

**Research Article**

## THE EFFECT OF AEROBIC TRAINING ON LEVELS OF FGF21 IN DIABETIC WOMAN

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### ABSTRACT

The aim of this study is to determine the effects of aerobic training on serum FGF21 levels and glucose in women with type II diabetes mellitus. Women with type II diabetes mellitus were divided into two groups including control (n=14) and aerobic training (n=14) the mean levels of serum FGF21, glucose were measured in all participants after 8 weeks exercise. The mean of FGF21 levels after exercise was increased significantly in aerobic ( $p < 0.001$ ) group. The mean of glucose was decreased significantly after exercise in exercised group ( $p < 0.01$ ). Aerobic training increase mean value of FGF21 levels and as the result decline the mean levels of glucose in blood of women with type II diabetic mellitus.

**Keywords:** FGF21, Aerobic Training, Diabetic Women

### INTRODUCTION

FGF21 is an endocrine hormone that belongs to the FGF family and is mainly expressed in adipocytes, liver and the pancreas (Kim and Lee, 2014). The most of studies have shown that FGF21 involved in metabolic regulations especially glucose uptake, stimulation of gluconeogenesis (Berglund *et al.*, 2010). The most of pharmacologic studies on animal models demonstrated that FGF21 to be a potential therapeutic way for the treatment of type 2 diabetes because of FGF21 administration leads to significant decrease in fasting blood glucose levels (Habegger *et al.*, 2013). Therefore, FGF21 can be considered as a therapeutic agent for obesity-related metabolic Diseases Hale *et al.*, (2012). However, in humans it's still not clear. In some clinical studies, high circulating FGF21 levels is associated with cardiometabolic disorders including the metabolic syndrome type 2 diabetes and non-alcoholic fatty liver disease (Lee *et al.*, 2014).

It seems that exercise training is critical for prevention and treatment of metabolic disorders such as diabetes type 2 and overweigh (Kim *et al.*, 2013). In this study, hypothesized it is may be mediated by FGF21 levels by exercise training.

Recently, have shown that increased serum FGF21 level is related to regular physical activity in healthy humans (Cuevas-Ramos, 2012). However, it is not well-known that whether aerobic training affects FGF21. Therefore, in this study we aimed to investigate the effects of an eight weeks regular aerobic training on FGF21 and glucose levels in diabetic women.

### MATERIALS AND METHODS

#### **Subjects**

30 women with type II diabetic mellitus without any contraindication for exercising, were included in this study. Participants had no history of vigorous physical activity and other chronic diseases such as cancer. The mean of demographic characteristics of all participants are shown in Table 1.

Then subjects were divided randomly into two groups including control and training groups. The levels of FGF21 and glucose were measured during the day of one and after 8 weeks.

#### **Exercise Training protocol**

The training program was performed during 8 weeks, 3 sessions each week. The intense of the training program proceeded form 45% to 50% (in the first 2 weeks), 50% to 55% (in the second 2 weeks), 55% to 60% (in the third 2 weeks) and 60% to 65% of maximum heart rate (in the last 2 weeks). All training programs included the warm up and cool-down processes from 10 to 15 minutes. The intense training

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program was controlled and regulated, using a polar. All subjects performed a warm up (20 minutes) and a cool-down (15 minutes) program in every training session (Kwon *et al.*, 2010).

### Biochemical Measurements

Blood samples centrifuged at  $3000 \times g$  at  $4^{\circ}\text{C}$  for 15 minutes. The serum was stored immediately at  $-80^{\circ}\text{C}$  until future analysis. The serum FGF21 and glucose concentrations were determined using ELISA kit (FGF21/UNQ3115/PRO10196, Cusabio, China) and enzymatic assay kit (Glucose /1 500 017/ pars azmon, IRI) according to the manufacturer's instructions and concentrations.

### Statistical Analysis

The Kolmogorov-Smirnov test was performed to assess the normality of data distribution. Student's *t-test* was used as appropriate for comparison of measurements before and after exercises.  $p < 0.05$  was considered statistically significant.

## RESULTS AND DISCUSSION

### Results

Patient profile and information on some demographic characteristics are summarized in Table 1.

**Table 1: The mean of demographic characters of all participants**

Variables	Training group	Control group	p-value
High (cm)	165.5±6.53	160.66±6.54	0.192
Weight (Kg)	79.5±8.96	75.66±9.44	0.158
Age (year)	50.83±6.79	50.17±5.34	0.103
BMI (Kg/m <sup>2</sup> )	30.71±3.44	29.37±4.55	0.885
SBP	152.43±8.18	152.71±9.56	0.937
DBP	92.14±8.80	91.42±9.93	0.995

The mean of FGF21 concentration after post-examination was increased significantly in training ( $p < 0.001$ ) group. However, in the control group there was no significant difference in FGF21 concentration during 8 weeks ( $p = 0.269$ ).

The mean of glucose was decreased significantly after 8 weeks in training ( $p = 0.002$ ) group. However, in the control group there was no significant difference in glucose concentration during 8 weeks.

**Table 2: The mean of some blood factors in each group**

Variables	Training group	Control group	p-value
<b>FGF21 (pg/ml)</b>			
Before exercise	267.57±28.62	353.28±24.63	<0.001
After exercise	393.43±33.39	367.57±28.62	0.132
<b>p-value</b>	<0.001	0.269	-
<b>Glucose (mg/dl)</b>			
Before exercise	176.43±42.69	163.71±39.31	0.818
After exercise	142.43±49.51	171.0±42.59	0.392
<b>p-value</b>	0.002	0.232	-

### Discussion

Most studies have shown that FGF21 levels are associated with the amount of physical activities (Kosola *et al.*, 2012).

Cuevas-Ramos *et al.*, (2012) reported that the levels of is increased after two weeks of exercise training (Cuevas-Ramos *et al.*, 2012). In this study, our results demonstrated that the mean of serum FGF21 levels was increased significantly after 8 weeks trainings in the training group. In addition, other findings showed that aerobic training, improve the glucose metabolism in studied subjects. Aerobic training significantly decreased the mean of serum glucose after 8 weeks trainings (Spolcova *et al.*, 2014).

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Previous studies have also reported FGF21 is related to insulin. Insulin inhibits lipolysis and blocks the main mechanism by which exercise stimulates FGF21 secretion (Alisi *et al.*, 2014).

Our results were consistent with Yang *et al.*, study. They reported that a three-month combined exercise program decreases the serum FGF21 levels as well as arterial stiffness in obese Korean women (Yang *et al.*, 2011).

Other study showed that serum FGF21 significantly increased after two weeks of physical activity in women (Cuevas-Ramos *et al.*, 2012). Then, Kim *et al.*, reported that FGF21 level is increased in mice after a single bout of acute exercise. They proposed that FGF21 may also be associated with exercise-induced increased catecholamines and reduced insulin (Kim *et al.*, 2013). It appears, aerobic training improve glucose metabolism by increasing in insulin levels and activating the AMPK pathways, that GLUT4 translocation to the muscle cell surface and glucose uptake (Lund *et al.*, 1995).

In this study, showed that aerobic training lead to increase of FGF21 levels as in diabetic women. Then, speculate that increased FGF21 mediates some of the beneficial effects of aerobic training on glucose metabolism in diabetic women.

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