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Full Length Research Paper

Anthropometry and Body Composition of Hypothyroid Females vs. Normal Females

Nidhi Budhalakoti[1] and Kalpana Kulshrestha[2]

1-PhD Scholar, Department of Foods and Nutrition, College of Home Science, G.B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

2-Professor and Head, Department of Foods and Nutrition, College of Home Science, G.B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

**Corresponding author: Nidhi Budhalakoti*

Abstract

Hypothyroidism is a condition in which the thyroid gland does not make enough thyroid hormone (a deficiency of thyroid hormone). The American Association of Clinical Endocrinologists (AACE) estimates that women are five to eight times as likely as men to be hypothyroid. Hypothyroidism can have serious health consequences for girls and women at all stages of the life cycle. The use of bioelectrical impedance analysis (BIA) is widespread to assess body composition both in healthy subjects and patients. Although, studies of body composition in hypothyroid patients are scant. Besides, only rarely have the changes induced by hormone replacement therapy been documented. The present study was undertaken, to assess the prevalence of hypothyroidism among female subjects and to compare their anthropometric measurements and body composition with that of normal female subjects. A total of 150 female subjects of 21-50 years of age were selected by random sampling from Pantnagar area of Udham Singh Nagar District, Uttarakhand. Out of 150 subjects 24 were already suffering from hypothyroidism and were on medications. Besides blood samples of 30 subjects who were suspected to have hypothyroidism by their symptoms and had no history of medication, were also collected for estimation of thyroid hormone levels. Out of those 30 subjects six were diagnosed with hypothyroidism. Total 30 (20%) subjects were suffering from hypothyroidism and their anthropometric measurements and body composition differed significantly from that of normal subjects except for height and waist-hip ratio.

Key Words: *Anthropometric measurements, BIA, Body composition, Hypothyroidism, Prevalence, Thyroid hormone levels*

Introduction

Hypothyroidism is defined as a deficiency of thyroid activity, which results from reduced secretion of both T3 and T4 irrespective of the cause. Iodine deficiency is the most common cause of hypothyroidism worldwide but it can be caused by other causes such as several conditions of the thyroid gland or, less commonly, the pituitary gland or hypothalamus. According to American Thyroid Association (2003) Low thyroid hormone levels cause the body's functions to slow down, leading to general symptoms like dry skin, fatigue, loss of energy, memory problems higher cholesterol levels etc.

In India, the reported prevalence of hypothyroidism is 25% reported by Riaz et al. (2009). According to De Lloyd *et al.* (2010) the impacts of hypothyroidism on body composition, i.e. the relative quantity and quality of bone, adipose tissue and muscle, have traditionally been attributed uniquely to abnormal levels of free thyroid hormones. The presence of biologically active TSH receptors in bone, fat and muscle, raises the possibility that both thyroid hormones and TSH contribute to the changes in body composition associated with thyroid disease.

Materials and Methods

Study area

The present study was undertaken to assess the prevalence of hypothyroidism among female subjects in Pantnagar area of Udham Singh Nagar District, Uttarakhand, and to compare their anthropometry and body composition with that of normal female subjects. The study was carried out during September 2012 to March 2013.

Methods

150 female subjects of age between 21 to 50 years were selected by random sampling and were interviewed using a predesigned proforma. On the basis of the interview the subjects already suffering from hypothyroidism, subjects suspected to have hypothyroidism on the basis of their symptoms and normal subjects with no symptoms were identified and the body composition analysis of these subjects was carried out using bioelectrical impedance using Maltron Bioscan 916 analyzer. Total body fat (%), fat free mass (%), total body water (%), mineral mass (kg) and protein mass (kg) was observed and recorded from the instrument. Anthropometric measurements like height, weight, waist and hip circumference were also measured. The derived anthropometric measurements *viz*. body mass index and waist and hip ratio were calculated. Besides blood samples of the subjects suspected to

have hypothyroidism on the basis of symptoms were also collected for estimation of thyroid hormone levels. Blood samples were then sent for examination to the "Thyrocare Laboratory Mumbai" India. The data was analyzed using summary statistics, such as means, while the null hypothesis was tested using Z-test and t-test.

Results

Out of 150 female subjects, 24 (16%) subjects were already suffering from hypothyroidism and receiving levothyroxine therapy and 30 were suspected to have hypothyroidism by their symptoms. These 30 people were biochemically evaluated and out of them only 6 (20%) were found to be positive with hypothyroidism with TSH range of 5.64-19.34 µIU/ ml. Reference range for TSH was 0.30-5.5 µIU/ml. All the other subjects had normal TSH values ranging from 0.83-5.09 µIU/ml. Besides the T3 and T4 levels were normal ranging from 88-174 ng/dl and 5.4-10.6 µg/dl respectively in all the six subjects who were found to be positive with hypothyroidism. The reference range for T3 was 60-200 ng/dl and for T4 was 4.5-12.0 µg/dl. Overall prevalence of hypothyroidism was found to be 20% with total 30 subjects suffering from hypothyroidism including both already known and newly detected cases.

Table 1 shows that weight (kg), waist and hip circumference (cm) and BMI were significantly higher in hypothyroid patients compared to normal subjects except for height and waist-hip ratio in which there was non-significant difference. According to Table 2, there was non-significant difference between the weight, waist and hip circumference (cm), BMI and waist-hip ratio of already known cases and newly detected cases of hypothyroidism.

Table 1: Anthropometric measurement and BMI of normal and hypothyroid subjects (N=150)

	Weight (kg)	Height (cm)	Waist circumference (cm)	Hip circumference (cm)	Waist-hip ratio	BMI (kg/m^2)
Hypothyroid patients (n=30)	67.16±9.87	154±3.53	97.04±9.16	106.38±7.97	0.91±0.07	28.23±3.66
Normal subjects (n=120)	57.24±8.77	154±4.59	88.04±10.36	98.53±7.33	0.88±0.06	24.05±3.80
Z-value	**5.03****	**-0.17 ns**	**4.68****	**4.08****	**1.79 ns**	**5.55****

****Significant difference [Z]>1.96***

Table 2: Comparison of the anthropometric measurements of newly detected and already known cases of hypothyroidism (N=30)

	Weight (kg)	Height (cm)	Waist circumference (cm)	Hip circumference (cm)	Waist-hip ratio	BMI (kg/m^2)
Newly detected cases of hypothyroidism (n=6)	61.0±5	154±2	94.8±6.2	102.9±2.6	0.92±0.04	27.6±1.4
Already known cases of hypothyroidism (n=24)	68.7±10.9	154±3.9	97.6±9.6	107.2±9.2	0.91±0.08	28.9±3.9
t-value	**1.42 ns**	**-0.00 ns**	**0.51 ns**	**1.67 ns**	**0.15 ns**	**1.53 ns**

'ns' means non-significant at 0.05 level of significance.

Table 3 reveals that the fat mass% of hypothyroid subjects was significantly higher than the normal patients in the present study. Whereas, the fat free mass%, total body water%, mineral mass (kg) and protein mass (kg) was found to be significantly lower in hypothyroid subjects compared to normal subjects. According to Table 4, there was non-significant difference between the fat mass%, fat free mass%, total body water%, mineral mass (kg) and protein mass (kg) of already known cases and newly detected cases of hypothyroidism.

Table 3: Body composition parameters of normal and hypothyroid subjects (N=150)

	Fat mass (%)	Fat free mass (%)	Total body water (%)	Protein mass (kg)	Mineral mass (kg)
Hypothyroid patients (n=30)	41.34±5.90	58.72±5.96	44.71±3.13	6.38±1.01	2.60±0.41
Normal subjects (n=120)	32.24±8.17	67.75±8.17	49.38±4.19	7.10±1.07	2.90±0.43
Z-value	**6.94****	**-6.84****	**-6.79****	**-3.45****	**-3.49****

****Significant difference [Z]>1.96***

Table 4: Comparison of the body composition parameters of newly detected and already known cases of hypothyroidism (N=30)

	Fat mass (%)	Fat free mass (%)	Total body water (%)	Protein mass (kg)	Mineral mass (kg)
Newly detected cases of hypothyroidism (n=6)	37.7±3.9	62.3±3.9	45.7±2.0	7.1±0.82	2.91±0.33
Already known cases of hypothyroidism (n=24)	42.3±6.2	57.8±6.3	44.5±3.5	6.2±1.01	2.52±0.41
t-value	**1.37 ns**	**1.34 ns**	**0.70 ns**	**1.66 ns**	**1.65 ns**

'ns' means non-significant at 0.05 level of significance

Discussion

According to Biondi (2010) there are evidence which suggests that slight variations in thyroid function, even as indicated by tests that are within laboratory reference ranges, contribute to the development of regional obesity and the tendency to gain weight. Akinci et al. (2007) reported a higher waist and hip circumference of hypothyroid patients compared to normal subjects with the mean values of 85 and 82.5 cm respectively in case of waist circumference and107 and 99.5 cm respectively in case of hip circumference. They also reported no difference between waist-hip circumference of hypothyroid patients and normal subjects with the mean values of 0.8 and 0.8 respectively. Dipankar et al. (2012) reported that there was significant ($P< 0.05$) increase in the values of BMI (31.2 kg/ m^2) in hypothyroid patients as compared with normal people (23.0 kg/m^2).

In a study conducted by Miyakawa et al. (1999) in female hypothyroidism (n=11) %FM was significantly higher than that in normal subjects (32.9±11.5%, $P<0.01$) and the percentage of fat free mass and total body water (%TBW) was significantly lower in hypothyroid patients. According to Vestergaard et al (2002) hypothyroidism is associated with reduced bone mineral density leading to increased fracture risk. In case of hypothyroidism fat metabolism is impaired which might be the reason for the increased fat mass% in the body of hypothyroid patients.

Conclusions

This study showed that hypothyroidism influences the anthropometry and body composition of the subjects significantly. Weight, waist and hip circumference and fat mass% are increased significantly, whereas fat free mass, total body water, mineral and protein mass (kg) are reduced significantly due to hypothyroidism.

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