment. Most studies show that patterns of behavior change and changes in lifestyle these patients is greatly effective in controlling the disease and resulting complications. Since this disease is multifactorial, due to the pattern of disease control is of particular importance to enjoy. High serum levels of inflammatory factors and the role of these factors in diabetes is considered the last 2 decades (Pickup, 2004). It seems that inflammatory factors such as TNF (tumor necrosis factor) directly and through the death of retinal vascular endothelial cells and indirectly through the increased expression of genes related to clotting factors inflammation- and adhesion molecules are involved in the development and progression of diabetic retinopathy (Aspangr, 2003). In the past it was believed that adipose tissue is a tissue ineffective and only serves for storage of triglycerides but now shown that adipose tissue as well as a number of bioactive proteins, which is generally called adipokines, secretes and in this way create systemic inflammation by increasing blood flow levels of inflammatory factors such as TNF-α and CRP plays a role associated (Dandona, 2004). Recent evidence suggests that inflammatory factors such as TNF-production obesity through chronic inflammation play a role. In fact, chronic inflammation, connecting the most important factor in obese adipose tissue mass with insulin resistance because TNF-α in addition to being a factor which is released from adipose tissue, an important mediator of insulin resistance in obese person comes to account. It is shown that the absorption of adipose tissue macrophages from blood circulation by the most important cause of inflammatory processes and a major source of inflammatory factors such as TNF-α synthesis in obese people. In between cytokine, TNFα is a pro-inflammatory cytokine that is secreted primarily by macrophages and lymphocytes and a trace amount of human adipose tissue itself is produced and its expression in subcutaneous adipose tissue and visceral identical (Greenberg and Obin, 2006)

Exercise Immunology studies on key elements of safety functions such as immune cells, immunoglobulins, glutamine and instant messenger molecules (cytokines) focused. Among the various components of the immune system is cytokines, soluble factors to this device. Cytokines, peptides or proteins that are released by cells of the immune system and the production and mediated immune responses are produced. In general, cytokines into two broad categories-inflammatory and anti-inflammatory divide. Pro-inflammatory cytokines are involved in the development of inflammation while anti-inflammatory cytokines are released in response to inflammation. And limiting and reverse the process of progressive inflammation (Abbas et al., 2007). Most studies on the effects of exercise training on glucose regulation as a method of strength training exercises. Some studies have shown that strength training 2 to 3 times the ability to improve glucose utilization by insulin in skeletal muscle as well. Many

adaptations observed in glucose regulation are looking for strength training include increased capillary density, increased content of GLUT4, increase the content of protein kinase B, glycogen synthase activity and become less oxidative muscle fibers of type 2B muscle fibers more sensitive to insulin 2A with higher oxidative capacity, possible changes in oxidative and non-oxidative enzymatic activity combined phosphorylated by sarcolemma and is (Anderson et al., 2003). It is shown that resistance training improves endurance training is similar in glucose regulation; resistance exercise increases insulin action in skeletal muscle, improves glucose tolerance and reduce the concentration of the transtheoretical model. Various studies using resistance training have observed improvements in insulin resistance (Grandfield et al., 1997). It is not known that resistance exercise improves glucose regulation mechanisms are similar to the effects observed improvement in the effect of endurance training or not? One of the adaptations resulting from resistance training increases testosterone levels blood flow (Cumming et al., 1986), it has been shown between testosterone responses to resistance exercise and obesity anthropometric markers were correlated (Seater, 1987). Testosterone induces suppression of proinflammatory cytokines such as TNF-α and thus reduces TNF-α leads to decrease insulin resistance and reduce the risks caused by diabetes. The aim of this study was to investigate the effects of resistance training on the expression of TNF-α protein in diabetic rats is fat.

The hypothesis of the study

1. One periods of resistance training has an effect on resting levels of serum glucose in diabetic rats.
2. One periods of resistance training has an effect on resting levels of serum insulin in diabetic rats.
3. One periods of resistance training has an effect on the expression of TNFα protein in diabetic rats fat.

Literature

Diabetes

Diabetes is the most common metabolic disease in the world, about 2.5 to 3% of the world population suffer from metabolic disorders and long-term complications of eye, kidney, nerve, blood vessel and determined and ultimately cause disability and mortality in these patients. Although many researchers have reported the disease perilous side effects, but diabetes can be controlled by maintaining blood glucose readings (Gasby, 2002).

Adipose tissue

Each texture is a collection of specialized cells that perform a certain task. The four main types of body tissues called epithelial tissue, connective tissue or connective, muscle tissue and nerve tissue are divided. Cartilage, bone, blood and adipose tissue are specialized connective tissue (Bodo et al., 2003). Despite the preliminary view that the relatively neutral adipose tissue and adipose tissue is known to separate knew congested and is metabolically very active. In addition to the special role of adipose tissue it acts as a place save energy. This is the general impression after completing a teenager growing number of fat cells remains constant. Changes in fat tissue volume size and lipid content of cells they are. Fat cells by liposuction or other surgical procedures are outside; again, it is not production. Or overall weight loss, fat cells shrink, and in fact may lose their distinctiveness. Although significant weight gain can cause further differentiation of fat cells or increase in their volume (Kerren et al., 2001). Adipose tissue consists of fat cells with thin cell wall is located within a fibrous network without protective fibers, fat cells have a tendency to collapse (collapse), an additional support network of connective tissue structures, causing fat cells which are clearly visible. Chronic inflammation is a known risk factor for insulin resistance. At present, it is believed that adipose tissue macrophages recruited from the circulating blood, the main source of inflammation in obesity and type 2 diabetes and can be involved in the pathophysiology of insulin resistance (the same).

Resistance training

"The first factor is robust and healthy muscle function; muscle fibers have a healthy and strong. This is the law of nature wherever muscle is calling for frequent use, it folds to a certain extent increased the diameter of the find and for strong performance and the ability to find them more readily. "The increase in cross-sectional area of muscle and neurological changes use duplicate of strength training. Increased cross-sectional area of muscle (hypertrophy) following resistance exercise as the synthesis is greater than protein breakdown occurred. Essentially responses to overload hypertrophy in terms of quality and quantity of new muscle cells through the production of cellular proteins and controlled. Adaptations to resistance training include increased protein synthesis by changing the settings on the mechanisms of transcription and translate that into existing myofibrils or combined to form new filaments for power generation is created. In addition, a certain degree of muscle protein breakdown is required for deformation. Resistance training may also reduce long-term activation

atrophy routes and thus help to synthesize protein purification. In response to the long-term muscle strength training is great. To investigate the effects of strength training on muscle growth in different such as muscle cross-sectional studies, CT or MRI. Muscle growth primarily through an increase in the size of muscle fibers known as hypertrophy caused. Several studies increase in the size of muscle fibers in response to resistance training have shown. It seems irritation caused by resistance training for muscle growth begins with the loss of integrity of the sarcomere. The theory is that when muscle damage created and satellite cells form a multi-core Miotube to copy new proteins help to form Miofylamnt (White, 2006). It was suggested that in the early stages of resistance training (8-2 weeks) neuromuscular system "learns" how to generate force. Changes in proteins, myosin heavy chain type with changes in type ATPase enzyme is characterized by resistance training program has been observed since the beginning of (the same).

RESEARCH METHODOLOGY

This study fundamental research and experimental methods to determine the effects of resistance training on serum TNF-α protein expression in adipose tissue in normal and diabetic rats by STZ was created. A total of 40 diabetic rats were randomly divided into groups and practice healthy exercise and healthy control groups were divided and diabetes. Diabetes injected with a single dose of STZ (55 mg per kg body weight, ip) was created and applied resistance training in 17 sessions. TNF-α protein expression level in fat tissue were measured by ELISA. To determine the statistical differences between groups Variables two-way analysis of variance and t-test was used.

Research findings

Hypothesis 1) resistance training on resting levels of serum glucose in diabetic rats has no effect.
Two-way ANOVA test results showed that diabetes causes significant changes in serum glucose levels have been resting. But exercise (P = 0.13) and interaction between exercise and diabetes (P = 0.18) was not significant.

Table 1. two-way ANOVA test results for serum glucose levels outs

sum of squares	Degrees of freedom	average of squares	F	Significant	
5296.104	3	1765.368	236.692	0.00	Corrected model
5214.780	1	5214.780	699.171	0.00	Effects of Diabetes Eeffect of exercise
17.855	1	17.855	2.394	0.13	
13.728	1	13.728	1.841	0.18	The interaction between exercise and diabetes

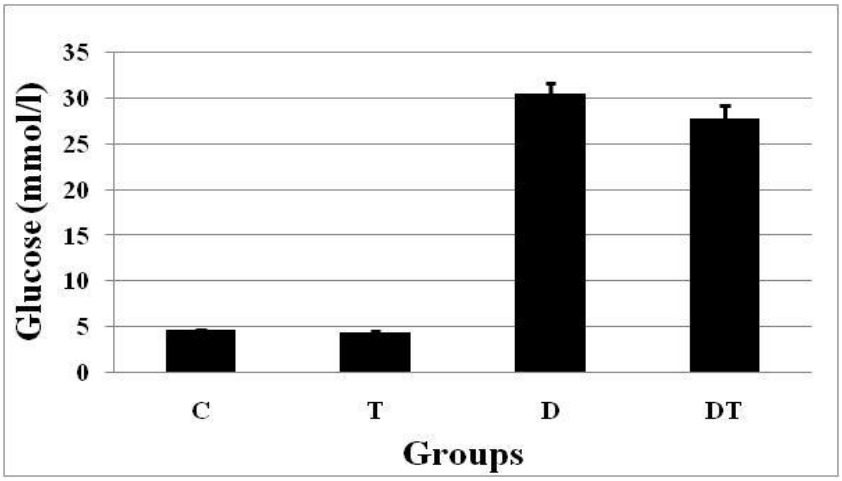

Figure 4-4) glucose paradigm shift in research groups after training

Hypothesis 2) resistance training on resting levels of serum insulin in diabetic rats has no effect. Two-way ANOVA test results showed that after 17 sessions resistance between resting concentrations of serum insulin in diabetic patients and non-diabetic and non-workout workout and there is a significant difference.
However, the interaction between exercise and diabetes was not significant (P = 0.76).

Table 4-2. two-way ANOVA test results for serum insulin levels outs

sum of squares	Degrees of freedom	average of squares	F	Significant	
2.064	3	0.688	42.847	0.00	Corrected model
1.971	1	1.971	370.047	0.00	Effects of Diabetes Eeffect of exercise
0.07	1	0.07	122.776	0.04	The interaction between exercise and
0.002	1	0.002	4.334	0.76	diabetes

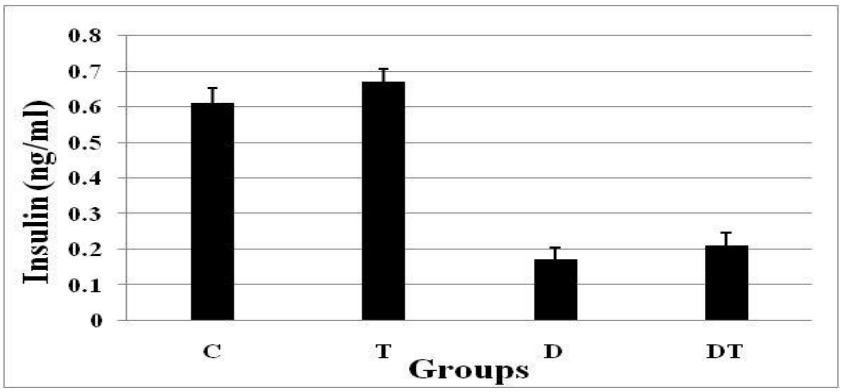

Figure 5), insulin paradigm shift in research groups after training

Hypothesis 3) resistance training on serum TNF-α protein in fat tissue of diabetic rats has no effect. Two-way ANOVA test results showed that after 17 sessions resistance between TNF-α concentrations of lipids in diabetic patients and nondiabetic and practicing and non-practicing there were significant differences (Figure 6 and 7).

However, the interaction between exercise and diabetes was not significant (P = 0.21).

Table 3. two-way ANOVA test results for serum insulin levels outs

sum of squares	Degrees of freedom	average of squares	F	Significant	
81818.171	3	27272.724	9.041	0.00	Corrected model
48236.140	1	48236.140	15.991	0.001	Effects of Diabetes Eeffect of exercise
19743.527	1	19743.527	6.545	0.018	The interaction between exercise and
5009.336	1	5009.336	1.661	0.211	diabetes

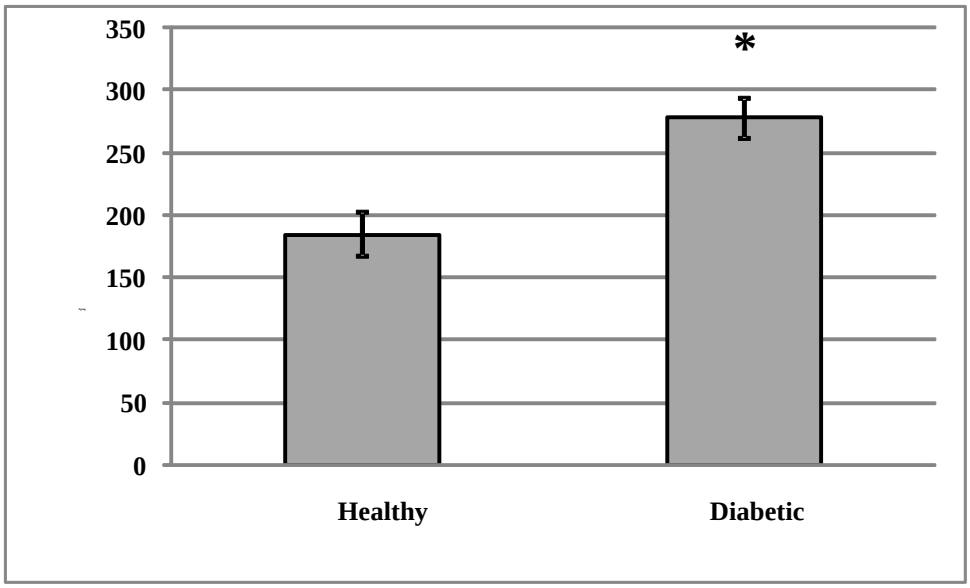

Figure 6) TNF-α protein levels in diabetic patients and healthy

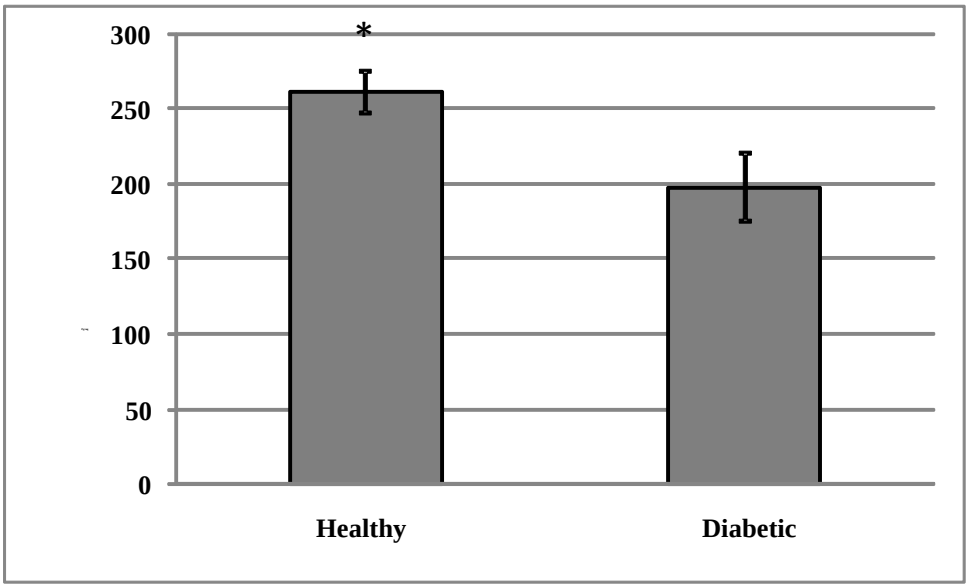

Figure 7) TNF-α protein in groups practicing and non-practicing

DISCUSSION AND CONCLUSION

The main results were as follows

After 17 sessions of resistance training showed no significant difference between groups in serum insulin concentrations have been observed.

Exercise ($P < 0.05$) and diabetes ($P < 0.001$) were the factors affecting insulin levels but there was no significant interaction between exercise and diabetes.

After 17 sessions of resistance training showed no significant difference between the groups was observed in serum concentrations of glucose. Diabetes was the only factor affecting plasma glucose levels ($P < 0.001$).

After 17 sessions of resistance training group showed a significant difference between the amounts of TNF-α in adipose tissue has been observed. Exercise ($P < 0.01$) and diabetes ($P < 0.001$) were impacting the amount of TNF-α but there was no significant interaction between exercise and diabetes.

DISCUSSION AND CONCLUSION

The results indicate that the effects of exercise and diabetes on the amount of TNF-α were released from adipose tissue. Practice and created with STZ diabetes by increasing the amount of protein that have adipokine. Diabetes is caused by STZ way Laboratory of developing diabetes That some sources due to changes in insulin and glucose intermediate between type 1 and 2 diabetes as known (Lee et al., 2003). Diabetes is a disease of the immune system in autoimmune disease that can be seen. It has been shown that TNF-α immunological source of adipose tissue macrophages are released. Macrophages also responsible for producing more than 50% of IL-6 are released from adipose tissue (Visberg et al., 2003). Due to poor immunological response in diabetes, it is possible the resistance training stimulus to stimulate the immune system, enabling it to be adipokine and production. Increased levels of mRNA and protein expression of TNF-α in other studies of endurance exercise training had used as an example and insulin resistance has been observed in mice (Nara et al., 1999). Another point is raised the survey conducted our study in animal models of rats. Further studies of this type have used samples increase or no change in the amount of TNF-α protein in fat tissue was observed (Gomez Mariano et al., 2007). It is likely that the use of human specimens we create inconsistent results with observations. The point has been proposed in the inflammation associated with insulin resistance in diabetes and obesity that control inflammation can be created through proper diet. Richard et al (2008) examined the effect of exercise on improving insulin sensitivity and inflammation of adipose tissue in rats fed a fattening diet began. They have a sports program on mouse models that were fed high-fat food sources. The results showed that mice that were fed a high-fat diet and did not participate in the exercise program had to have insulin resistance while mice that had participated in the exercise program, insulin sensitivity were perfectly normal. In addition, TNF

expression in adipose tissue in mice that received the high-fat diet had increased, while the exercise was able to reduce the amount of inflammatory cytokines (Bradley et al., 2008).

Another possible point of discussion was training intensity. Cytokines includes IL-1 and TNF-α warning requirement. They act in the proper sequence is secreted by macrophages living tissue and are stimulated by injury or infection. Extreme sports cytokines is increased. Extreme sports with a muscle injury is secretes cytokines (Great and Krkndal, 2000). It is likely that practice creates severe inflammatory response in fatty tissue and increase the amount of protein is TNF-α. However, in a study conducted by the Solar Molanouri et al (2013) fast and slow muscle mass gain has been observed with the use of this practice and in muscle tissue increased levels of inflammatory cytokines in training groups yet. Possible link between myokines released from muscle tissue and released from adipose tissue during exercise adipokine raised. More research in this area in response to questions raised by adipokine will respond to exercise.

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