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Comparative studies on effect of endocrine hormones in individuals with *Diabetes mellitus*

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ABSTRACT

Diabetes [1-4], which is characterized by excessive flow of urine and insatiable thirst, was coined by the Graeco-Roman physician Aretaeus of Cappadocia (approx. 80–130 A.D.) (1) It is a state of chronic hyperglycaemia caused by absolute or relative insulin deficiency and profound changes in the body lipid and protein. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Diabetes mellitus is defined by fasting blood glucose level of 126 milligrams per deciliter (mg/dL) or more. An estimated 177 million people are affected by diabetes mellitus.

The major actions of thyroid hormones [5-7] in the human body are contribution to energy levels and the body's ability to maintain a constant temperature. It increases fat breakdown, improves head hair growth, reduces cholesterol levels and bodyweight. Thyroid hormones control the body's metabolism. The brain produces thyroid stimulating hormone (TSH) which triggers the thyroid gland to produce two types of hormones – T4 and T3. T4 is the main product secreted by the thyroid follicular cells and is regarded as a precursor of the bioactive hormone T3. The present study is to explain the correlation between the levels of thyroid hormones, at the end of the proposed study a detailed discussion based on the levels is completely discussed.

Key words: Tri-iodo thyronine, Thyroxine, TSH, Diabetes, Analysis.

INTRODUCTION

Diabetes is known to be the third largest life taking disease after HIV and Cancer, that effects majority of mankind, irrespective of cast, creed and religion. It is one disease that affects each and every part of the human body right from the tip of the finger to the brain. As someone has said the disease cannot be cured but can only be prevented by controlling the blood glucose levels through proper medicines, diet and exercise. Endocrine hormones especially divide themselves into two categories, one of which is responsible for increasing the blood glucose levels and include hormones like, glucagon, epinephrine, corticosteroids etc., the other category includes insulin a hormone responsible for reducing blood glucose levels. The normal levels of glucose in blood when both anabolic and catabolic pathways concurrently occur are maintained at 120 mg/dl under fasting conditions. However due to hormonal imbalances and related morphological and pathological changes taking place in the body there is a possibility that a variation in blood glucose levels is observed. The present study was undertaken to explain the affect of thyroid hormones especially T_3 and TSH along with T_4 in the metabolism of diabetes. The study describes a detailed analysis of the blood glucose levels of individuals from different age groups and their thyroid levels, so as to correlate diabetes with hypo and hyper thyroidism.

EXPERIMENTAL

Material and methods

Visible spectrophotometer (Systronics 106, Ahmedabad, India) for analysis of blood glucose, luminescent test kits for assay of thyroid hormones, micropipettes, serum samples. The glasswares used were made up of Borosil and all the chemicals used were of high analytical grade. Double distilled water was used for analysis wherever necessary.

Estimation of Blood Glucose [8-10]

Quantitative determination of glucose is important in clinical chemistry, biochemistry, and food science. In this experiment, we measured glucose levels using enzymatic reactions and visible absorption spectrophotometry. Glucose is oxidized to D-gluconolactone and hydrogen peroxide in the presence of Glucose oxidase to produce hydrogen peroxide and D-gulonolactone. The production of hydrogen peroxide is coupled to a reaction catalyzed by Horse raddish peroxidase in the presence of phenol and 4 amino-antipyrene to form a colored complex that can be measured spectro-photometrically at 505 nm using reagent blank.

Estimation of T_3 and T_4 [11-15]

The principle of the chemiluminescence immunoassay (LIA) test for the determination of T3 and T4 follows the typical competitive binding scenario. Competition occurs between an unlabeled antigen (present in standards, control and patient samples) and an enzyme-labeled antigen (conjugate) for a limited number of antibody binding sites on the microwell plate. The washing and decanting procedures remove unbound materials. After the washing step, the luminescence substrate solution was added. The relative luminescence units (RLUs) were measured on a micro titer plate luminometer. The RLU values are inversely proportional to the concentration of T_4 in the sample. A set of calibrators were used to plot a standard curve from which the amount of T_4 inpatient samples and controls can be directly read. The binding sites on the microwell plates are designed to be of a low binding-capacity in order not to disturb the equilibrium between T_4 and its carrying proteins. The assay was carried out under normal physiological conditions of pH, temperature and ionic strength.

Estimation of TSH

This test for determination of TSH was based on two-site sandwich enzyme immunoassay principle. Tested specimen was placed into the microwells coated by specific anti-TSH-antibodies. Antigen from the specimen was captured by the antibodies coated onto the microwell surface. Unbound material was removed by washing procedure. Second antibodies directed towards another epitope of TSH, and labeled with peroxidase enzyme, were then added into the microwells. After subsequent washing procedure, the remaining enzymatic activity bound to the microwell surface was detected and quantified by addition of chromogen-substrate mixture, stop solution and photometry at 450 nm. Optical density in the microwell was directly related to the quantity of the measured analyze in the specimen.

RESULTS

After carrying out a systematic analysis described under material and methods the following results were obtained and are presented in table-1, the normal levels of the parameters estimated are indicated in brackets. Blood Glucose (Fasting: 70 -

Table 1: Correlation of blood glucose and thyroid hormones

S. No	Sex/Age	T_3	T_4	TSH	Blood glucose (mg/dl)
1	F/37	96	7.36	3.90	127
2	M/35	43	1.40	>150	133
3	M/48	56	3.6	71.27	123
4	M/57	121	13.6	0.20	141
5	M/58	58	5.29	35.00	121
6	M/62	69	7.89	6.28	152
7	M/49	74	6.90	62	167
8	M/56	90	6.88	9.29	129
9	F/53	81	9.12	12.54	131
10	F/57	72	8.67	8.10	147
11	F/59	65	5.62	10.68	127
12	M/41	54	2.90	77	182
13	M/49	52	2.17	112	200
14	F/67	112	5.32	3.2	193
15	F/49	49	2.09	97	212

110 mg/dl), T_3 (60 - 200 mg/dl), T_4 (4.5 - 12.0 mg/dl), TSH (0.30 -5.5 Micro IU/ml).

DISCUSSION

From the results it was quite evident that there lies a strong relationship between diabetes and thyroid metabolism. However, with respect to age, a few observations could be made such as individuals who were having low blood glucose levels in the age group of 35 to 50 years were found to suffer for hypothyroidism, in such individuals there was an elevation in the TSH levels but only slight variation in T_3 and T_4 levels showing a decline and indicating hypothyroidism. In case of chronic diabetic patients of the age group 60 to 70 years, elevation of T_3 and T_4 levels were observed, however there was a slight change in the values of TSH, these people were found to exhibit marked hyperthyroidism.

CONCLUSION

It could thus be concluded that there is a strong relationship between diabetes, hyper and hypothyroidism and the marked variation in the clinical parameters could be either due to defective carbohydrate metabolism or in most of the cases due to obesity. The variation in levels of thyroid hormones is primarily due to their age difference and obesity as was seen in individuals on whom the experiments were performed.

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