

## Thyroid Dysfunction among Young Adults in Uganda

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**Background:** Most studies on thyroid dysfunction have been on patients referred for treatment, little is known about the prevalence in the general populations. The importance of knowing such prevalence data lies in that fact that subclinical thyroid dysfunction is an important risk on development of heart disease, osteoporosis, hypercholesterolemia and mental illness. This study set out to determine thyroid dysfunction prevalence in a healthy young adult population.

**Methods:** A cross sectional study carried out at the College of Health Sciences, Makerere University enrolled 100 Undergraduate medical students by invitations through notices and announcements. Informed consent was sought after approval from research ethics committee.

**Results:** Of the 100 students enrolled and the samples drawn; 83 tests for TSH and 82 tests for FT4 were successfully run. Three results were abnormal making a prevalence of 3.6% for thyroid dysfunction; a high TSH (5.71) with a normal fT4 (19.2), a normal TSH (1.67) with a high fT4 (22.31) and one with a low TSH (0.03). The mean age of participants was 23 years, there were slightly more males 1.3:1.

**Conclusion:** The prevalence of thyroid dysfunction in this cohort was low but falls in the range found elsewhere. These findings could inform the criteria of screening asymptomatic otherwise young healthy adults.

## Introduction

Most studies on thyroid dysfunction have been on patients referred for treatment, little is known about the prevalence in the general population<sup>1, 2</sup>. However some studies state the thyroid dysfunction is common in adults<sup>3, 4</sup>. The prevalence in the Ugandan population is not known. It is now known that sub clinical thyroid dysfunction has an important impact on the risk of developing heart disease, osteoporosis, hypercholesterolaemia and mental illness<sup>2</sup>.

Hypothyroidism and hyperthyroidism can be accurately diagnosed with laboratory tests<sup>5</sup>, they frequently have significant clinical consequences yet readily treatable. The serum TSH assay is an accurate, widely available safe and relatively inexpensive diagnostic test for all common forms of hypothyroidism and hyperthyroidism<sup>6</sup>. Serum TSH measurement is the single most reliable test to diagnose all common forms of hypothyroidism and hyperthyroidism particularly in the ambulatory setting. An elevated serum TSH concentration is present in both overt and mild hypothyroidism. In the later serum free T<sub>4</sub> concentration is by definition normal.

Virtually all types of hyperthyroidism encountered in clinical practice are accompanied by suppressed serum TSH concentrations, typically less than 0.1mIU/L. To diagnose hyperthyroidism accurately, TSH assay sensitivity, the lowest reliably measured TSH concentration, must be 0.2mIU/L or less<sup>7</sup>.

The purpose of this study was to determine the prevalence of thyroid dysfunction evaluated by biochemical variables with sensitive assays in an area of presumed minimal iodine deficiency.

## Subjects and Methods

A cross sectional study was carried out at the College of Health Sciences, Makerere University enrolled 100 Undergraduate medical students by invitations through notices and announcements. Informed consent was sought after approval from research ethics committee. Data was collected by using a pre tested questionnaire. Blood samples were drawn for the various thyroid variables: TSH

and free T<sub>4</sub>. TSH were measured by chemiluminescence Immuno assay with mouse monoclonal antibody (Roche Elecsys 2010). The cut off values were as shown in Table 1. These criteria were chosen from the reference interval given by the laboratory for daily use. Data analysis was done using SPSS 11.5 software for windows.

**Table 1.** The cut off values of Thyroid Functions

|                                                                                   | <b>TSH <math>\mu</math>IU/ml</b> | <b>Free T<sub>4</sub> pmol/l</b> |
|-----------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| Hyperthyroidism                                                                   | < 0.27                           | < 22                             |
| Sub clinical hyperthyroidism                                                      | < 0.27                           | < 22                             |
| Euthyroidism                                                                      | 0.15-5                           | -                                |
| Sub clinical hypothyroidism                                                       | > 4.2                            | < 10                             |
| Hypothyroidism                                                                    | > 4.2                            | > 10                             |
| Corresponds to the 2.5 <sup>th</sup> and 97.5 <sup>th</sup> percentile of results | 0.27 – 4.2 $\mu$ IU/ml           | 12-22pMol/L                      |

## Results

Of the 100 students enrolled and the samples drawn, 83 tests for TSH and 82 tests for FT<sub>4</sub> were successfully run. Three results were abnormal; a high TSH (5.71) with a normal FT<sub>4</sub> (19.2), a normal TSH (1.67) with a high FT<sub>4</sub> (22.31) and one with a clearly low TSH (0.03).

**Table 2.** Summary of the Results

| <b>Variable</b>        | <b>Result</b>                             |
|------------------------|-------------------------------------------|
| Age (n) 89             | Mean 23.1<br>Medium 22<br>Range 19-36     |
| Sex (n) 89             | Male 50<br>Female 39<br>Ratio M:F (1.3:1) |
| BMI (n) 89             | Mean 23<br>Median 22<br>Range 18-33.3     |
| TSH (n) 83             | Mean 1.6<br>Median 1.46<br>Range 0.3-5.71 |
| FT <sub>4</sub> (n) 82 | Mean 16.0<br>Median 15.6<br>Range 12-22.3 |

## Discussion

This study reveals a thyroid dysfunction prevalence of 3.6%. The prevalence of thyroid dysfunction in an adult population in literature ranges 0.1 – 17%<sup>3</sup>. The interpretation of the three abnormal results follows; the participant who had a high FT<sub>4</sub> and a normal TSH with no overt symptoms falls under two possibilities of dysfunction either euthyroid hyperthyroxinemia or thyroid hormone resistance that would potentially lead to overt thyrotoxicosis later. The second participant with a normal TSH and a normal FT<sub>4</sub> has subclinical hypothyroidism

The third with a clearly low TSH and a normal FT<sub>4</sub> falls under the category of early grave's disease, iodine deficiency or a solitary nodule.

This study population is presumed to be taking iodized salt, its young and considered healthy. Those on drugs that might have interfered with tests were excluded, including multivitamin supplements for any reason. So the results represent a presumed healthy young adult population.

Iodized salt intake achieves a 150-250µg/d intake, which is adequate. Foods of marine origin have high iodine content. Major other sources are milk, bread and eggs<sup>9</sup>. Iodine (as iodine) is widely but unevenly distributed in the earth's environment. In many regions, leaching from flooding, erosions and glaciations have depleted surface soils of iodine and most iodine is found in the oceans (approx 50mg/liter). Iodine ions in sea water evaporate into the atmosphere and return to the soil by rain to complete the cycle. However iodine cycling in many regions is slow and incomplete, leaving soils and drinking water iodine depleted. Crops grown in these soils will be low in iodine and humans and animals consuming food grown in these soils become iodine deficient. The study setting area is considered to be iodine sufficient, though there could be pockets of deficiency in highland mountainous areas.

The thyroid adapts to low intakes of dietary iodine by marked modification of its activity, triggered by increased secretion of TSH by the pituitary. In most individuals, if iodine intake falls below approximately 100µg/day, TSH secretion is augmented which increases plasma inorganic iodine clearance by the thyroid<sup>10</sup>. As long as daily iodine intake remains above a threshold of approximately 50µg/day, despite a decrease in circulating plasma inorganic iodine, absolute uptake of iodine by the thyroid remains adequate and the iodine content of the thyroid remains within normal limits (10-10mg). Below this threshold, despite high fractional clearance of plasma inorganic iodine by the thyroid, absolute intake falls, the iodine content of the thyroid is depleted and many individuals develop goiter<sup>11</sup>.

The participants in this study that had thyroid dysfunction had no overt symptomatology, it is well documented that the effects of iodine deficiency and hypofunction are extremely variable among populations and individuals even in endemic areas. Dietary substances that interfere with thyroid metabolism can aggravate the effect of iodine deficiency; these goitrogens include cabbage, cassava, sorghum and sweet potatoes which are commonly eaten in this region. Linamarin is a thyroglycoside in cassava, if cassava is not adequately soaked or cooked, to remove it; it hydrolyses in the gut to release cyanide which is metabolized to thiocyanate<sup>12</sup>. Thiocyanates compete with iodine for thyroid uptake.

Cigarette smoking is associated with higher serum levels of thiocyanate. No participant admitted to smoking in this study. Deficiencies of selenium, iron and vitamin A, influence iodine deficiency and therefore thyroid function<sup>13</sup>. Coverage of iodized salt use in Uganda is more than 90%<sup>14, 15</sup>.

## Conclusion

The prevalence of thyroid dysfunction in this cohort was low but falls in the range found elsewhere. These findings could inform the criteria of screening asymptomatic young otherwise healthy adults.

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