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FULL PAPER

Evaluation of serum zinc in women of childbearing age and its relationship with obesity

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Women of childbearing age are prone to gain weight. This article evaluates the levels and range of zinc in overweight or obese women of childbearing age and its relevance with lipid profile, hormones, and other related metabolic parameters. The study group consists of 50 females who did not have heart disease and diabetes and did not subject to the processes of removing the fallopian tube or removing one of the ovaries. Where they were divided into three subgroups (the first normal weight with BMI =(18-24.9), the second overweight BMI=(25-29.9). and the third obese with BMI ≥ 30. Fasting blood sugar (FBS), lipid profile, level of insulin in fasting, Homeostatic Model Assessment for Insulin Resistance (HOMA IR), Luteinizing hormone (LH), follicle-stimulating hormone (FSH), serum Testosterone, and zinc were performed in all subjects. There was an increase in the insulin level in fasting, HOMA-IR level, and testosterone levels. However, the serum of zinc, FSH, and LH were low when comparing overweight and obesity with normal weight. In summary, there is a major association between zinc levels, obesity, and women of childbearing age. These conclusions promote the hypothesis that increase may be associated with a disturbance of glucose metabolism represented by insulin resistance, dyslipidemia leading to oxidative stress, and finally increase Zn. This association could cause the early development of cardiovascular diseases in females.

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KEYWORDS

Serum zinc; women of childbearing age; obesity; BMI.

Introduction

Obesity is becoming more common in women around the world, with its prevalence rates from 6.4 percent in 1975 to 14.9 percent in 2014 [1]. Weight gain is particularly dangerous for women of childbearing age (15 to 44 years) [2]. Women in their younger generation (aged 18–23 years at survey gain an average of 6.3 kg over ten years, according to the Australian Longitudinal Study of Women's Health [3]. Pregnancy has been studied as a possible cause for excessive weight gain and the development of overweight and obesity in women of childbearing age. However, the findings are mixed, with some research suggesting a correlation between parity and weight gain and/or the development of overweight and obesity in women of childbearing age, while others show no relevance [4].

Obesity during a woman's reproductive years has also been linked to the poor pregnancy outcomes for both the mother and the baby [5,6]. Iron, zinc, copper, cadmium, magnesium, and calcium are important and major metal ions in the human body [7]. It is one of the main vital elements in the natural cell to maintain organ function. Zinc, after the

iron element, is one of the most present elements in the body of the organism. It is absorbed into the body by the small intestine, and the presence of fiber reduces its absorption. It is stored primarily in the liver and kidneys. Within the living cell, it is usually bound to mineral proteins. It plays a key role as a stimulant to many enzymes and helps fight infection by enhancing the natural phagocytic function and manufacturing immunoglobulin, as well [8]. In addition, zinc is associated with many enzymes which work to regulate many metabolic activities in the body. Likewise, zinc is a key factor in the reproductive system [7,9]. The purpose of this study is to ponder the role of zinc in women of childbearing age and its relationship with lipid profile and the other sex hormones and the parameters which are related to metabolic.

Patients and methods

This survey search was approved by the Scientific Committee in the College and a verbal consent form was obtained from each participant enrolled in the study. This study was conducted in Kamal Al- married Hospital, From January to December 2019. 50 women of childbearing age (their ages ranging from (18-38) years, subdivided according to BMI. BMI was determined utilizing the accompanying equation: weight in (kg/m^2) into three sub-groups: 25 of females that obviously normal range BMI =18-24(kg/m^2), overweight BMI <30 kg/m^2 (n=10), and obese BMI ≥ 30 (kg/m^2) (n=15). The prohibition criteria include: pregnancy, the early ovarian disappointment, ovarian neoplasia with atherosclerosis, women who are planning to begin an eating regimen, or a particular plan of corporal movement, during the day 2-5 of the menstrual cycle through the early follicular stage; ten milliliters of venous blood were drawn from each woman by vacutainer into gel tube, and then the tube was laid aside to be separation, after that centrifuged at (3000 rpm) for (10 minutes) to get the serum. The blood serum was used to check inc and blood glucose levels and lipid profile and manual measurement was carried out using a kit (human, Germany), the hormonal profile was done using VIDAS analyzer (Biomerieux France), the remaining serum was saved frozen at -30 °C to the evaluation of fasting insulin using ELISA (Demeditec, Germany).

Statistical analysis

SPSS was used to conduct the statistical analysis (version 23). For normally distributed numerical variables, the mean and standard deviation were used, and for categorical variables, the frequency/percentage was applied, as well. The significance of the difference between the typically numerical variables was further tested using an independent t-test and an ANOVA test. The significance level was chosen at p 0.05, and the Pearson correlation was determined using the t-test to examine the significance of correlation for the link between the two quantitative variables.

Results

The distribution of women of childbearing age was conducted by BMI range categories. Based on Figure 1, we notice that there was a highly significant difference ($P<0.01$) between women in BMI ranges.

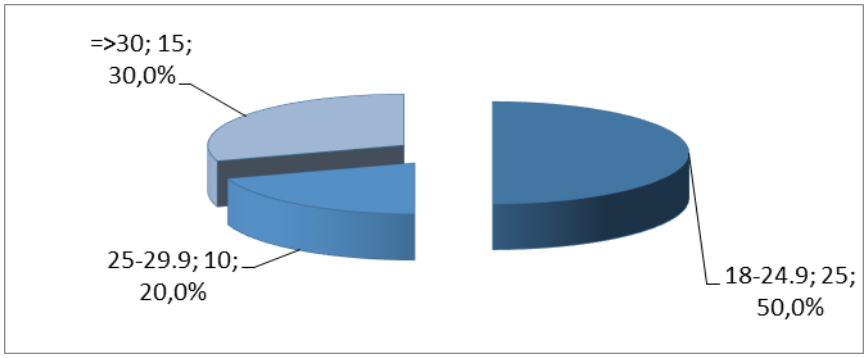

FIGURE 1 Women of childbearing age distribution by BMI categories

As reported in Table 1, the mean value ± SD are compared within normal and each (overweight and obesity) BMI categories groups, the results indicate the significance increased ($p<0.05$) in FBS, Cholesterol, Triglycerides, LDL, and VLDL, but a non-significance increased with insulin level and HOMA-IR ($p>0.05$).

TABLE 1 Levels (Mean ± SD) of metabolic factor in three BMI categories

Groups / Parameters	Normal Range	Overweight and Obesity	P-Value
FBS (mmol/L)	4.35 ± 0.12 (3.3-5.4)	5.16± 0.49 (4.3-5.8)	*0.001
Insulin (µIU/mL)	22.81 ± 3.47 (0.4-67.0)	28.08± 5.99 (2.40-99.15)	0.378
HOMA-IR	4.66 ± 0.78 (0.09-16.0)	6.55± 1.42 (0.45-24.55)	0.254
Cholesterol (mmol/L)	4.08 ± 0.44 (3.2-4.8)	4.41 ± 0.88 (2.9-7.7)	*0.027
Triglycerides (mmol/L)	0.87 ± 0.30 (0.4-1.4)	1.69 ± 0.91 (0.2-4.0)	*0.0001
HDL (mmol/L)	2.28 ± 0.33 (1.7-2.8)	1.12 ± 0.46 (0.4-3.1)	*0.0001
LDL (mmol/L)	1.39 ± 0.36 (0.3-1.9)	2.51 ± 0.80 (0.7-4.9)	*0.0001
VLDL (mmol/L)	0.39 ± 0.13 (0.1-0.6)	0.77 ± 0.41 (0.1-1.8)	*0.0001

As depicted in Table 2, the data reveal that there was significant difference ($P<0.05$) between LH, and FSH levels consecutively with mean BMI to each range. Regarding testosterone, the table demonstrates that mean testosterone for overweight and obesity group were (0.58 ± 0.24), (0.44 ± 0.19), respectively which were comparable to that of normal weight mean (0.61 ± 0.14). Women with overweight and obesity clearly illustrated that testosterone had a significant difference in comparison with the normal weight ($P >0.05$), as presented in Table 2.

TABLE 2 Mean distribution of hormonal level in relation to BMI (Kg/m^2)

Groups / Parameters	Normal Range	Overweight	Obesity	P-Value
FSH (mIU/ml)	4.37± 1.80 (1.4-8.5)	4.67± 1.64 (2.1-6.7)	7.06 ± 1.85 (4.3-9.6)	*0.0001
LH (miU/ml)	8.0 ± 2.43 (2.7-15.4)	7.79± 2.96 (3.1-16.2)	5.74 ± 1.64 (3.1-8.7)	*0.0001
Testosterone (ng/ mL)	0.44 ± 0.19 (0.1-0.9)	0.58 ± 0.24 (0.2-1.2)	0.61 ± 0.14 (0.2-1.3)	*0.001

In the proposed study, the serum zinc levels were higher in obesity women when contrasted with normal weight group (P= *0.016), as displayed in Figure 2. There was a significant increase in zinc levels in overweight when compared with normal weight.

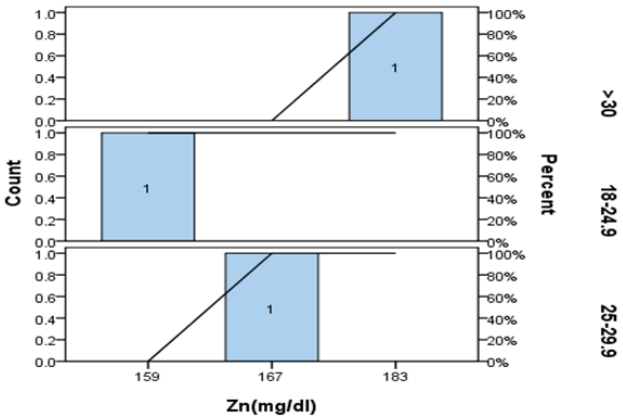

FIGURE 2 Mean distribution of zinc in relation to Body mass index (Kg/m^2)

Discussion

Despite the fact that BMI does not distinguish between the extra fat and muscle, it is a body fat calculation. It also predicts the start of obesity-related health problems. For these purposes, health care workers frequently utilize BMI [9],[10]. The majority of females (50.8 percent) were in a healthy weight range, however the overweight women (20 percent) and obese ones (20 percent) were both present (30 percent). Insulin action in the peripheral tissues may promote weight gain by promoting the storage of metabolic fuels, resulting in hunger and increased calorie intake, according to Rhodes *et al.* [11].

The current study indicated that raised FBG levels are related with a higher risk of cardiovascular disease than the blood lipid levels, which is consistent with a clinical investigation which found that elevated FBG levels are associated with a higher risk of cardiovascular disease than serum lipid levels. Despite the fact that all of the individuals were reportedly stable, 13.6 percent (n = 1140) of the total sample had higher fasting blood glucose levels (i.e. > 7.0 mmol/L). The FBG levels were higher than usual in 13.6 percent of the subjects, indicating that more investigation could lead to a diagnosis of type 2 diabetes [12]. The majority of the previous research has found that triglyceride levels in obese people are related to their BMI and body fat [13,14].

Both obesity and overweight are linked to abnormal blood lipid profiles. Other risk factors for coronary heart disease, such as hypertension, smoking, diabetes, or a family history of cardiovascular disease, are present in a considerable proportion of overweight or obese people [15]. Obesity (BMI of 30) is a marker of lipid metabolism impairment and a strong indication of hypertension, coronary heart disease, diabetes mellitus, and hepatobiliary illness [16] and it is often linked to artery hypertension and dyslipidemia (high serum TG and low serum HDL-C vs. high serum TC and LDL-C) [17].

In terms of lower levels of FSH and LH, the findings are consistent with those of De Pergola et al. who found that obese and overweight fertile women have lower levels of FSH, LH, inhibitor B, and estradiol in the early follicular phase, likely due to a direct inhibitory action of fat mass on the synthesis of gonadotropin and estradiol, regardless of age, insulin, and other hormones [18]. In comparison to the women of normal weight, those women who were overweight or obese indicated a substantial difference in

testosterone levels. These findings are consistent with the previous research. The findings of this study are in line with a cross-sectional study of 2543 overweight pre- and perimenopausal women from various ethnic origins [19]. Hyperandrogenemia (HA) remained a significant predictor of MetS, dysglycemia, low HDL cholesterol, and hypertriglyceridemia in a sub-analysis of 1588 severely obese women without PCOS [20].

Zinc is a trace element that functions as a structural, catalytic, and regulatory ion in numerous enzymes, proteins, and transcriptional factors [21]. Intracellular zinc plays a vital role in the redox signaling system, in which the stimuli such as ischemia and infarction cause zinc to be released from proteins, resulting in myocardial damage. As a result, zinc plays a role in a number of body homeostatic responses (such as oxidative stress) as well as biological processes (e.g. immune deficiency). Zinc has further been proven in cell cultures and animal models to have a variety of anti-inflammatory modulator effects. In obese persons, zinc supplementation improves the inflammatory response [22]. Insulin resistance, dyslipidemia, and endocrine disruption are all linked to oxidative stress, which can lead to an increase in the metal (Zn). Many studies have associated elevated zinc levels in the body to a risk for developing severe insulin resistance problems (e.g. high blood glucose and hyperlipidemia). A variety of causes could be to blame for the higher zinc levels. One possible reason for the elevated zinc levels is increased oxidative stress, which can release zinc from its binding sites when it performs the coordinating role like a number of proteins. Protein-emitted zinc ions have the ability to operate as signal transducers, control mitochondrial metabolism, and be in an oxidative state in the cell. Zinc can either improve a cell's antioxidant capabilities or lead it to release more hazardous reactive oxygen species at different amounts.

Conclusion

The rise in levels of zinc, insulin level, and HOMA IR, in obese woman than the overweight and normal weight with decreasing the levels of HDL increases the risk of heart disease and CVD in obese women. This increase may be associated with disturbance of glucose metabolism represented by insulin resistance, dyslipidemia leading to oxidative stress and finally increase Zn.

Acknowledgments

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Ethic Approval

The Kamal Al-Samarrai Hospital Committee of Ethics, the Iraqi Ministry of Health's National Centre for Training and Human Development, and the University of Baghdad Ethical Committee all gave their permissions to this study. All participants gave informed written permission before being included in the study and the study was conducted in compliance with the Helsinki Declaration.

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