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Correlation of Hypothyroidism and Hyperthyroidism with Body Mass Index

[1]Maryam, [2]Dr. Farah Zaidi, [3]Dr. Shakeel Ahmad, [4]Julhabib

Article Details

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Maryam
Lecturer, Peshawar Model Girls Degree College, Peshawar. mery.environ@gmail.com
Dr. Farah Zaidi
Associate Professor, University of Peshawar Zaidi_farrah@yahoo.com
Dr. Shakeel Ahmad
Institute of Education and Research, University of Peshawar Kittynaz2000@yahoo.com
Julhabib
M.Phil Scholar, Qurtuba University of Science and Information Technology, Peshawar julhabib2030@gmail.com

ABSTRACT

The study was conducted to evaluate relationship between thyroid disorder and body mass index. The study was conducted at Institute of Radiotherapy & Nuclear Medicine (IRNUM) Peshawar. The population studied consists of 250 subjects in which 125 were hypothyroid patients and 125 were hyperthyroid patients. The samples were divided into three groups according to age that is 20-40, 41-60 and 61 and above years. Detailed age, medical history, was obtained through questionnaire method. Body Mass Index was obtained by measuring height and weight of patients. The Body Mass Index of hypothyroid patients was increased as compared to hyperthyroid patients. According to the standards suggested by World Health Organization and Asian criteria for Body Mass Index, the total percentage of female obese patients due to hypothyroid disorder was recorded to be 52.8 % and the percentage of male obese patients was 17.6 % While Total percentage of hyperthyroid female obese patients was recorded to be 9.6 % and percentage of male population was recorded to be 3.2 %. It is concluded from the present study that the level of thyroid stimulating hormone (TSH) has positive relation with Body Mass Index. It is suggested that every thyroid patient should do regular physical exercise along with medicine recommended by Doctor to improve thyroid function. The thyroid patients should focus on healthful behaviors such as eating nutritious foods, exercising regularly, managing stress, and sleeping adequately, normal level of iodine intake is necessary for proper functioning of thyroid gland.

INTRODUCTION

The thyroid is situated at the front of the neck and is the largest endocrine gland in the human body (White, and Porterfield, 2013). Hyperthyroidism and hypothyroidism are accompanied by distorted rate of metabolism, heat production, and weight of body.(Stangierski,*et al.,*2016). The hormones secreted by thyroid gland maintain various processes of metabolism and is therefore considered as catabolic hormone. (Rizos, *et al.,* 2011). Thyroid disorders impact body weight in multiple ways, and hypothyroidism is traditionally claimed as a contributor of weight accrual via altered metabolic efficiency, water retention, decreased lipolysis.(Santini, *et al.,*2014).

Hypothyroidism is caused by inadequate supply of, or response to, thyroid hormones throughout the body. Hypothyroidism affects hundreds of millions of people around the world. People with hypothyroidism typically suffer from a lack of energy and many other symptoms including cold intolerance, dry skin, weight gain, constipation, slow movement, and dry, thinning or coarse hair. When the hypothyroid condition is not adequately diagnosed and treated, more severe problems such as high cholesterol, heart problems, obesity, joint and muscle pain, gradual hearing loss, reproductive system disorders, depression, sleep problem and diabetes will eventually appear; in extreme cases it may even result in coma or death. (Rowe, *et al.,* 2016).

In hyperthyroidism, the thyroid gland highly synthesis and secrete thyroid hormone. (Bahn, *et al.,* 2011). Symptoms of hyperthyroidism which are widely spread are loss in weight, difficulty during breathing, feeling tiredness, abnormality in the beating of heart, unable to tolerate heat, increase sweating, Nervousness, uncontrolled movement of different parts of the body, Muscle become weak, Menstrual instability, the heart beat become significantly faster, Skin erythema, unorganized and fast contraction of heart, the nail separated from nail bed painlessly, Thyroid bruit, eyes become prominent and retraction of eyelid occur, the systolic blood pressure become high that is greater than 140. (Vaidya, and Pearce, 2014).

Body mass index is the value which can be measured by dividing the weight of a body in kg by the height taken in meter square. And use as an marker for finding the nutritional status of young people, and broadly use in epidemiological studies and thus suggested by the World Health Organization (WHO). (Dutra, *et al.,* 2006 and Eaton, *et al.,* 2005). For finding the level of obesity, BMI is the main generally used method. (Wellens, *et al.,* 1996). It shows an index of fatness of individual. As a possibility factor for development and prevalence of different health issues the BMI is calculated. (Nuttall, 2015). Obesity and thyroid dysfunction are common diseases, and consequently clinicians should be particularly alert to the possibility of thyroid dysfunction in obese patients. (Kaptein,*et al.,* 2009).

METHODOLOGY

A hospital based study conducted at Institute of Radiotherapy & Nuclear Medicine (IRNUM) Peshawar, KPK, Pakistan. The present study used quantitative method to obtain primary data. Keeping in view the research topic the questionnaire method was used because it easily quantifies the information. In order to simplify the statistical process closed ended questions were used. It is also more feasible that patients will be willing to complete this type of questionnaire relatively than open questions; and this method will provide more information in limited time. A letter of consent was sent to the Institute of Radiotherapy & Nuclear Medicine (IRNUM) Peshawar, for conducting a research work. The study was purely for academic reason and that privacy of participants guaranteed.

The study was conducted for 3 months. A total of 250 patients, those fulfilled the inclusion and

exclusion criteria, were recruited for the study. For the present study purposive sampling was done by selecting thyroid patients having age of 20 years and above 20 years, and having hypothyroidism and hyperthyroidism.

a. **INCLUSION CRITERIA**

- Patients of either gender between the age of 20 and above 60 years.
- Patients with known case of hypothyroidism and hyperthyroidism.

b. **EXCLUSION CRITERIA**

- Patients with chronic medical illness except hypothyroidism and hyperthyroidism.
- Patients with gastrointestinal disorders.
- Patients with cognitive impairment.

DATA ANALYSIS

The respondents were classified according to their background variables – i.e. age, gender. The respondents were 20 to above 60 years old. The data was calculated through Microsoft Excel. Mean and standard deviation were executed. The quantitative data were expressed in number and percentage. The data obtained were compared with WHO and Asian criteria for BMI.

The body mass index was calculated by Quetelet's index which is equal to weight of body in kg divided by height of body taken in meter square. **(Nuttall, 2015).**

All subjects were measured without shoes, the subject were insured to standing as tall as possible, the height were measured in feet-inch and then after calculation was converted to meter square. All subjects were weighed in light clothing and without shoes.

BMI was calculated using the following formula,

$$\text{BMI} = \frac{weight\ in\ kg}{height\ in\ m^2}$$

The standards of BMI suggested by WHO for Asian region is as follows, individuals whose body mass index is, less than 18.5 kg/m² are considered to be underweight, normal weight having BMI ranging between 18.5 and 22.9 kg/m², overweight having BMI ranging between 23 and 24.9 kg/m² and obese having BMI value is equal to or greater than 25 kg/m² **(World HEALTH ORGANIZATION, 1995)**

RESULTS

Average age of hypothyroid patients among age group of 20-40 yrs was 32.9 yrs for male and 32.2 yrs for female, among age group of 41-60 yrs was 50.6 yrs for male and 49.2 yrs for female and among age group of 61 and above 61 yrs was 63 yrs for male and 62 yrs for female, Average weight of hypothyroid patients among age group of 20-40 yrs was 80.7 kg for male and 68.01 kg for female, among age group of 41-60 yrs was 77.4 kg for male and 68.84 kg for female and among age group of 61 and above 61 yrs was 89.6 kg for male and 59.5 kg for female. Average height in m² of hypothyroid patients among age group of 20-40 yrs was 2.97 m² for male and 2.48 m² for female, among age group of 41-60 yrs was 2.89 m² for male and 2.46 m² for female and among age group of 61 and above 61 yrs was 2.92 m² for male and 2.43 m² for female. Average BMI of hypothyroid patients among age group of 20-40 yrs was 27.4 kg/m² for male and 27.38 kg/m² for female, among age group of 41-60 yrs was 26.7 kg/m² for male and 27.7 kg/m² for female and among age group of 61 and above 61 yrs was 30.5 kg/m² for male and 24.4 kg/m² for female. Table 1 shows data related to hypothyroid male and table 2 shows data related to hypothyroid female.

Average age of hyperthyroid patients among age group of 20-40 yrs was 30.8 yrs for male and 33.6yrs for female, among age group of 41-60 yrs was 51 yrs for male and 50.3yrs for female

and among age group of 61 and above 61 yrs was 63.4 yrs for male and 63.8 yrs for female. Average weight of hyperthyroid patients among age group of 20-40 yrs was 61.3 kg for male and 55.06 kg for female, among age group of 41-60 yrs was 63.2 kg for male and 55.5 kg for female and among age group of 61 and above 61 yrs was 66 kg for male and 54.6 kg for female. Average height in m^2 of hyperthyroid patients among age group of 20-40 yrs was 2.7 m^2 for male and 2.4 m^2 for female, among age group of 41-60 yrs was 2.83 m^2 for male and 2.42 m^2 for female and among age group of 61 and above 61 yrs was 2.8 m^2 for male and 2.39 m^2 for female. Average BMI of hyperthyroid patients among age group of 20-40 yrs was 21.8 kg/ m^2 for male and 22.2 kg/ m^2 for female, among age group of 41-60 yrs was 22.25 kg/ m^2 for male and 22.9 kg/ m^2 for female and among age group of 61 and above 61 yrs was 22.6 kg/ m^2 for male and 22.7 kg/ m^2 for female. Table 2 shows data related to hyperthyroid male and table 3 shows data related to hyperthyroid female. Questionnaire based method was used for the background information, the details are given in graph 1,2,3,4,5 and 6.

TABLE 1. AVERAGE AGE, WEIGHT, HEIGHT AND BMI OF HYPOTHYROID MALE POPULATION.

S.No	Age groups	Age Mean ± S.D	Weight in kg Mean ± S.D	Height in m2 Mean ± S.D	BMI Mean ± S.D
1.	20-40 yrs	32.9 ± 5.1	80.7± 16.2	2.94± 0.14	27.4 ± 5.72
2.	41-60 yrs	50.6± 5.80	77.4± 7.4	2.89 ± 0.07	26.6 ± 2.4
3.	Above 60 yrs	63 ± 2.6	89.6 ± 5.5	2.92± 0.05	30.5 ± 2.08

TABLE 2. AVERAGE AGE, WEIGHT, HEIGHT AND BMI OF HYPOTHYROID FEMALE POPULATION

S.No	Age groups	Age Mean ± S.D	Weight in kg Mean ± S.D	Height in m2 Mean ± S.D	BMI Mean ± S.D
1.	20-40 yrs	32.2 ± 5.8	68.01± 13.3	2.48 ± 0.12	27.38± 5.5
2.	41-60 yrs	49.2 ± 5.4	68.84 ± 10.6	2.46 ± 0.11	27.7± 4.40
3.	Above 60 yrs	62 ± 1.4	59.5± 0.7	2.43± 0.06	2.44 ± 0.98

TABLE 3. AVERAGE AGE, WEIGHT, HEIGHT AND BMI OF HYPERTHYROID MALE POPULATION

S.No	Age groups	Age Mean ± S.D	Weight in kg Mean ± S.D	Height in m2 Mean ± S.D	BMI Mean ± S.D
1.	20-40 yrs	30.8 ± 5.9	61.3 ± 11.0	2.79 ± 0.07	21.8 ± 3.7
2.	41-60 yrs	51±5.8	63.25± 6.7	2.83 ± 0.09	22.2 ± 2.4
3.	Above 60 yrs	63.4 ± 2.1	66 ± 1.4	2.808 ± 0	22.6 ± 0.75

TABLE 4. AVERAGE AGE, WEIGHT, HEIGHT AND BMI OF HYPERTHYROID FEMALE POPULATION

S.No	Age groups	Age Mean ± S.D	Weight in kg Mean ± S.D	Height in m2 Mean ± S.D	BMI Mean ± S.D
1.	20-40 yrs	33.6± 4.6	55.06± 6.2	2.4± 0.1	22.2 ± 2.5
2.	41-60 yrs	50.3 ± 5.5	55.5 ± 4.2	2.4 ± 0.1	22.9 ± 2.5
3.	Above 60 yrs	63.8 ± 2.04	54.6 ± 2.16	2.39 ± 0.05	22.7 ± 0.6

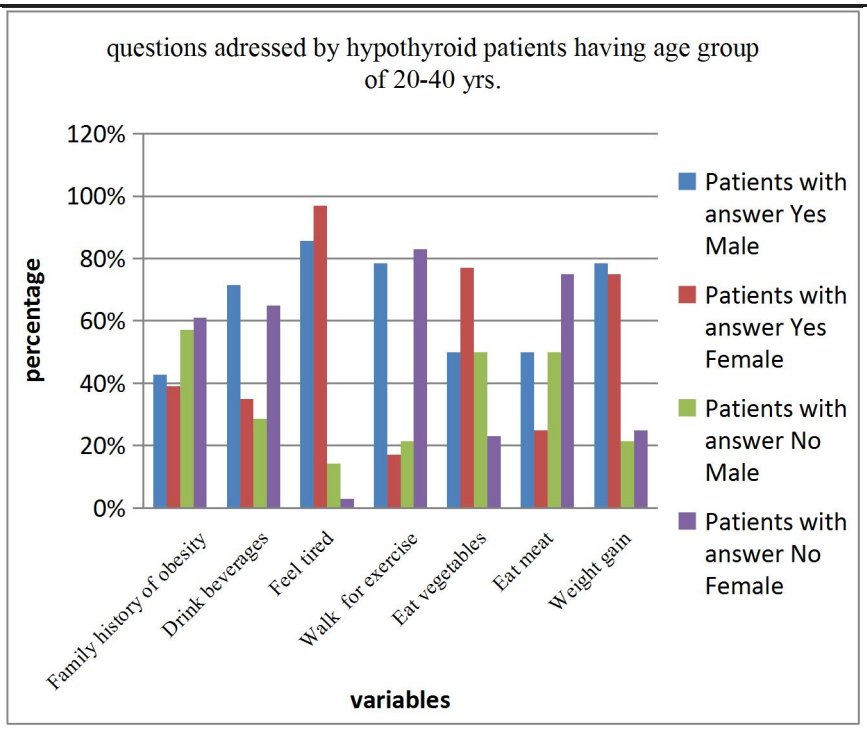

FIGURE 1. SHOWS QUESTIONS ADDRESSED BY HYPOTHYROID PATIENTS HAVING AGE GROUP OF 20-40 YRS.

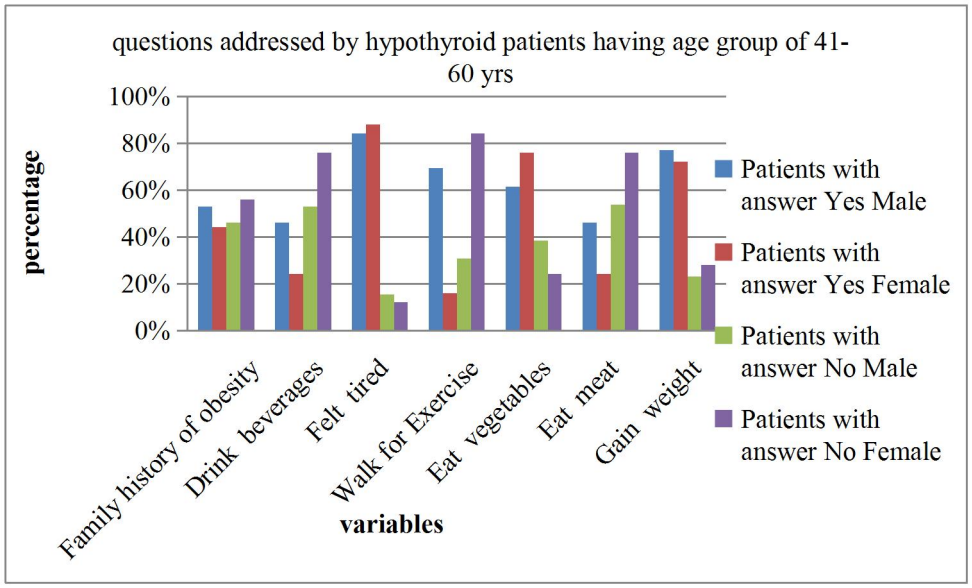

FIGURE 2. SHOWS QUESTIONS ADDRESSED BY HYPOTHYROID PATIENTS HAVING AGE GROUP OF 41-60 YRS.

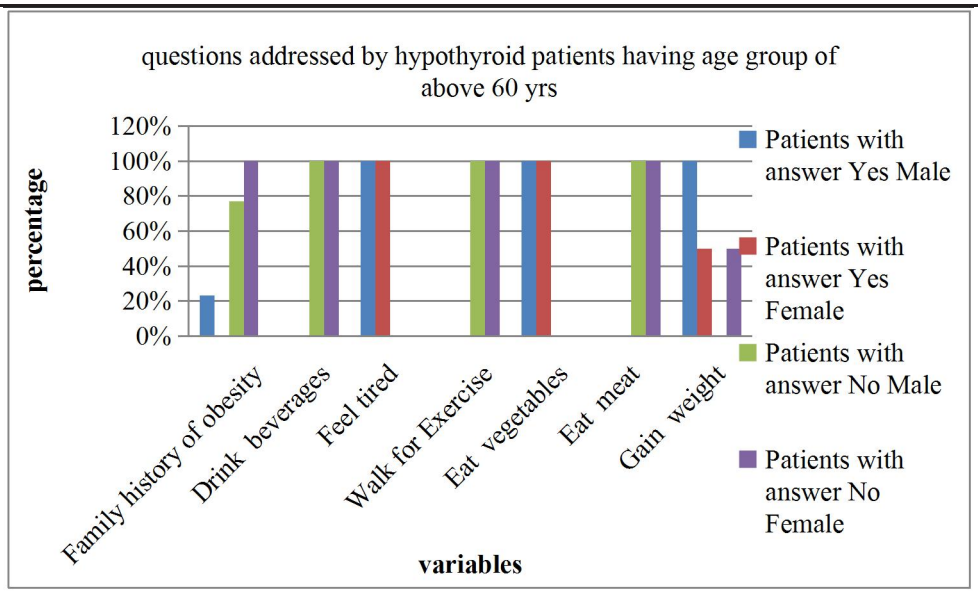

FIGURE 3. SHOWS QUESTIONS ADDRESSED BY HYPOTHYROID PATIENTS HAVING AGE GROUP OF ABOVE 60 YRS.

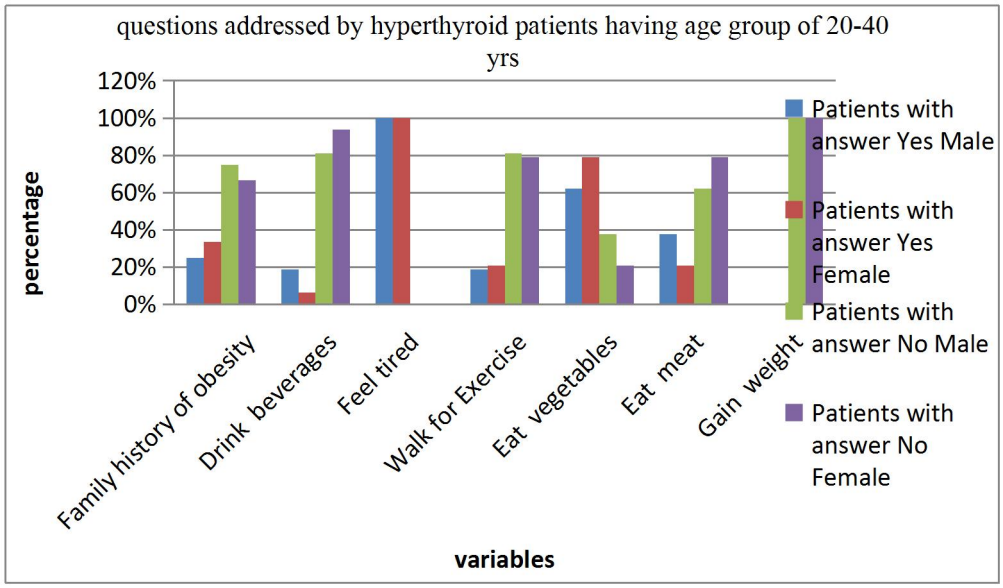

FIGURE 4. SHOWS QUESTIONS ADDRESSED BY HYPERTHYROID PATIENTS HAVING AGE GROUP OF 20-40 YRS.

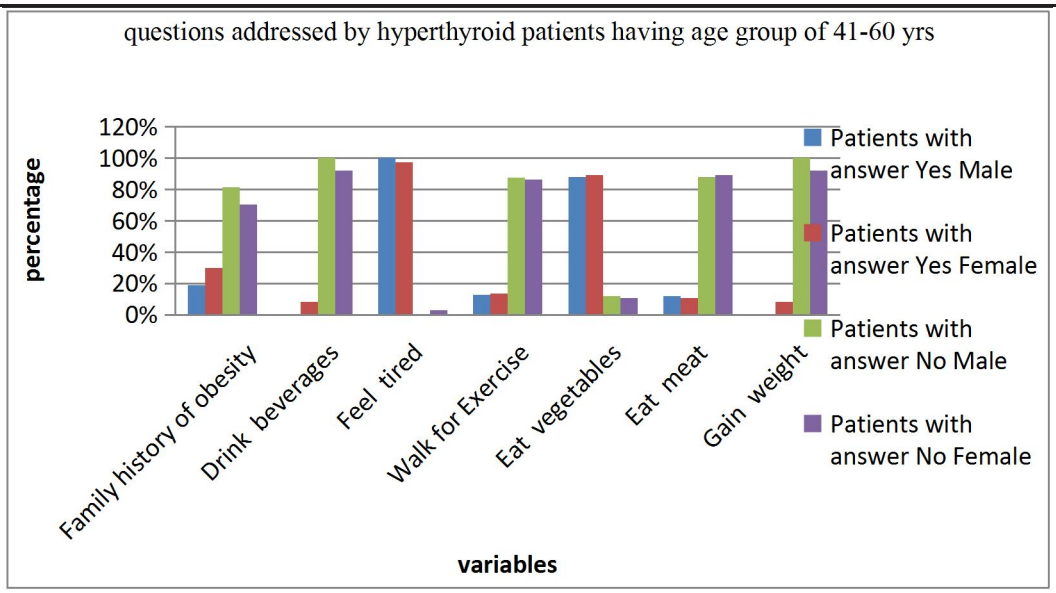

FIGURE 5. SHOWS QUESTIONS ADDRESSED BY HYPERTHYROID PATIENTS HAVING AGE GROUP OF 41-60 YRS.

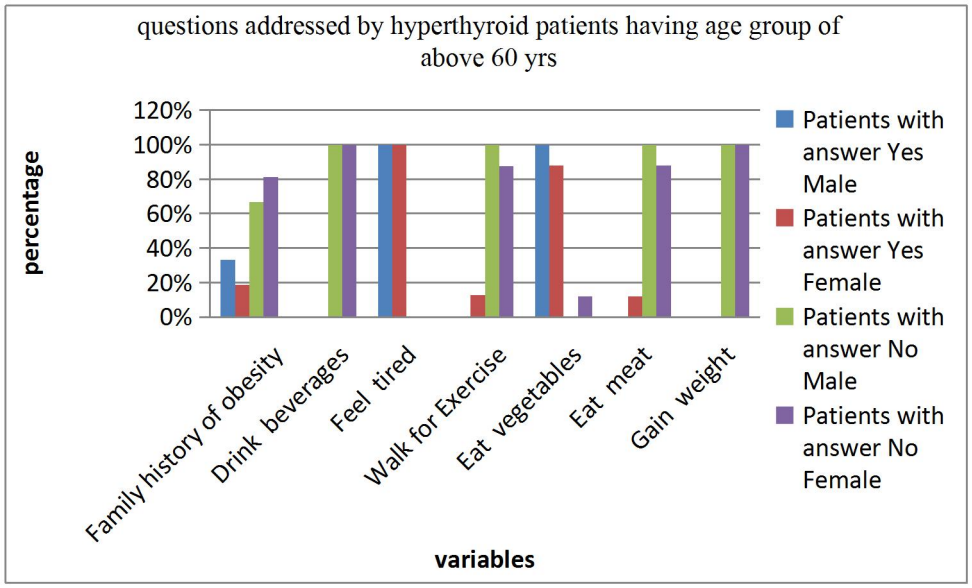

FIGURE 6. SHOWS QUESTIONS ADDRESSED BY HYPERTHYROID PATIENTS HAVING AGE GROUP OF ABOVE 60 YRS.

COMPARISON OF RESULTS WITH WHO AND ASIAN CRITERIA FOR BODY MASS INDEX

Nutritional status	Hypothyroid						Hyperthyroid						WHO criteria	Asian criteria
	Age groups						Age groups							
	20-40 yrs N= 83		41-60 yrs N= 37		61 & above yrs N= 5		20-40 yrs N= 63		41-60 yrs N= 54		61 & above yrs N= 8			
	Male n = 14	Female n = 69	Male n = 12	Female n = 25	Male n = 3	Female n =2	Male n = 16	Female n = 47	Male n = 16	Female n = 38	Male n = 2	Female n = 6		
Under weight	17.26 ± 0 n = 1	16.6 ± 0 n = 1	n = 0	n = 0	n = 0	n = 0	14.21 ± 2.82 n = 2	18.05 ± 0.09 n = 3	17.99 ± 0 n = 1	18.1 ± 0.65 n = 3	n = 0	n = 0	<18.5	<18.5
normal	21.2 ± 0.1 n = 2	20.5 ± 1.3 n = 10	22.07 ± 0 n = 1	22.2 ± 0 n = 1	n = 0	n = 0	21.3 ± 1.19 n = 7	21.01 ± 1.32 n = 26	20.9 ± 1.09 n = 9	21.7 ± 0.73 n = 17	n = 0	22.3 ± 0.4 n = 5	18.5-24.9	18.5-22.9
Over weight	23.4 ± 0 n = 1	23.7 ± 0.6 n = 12	23.7 ± 0.9 n = 2	23.8 ± 0.4 n = 5	n = 0	23.7 ± 0 n = 1	23.98 ± 0.67 n = 5	23.9 ± 0.51 n = 11	24.1 ± 0.7 n = 4	23.6 ± 0.53 n = 14	23.4 ± 0.4 n = 2	n = 0	25-29.9	23-24.9
obese	30.1 ± 4.1 n = 10	30.04 ± 4.7 n = 46	30.1 ± 3.03 n = 9	30.2 ± 4.08 n = 19	30.5 ± 2.08 n = 3	29.2 ± 0 n = 1	26.3 ± 0.4 n = 2	25.9 ± 0.8 n = 7	26.6 ± 1.7 n = 2	28.08 ± 3.6 n= 4	n = 0	26.2 ± 1.3 n= 1	≥ 30	≥ 25

DISCUSSION

Due to hypothyroid disorder the percentage of female obese patient was high and recorded to be 52.8 % as compare to male obese patients which was 17.6 %. While Total percentage of female obese patients due to hyperthyroid disorder was recorded to be 9.6 % and percentage of male population was recorded to be 3.2 %.

The thyroid function disorders in conjunction with the strong influence of various environmental factors can increase body weight and lead to obesity **(Milionis, and Milionis, 2013).** Overt thyroid dysfunction and Body weight are linked. A population based Cross-sectional studies have found frequently that levels of thyroid hormone, might be linked with weight of body. **(Bjergved, *et al.,*2014).**

CONCLUSION

This study concludes that thyroid disorder has more impact on female population as compare to male population and the level of TSH has positive relation with Body Mass Index. Most of the patients were gaining weight during hypothyroidism and were losing weight during hyperthyroidism, but against **(Shabbir, *et al.,* 2015)** suggested that There is no significant correlation between hypothyroid and obesity in our population.

Every hypothyroid patient should do regular physical exercise along with thyroxine replacement to improve thyroid function. **(Bansal, *et al.,* 2015).** In addition, the role of depression, obesity and diabetes must be extensively studied and explicitly defined. **(Aryal, *et al.,* 2010).** Calcium supplements have the potential to interfere with proper absorption of thyroid medications consider the timing when taking both. Studies recommend spacing calcium supplements and thyroid medications by at least four hours. **(Mazokopakis, *et al.,* 2008).**

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