The Association of Serum Irisin with Vitamin D and Body Mass Index in Healthy Adults

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Abstract

Objectives: This study was designed to explore the relationship between serum irisin hormone with Vitamin D levels and investigate the association of serum Vitamin D3 concentrations and serum irisin levels with BMI of male healthy individuals in Anbar province.

Method: This study included 84 Iraqi men with the age range (20-40) year, divided into three groups depending on body mass index (BMI). The weight and height of all participants were taken to extract BMI. The ELISA method has been used to estimate levels of vitamin D and the irisin hormone in the serum. Pearson correlation coefficient was used to find the association between the studied variables.

Results: The mean and standard deviation of serum vitamin D concentrations was significantly lower in all groups. This study showed there was non- significant difference in the mean of irisin among the three groups. A negative linear correlation was found between vitamin D and BMI, while a positive correlation with irisin. A positive correlation was found between irisin with BMI.

Conclusion: People with a high BMI are deficient in Vitamin D. There was a positively relation between serum irisin levels and BMI.

Keywords: *Serum, Irisin, hormone, Vitamin D, BMI.*

Introduction

Vitamin D is a set of sterol hormones which have a function as a hormone and are required for the growing and conservation of bone tissue, also for the calcium and phosphorous homeostasis [(1)]. Its levels are evaluated through the plasma 25-hydroxyvitamin D levels [$25(OH)_2D$] [(2)]. It is regarded as a hormone which acts through nuclear receptors called vitamin D receptor (VDR) which present in various organs such as bone, kidneys, intestine, brain, immune system, and most different body parts [(3)]. The main source of 25(OH) D is daily sunlight exposure, numerous functions of over two hundred genes regulated by vitamin D and is vital for maturity and growth, There are two forms of vitamin D: Ergocalciferol (Vitamin D2) and Cholecalciferol (vitamin D3) [(4)]. Vitamin D3 can be performed in two ways: firstly, by intestinal absorption, secondly, endogenously by a precursor of 17-hydroxyl cholesterol on the skin with adequate exposure to UV day time [(5)]. Many studies have revealed that obesity, described as a BMI ≥ 30 kg/m², and low serum 25(OH)D levels are linked with many diseases [(6, 7)].

Irisin/FNDC5 a newly detected hormone that became a promising target for the connection between health and physical exercise in recent years [(8)]. Irisin is a hormone similarly as polypeptide consisting of 112 amino acid and is split from the carboxyl end of a membrane-spanning protein with 196amino acid so-called FNDC5 [(9)]. Fibronectin type three domain-containing protein five(FNDC5) forms of an extracellular area containing the fibronectin type three (FnIII) domain, which is disunited from a slight cytoplasmic area by the helical trans membrane part and is split to irisin[(10)]. Irisin is a myokine that expressed and secreted principally by muscle tissue, and its secretion is especially stimulated by exercise performing on white adipose tissue by

Peroxisome proliferator-activated receptor gamma (PPAR-γ) coactivator-1α (is a part of a family of transcription co-activators that acts a fundamental role in the regulation of cellular energy metabolism) [9]. Irisin hormone is considered a transporter that enhances the transformation of the lipid-storing white adipose to the brown adipose tissue that catabolize the energy leading to raise thermogenesis [11]. Additionally, Irisin improves oxidation of fatty acid and glucose metabolism, retard atherosclerosis [12]. Pardo et al., They indicated that an increase in fat body mass about (1) kilogram could cause a double rise in irisin levels [13], Whereas two previous studies have shown that losing weight in people described as obese leads to low levels of irisin in the blood [14]. Vitamin D and irisin hormone are essential regulating agents of energy homeostasis and the musculoskeletal system. Nonetheless, the influence of the vitamin D-irisin relation on the total energy expenditure (TEE), food intake, and substrate metabolites is not well known[15].

Materials and Method

The current study was done at the college of science, University of Anbar, and the General Educational Hospital in Ramadi city from August 2019 to January 2020. This study includes three groups of healthy individual men in the range of age (20-40) years. These groups have no chronic disease or infectious disease when they are tested, were chosen by depending on body mass index (Normal group (A): BMI=18.5 to 24.9 kg/m^2, Obese group (B): BMI≥30 kg/m^2, and Underweight group (C): BMI≤18.5 kg/m^2). From each individual, (5 mL) of blood were obtained in the early morning after fasting (10-12) hours. This amount of blood, after serum isolation, stored in Eppendorf tubes in a freezer at -20ºC for hormonal analysis. Serum vitamin D levels and irisin hormone levels were estimated by the enzyme-linked immunosorbent assay (ELISA). Calculation of body mass index was done by "dividing the body weight in (Kilogram) by the square of the height (in meter)"[16].

Statistical Analysis: The statistical analysis was carried by using the computer program SPSS version 16 (Statistical Package for Social Sciences). All studied parameters were expressed as mean±standard deviation (SD). The significance of differences among the groups was determined by a one-way ANOVA test. The correlations between variables were confirmed by Pearson correlation analysis.

Results

The mean of BMI in group A was (24.4 ±1.48 kg/m^2), which showed a significant difference with group B (36.7 ±4.52 kg/m^2) and group C (18.4±0.45 kg/m^2) at p ≤ 0.05, Table 1. The mean of Vitamin D in A, B and C groups (18.27±10.23 ng/mL), (17.26±8.17 ng/mL), (20.25±10.77 ng/mL) respectively showed there was non-significant difference (Table 1). In this study, there was non- significant difference in serum irisin among A, B, and C groups (Table 1). As appeared in Table 2, Pearson analysis showed a negative correlation between vitamin D and BMI (r=- 0.252) at P ≤ 0.05. While a weakly positive association was shown between vitamin D and irisin (r=0.21) at p≤ 0.05. A moderate positive correlation was showed between irisin with BMI at p≤0.05 (r= 0.477).

Table 1: The mean and SD for parameters in study

Underweight (N=28)	Obese (N=28)	Normal weight (N=28)	Variables
18.4±0.45^c	36.7 ±4.52^b	24.4 ±1.48^a	BMI (kg/m^2)
20.25±10.77^a	17.26±8.17^a	18.27±10.23^a	Vitamin D (ng/mL)
7.25±2.32^a	7.93±1.33^a	7.91±1.77^a	Irisin (ng/mL)

Table 2: Correlations of study parameters

BMI (kg/m^2)		Irisin (ng/mL)		Variables
P. Value	r	P. Value	r	
≤ 0.05	- 0.252*	≤ 0.05	0.21*	Vitamin D (ng/mL)
≤ 0.05	0.477*	-	-	Irisin (ng/mL)

Discussion

This result showed that the majority of the individuals who participated in this study were suffering from hypovitaminosis D. Most of those with vitamin D deficiency were in the obesity and normal groups compared with underweight group. In 2016, Wakayo T et al.,[17] indicated that vitamin D deficiency was associated with metabolic syndrome. Vitamin D levels insufficient could have numerous causes, like irregular intestinal function or malabsorption, decreased intake or raised degradation of vitamin D[18]. Some researches proposed that obesity improved the chance of vitamin D deficiency[19]. In a study to observe the predominance of vitamin D deficiency in adult Iraqi personages including postmenopausal women, they showed that

deficiency of vitamin D happened in more than (85%) of postmenopausal women, more than (60%) of young men in age (25-49) years [20]. The significant decrease in the level of vitamin D in this study is due to numerous causes, such as: eating poor meals with vitamin D, lack of exposure to sunlight, the geographic location or the lack of animal sources (milk, cheese, and egg yolks) as a similar result with the previous study [21]. Underweight is considered as an abnormal condition like obesity due to its association with several cases such as mental health defect, a decline of muscle strength, osteoporosis and cardiovascular disease[22]. In the current period, FNDC5/irisin became a hopeful aim for the link between physical activity and body health[23]. There are some studies investigated that serum irisin is unclear in obese individuals. One previous study includes (300) obese cooperators discovered that serum irisin levels were not significant higher than those in the group of controls (24). Other investigations reported to lowering the serum irisin concentrations in obese subjects than in normal weight, but the variation was correlated with presence or absence of DM [25,26]. The mechanisms that control synthesis and secretion of irisin are not perfectly known [27]. In the common people, irisin levels increase with daily activities and serum irisin is correlated with the lipid profile [28].

For the correlation relationships, These results agreed with Taheri et al., [29] who have found that serum levels of 25(OH)D has a negative correlation with body mass index in adults with and without type 2 diabetes mellitus in Iran. A new meta- analysis revealed a positive linking between obesity and vitamin D deficiency in whole age groups [30]. A study by Vimaleswaran *et al.,* [31] showed high BMI cause lowering in vitamin D levels between both men and women in various age groups, presenting strong argument about role of obesity as a crucial risk agent in hypovitaminosis D. This finding corresponding with Al-Daghri *et al.,* [32] who found a significant increase in circulating irisin level at 12 months post-vitamin D intervention. Also this result agreed with previous study in Iraqi rheumatoid arthritis males patients with diabetes mellitus type II [30]. In a previous study, Irisin levels were associated with "body mass index (BMI)" and fat accumulation, and researchers revealed that the main source of irisin levels is adipose tissue in the serum of patients [13]. Most studies additionally revealed a positively association between the levels of irisin hormone and body mass, mass of fats, and, infrequently, waist-hip ratio. In a health people, the greatest of the irisin concentrations in the blood comes from the muscle cells, but, in case of obesity, the rate of irisin that secreted from adipose tissue is apparently more elevate than in lean status because of the rise in fat mass totally[31]. There is second clarification about the relationship between irisin levels with fat mass and BMI, might be in the resistance progression of irisin. In obesity, the secretion of Irisin increased from muscle cells, perhaps to increase using of energy and glucose homeostasis to reach a metabolic balance [32].

Conclusion

The current study showed a decrease in vitamin D levels in the study sample subjects for the three groups who are healthy. The hormone irisin has a critical correlation with BMI. People with a higher body mass index are more likely to have a vitamin D deficiency.

Conflict of Interest: None

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Ethical Clearance: Not required

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