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Comparative study on health status between hypothyroidism with diabetic patient (Sample-1), hypothyroidism patient (Sample-2) and diabetic patient (Sample-3) 30-50 years (Female), Tamluk, West Bengal

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Abstract
Hypothyroidism is a condition in which the thyroid gland is not able to produce enough thyroid hormone. Since the main purpose of thyroid hormone is to "run the body's metabolism," it is understandable that people with this condition will have symptoms associated with a slow metabolism. Diabetes Mellitus (DM) is a clinical syndrome characterize by high blood glucose concentration resulting from defects in insulin secretion, insulin action or both. The main objectives of this study are: To find out the association between Hypothyroidism & D.M., to find out the anthropometric assessment and physiological status of hypothyroidism and diabetic patient, to find out the nutritional status of hypothyroidism and diabetic patient, to find out the biochemical status of hypothyroidism and diabetic patient. A total of 30 subjects were studied for the study. 10 subjects with Thyroid (Hypothyroidism) patient with Diabetic patient (sample-1), 10 subjects with Thyroid (Hypothyroidism) patient (sample-2) and 10 subjects with Diabetic patient (sample-3) from local area (Tamluk) of West Bengal. It is living standards survey focuses on only urban and rural community when collecting data, data were collected at the study location via face to face questionnaire method. Here all the subject that has been taken have type-2 diabetes, & thyroid disease. Here it is make sure that these persons do not have any other complication like kidney disease, hematological abnormalities, liver disease, albuminuria (300 mg/24 h). after the study it was found that the patients who are suffering from diabetes (sample-1) & compare their health status with the patient of thyroid dysfunction(sample-2) & found that there is a significant difference in T_3, T_4&TSH level. In this study the samples are also significantly differ in both Systolic & diastolic blood pressure, at the level of 0.001 & 0.05 respectively. There is also significant difference of pulse rate at the level of 0.05 between the three samples. In the study of nutritional status, it was found that, Carbohydrate consumption is higher in sample -1 (thyroid patient with diabetes patient) than sample -2 (thyroid patient)& sample -3 (diabetes patient), protein consumption is higher in sample -1 (thyroid patient with diabetes) than sample -2 (thyroid patient) & sample -3 (diabetes patient) and fat consumption is higher in sample -3 (diabetes patient) than sample -2 (thyroid patient) & sample -1 (thyroid patient with diabetes patient). From this study it was concluded that Thus, thyroid dysfunction was found to be more prevalent in diabetic subject in comparison to controls. Subclinical hypothyroidism was significantly more common than overt hypothyroidism and both overt & subclinical hypothyroidism were more common in diabetic females. There were enough hypothyroid cases (both asymptomatic and symptomatic) even through the sample size was small, to warrant a conclusion that routine testing of thyroid functions in all diabetics will be beneficial and should be recommended.

Keywords: diabetes, hypothyroidism, diet, nutritional assessment, biochemical assessment

Introduction
The thyroid gland is the largest endocrine glands of the body. It consists of two lobes joined together by narrow isthmus. The thyroid gland lies in the neck, in front of the upper part of the trachea, it secrete hormones which are the iodine containing hormones; tri-iodothyronine (T_3) and thyroxine (T_4). Thyroid hormones regulate the basal metabolic rate and are important in the regulation of growth of tissues, particularly nervous tissue. Release stimulated by TSH from the pituitary. The second type of hormone produced from the thyroid gland is calcitonin, which regulates blood calcium levels along with parathyroid hormone and acts to reduce blood calcium by inhibiting its removal from bone.

Histologically each lobe of thyroid gland is divided in to lobules which are made up of several follicles, the functional unit of thyroid gland.

Follicular cell which vary in shape with the degree of granular activity. These cells are cuboidal & the colloid in the follicle s is moderate in amount. These cells secrete the thyroid hormones.

Para-follicular cells or C cells are also present, it does not border the follicular lumen but scattered in follicular cells & membrane, they may also lie in the intervals between the follicular cells. These cells secrete calcitonin.

Colloid is a homogeneous material that fills the cavity of each follicle. The major constituent of colloid is thyroglobulin, a glycoprotein.

Thyroid stimulating hormone (TSH) is a hormone, which is released from the pituitary gland and it regulates the production of thyroid hormones T3 and T4 from the thyroid gland. Its level is regulated by a negative feedback mechanism from T_3 and T_4, which means that if T_3 and T_4 are low, the TSH level goes up and when T_3 and T_4 are high,

the TSH levels go down. While treating thyroid hormone deficiency, as thyroid hormone pill is given the TSH levels become normal once the dose is appropriate. Thyroid hormone dose fluctuation can be related to variable compliance with medications, or any factors that affect its absorption from the gut, like taking it along with food, vitamins, calcium.

Thyroid dysfunction is a disorder of the thyroid gland which manifests either as hyper/or hypothyroidism & is reflect in the levels of thyroid stimulating hormone.

The pancreas is a flat, pear-shaped gland. It is behind and below the stomach. The pancreas is part of the digestive system. It is also part of the endocrine system. The endocrine system is the group of glands and cells in the body that make and release hormones (which control many functions such as growth, reproduction, sleep, hunger and metabolism) into the blood.

The pancreas has a series of small tubes that drain into the pancreatic duct. The pancreatic duct joins the common bile duct and empties into the duodenum.

Most of the cells in the pancreas are exocrine cells. Exocrine cells make and release pancreatic juice. The juice travels through the pancreatic duct into the duodenum. Enzymes in the pancreatic juice help digest fat, carbohydrates and protein in food.

A small number of the cells in the pancreas are endocrine cells. They are arranged in clusters called islets, or islets of Langerhans. The endocrine portion of the pancreas is made of small bundles of cells called islets of Langerhans. Many capillaries run through each islet to carry hormones to the rest of the body. There are 2 main types of endocrine cells that make up the islets: alpha cells and beta cells. Alpha cells produce the hormone glucagon, which raises blood glucose levels. Beta cells produce the hormone insulin, which lowers blood glucose levels.

Diabetes Mellitus (DM) is a clinical syndrome characterize by high blood glucose concentration resulting from defects in insulin secretion, insulin action or both. A majority of cases of DM suffers from lack of insulin. A fair percentage of cases may due to:

1. over production of other hormones which is antagonistic to insulin like glucagon, adrenalin, thyroid hormones, hormones of pituitary.
2. Due to increase production of substance which inactivate insulin like insulin & insulin antagonistic present in plasma.

Diabetes is a single most important metabolic disease which can affect nearly every organ system in the body. It can be autoimmune in origin & is associated with many other autoimmune disorders such as autoimmune thyroiditis, celiac disease etc. It may also associated with such as metabolic syndromes, hyper/ hypothyroidism & obesity. Thyroid is also most common endocrine disorder in the general population after diabetes.

Defective insulin secretion leads to various metabolic disorder aberrations in T-2 DM, spanning from hyperglycemia due to defective insulin-stimulated glucose uptake & up regulated hepatic glucose production, along with dyslipidemia, which includes impaired homeostasis of fatty acids, triglycerides, & lipoproteins.

DM appears to influence thyroid function in two sites; 1^{stly}at the level of hypothalamic control of TSH release & 2^{ndly} at peripheral tissue by converting $T_4$to T_3.Hyperglycemia causes reduction in hepatic concentration of $T_{4\text{-}5}$ deiodinase, low serum concentration of T_3,raised the level of reverse T_3& low, normal, or high level of T_4. Thyroid hormone regulate metabolism & diabetes can alter metabolism.

The present study is conducted to find out the relationship between type-2 DM & thyroid dysfunction in patients with type 2 diabetes, as the benefits of identifying at early stage, & even in asymptomatic patients is considerable.

The main objectives of my studies are as follows

- To find out the association between Hypothyroidism & D.M.
- To find out the anthropometric assessment and physiological status of hypothyroidism and diabetic patient.
- To find out the nutritional status of hypothyroidism and diabetic patient.
- To find out the biochemical status of hypothyroidism and diabetic patient.
- To search out the difference metabolic activities in diabetic patients.
- To search out the effect of hypothyroidism on human health.

Materials and Methods

A total of 30 subjects were studied. 10 subjects with Thyroid (Hypothyroidism) patient with Diabetic patient (sample-1), 10 subjects with Thyroid (Hypothyroidism) patient (sample-2) and 10 subjects with Diabetic patient (sample-3) from local area (Tamluk) of West Bengal. It is living standards survey focuses on only urban and rural community when collecting data, data were collected at the study location via face to face questionary method. Here all the subject that has been taken have type-2 diabetes, & thyroid disease. Here it is make sure that these persons do not have any other complication like kidney disease, hematological abnormalities, liver disease, albuminuria (300 mg/24 h).

Anthropometric assessment

For weight measurement we have used human weighing machine. For height measurement a vertical measured rod or a scale fixed to a wall can be used. BMI is a mathematical formula which correlates with the body fat of an individual. The BMI of each individual is calculated from the formula weight in (kg) / height (m2) by putting the value of weight in kg and height in meter square.

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}} = \text{kg / m}^2$$

Physiological status

The blood pressure measurements were made of after the completion of the anthropometric measurements. Left arm blood pressure was taken with a sphygmomanometer and Stethoscope after the Participate has been seated in a released position for 5minutes. Prior to taking measurements, subjects were instructed to lie on the bed and then the left arm was placed at the inside of the body. Two former measurements were recorded and average for analysis. A 5minute relaxation period between the two measurements was maintained for all subjects, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP)

were recorded to the nearest mm of Hg as the appearance (Phase I) and disappearance (Phase II) of karat off sounds respectively.

Bio-chemical Test

- **Blood sugar level:** blood sugar level taken in this project work by measuring the blood glucose level in fasting condition.
- **Thyroid hormone test:** The blood level of thyroid hormones (T_3& T_4) & thyroid stimulating hormone (TSH) is taken for this study.

Dietary assessment

Diet survey constitutes an essential part of any complete study of nutritional status of individual or groups. We followed the interview questionnaire method for the purpose of dietary assessment.

Statistical analysis of data

The calculated data was analyzed by the mean value, standard deviation, Standard error and T- test with the help of computer package.

Result and Discussion

Anthropometric assessment

Table 1: Measurement of Height, Weight, BMI, Pulse rate of Thyroid (Hypothyroidism) patient with Diabetic patient (sample-1)

Case study (Sample-1)	Age (Years)	Height (cm)	Weight (kg)	BMI (kg/m2)	Pulse rate(bites/min)
1	40	160.5	62	24.06	72
2	50	162.7	60	22.66	80
3	40	159	70	27.68	76
4	38	160	65	25.39	78
5	30	161.9	63.3	24.14	70
6	32	160.2	65	25.32	74
7	40	155	64	26.63	80
8	46	163.3	65	24.37	72
9	39	155	72	29.96	72
10	39	160.8	68	26.29	76
	Mean	159.84	65.43	25.65	75
	SD	2.857038	3.636863728	2.09841739	3.559026084
	SE	0.904126	1.150906243	0.66405614	1.126274077

Table 2: Measurement of Height, Weight, BMI, Pulse rate of Thyroid (Hypothyroidism) patient (sample-2)

Case study (Sample-2)	Age (Years)	Height (cm)	Weight (kg)	BMI (kg/m2)	Pulse rate (bites/min)
1	30	158	65	26.03	78
2	42	154.5	67	28.06	76
3	30	156.2	70	28.69	84
4	40	158	72	28.84	76
5	46	160	69	26.95	78
6	34	156	70	28.76	88
7	37	155	69	28.72	78
8	44	152	70	30.29	82
9	46	160	69	26.95	80
10	38	158	74	29.64	76
	Mean	156.77	69.5	28.293	79.6
	SD	2.524568	2.460804	1.309894	3.977715704
	SE	0.798914	0.778735	0.414524	1.258770792

Table 3: Measurement of height, weight, BMI, Pulse rate of Diabetic patient (sample-3)

Case study (Sample-3)	Age(years)	Height (cm)	Weight (kg)	BMI (kg/m2)	Pulse rate(bites/min)
1	36	156	55	22.6	68
2	43	154	61	25.72	70
3	49	158.9	62	24.55	66
4	44	160	48	18.75	72
5	42	157	50	20.28	65
6	39	156	55	22.6	68
7	46	158.2	60	23.97	74
8	35	155	52	21.64	66
9	37	162	50	19.05	70
10	40	154.2	48	20.18	72
	Mean	157.13	54.1	21.934	69.1
	SD	2.618757	5.363457	2.370270496	2.998147576
	SE	0.828721	1.697296	0.7500856	0.948780879

Graphical Representation

Table 4: Comparison of BMI between sample -1, sample -2, sample-3

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
BMI (kg/m^2) Mean±SEM	25.65±0.66	28.29±0.41	21.93±0.75

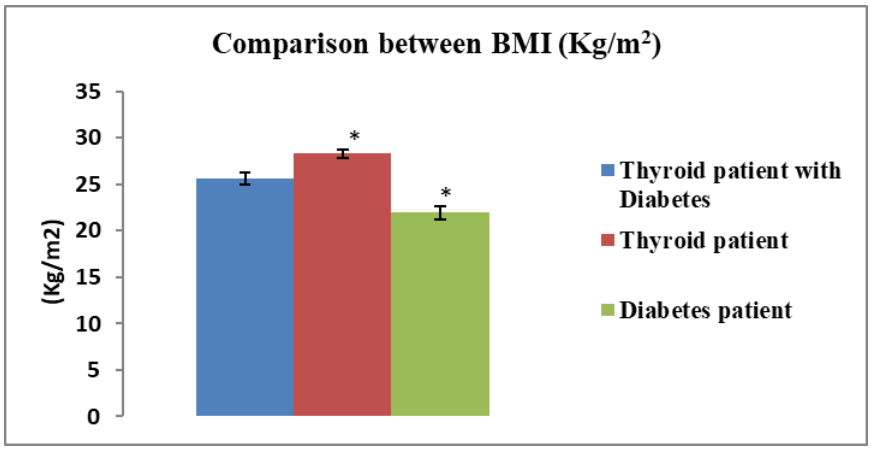

Fig 1: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar of sample 1 & sample 2 indicate the significant ($p<0.01$) of difference between two groups. As computed t value (3.38) is greater than the critical value t0.01 (18) =2.878 at 0.01 level of degree of freedom (df)18.

The bar of sample 1 & sample-3 indicate the significant ($p<0.01$) of difference between two groups. As computed t value (3.72) is greater than the critical value t 0.01 (18) =2.878 at 0.01 level of degree of freedom (df)18.

So there is a significantly difference ($p<0.01$) of the BMI value of these three samples.

Table 5: Measurement of T_3, T4 TSH level, Fasting Blood Sugar, & Blood Pressure (B.P) of sample-1

Case study (Sample-1)	T3	T4	TSH	Fasting Blood Sugar(mg/dl)	Systolic B.P(mm/Hg)	Diastolic B.P(mm/Hg)
1	0.68	8.78	8.1	150	130	86
2	0.98	10.96	9.04	141.8	138	88
3	1.96	8.94	9.51	152	132	84
4	1.21	11	8.46	145	140	90
5	0.41	9.4	32.19	146	144	92
6	0.78	8.9	7.7	140	146	90
7	1.21	8.98	8.02	179.65	138	80
8	0.72	10.6	6.7	156.8	136	90
9	1.48	10.56	10.78	142.27	138	94
10	0.98	7.98	11.3	150	132	86
Mean	1.041	9.61	11.18	150.352	137.4	88
SD	0.447399	1.073778	7.513057	11.52830507	5.168279318	4.109609335
SE	0.141582	0.339803	2.37755	3.648197807	1.63553143	1.300509283

Table 6: Measurement of T_3, T_4 TSH level, Fasting Blood Sugar, & Blood Pressure (B.P) of sample-2

Case study (Sample-2)	T3	T4	TSH	Fasting Blood Sugar(mg/dl)	Systolic B.P(mm/Hg)	Diastolic B.P(mm/Hg)
1	1.56	0.82	16.58	108	128	80
2	1.98	7.31	19.89	98	130	82
3	1.54	5.8	16.78	88.3	132	78
4	1.94	6.32	18.24	84.26	128	86
5	1.56	7.4	20.98	72.48	130	82
6	1.66	4.62	28	92	126	86
7	0.72	9.3	20.64	100	134	84
8	1.24	0.89	18.56	87.64	126	80
9	1.26	5.4	17.24	105.86	130	82
10	1.08	6.1	16.86	83	128	80
Mean	1.454	5.396	19.377	91.954	129.2	82
SD	0.386902	2.713735	3.435339	11.06905617	2.529822128	2.666666667
SE	0.122437	0.858777	1.087133	3.502865876	0.800576623	0.843881857

Table 7: Measurement of T_3, T_4TSH level, Fasting Blood Sugar, & Blood Pressure (B.P) of sample-3

Case study (Sample-3)	T3	T4	TSH	Fasting Blood Sugar(mg/dl)	Systolic B.P(mm/Hg)	Diastolic B.P(mm/Hg)
1	0.54	6.78	1.4	189.5	120	76
2	1.2	4.98	2.48	184.46	120	78
3	0.46	7.61	2.47	156.4	118	68
4	0.58	5.76	2.1	172.4	132	84
5	1.07	6.46	4.32	160.86	122	86
6	0.34	5.24	3.4	150.24	128	84
7	0.34	4.89	1.74	160.42	130	88
8	0.34	1.27	0.37	165.98	126	80
9	0.62	3.56	0.29	160.24	124	82
10	0.86	6.08	2.09	150.98	130	90
Mean	0.635	5.263	2.066	165.148	125	81.6
SD	0.309668	1.801882	1.237239	13.26480121	4.921607687	6.449806199
SE	0.097996	0.570216	0.391531	4.197721902	1.557470787	2.041077911

Table 8: Comparison of T3 value between sample -1, sample -2, sample-3

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
T_3 value Mean±SEM	1.04±0.14	1.45±0.12	0.63±0.09

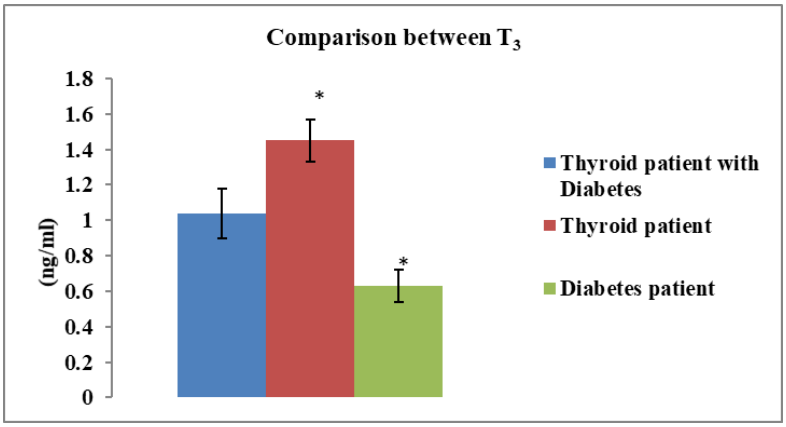

Fig 2: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant ($p<0.05$) of difference between two groups. As computed t value (2.20) is greater than the critical value t0.05 (18) =2.101at 0.05 level of degree of freedom (df)18.

The bar diagram of sample 1 & sample 3 indicate the significant ($p<0.05$) of difference between two groups. As computed t value (2.38) is greater than the critical value t 0.05 (18) =2.101 at 0.01 level of degree of freedom (df)18. *So there is a significantly difference ($p<0.05$) of the T_3value of these three samples.*

Table 9: Comparison of T_4value between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
T4 value Mean±SEM	9.61±0.33	5.39±0.85	5.26±0.57

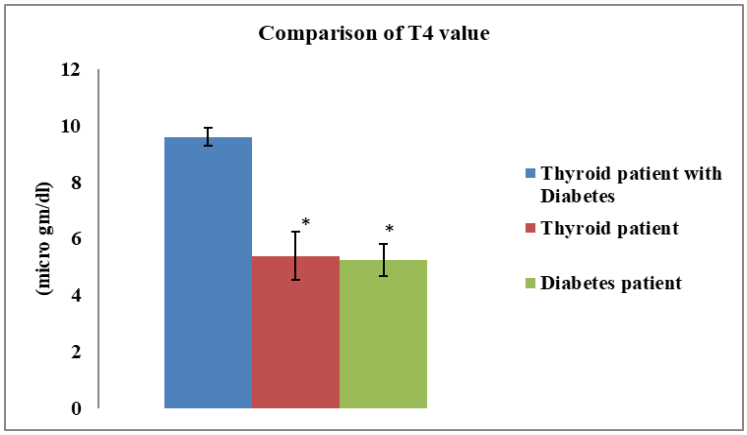

Fig 3: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant (p<0.001) of difference between two groups. As computed t value (4.59) is greater than the critical value t0.001 (18) =3.992 at 0.001 level of degree of freedom (df)18.
The bar diagram of sample 1 & sample 3 indicate the significant (p<0.001) of difference between two groups. As computed t value (6.56) is greater than the critical value t 0.001 (18) =3.992 at 0.01 level of degree of freedom (df)18.
So there is a significantly difference (p<0.001)of the T_4 value of these three samples.

Table 10: Comparison of TSH value between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
TSH (Mean±SEM)	11.18±2.37	19.37±1.08	2.06±0.39

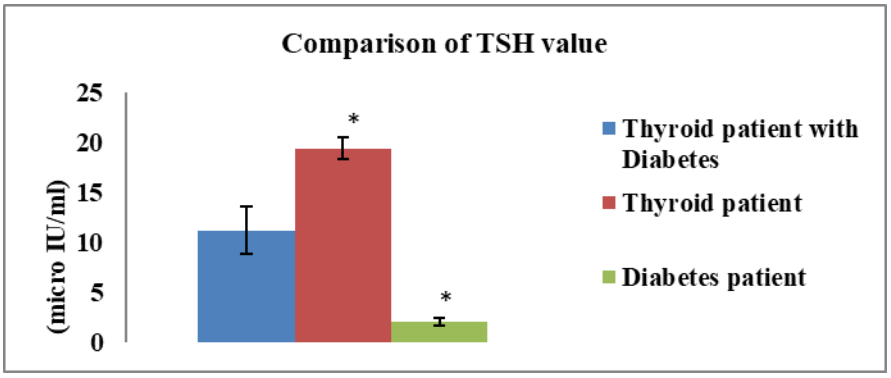

Fig 4: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant (p<0.01) of difference between two groups. As computed t value (3.13) is greater than the critical value t0.01 (18) =2.878 at 0.01 level of degree of freedom (df)18.
The bar diagram of sample 1 &sample 3 indicate the significant (p<0.01) of difference between two groups. As computed t value (3.78) is greater than the critical value t 0.01 (18) =2.878 at 0.01 level of degree of freedom (df)18.
So there is a significantly difference (p<0.01) of the TSH value of these three samples.

Table 11: Comparison of Fasting Blood Sugar (mg/dl) level between sample -1, sample -2, sample-3

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Fasting Blood Sugar (mg/dl) Mean±SEM	150.35±3.64	91.95±3.50	165.14±4.19

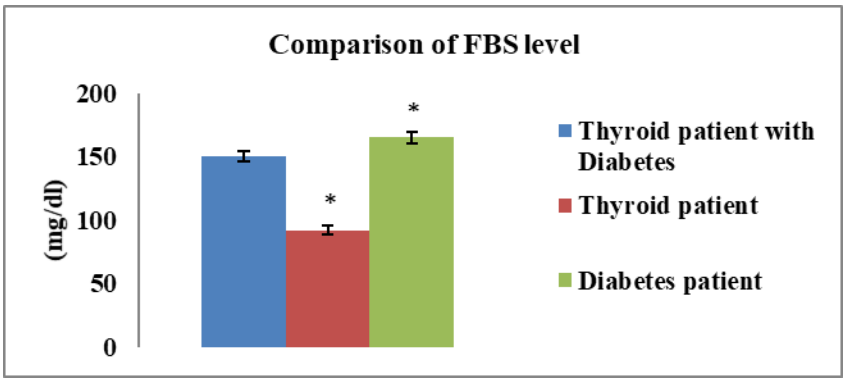

Fig 5: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant (p<0.001) of difference between two groups. As computed t value (11.58) is greater than the critical value t0.001 (18) =3.922at 0.01 level of degree of freedom (df)18.
The bar diagram of sample 1 & sample 3 indicate the significant (p<0.05) of difference between two groups. As computed t value (2.66) is greater than the critical value t 0.05 (18) =2.101 at 0.01 level of degree of freedom (df)18.
So there is a significantly difference (p<0.05) of the FBS value of these three samples.

Table 12: Comparison of Systolic Blood Pressure between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Systolic B.P (mm/Hg) Mean±SEM	137.4±1.63	129.2±0.80	125±1.55

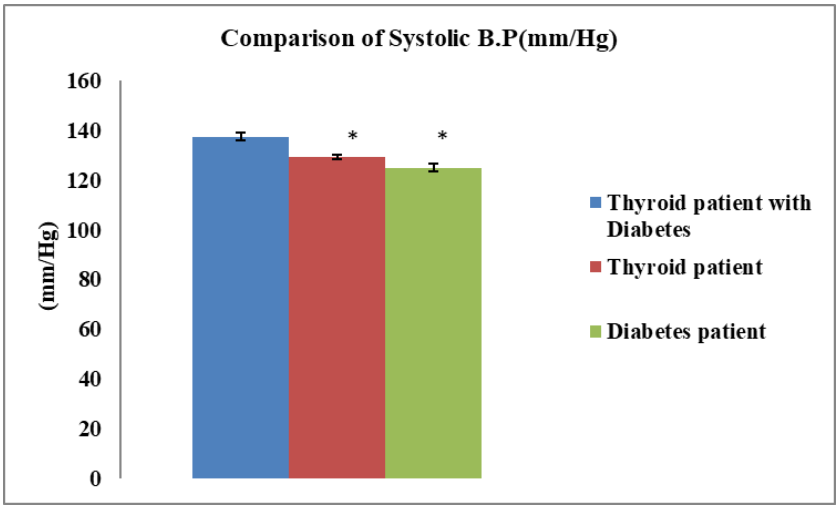

Fig 6: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant (p<0.001) of difference between two groups. As computed t value (4.53) is greater than the critical value t0.01 (18) =3.922 at 0.01 level of degree of freedom (df)18.

The bar diagram of sample 1 &sample 3 indicate the significant (p<0.001) of difference between two groups. As computed t value (5.51) is greater than the critical value t 0.001 (18) =3.922 at 0.01 level of degree of freedom (df)18.

So there is a significantly difference (p<0.001) of the Systolic B.P of these three samples.

Table 13: Comparison of Diastolic Blood Pressure between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Diastolic B.P. (mm/Hg) Mean±SEM	88±1.30	82±0.84	81.6±2.04

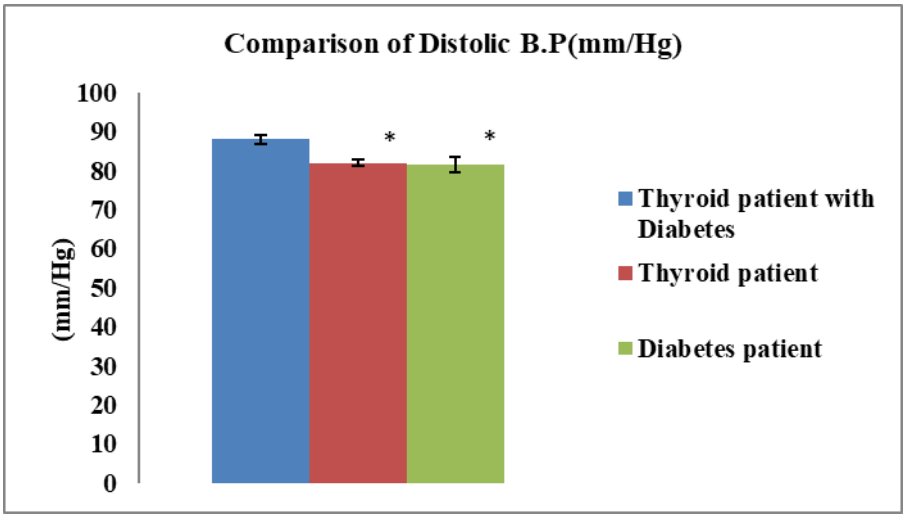

Fig 7: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant (p<0.01) of difference between two groups. As computed t value (3.87) is greater than the critical value t0.01 (18) =2.878 at 0.01 level of degree of freedom (df)18.

The bar diagram of sample 1 &sample 3 indicate the significant (p<0.05) of difference between two groups. As computed t value (2.64) is greater than the critical value t 0.05 (18) =2.101 at 0.01 level of degree of freedom (df)18.

So there is a significantly difference (p<0.05) of the Diastolic B.P of these three samples.

Table 14: Comparison of Pulse rate between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Pulse rate (bites/min) Mean±SEM	75±1.12	79.6±1.25	69.1±0.94

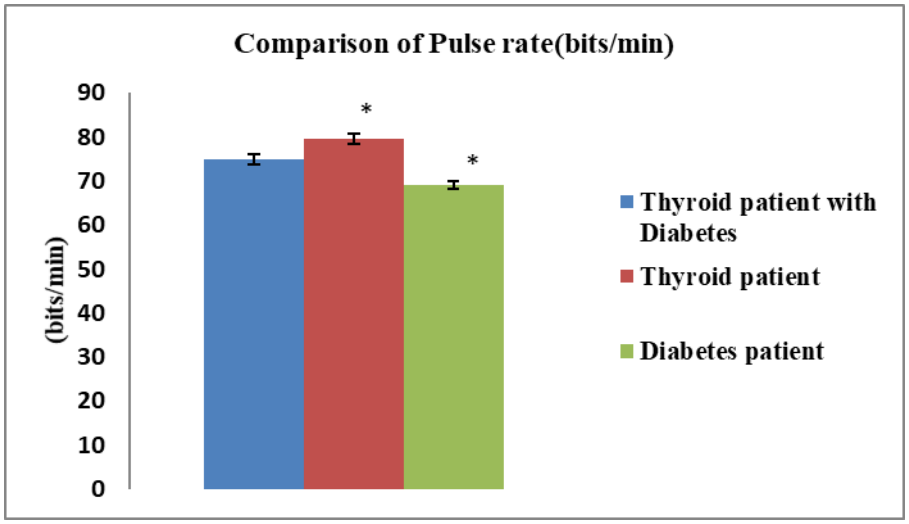

Fig 8: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar diagram of sample 1 &sample 2 indicate the significant ($p<0.05$) of difference between two groups. As computed t value (2.73) is greater than the critical value t0.05 (18) =2.101 at 0.05 level of degree of freedom (df)18.

The bar diagram of sample 1 &sample 3 indicate the significant ($p<0.001$) of difference between two groups. As computed t value (4.04) is greater than the critical value t 0.001 (18) =3.922 at 0.01 level of degree of freedom (df)18. *So there is a significantly difference ($p<0.05$) of the Pulse rate of these three samples.*

Nutritional Assessment

Table 15: Diet intake for 7 days by sample-1 (Interview method):

Case study (Sample- 1)	Energy (kcal/ day)	Carbohydrate (gm/day)	Protein (gm/day)	Fat (gm/day)
1	2336	408	68	48
2	2156	395	54	40
3	2290	395	65	50
4	2002	360	55	38
5	2197	387	61	45
6	2263	394	66	47
7	2134	375	64	42
8	2282	402	65	46
9	2318	398	69	50
10	2188	380	68	44
Mean	2216.6	389.4	63.5	45
SD	102.2558882	14.25326473	5.275730597	4.055175
SE	32.35945828	4.510526814	1.669534999	1.283283

Table 16: Diet intake for 7 days by sample-2 (Interview method):

Case study (sample-2)	Energy (kcal/day)	Carbohydrate (gm/day)	Protein (gm/day)	Fat (gm/day)
1	1871.47	299.04	58.24	49.05
2	1914.1	304	53.25	53.9
3	1916.22	294	59.1	55.98
4	1885.02	305	52	50.78
5	1993.02	310	60.05	56.98
6	1745.54	289.1	55.08	40.98
7	1909.45	315.26	60.65	45.09
8	1910.34	285.98	67.9	54.98
9	1899.06	301.95	58.56	50.78
10	2002.16	309.09	60.95	54.25
Mean	1904.638	301.342	58.578	51.277
SD	70.26104386	9.396101792	4.512535134	5.097213
SE	22.23450755	2.973449934	1.428017447	1.613042

Table 17: Diet intake for 7 days by sample-3 (Interview method)

Case study (Sample-3)	Energy (kcal/day)	Carbohydrate (gm/day)	Protein (gm/day)	Fat (gm/day)
1	2000.18	320.54	56.91	54.5
2	1908.5	303.5	58.2	51.3
3	1871.84	307.71	54.5	47

4	1927.98	304.2	59.22	52.71
5	1899.38	312	53.27	48.7
6	1976.68	303.55	62.37	57
7	1955.07	301	59.72	56.91
8	1976.84	309.25	61.21	55
9	2017.28	316.32	59.3	57.2
10	1984.54	302.25	62.89	58.22
Mean	1951.829	308.032	58.759	53.854
SD	47.773	6.5035	3.154	3.838
SE	15.118	2.058	0.998	1.214

Table 18: Comparison of Energy intake between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes(sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Energy (kcal) Mean±SEM	2216.6±32.35	1904.63±22.23	1951.82±15.11

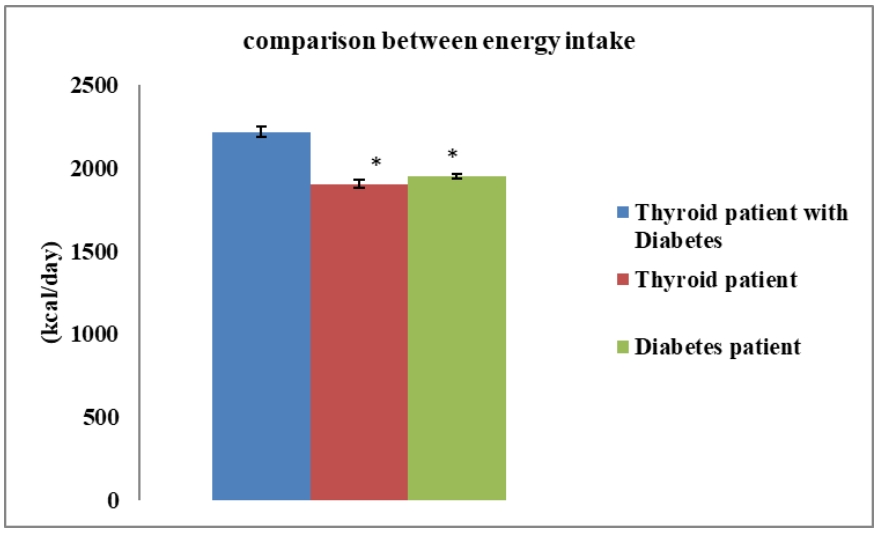

Fig 9: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar of sample 1 &sample 2 indicate the significant ($p<0.001$) of difference between two groups. As computed t value (7.95) is greater than the critical value t0.001 (18) =3.922 at 0.01 level of degree of freedom (df)18.

The bar of sample 1 &sample 3 indicate the significant ($p<0.001$) of difference between two groups. As computed t value (7.41) is greater than the critical value t 0.001 (18) =3.922 at 0.001 level of degree of freedom (df)18.

So there is a significantly difference ($p<0.001$) of the Energy intake of these three samples.

Table 19: Comparison of Carbohydrate intake between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes(sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Carbohydrate(gm/day) Mean±SEM	389.4±4.51	301.34±2.97	308.03±2.05

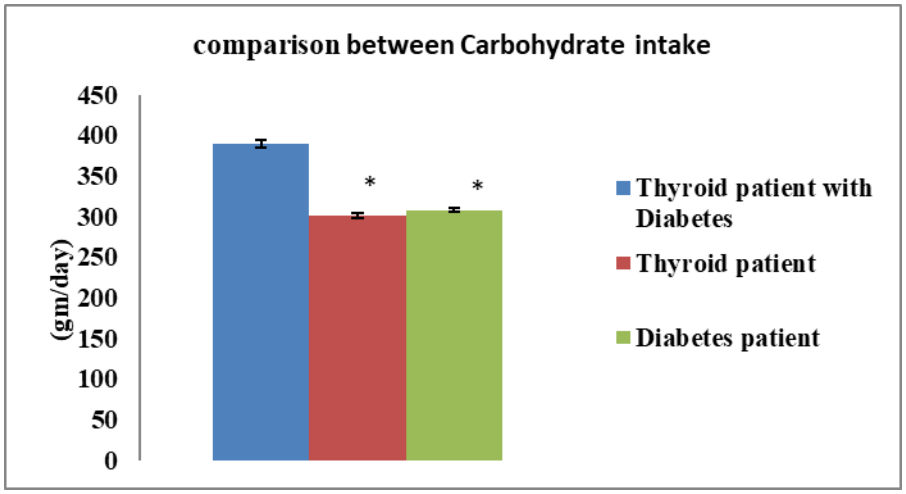

Fig 10: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar of sample 1 &sample 2 indicate the significant ($p<0.001$) of difference between two groups. As computed t value (16.33) is greater than the critical value t0.001 (18) =3.922 at 0.001 level of degree of freedom (df)18.
The bar of sample 1 & sample 3 indicate the significant ($p<0.001$) of difference between two groups. As computed t value (16.43) is greater than the critical value t 0.001 (18) =3.922 at 0.001 level of degree of freedom (df)18.
So there is a significantly difference ($p<0.001$) of the Carbohydrate intake of these three samples.

Table 20: Comparison of Protein intake between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Protein (gm/day) Mean±SEM	63.5±1.66	58.57±1.42	58.75±0.99

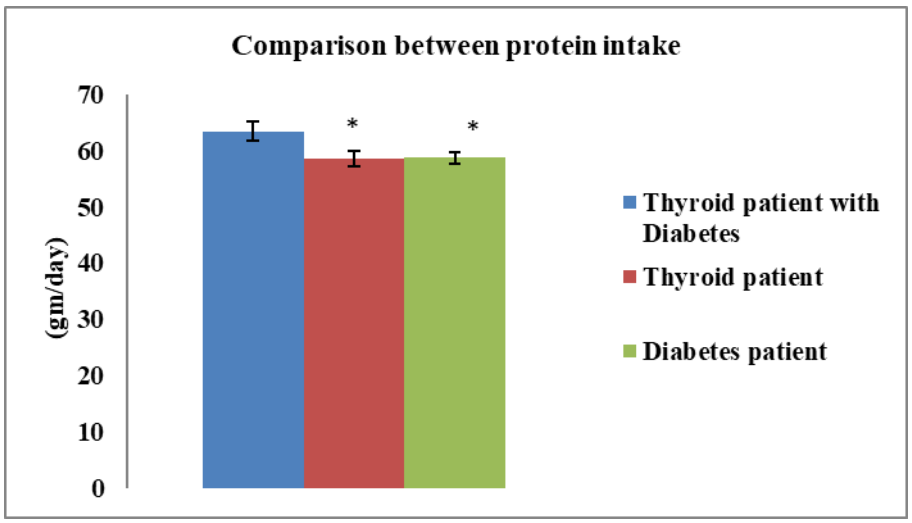

Fig 11: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar of sample 1 &sample 2 indicate the significant ($p<0.05$) of difference between two groups. As computed t value (2.25) is greater than the critical value t0.05 (18) =2.101 at 0.05 level of degree of freedom (df)18.
The bar of sample 1 &sample 3 indicate the significant ($p<0.05$) of difference between two groups. As computed t value (2.44) is greater than the critical value t 0.05 (18) =2.101at 0.05 level of degree of freedom (df)18.
So there is a significantly difference ($p<0.05$) of the Protein intake of these three samples.

Table 21: Comparison of Fat intake between sample -1, sample -2, sample-3:

Type of patient	Thyroid patient with Diabetes (sample-1)	Thyroid patient (sample-2)	Diabetes patient (sample-3)
Fat (gm/day) Mean±SEM	45±1.28	51.27±1.61	53.85±1.21

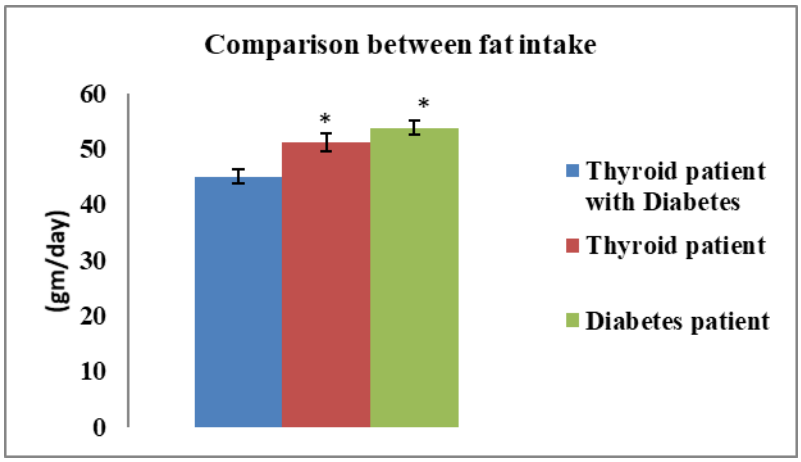

Fig 12: Each bar represents (Mean ± SEM) of Thyroid with diabetes, thyroid & diabetes.

The bar of sample 1 &sample 2 indicate the significant ($p<0.01$) of difference between two groups. As computed t value (3.05) is greater than the critical value t0.01 (18) =2.878 at 0.01 level of degree of freedom (df)18.
The bar of sample 1 &sample 3 indicate the significant ($p<0.001$) of difference between two groups. As computed t value (5.02) is greater than the critical value t 0.001 (18) =3.922 at 0.001 level of degree of freedom (df)18.
So there is a significantly difference ($p<0.01$) of the Fat intake of these three samples.
In recent years, tremendous interest has been raised in the effect of thyroid function on insulin levels. It is established

that clinical hypothyroidism is considered as an insulin-resistant state. Following their studies on patients with hypothyroidism, Handisurya and Stanicka have concluded that hypothyroidism makes glucose inaccessible to insulin. However; an exact pathogenetic mechanism involved in insulin resistance in hypothyroidism is still unknown. In current study with enrolling different groups of hypothyroid patients, we tried to detect any association of autoimmunity against thyroid and insulin resistance. Adjusting for age and sex, hypothyroid patients had more frequency of central obesity than general population of Zanjan, the city that this study was conducted (67% vs.40%).Having high prevalence of insulin resistance (44%) in our patients, who all were euthyroid for a long time before the study, reveals another mechanism other than role of lowthyroid hormonesfor the insulin resistance in hypothyroidism. Higher central fat in the subjects may explain the higher prevalence on insulin resistance among participants, however; a significantly more prevalence of elevated fasting insulin level was detected in a subgroup of patients with Hashimoto's thyroiditis and highly elevated levels of Anti TPO antibodies more than 1000 IU/ml which might support the concept of autoimmunity role in insulin resistance.

Thyroid disease is very common in the general population and the prevalence increases with age. The assessment of thyroid function by modern assays is both reliable & expensive. Screening for thyroid dysfunction is indicated in certain high risk groups, such as neonates & elderly.

The patients who are suffering from diabetes (sample-1) & compare their health status with the patient of thyroid dysfunction(sample-2)& found that there is a significant difference in T_3, T_4&TSH level.

In case of, comparison of blood sugar between the thyroid patients who are suffering from diabetes (sample-1) with diabetes patient(sample-3) I found that there is a significant difference in the fasting blood glucose level.

In my study the samples are also significantly differ in both Systolic & diastolic blood pressure, at the level of 0.001 & 0.05 respectively.

There is also significant difference of pulse rate at the level of 0.05 between the three sample.

In the study of nutritional status, it was found that

Carbohydrate consumption is higher in sample -1 (thyroid patient with diabetes patient) than sample -2 (thyroid patient) & sample -3 (diabetes patient)

Protein consumption is higher in sample -1 (thyroid patient with diabetes) than sample -2 (thyroid patient) & sample -3 (diabetes patient)

Fat consumption is higher in sample -3 (diabetes patient) than sample -2 (thyroid patient) & sample -1 (thyroid patient with diabetes patient.

Conclusion

Thus, thyroid dysfunction was found to be more prevalent in diabetic subject in comparison to controls. Subclinical hypothyroidism was significantly more common than overt hypothyroidism and both overt & subclinical hypothyroidism were more common in diabetic females. There were enough hypothyroid cases (both asymptomatic and symptomatic) even through the sample size was small, to warrant a conclusion that routine testing of thyroid functions in all diabetics will be beneficial and should be recommended.

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