Experimental Evidence Spotlighting the Physical Inactivity as Risk of Diabetes Development

Ahmadi R*, Kassaee M, and Shabanloo F

***Abstract*—** There are studies indicating the association between physical activities and glucose homeostasis. The main aim of this study was to determine the association between low physical activity and serum levels of glucose and insulin in male rats. Male Wistar rats were randomly divided into control and immobilized rats of 5 in each group. After 6 weeks blood samples were collected using cardiac puncture method. Following serum collection, glucose and insulin levels were measured. Data were statistically analyzed and compared between groups using ANOVA. The results indicated that serum glucose to insulin level was significantly increased in immobilized rats compared with control animals ($p<0.001$). Our finding indicates that low physical activity have a significant role in developing of diabetes.

***Keywords*—** Immobilization, Insulin, Glucose, Rat.

I. Introduction

PHYSICAL activity is performed for various reasons including strengthening muscles and the cardiovascular system, weight loss or maintenance, as well as for the purpose of enjoyment. The studies show that there is association between physical activity and many different physiological functions in the body. Frequent and regular physical exercise boosts the immune system, and helps prevent the "diseases of affluence" such as heart disease, cardiovascular disease, Type 2 diabetes and obesity [1], [2]. The reports have indicated that regular and formal physical activity can improve body mass, therefore, low physical activity has a considerable role in developing of obesity in all age ranges [3], [4]. Low physical activity or physical inactivity is also a risk factor for hypertension [5]. There is also association between prevalence rates of low physical activity or physical inactivity and diabetes [6]. Immobilizing and restraining can influence many physiological aspects of organism and are considered as stress condition which is followed by alterations in body systems [7]-[9].

An alarming increase in the prevalence of diabetes and associated diseases can be observed world-wide during the past 20 years in part because of low physical activity and although there are reports indicating the effects of low physical activity on diabetes developing, there are still conflicting data on direct effect of physical inactivity on glucose and insulin levels. This experimental laboratory study was exerted to determine the effects of physical inactivity on serum glucose and insulin level in male rats through immobilizing of the animals.

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II. Material and Methods

A. Animlas

Adult male Wistar rats weighting 200±30g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran).The temperature was at 23±2 ^{0}C and animals kept under a schedule of 12h light: 12h darkness with free access to water and standard laboratory chow.

B. Protocol of Study

Male Wistar rats were randomly divided into control and immobilized animals (4h/day) of 5 in each group. For immobilizing the animals, a standard restrainer was used. After 6 weeks blood samples were collected using cardiac puncture method. Blood samples were collected in appropriate tubes by cardiac puncture technique 24h after the last treatment. After collection, the blood samples left to clot at room temperature for 15 minutes and then centrifuged at 2500 r.p.m. for 15 minutes. The serum layer was then separated and aliquoted into small test tubes. Serum glucose level was measured using spectrophotometery method and serum insulin level was measured using radioimmunoassay method.

C. Statistical Analysis

All values are presented as mean±SEM. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Game-s Howell significant for the exact P values and significant differences are noted in the results. Differences with $P<0.05$ were considered significant.

III. Results

The results indicated that serum insulin level was insignificantly decreased and glucose level were significantly increased ($P<0.05$) in immobilized rats compared with control animals. Glucose/ insulin ratio was significantly increased in immobilized animals compared to control rats ($P<0.05$) (Fig I, II and III).

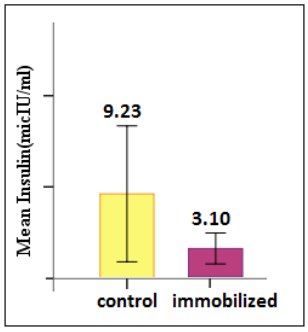

Fig. 1 Serum insulin level in control and immobilized rats.

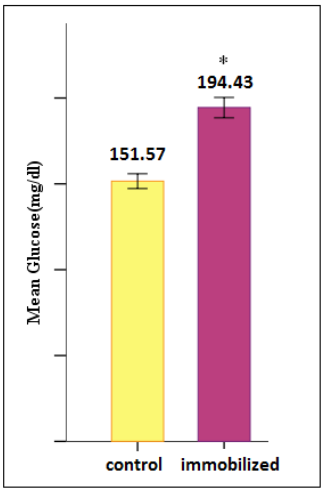

Fig. 2 Serum glucose level in control and immobilized rats.
* indicates significant difference compared to control group.

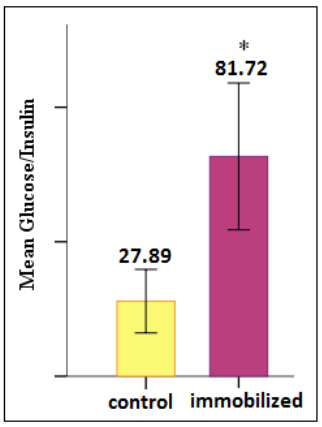

Fig. 3Serum glucose to insulin ratio in control and immobilized rats.
* indicates significant difference compared to control group.

IV. Discussion

The results of current research show that the glucose/insulin ratio increased in immobilized rats compared with control animals; that is insulin sensitivity decreased in immobilized rats. Glucose to insulin ratio is a useful measure for insulin sensitivity [10] and decreasing of insulin sensitivity is a useful measure for predicting the diabetes development, according to which, it is suggested that diabetes development is facilitated in immobilized rats.

In line with our finding the other studies reported that there is association between low physical activity and diabetes prevalence [6]. Studies also show that physical inactivity, which has progressively increased over the past several decades, significantly increases the risk of numerous diseases/disorders, including several forms of cancer, diabetes, hypertension, coronary and cerebrovascular diseases, overweight/obesity, and all-cause mortality, among others [11]. The studies also show that increased physical activity can improve glycemic regulation, reduce obesity and prevent or delay the onset of developing diabetes [12]. Physical activity play its role in preventing diabetes development partly due to its inhibitory effects on lipid accumulation [13]. The reports also indicate that physical inactivity results in increased insulin resistance and reduced glucose tolerance [14]. Exercise training improves insulin-mediated capillary recruitment and glucose uptake by muscles [15].

V. Conclusion

We have shown that immobilization is a risk factor for development of diabetes, according to which, it is suggested that physical activity and exercise to be considered as a highly effective preventing measure for fighting against prevalence of diabetes.

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