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Iodine Deficiency is Associated with Overweight and Obesity on Adults

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ABSTRACT

The aim of this research was analyze the iodine levels in normal weight, overweight and obesity and its association with body mass index (BMI). We use a cross-sectional study done in 120 adults, 42 males and 78 females aged 18-44 years. Body mass index and iodine urinary levels were calculated and were associated by Spearman´s correlation test. The iodine mean concentration for all subjects were 2.2473± 0.7843 µmol/L, we found that iodine levels decrease in overweight (2.1408 ± 0.7111 µmol /L) and obese subjects (1.6658 ± 0.9902 µmol/L) vs normal weight (2.6992 ± 0.3656 µmol/L), $p<0.05$. In addition to, we found a significant Spearman´s negative correlation between an increase of BMI with iodine deficiency ($r=-0.463$, $p = 0.001$). Conclusion: iodine shown to be lower in people who have overweight and obesity.

Key words: Iodine, deficiency, body index mass, obesity, overweight.

INTRODUCTION

The situation in Mexico is extremely alarming it was the first country ranked in high obesity index (Aceves-Martins M et al., 2016). According to the last survey in 2016 the prevalence of overweight and obesity continued increasing from 71.2% in 2012 to 72.5% in 2016 (INEGI, 2014). The main cause of obesity is an imbalance between calorie intake and calorie intake, mainly due to an increase in the consumption of hypercaloric foods and low essential micronutrients, as well as a sedentary lifestyle (Fernald, LC et al., 2004). As far as the endocrinological factor that is well known important in fats oxidation are thyroid hormones, principally triiodothyronine (T3), among many other actions. For its part iodine is a micronutrient that is involved directly in the synthesis of thyroid hormones, the only way to obtain it is through dietary intake, however, very few foods contain it. The deficiency or excess of iodine, brings with it alterations in the metabolism and synthesis of the thyroid hormones, what implies alterations in the energetic metabolism, which has been associated with overweight and obesity (Longhi S et al., 2013), also iodine has been associated with lipolysis in male mice (Barbara MLC Bocco et al., 2020). In this study was done to establish a possible association between ioduria with overweight and obesity based in BMI.

METHODS

Design and iodine quantification

An analytical case-control study was carried out in 120 subjects. The study was approved by the bioethical committee of the health institute of the University of Veracruz. Each user signed an informed consent letter and questionnaires were

applied in order to known the sociodemographic, and clinical characteristics. BMI was determined by the equation: weight in kilograms divided by height in square meter. The quantitative determination of iodine in urine was made using colorimetric methods, using a standard curve with potassium iodate (0, 0.079, 0.158, 0.395, 0.79. 1.58. 2.37, and 3.16 µmol / L). The urinary iodine levels are: severe deficiency, 0–0.15 µmol/L (0–19 µg/L); moderate deficiency, 0.16–0.38 µmol/L (20–49 µg/L); mild deficiency, 0.40–0.78 µmol/L (50–99 µg/L); optimal iodine nutrition, 0.79–1.56 µmol/L (100–199 µg/L); more than adequate iodine intake, 1.57–2.36 µmol/L (200–299 µg/L); and excessive iodine intake, ≥2.37 µmol/L (≥300 µg/L) (Cruz-Mejia S et al., 2018).

Statistical analysis

Data were analyzed using SPSS 22 windows version (SPSS, Inc, Chicago IL), and expressed as frequency, percentage and means ± SD. The results obtained between the groups were analyzed by multivariable analysis with adjusted variables, the frequency, odds ratio (OR) and Spearman correlation were calculated, where differences with ($p<0.01$ $p<0.05$, IC 95%) shows statistical significance.

RESULTS

Anthropomorphic and sociodemographic characteristics

The average age was 30.15 ± 7.27 years between 18 and 44 years. The average age of men and women were 26.78 ± 5.07 and 31.96 ± 7.66, respectively. As for the anthropomorphic parameters of the total evaluated (n = 120), 37.5% (n = 45) were found in normal weight and the remaining 62.5% of subjects were found to be overweight or obese. According with the women's group, 46.2% were found in normal weight, 34.4% belong to overweight and 19.2% correspond to obesity, meanwhile in the men's group only the 21.4% were found in normal weight, 52.4% had overweight and 26.2% obesity (Table 1 and 2).

Table 1. Sociodemographic characteristics by body mass index type

Variable	Normal weight (n=45)	Overweight (n=49)	Obesity (n=26)	Total (n=120)
Age (mean ± SD)	30.33 ± 7.94	30.24 ± 6.90	29.65 ± 7.02	30.15 ± 7.27
Sex (n, %)				
Men	9 (21.4%)	22 (52.4%)	11 (26.2%)	42(35%)
Women	36 (46.2%)	27 (34.6%)	15 (19.2%)	78(65%)
Level of schooling(n, %)				
Basic to medium	26 (57.77%)	34 (69.38%)	15 (57.69%)	75 (35%)
Superior and postgraduate	18 (40%)	16 (32.65%)	9 (34.61%)	42 (38.60%)
No one	1 (2.2%)	1 (2%)	1 (3.8%)	3 (1.75%)
Working condition (n, %)				
Without remuneration	25 (55.55%)	33 (67.34%)	16 (61.53%)	74 (61.66%)
With remuneration	20 (44.44%)	16 (32.65%)	10 (38.46%)	46 (48.36%)
Income (n, %)				
Low	20 (44.4%)	20 (40.8%)	8 (30.8%)	48 (40%)
Middle-High	20 (44.4%)	28 (57.1%)	17 (65.4%)	65 (54.2%)
Refused to response	5 (11.1%)	1 (2%)	1 (3.8%)	7 (5.8%)
Place of origin (n, %)				
Urban	42 (93.3%)	43 (87.8%)	21 (80.8%)	106 (88.3%)
Suburban	3 (6.7%)	5 (10.2%)	5 (19.2%)	13 (10.8%)
Rural	0	1 (2%)	0	1 (0.8%)

Table 2. Relationship between Body mass index and ioduria.

Variable	Men	Women	Total
Age (mean ± SD)	26.78 ± 5.07	31.96 ± 7.66	30.15 ± 7.27
BMI (N, %)			
Normal weight	9 (21.4%)	36 (46.2%)	45 (37.5%)
Overweight	22 (52.4%)	27 (34.6%)	49 (40.8%)
Obesity	11 (26.2%)	15 (19.2%)	26 (21.7%)
Ioduria µmol/L	Normal weight (n=45)	Overweight (n=49)	Obesity (n=26)
Rank	1.7756-3.4178	0.3010-3.1249	0.0764-2.92
Media ± SD	2.699 ± 0.365	2.140 ± 0.711*	1.665 ± 0.990**

*SD: Standard deviation; Age in years; BMI: Body mass index. *P<0.05 vs normal weight; **P<0.01 vs normal weight*

Table 3 Urinary iodine levels according body mass index type

Variable	Normal weight (n=45)	Overweight (n=49)	Obesity (n=26)	Total (n=120)
Ioduria µmol/L				
Rank	1.7756-3.4178	0.3010-3.1249	0.0764-2.92	0.0766-3.4178
Media ± SD	2.699 ± 0.365	2.140 ± 0.711*	1.665 ± 0.990**	2.2473 ±0.7843

**P<0.05 vs normal weight; **P<0.01 vs normal weight*

Ioduria levels and correlation with BMI

The mean of ioduria was 2.2473 ± 0.7843 µmol /L for all population and were classified in adequate (<0.79 µmol / L) and deficiency (<0-0.78 µmol / L), where it was obtained a percentage of 90% and 10%, respectively. Likewise, it was observed that the groups with lower values were overweight and obese (Table 1). According a bivariate logistic regression analysis, we associate the increase of BMI with iodine levels. The results show that people who have an increase of weight have 2.2 times more risk to have iodine deficiency than those with normal weight (2.2; 95% IC: 1.37-3.79. The Spearman analysis show a negative association between the increase of weight with iodine deficiency (r= -0.463, p = 0.01).

DISCUSSION

The role of iodine in adipose tissue is unknown, however, has been report in adipose tissue from rats the expression of sodium/iodide symporter (NIS) mRNA, and the store of iodine in fat tissue (Ajjan RA et al., 1998: Cuellar-Rufino S et al., 2020). In this study we found low levels of iodine in overweight and obesity persons in comparison with normal weight, also we found negative association between iodine deficiency with the increase of BMI. It is evident that iodine plays a significant role in the metabolism of fat tissue. In previous studies have been reported the effect of iodine in several tissues that concentrate iodine; for example, iodine-deficient rats exposed to potassium iodide increase a total antioxidant in the retina (Ajjan RA et al., 1998). In patients with diabetes mellitus type II, drinking brines with iodine increased the enzymatic activity of catalase and glutathione peroxidase (Wu YX et al., 1991). In rats intoxicated with alloxan monohydrate to induce diabetes, iodine treatment increase catalase and superoxide dismutase activities (Mose M et al., 1991). In adipocytes, iodine treatment inducing lipolysis through Upregulation of PPAR-Gamma and Down regulation of C/EBP-Alpha in mature 3T3-L1 adipocytes (Cuellar-Rufino S et al., 2020). All this data shown that iodine *per se*, not thyroid hormones, have physiological effects, however, it is necessary analyze the iodine effect in the metabolism of fat. In addition to this, iodine requirements are important to the synthesis of the thyroid hormones, and small variations in thyroid hormones levels are related to body weight (Longhi S et al., 2013). However, little is known about the association between iodine levels *per se* and body mass index. In this study, we report a significant negative association between iodine deficiency with the increase of BMI. A previous study shown in adolescents with iodine deficiency an elevated total cholesterol and LDL cholesterol (Ronnerfarth G et al., 1996), indicating the roll of iodine and thyroid hormones to maintain an equilibrium in the metabolism of fat tissue. In conclusion, this study shown the relationship between iodine deficiency levels, with overweight and obesity in subjects from Mexico. The most important finding was the negative correlation between the iodine deficiency with the increase of body weight. Is important considering iodine supplement in subjects with overweight following the WHO and Mexican norm recommendations.

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