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A study of anthropometric parameters, skin and its appendages in hypothyroid patients in Western Rajasthan Population

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Abstract
The study was planned in hypothyroid patients in Western Rajasthan for finding relationship with various skin changes and anthropometric parameters.
The study was conducted on 100 healthy subjects and 100 clinically established patients of either sex and varying age groups (20-60 yrs.) suffering from hypothyroidism attending from the Out Patient Clinics of Department of Medicine, Dr. S.N. Medical College, and associated group of hospitals, Jodhpur. Anthropometric parameters like height, weight, BMI & various circumferences were measured. fT_3, fT_4 and TSH were evaluated. Cutaneous examination was done under the guidance of Dermatologist.
Body Mass Index (BMI), W/H ratio, waist and hip circumference showed a highly significant relation ($p<0.001$) in hypothyroid patients. Neck circumference and mid arm circumference showed a significant relation ($p<0.05$).The most common findings were the dry, pale, cold wrinkled skin (60%), pruritus (45%), palmoplantar keratoderma (30%), xerosis (20%) and hyperpigmentation (24%).

Keywords: Anthropometric, Hypothyroid, BMI, Skin changes.

1. Introduction
Endocrine glands [Endo=within, Krinein=to secrete] are the ductless glands which secrete mediator substances called as hormones. (DeGroot LJ) [1].
The thyroid is a brownish red gland consisting of right and left lobe connected by a narrow isthmus. In a normal adult the entire gland is 6-7 cm wide and 3-4 cm long. A thin connective tissue capsule encloses the thyroid.
The thyroid gland secretes following hormones which are responsible for various physiological, morphological and biochemical changes in the body. The hormones produced by gland are found in the blood and thyroid gland.
They are subdivided as:
L- thyroxine (tetraiodothyronine) T_4
L- triiodothyronine T_3

1.1 Thyroid Stimulating Hormone (TSH)
Thyroid stimulating hormone (TSH) is a glycoprotein, synthesized and secreted from thyrotrophs of anterior pituitary gland. TSH stimulates thyroid function such as iodine uptake and organification of thyroglobulin production as well as release of iodothyronines from the gland. (DeGroot LJ) [1]. Many structural abnormalities can impair the production of thyroid hormones and the clinical state is termed as hypothyroidism.

1.2 Symptoms of Hypothyroidism
(Wg Cdr Sampath) [2]
Fatigue and weakness
Weight gain or increased difficulty in losing weight
Cold intolerance
Abnormal menstrual cycle (Oligomenorrhoea)
Constipation
Pale, cold, scaly, wrinkled skin

Hair loss of scalp, groin, eyebrows
Brittle thick nails
Puffy edema

2. Material and Methods

The present study was conducted on 100 healthy subjects and 100 clinically established patients of either sex and of varying age groups suffering from hypothyroidism attending from the Out Patient Clinics of Department of Medicine, Dr. S.N. Medical College and associated group of hospitals, Jodhpur.
The selected subjects were further grouped as

Group 1: Healthy control subject (n=100) was ensured by routine examinations that all the subjects were healthy and there were no signs and symptoms or positive history of thyroid abnormalities.

Group 2: Hypothyroid patients (n=100). It included the clinically established patients of hypothyroidism.

2.1 Anthropometric Measurements

Height: Mt, Weight: Kg,
Body Mass Index (BMI) - BMI was calculated using following formula:

$$BMI\ (Kg/m^2) = Weight\ (Kg)/\ Height\ (m)\ ^{[2]}$$

Proposed Classification of BMI in adult Asian (WHO, 2000)

Class	**BMI (kg/m^2)**
Underweight	< 18.5
Normal	18.5- 22.9
Overweight	23-24.9
Obese	25-29.9
Extremely obese	>30

Waist to Hip Ratio (W in cm/H in cm) - W/H was calculated by dividing waist circumference by hip circumference.
Waist circumference (cm) - WC was measured with the subject in the standing position at the level midway between the lowest rib and iliac crest by measuring tape.
Hip circumference (cm) - HC was measured at the maximum circumference over the buttocks to the nearest 0.5 cm by measuring tape.
Neck circumference (cm) - NC was measured at the level of Adam apples by measuring tape.
Mid arm Circumference (cm) - Mid arm circumference was taken at maximum girth of arm by the help of measuring tape.

2.2 Laboratory investigations

The level of T_3, T_4, and TSH were recorded from the Microbiology Department of Dr. S.N. Medical College, Jodhpur.

2.3 Skin Examination

Changes in skin and its appendages (Nails, Hairs) were recorded of hypothyroid subjects under the guidance of the Dermatologist in Skin and V.D. Department, Dr. S.N. Medical College, Jodhpur.

2.4 Observations

Table: 1 Mean Weight (Kg), Height (m), Waist to Hip Ratio [W/H], BMI (kg/m^2) of the Subjects Studied

S. N.	**Anthropometric parameters**	**Group –I**	**Group -II**	**p-value**
1	Height (m) Mean ± S.D. [Range]	1.56 ± 0.70 [1.42 – 1.70]	1.54 ± 0.07 [1.37 – 1.75]	p>0.05 (NS)
2	Weight (Kg) Mean ± S.D. [Range]	58.5 ± 9.37 [42 – 74]	71.5 ± 11.17 [55 – 105]	p<0.001 (HS)
3	BMI (kg/ m^2) Mean ± S.D. [Range]	23.82± 3.02 [15.44–28.88]	30.03 ± 4.68 [21.32 – 43.75]	p<0.001 (HS)
4	W/H Mean ± S.D. [Range]	0.818 ± 0.05 [0.675 – 0.916]	0.854 ±0.05 [0.756 –0.980]	p<0.001 (HS)

* HS = Highly Significant; * NS = Non Significant

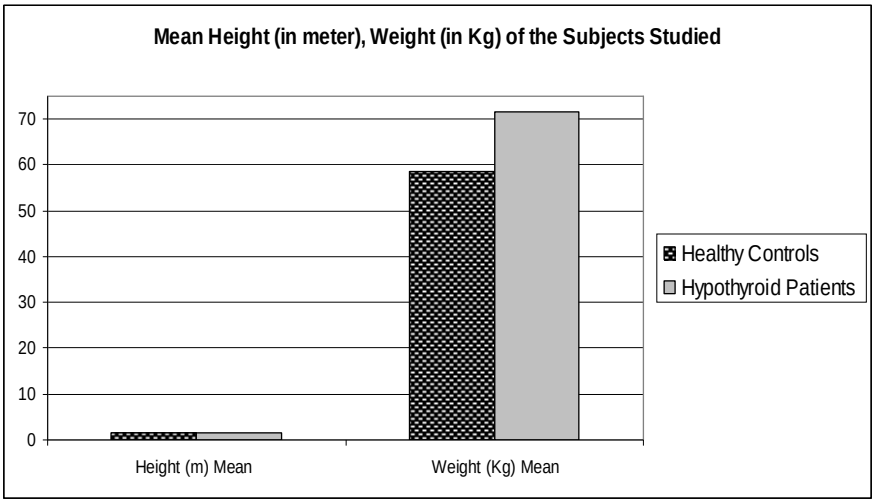

Fig 1: Represent Mean values of Weight (Kg), Height (m) of subjects

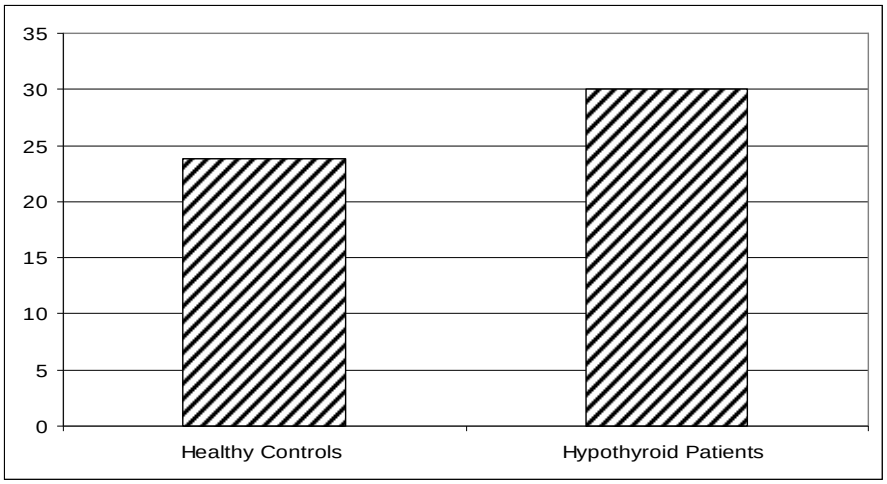

Fig 2: Represent Mean values of BMI ((kg/ m^2) of subjects

Table 2: Mean Waist Circumference [WC (cm)], Hip Circumference [HC (cm)], Neck Circumference [NC (cm)], Mid Arm Circumference [MAC (cm)] of the Subjects Studied

S. N.	Anthropometric parameters	Group –I	Group –II	p-value
1.	**WC (cm) Mean ± S.D. [Range]**	77.9 ± 9.73 [57.5-92.5]	90.25 ± 9.73 [70-122.5]	p<0.001 (HS)
2.	**HC (cm) Mean ± S.D. [Range]**	94.85 ± 7.66 [82.5-107.5]	105.35 ± 9.32 [80-125]	p<0.001 (HS)
3.	**NC (cm) Mean ± S.D. [Range]**	31.55 ± 2.13 [27.5-35]	32.75 ± 2.32 [30-37.5]	p<0.05 (S)
4.	**MAC (cm) Mean ± S.D. [Range]**	28.2 ± 3.88 [17.5-35]	30.6 ± 2.93 [25-37.5]	p<0.001 (HS)

* HS = Highly Significant,
* S = Significant

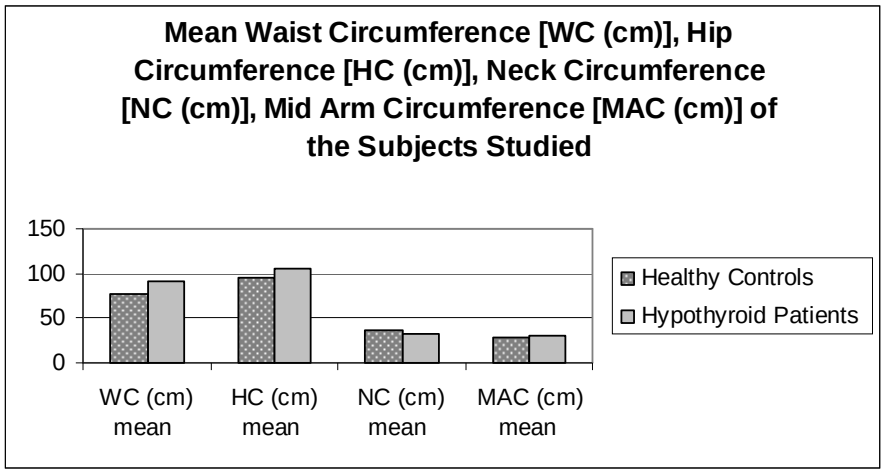

Fig 3: Represent Mean values of WC (cm), HC (cm), NC (cm) and MAC (cm) of subjects.

Table 3: Findings of Cutaneous Signs and Symptoms in Hypothyroid Patients

S. No.	Disease	No. of Patients	Percentage
Skin Changes			
1.	Dry, Pale, Cold, Wrinkled skin	60	60%
2.	Pruritus	45	45%
3.	Xerosis	20	20%
4.	Palmoplantar Keratoderma	30	30%
5.	Puffy edema of face, hand and eyelid	15	15%
6.	Purpura/ ecchymosis	18	18%
7.	Anhidrosis	8	8%
8.	Hyperpigmentation (Ivory, Yellow skin)	24	24%
9.	Idiopathic Urticaria	9	9%
Nail Changes			
1.	Brittle and striated Nail	38	38%
2.	Slow nail growth	45	45%
Hair Changes			
1.	Coarse, Sparse scalp hair	35	35%
2.	Superciliary madarosis	8	8%

3. Discussion

3.1 Body Weight

In the present study, it was 58.5 ± 9.37 and 71.5 ± 11.17 kg in the healthy controls and hypothyroid subjects, which aries from 42 to 74 and 55 to 105 kilograms, respectively [Table No. 1]. A statistically highly significant relation ($p< 0.001$) was observed in the body weight of hypothyroid patients. Thomas Reinehra *et al* [3] observed that thyroid function reversibly related to weight status with increased TSH and fT_3 concentration in obesity.

3.2 Body Mass Index (BMI)

The mean BMI of the healthy controls was 23.82 ± 3.02; which varies from 15.44 to 28.88kg/m^2. It was 30.03 ± 4.68 kg/m^2 in hypothyroid patients which varies from 21.32 to 43.75 kg/m^2 as shown in table no. 1. A statistically highly significant relation ($p< 0.001$) was observed in the BMI of hypothyroid patients. Pesic M*et al*[4] observed that elevated level of TSH (> 4.5 µIU/L) associated with increase in BMI ($p<0.05$) in hypothyroid patients comparison to healthy control subjects.

3.3 Waist to Hip Ratio (W/H)

W/H is a measure that reflects central obesity, it has a strong relationship with hypothyroidism, diabetes and hypertension and is a robust predictor of disease risk and mortality.

The mean W/H ratio of healthy and hypothyroid subjects was 0.818 ± 0.05 and 0.854 ± 0.05 which varies from 0.675 to 0.916 and 0.756 to 0.980, respectively [Table No. 1]. A statistically highly significant relation ($p<0.001$) was observed in hypothyroid patients. Jung CH *et al* [5] concluded that patients with hypothyroidism exhibited higher waist to hip ratios.

3.4 Circumferences

i) Waist circumference (WC)

Mean WC of healthy and hypothyroid subjects was 77.9 ± 9.73 cm and 90.25 ± 9.73 cm, respectively as shown in table no. 2. A statistically highly significant relation ($p<0.001$) was observed in hypothyroid patients when the results were compared with the healthy controls.

Luboshitzky *et al* [6] observed that subclinical hypothyroid patients had greater waist circumference than controls (90.7 ± 13 cm vs 81.8 ±10.56, p =0.0007).

ii) Hip Circumference (HC)

Mean HC of healthy and hypothyroid subjects was 94.85 ± 7.66 cm and 105.35 ± 9.32 cm which varies from 82.5 to 107.5 and 80 to 125 cm, respectively in table no. 3. A statistically highly significant relation ($p<0.001$) was observed.

iii) Neck Circumference (NC)

According to table no. 2, mean NC of healthy and hypothyroid subjects was 31.55 ± 2.13 cm and 32.75 ± 2.32 cm which varies from 27.5 to 35 and 32 to 37.5 cm, respectively. A statistically significant relation ($p<0.05$) was observed in hypothyroid patients. O. Resta *et al* [7] observed that neck circumferences were significantly higher in those persons who had obstructive sleep apnea (OSA) with hypothyroidism.

iv) Mid Arm Circumference (MAC)

Mean MAC of healthy and hypothyroid subjects was 28.2 ± 3.88 cm and 30.6 ± 2.93 cm which varies from 17.5 to 35 and 25 to 37.5 cm, respectively as shown in table 2. A statistically highly significant relation ($p<0.001$) was observed in hypothyroid patients.

Thyroid disorders have a high prevalence in medical practice. They are associated with a wide range of diseases with which they may or may not share etiological factors. One of the organs which best show this wide range of clinical signs is the skin.

In present study, the most common findings were the dry, pale, cold wrinkled skin (60%), pruritus (45%), palmoplantar keratoderma (30%), xerosis (20%) and hyperpigmentation (24%). (Fig. 1, 2, 3).

Nail and hair changes also occurred in hypothyroidism. Brittle and striated nails (38%), coarse, sparse scalp hair (35%) (Fig. 4) and superciliary madarosis (8%) were present in hypothyroid patients as in table no.3.

Alka Dogra *et al.* [8] observed on cutaneous examination that dry, coarse texture of skin (56%), pigmentary disorders (37.5%) and telogen effluvium (40.62%) were the most common finding with other associated disorders like vitiligo melasma, xanthelasma.

With our limited experience, we had reached a conclusion that there definitely exist a strong association between changes of the skin, its appendages and anthropometric parameters like weight, BMI, circumferences with hypothyroidism.

Fig. 1 : Palmar Keratoderma

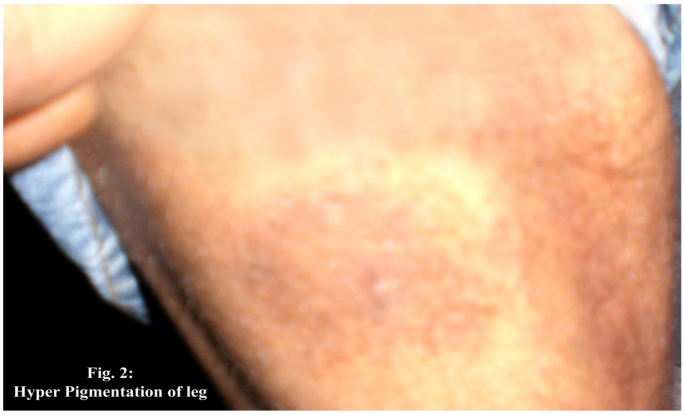

Fig. 2:
Hyper Pigmentation of leg

Fig. 3 : Hyper Pigmentation of Abdomen

Fig. 4 : Sparse Scalp Hair

4. Acknowledgement

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