Thyroid status among individuals attending a tertiary care center in central part of Nepal

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ABSTRACT

Introduction: Thyroid dysfunction is one of the common endocrine problems. Only a few community-based studies have been done in our country to determine the prevalence of thyroid dysfunction. Studies from various parts of the country have shown different prevalences, with an average of around 25%. The prevalence and pattern of thyroid dysfunction vary based on demographic and environmental factors, including iodine level. The study aims to determine the prevalence of thyroid dysfunction in a tertiary care center in the central part of the country based on hospital laboratory records.

Methods: A hospital-based observational cross-sectional study was performed in the department of Biochemistry at KIST Medical College Teaching Hospital (KISTMCTH). Hospital laboratory data records from 2022 to 2023 were reviewed with ethical approval from the Institutional Review Committee (Reference number: 2079/80/106). Descriptive statistics were presented as frequency, mean, and standard deviation. Comparison of thyroid profile among gender & age groups of the study population was performed by chi-square, and means were compared with the student's test.

Results: Among 2602 individuals, 607 (23.3%) were male and 1995 (76.7%) were female. Among them, 646 (24.8%) had abnormal thyroid function. The mean age of females was 38.2 years ± 15.2 years, and that of males was 44 years ± 20.6 years. The study revealed a higher prevalence of thyroid dysfunction among individuals over the age of 40 years. Females are affected more, and subclinical hypothyroidism accounts for much more of thyroid dysfunction.

Conclusion: The thyroid dysfunction prevalence is 24.8%, which is considerably high, with a female preponderance, and individuals above the age of 40 years are affected more than individuals below the age of 40.

Keywords: Prevalence, thyroid dysfunction, thyroid hormone.

INTRODUCTION

Thyroid dysfunction is defined as a pathological condition characterized by the abnormal production or secretion of thyroid hormones (thyroxine/T4 and triiodothyronine/T3), leading to metabolic, physiological, and clinical disturbances.[1] Thyroid dysfunction comes next to diabetes mellitus in endocrine-related problems.[2] Many literatures from different countries differ in their prevalence for both hypothyroidism and hyperthyroidism.[3] Around 300 million people worldwide suffer from thyroid dysfunction, and it is assumed that more than half are completely unaware of their illness. The age-standardized prevalence of thyroid disease was 5.05% in the US.[4] Hypothyroidism was found in 4.6% of the population in the United States.[5] Only a few community-based studies have been done to determine prevalence of thyroid dysfunction in our country. Studies done in different hospitals in Nepal have shown different prevalences, with average prevalence of about 25%.[2,3,5-8] The occurrence and characteristics of hypothyroidism

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are influenced by demographic and environmental components such as iodine consumption and other causes, likewise congenital thyroid disorders, previous thyroid surgery and irradiation, drugs such as lithium carbonate and amiodarone, and pituitary and hypothalamic disorders.[9,10] Hyperthyroidism is usually caused by autoimmune disorders, followed by toxic thyroid nodules and thyroiditis. Patients with thyroid dysfunction with clinical manifestations may need more regular serum Thyroid Stimulating Hormone (TSH) testing as TSH level helps in treatment response too.[11] Those adults vulnerable to risk factors like suboptimal iodine intake, autoimmune disorders, are likely to aggravate the thyroid dysfunction as iodine is the key component of thyroid hormone, and anti-TPO antibodies interfere with the biosynthesis of thyroid hormones.[12]

Thyroid dysfunction may be associated with remarkable morbidity if not diagnosed in a timely and left untreated due to increased susceptibility to adverse consequences.[12] The American Thyroid Association has also recommended that individuals should be screened for thyroid dysfunction by measuring the serum thyroid hormone levels, beginning at the age of 35 years and thereafter every 5 years.[13]

Thyroid dysfunction is common but often underdiagnosed. Symptoms are non-specific, causing delayed diagnosis. Subclinical hypothyroidism is increasingly detected by routine TSH screening. We aim to estimate the thyroid dysfunction prevalence among the patients visiting a tertiary center in Kathmandu valley from hospital laboratory records. Thyroid dysfunction has been reported less from the central part of the country, and subclinical forms may be underestimated. Early diagnosis of thyroid dysfunction helps early treatment to prevent complications such as cardiovascular disease, infertility, dyslipidemia, and pregnancy complications, aiding in estimating disease burden, guide screening policies and provide baseline data for future interventional and longitudinal studies.

METHODS

It was a hospital based observational cross-sectional study conducted in Biochemistry Department, KIST Medical College Teaching Hospital (KISTMCTH). The hospital laboratory records were reviewed from February 2022 to January 2023 of the population presenting to different departments and referred to the laboratory for thyroid function test. Thyroid status was classified as euthyroid when (TSH level = 0.3 – 4.2 µIU/ml, fT_3 level = 2.0 – 4.2 pg/ml, fT_4 level= 0.89 – 1.72 ng/dl), primary hypothyroidism when (TSH >4.2 µIU/ml and low fT_4 or fT_3), subclinical hypothyroidism when (TSH level >4.2 µIU/ml and normal serum fT_4 or fT_3), primary hyperthyroidism when (TSH level <0.3 µIU/ml and high fT_4 or fT_3), and subclinical hyperthyroidism when (TSH level <0.3 µIU/ml and normal fT_4 and fT_3).[14]

The study was approved by Institutional Review Committee (Reference number: 2079/80/106) of KISTMCTH. General individuals between newborn "0" to 89 years of age visiting different OPDs of KISTMCTH were included as we intended to determine thyroid dysfunction prevalence among the population. Patients who were suspected or evaluated for thyroid dysfunction by clinician were included hence, clinical features were not considered. Individuals above 90 years old were excluded because people above 90 seldom come to hospital.

Hospital laboratory records of Thyroid Function Test (TFT) which included free T_3 (fT_3), free T4 (fT_4), Thyroid Stimulating Hormone (TSH) was done by using an instrument Maglumi X3 chemiluminescence immunoassay (CLIA). All the data records were entered in Microsoft Excel and further statistical analysis were done on SPSS version 16. Descriptive statistics were presented using frequency, percentage, mean and standard deviation. Comparison of thyroid profile among gender & association of thyroid status among age groups of study population were done by chi square and independent student's t-test respectively.

The sample size was taken with reference to the article by Yadav NK et al.[5] The sample size was calculated by using the formula

$n= (z/d)^2 pq = 829.44 = 830$

where,

sample size= n

estimated proportion[5] of an attribute that is present

in population (p) = 36% = 0.36,
q= (1-p)= 64% = 0.64,
confidence level (z-value)= 3 for almost certain, margin of error to determine the sample size (d) = 5% = 0.05

However, 2602 individuals were included in the study. Although sample size calculation was calculated with reference to Yadav NK et al.[5] high sample size was taken for more accuracy.

RESULTS

Total of 2602 individuals had tested for thyroid function status (TFT). Among them, 607 (23.3%) were male and 1995 (76.7%) were female. Among 2602 subjects, 646 (24.8%) had thyroid dysfunction; thus, the thyroid dysfunction prevalence was 24.8% among the hospital patients who underwent TFT. Among the subjects, 1956 (75.2%) were euthyroid. The individuals were divided according to thyroid status as primary hypothyroidism, primary hyperthyroidism, subclinical hypothyroidism, subclinical hyperthyroidism and euthyroid taking references of hormones level as mentioned above.

Distribution of Thyroid Dysfunction

Among the subjects, 17.3% were found to be subclinical hypothyroidism, 3.6% of the individuals were found to be primary hypothyroidism, 2% are of subclinical hyperthyroidism and 1.9% individuals are of primary hyperthyroidism. Individuals in euthyroid state was of 75.2%.

Sex distribution

Among the total sample population, females accounted for 72.6% and male accounted 27.4%. The male: female ratio was 1:3.3. Mean age of female was 38.2 ± 15.2 years and that of male was 44.2 ± 20.6 years. The mean age of individuals who had thyroid dysfunction was 39.67 ± 16.85years.

Age wise distribution

When age-wise prevalence of thyroid dysfunction was considered, the prevalence of thyroid dysfunction to be higher among individuals more than 40 years compared to individuals less than

Table 1: Mean TSH in Male and Female

Sex	N (frequency)	Mean TSH ± SD	P-value (student's t test)
Female	1995	3.13+3.81	<0.001*
Male	607	4.33+7.58	

*Significant p <0.05

Table 2: Distribution of Thyroid Dysfunction among sex

Sex	N (frequency of abnormal TSH)	p-value (chi-square)
Male	469	< 0.015*
Female	177	
Total	646	

Table 3. Distribution of Thyroid Status according to sex

Sex	Subclinical Hyper thyroidism	Subclinical Hypo thyroidism	Primary Hyper thyroidism	Primary Hypo thyroidism	Euthyroid	Total
Female	43 (1.7%)	343(13.2%)	35 (1.3%)	48 (1.8%)	1526 (58.6%)	1995 (76.7%)
Male	7 (0.3%)	107 (4.1%)	15 (0.6%)	48 (1.8%)	430 (16.5%)	607 (23.3%)
Total	50 (2%)	450(17.3%)	50 (1.9%)	96 (3.6%)	1956 (75.2%)	2602(100.0%)

Table. 4 Age wise distribution of Thyroid Function Status

Age groups	Thyroid function					
	Subclinical Hyper thyroidism	Subclinical Hypo thyroidism	Primary Hyper thyroidism	Primary Hypo thyroidism	Euthyroid	Total
< 1	2	6	1	3	34	46
1 – 20	2	9	2	1	120	134
21 – 40	31	231	19	41	1081	1403
41 – 60	12	136	19	29	492	688
61 – 80	3	61	7	19	201	291
81 and Above	0	7	2	3	28	40
Total	50 (1.9%)	450 (17.3%)	50 (1.9%)	96 (3.7%)	1956 (75.2%)	2602 (100.0%)

Table 5: Comparison of thyroid status among patients above 40 and below 40 years

Age (years)	Thyroid status		P- value (chi square test)
	Thyroid dysfunction	Euthyroid	
<40	348	1235	<0.001*
>40	298	721	
Total	646	1956	

40 years (29.24% vs 21.98%). There is significant relation between age groups and development of the thyroid dysfunction by chi-square (p<0.001)

DISCUSSION

The thyroid dysfunction prevalence varies depending on many aspects including the age, sex, test procedure and serum reference ranges defining hypothyroidism and hyperthyroidism used in the study.[15] The present study showed an overall 24.8 % prevalence of thyroid dysfunctions among the patients visiting to KISTMCTH for medical-related problems. Similar hospital-based studies determining prevalences done in tertiary care centers of Nepal have come up with similar results. The prevalence ranged from 17.42% to 33.66%.[3,5-7] This variation might have been due to geographic, autoimmune thyroid disorders, drug induced and environmental factors including iodine consumption.[15,16]

Individuals those who were in age group >40 years were affected more, similar to the study done by Zhang X et al.[4] and Antony J et al.[17], who showed higher prevalence among individuals aged ≥60 years, and also higher prevalence in women. In contrast to our study, some of literatures have reported higher thyroid dysfunction prevalence in reproductive age groups.[18]

The thyroid-related problems are more common in females.[19-21] In our study also females were affected more. Exact cause of female preponderance is not known. It might be due to hormonal influences, autoimmune thyroid disease (AITD), genetic susceptibility, and immune regulatory differences.[9,10] However, Baral N et al. revealed equal proportion of male and female suffer from thyroid dysfunction.[6] In another related study, by Aminorroaya et al., the thyroid dysfunction prevalence was more common among women (13%) compared to men (5%).[22] A study by Flynn RW et al. presented that thyroid dysfunction increase with age, and females were affected 2 to 8 times compared to males[23], which is in line with this study, showing females were more vulnerable to thyroid dysfunction than males.

Similar to our study, Tunbridge et al showed the mean age of thyroid dysfunction was approximately 39 years of age.[24] Other studies

have concluded that thyroid dysfunction prevalence rises with advancing age.[24,25] Children less than 15 years of age with hypothyroidism may be associated with iodine deficiency disorder or other causes such as congenital thyroid disorders, previous thyroid surgery and irradiation, drugs such as lithium carbonate and amiodarone, and pituitary and hypothalamic disorders. Worldwide, dietary iodine deficiency remains an important cause,[10] which delays physical and mental growth and development.[8] In the present study, prevalences in children as well as infants were considerable. Among children, the prevalence of hypothyroidism was also significant. Hypothyroidism is usually related to iodine deficiency, and Nepal is an endemic area of iodine deficiency affecting about 26.5% of the population.[8] However, other conditions need to be ruled out.

Limitations of the study: Our study was based on laboratory reports. It is single centered study. Since clinical features, proper history, and congenital or other medical conditions were not considered, they need to be ruled out for the final diagnosis of thyroid dysfunction.

CONCLUSIONS

The thyroid dysfunction prevalence in the central part of the country is notably elevated, with a female preponderance. The prevalence of thyroid dysfunction in children as well as infants is considerable. Further large community-based studies are needed for an accurate prevalence of thyroid dysfunction. Adults should be screened for thyroid dysfunction by measuring thyroid hormone levels, beginning at age 35 years..

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