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Prevalence of Thyroid Maladies with a Focus on Hyperthyroidism and Goiter at District Jamshoro, Sindh, Pakistan

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Abstract: The present study investigates the prevalence and risk factors of thyroid disorders, specifically hyperthyroidism and goiter, in the mixed population of District Jamshoro and patients visiting NIMRA and LUHMS hospitals. A cross-sectional quantitative approach was used. Data were collected through a structured questionnaire comprising bio data, thyroid conditions, and dietary practices. Blood samples from thyroid patients were analyzed for FT3, FT4, and TSH using automated analyzers. A total of 120 participants were enrolled, including 85 females (70.83%), 33 males (27.5%), and 2 children (1.66%), aged 18–65 years.

Hyperthyroidism was observed in 95 patients (79.16%), of whom 70 (73.68%) were females and 25 (26.31%) were males. Goiter was identified in 25 patients (20.83%), including 15 females (60%), 8 males (32%), and 2 children (8%). The surveyed population predominantly consumed filtered surface water from the Indus River rather than groundwater. Goiter was more common in communities relying on this water source. To investigate environmental factors, 200 water samples were analyzed using handheld colorimeters and spectrophotometers. Iodine levels ranged from 3–5 µg/L, indicating insufficient iodine concentration in the local water. These findings suggest that both environmental and dietary iodine levels in the region are low, placing residents at increased risk of iodine deficiency disorders.

The study concludes that iodine deficiency, linked to low iodine levels in drinking water and locally available food, contributes significantly to the prevalence of hyperthyroidism and goiter in Jamshoro. Strengthening iodized salt consumption and public health awareness is recommended.

Keywords: Thyroid Hormones, Hyperthyroidism, Goiter, LUMHS, NIMRA, Spectrophotometers.

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Introduction

Thyroid diseases are fairly widespread all around the world, affecting people of all ages and genders. The World Health Organization (WHO) estimates that 750 million individuals worldwide suffer from thyroid illness. According to a study, 5-10% of Pakistanis have thyroid issues [1]. Thyroid illness can be diagnosed if thyroid gland synthesizes and releases higher quantity or lower quantity of its hormones. When your thyroid isn't functioning in its proper manner, it can have a negative influence on the rest of your body.

Hyperthyroidism: It excessive production and secretion of thyroid hormones (T3 and T4). This greater level causes transcription to speed up, resulting in more cellular protein synthesis and a

faster rate of metabolism. Although thyrotoxicosis is the term used to describe hyperthyroidism, not all cases of hyperthyroidism may be thyrotoxicosis. Rapidly consuming energy would not only make leave you tired, but it makes faster heart beat rate, lead you to decrease weightage besides trying, and even make you exhausted and fearful. Goiter may cause instability to heat, perspiration increases, the menstrual cycle changes, and stool material moves quickly [2]. Hyper-functional multinodular goiter, hyper-function thyroid adenoma, distributed hyperplasia of the thyroid linked to Graves' disease, and excessive exogenous thyroid hormone consumption is the most frequent causes of hyperthyroidism. Some types of thyroiditis, pituitary adenoma that secretes thyroid stimulating hormone (TSH), and ectopic thyroid that arises in ovarian tetramas are less common causes of hyperthyroidism. Palpitations, anxiety, tachycardia, tremor, adrenergic stimulation, elevated blood pressure, and heat sensitivity are all signs of hyperthyroidism. Females were found to have a 5.26% [3]. The prevalence of hyperthyroidism in women is ten times higher than in men. In Pakistan, the prevalence of hyperthyroidism is found in 5.1% of the population. Additionally, subclinical hyperthyroidism has prevalence rates of 5.8%. Hyperthyroidism is divided into primary and secondary forms according to its origin. Primary hyperthyroidism results from a problem with the thyroid gland itself, whereas secondary hyperthyroidism is caused by pituitary gland issues that indirectly result in an overactive thyroid. [4]

Goiter: It is linked to either hypothyroidism or hyperthyroidism, which is an enlarged thyroid gland. Goiter occurs when the thyroid gland does not receive enough iodine to produce enough thyroid hormones. Goiter was more common in people who drank surface water (80.75%) than in people who drank ground water (19.25%) and in people who drank mine salt (67.54%) than in people who drank sea salt (32.46%). Goitrogens in food and drinking water are environmental variables that contribute to goiter condition, while family history is a genetic element [5].

In 1980, the World Health Organization (WHO) released its first global estimate of the prevalence of goiter, estimating that 20–60% of people worldwide had the condition. However, currently (WHO) estimates that 15.8% of the global population has goiter. However, the prevalence varies by region, with 4.7% in America and 28.3% in Africa. One of the nations in the world with the worst iodine deficiencies is Pakistan. According to Zhen Quan (who died in 643) and other publications, the iodine-rich thyroid gland of animals like sheep and pigs was used by Chinese medics during the Tang Dynasty to treat eyelashes for the first time [6]. Although Pakistan was classified as a seriously iodine deficient country in 2004, the National Nutrition Survey (NNS) of Pakistan found that the prevalence of goiter in mothers was 10.4% in 2001 (5.8% in urban areas and 11.8% in rural areas). After ten years, NNS reported encouraging success in 2011 in reducing the prevalence of goiter to 3.4% in rural regions and 1.8% in urban areas, [7].

Iodine (I) is a natural element found in minute amounts in different foods (beef, seafood, shellfish, cow milk) and water e.g. sea water [8]. The WHO recommends that adults (men and women) consume 150 microgram (µg) of iodine per day [9]. Thyroid follicular cells actively transport iodine from the blood where it is converted into iodide via the enzyme Thyroid Peroxidase (TPO) [10]. Iodide (I-) is used in formation of thyroid hormones (T4 and T3) in thyroglobulin protein of thyroid follicular cells using thyroid peroxidase. Thyroid hormones (TH) are released as early as 10 to 12 weeks of pregnancy [11]. The anterior pituitary gland, which functions under the hypothalamus, regulates the physiology of the thyroid gland [12]. Thyroid hormones are important for child's development, appropriate growth, brain development and sensory development and also for metabolism of the body [13]. Therefore, the study has served following objectives, given below:

1. To evaluate the prevalence of Hyperthyroidism and goiter diseases in mixed population of District Jamshoro, Sindh
2. To examine iodine concentration in water that is consumed by population of study area
3. To identify the food consumption associated with thyroid affected population of study

area as well as visiting thyroid patients at NIMRA and LUMHS, hospital Jamshoro.

Methods
The current study investigates the prevalence of thyroid maladies (disorders) focused on Hyperthyroidism and goiter in mixed population of District Jamshoro as well as the patients that visiting NIMRA and LUHMS hospitals of Jamshoro belongs to different districts of Sindh Province. The blood samples were collected of thyroid patients and analysed using automation machines and also blood results (FT3, FT4, and TSH) were collected. However, 200 water samples were collected and analysed by photometers (including handheld colorimeters and spectrophotometers). This study has been quantitatively carried out and depends on a method of statistical data analysis. The data was collected through designed questionnaire prepared by research Scholar and from conducted thyroid tests.

Study Design
The method and design, selected for the intended study was case study. The entire study was carried out in a very congenial setting and the places mentioned in the study are two hospitals i.e. namely Nuclear Institute of Medicines and Radiotherapy, NIMRA and Liaquat University of Medical and Health Sciences, LUMHS.

Duration
The study was based on time duration of a year from June 2023 to June 2024. During that period of time scholar actively participated and conducted questionnaires and collected data from outdoor and indoor patients.

Samples
A total of 120 participants were enrolled in the study, including males, females, and children, with ages ranging from 18 to 65 years. Each participant was administered a structured questionnaire, and responses were recorded in the presence of the research scholar to ensure accuracy and completeness. The collected data were subsequently used for statistical analysis to address the objectives of this research study.

Inclusion Criteria
The study included all patients diagnosed with thyroid disorders, specifically those presenting with hyperthyroidism or goiter, confirmed through clinical assessment and thyroid function tests (TSH, T3, and T4).

Exclusion Criteria
Patients with other endocrine or hormonal disorders, such as diabetes mellitus, dwarfism, Addison's disease, or any additional chronic endocrine abnormalities, were excluded from the study to avoid potential confounding effects on thyroid function.

Ethical Approval
The study protocol was approved by the Ethics Committee of Director, Research & Graduate Studies, University of Sindh, Jamshoro Sindh, Pakistan (Approval No: DRGS/1111).

Results and Discussion
The present cross-sectional study assessed the prevalence of thyroid disorders; specifically hyperthyroidism and goiter by evaluating clinical cases. Blood samples were analysed using automated analyzers, and thyroid function parameters (FT3, FT4, and TSH) were recorded. The findings indicate a notably high burden of thyroid dysfunction within the studied population.

According to the Anjum, Muhammad Usman, et al. (2016), globally, WHO also estimates that nearly 750 million individuals suffer from thyroid disorders, and national data suggest that 5–10% of Pakistanis are affected [1].
The total number of study population comprising on 120 in which 33 were male, 85 were female that is biggest number among others, however, 2 were children, as shown in (Figure 1).

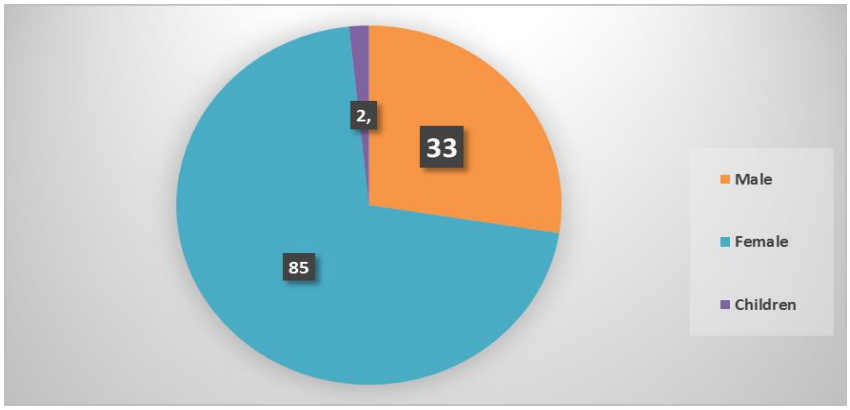

Figure No: 1 Showing the number of Participants in study

Hyperthyroidism emerged as the most prevalent condition, accounting for 95 (79.16% of all diagnosed cases. The predominance of hyperthyroidism among females 70 (73.68% of cases) aligns with global evidence suggesting a higher susceptibility of women to thyroid dysfunction due to hormonal and autoimmune factors. However, 25 (26.31%) were males. Nafisa et al, (2021), the findings show that the prevalence of hyperthyroidism was significantly higher in females compared to males. This trend is consistent with global epidemiological data, which indicate that women are up to ten times more likely to develop thyroid disorders than men. The higher prevalence in females may be attributed to hormonal fluctuations, including variations in estrogen levels, which influence thyroid function and immune regulation. Additionally, physiological factors such as menstruation, pregnancy, and postpartum changes may further contribute to thyroid instability in women. Pregnancy, in particular, increases metabolic demands and alters iodine requirements, making women more vulnerable to thyroid dysfunction if iodine intake is insufficient. These biological and hormonal factors collectively explain the predominance of hyperthyroidism among females [4], additionally, 25 participants (20.83%) were diagnosed with goiter, including 15 females (60%), 8 males (32%), and 2 children (8%), as shown in (Figure. 2).

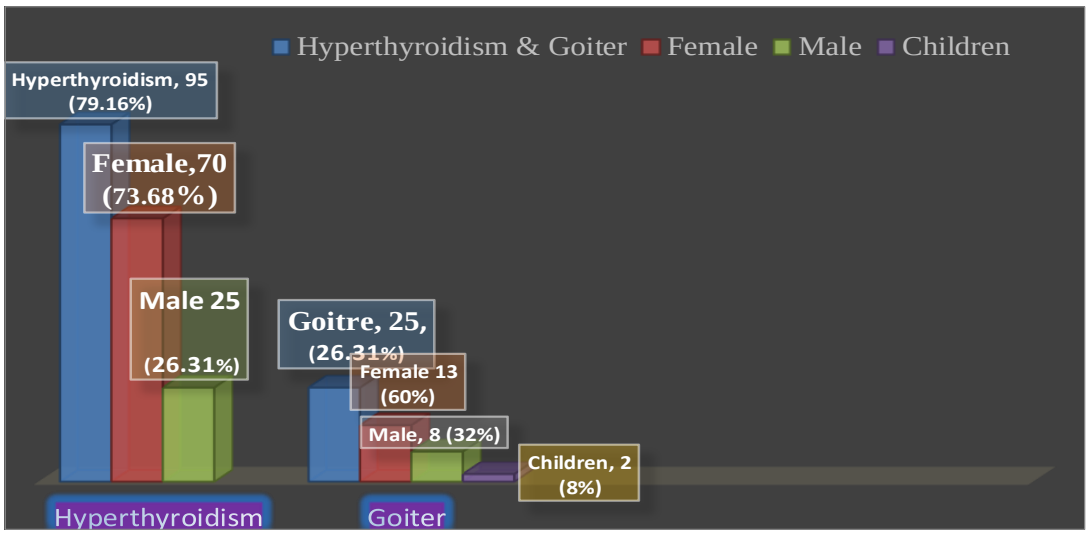

Figure No. 2: Prevalence of Hyperthyroidism and Goiter in mixed population.

Goiter prevalence may reflect long-standing iodine deficiency within the community. The measured water iodine concentration by using photometers (including handheld colorimeters and spectrophotometers), ranging from 3 µg/L to 5 µg/L. Alam Khan et al. (2002), WHO recommends daily iodine intake of 150 µg for adults to maintain normal thyroid function, [9]. Saqlain, S et al. (2018), According to the World Health Organization (WHO), approximately 15.8% of the global population is affected by goiter, with substantial regional variation—4.7% in the Americas and 28.3% in Africa. [6]. Jahangir, et al. (2015), On a national level, Pakistan was previously classified as a severely iodine-deficient country. The National Nutrition Survey (NNS) reported a goiter prevalence of 10.4% among mothers in 2001, with higher rates in rural areas (11.8%) compared to urban settings (5.8%). A decade later, the 2011 NNS indicated significant improvement, showing a decline to 3.4% in rural and 1.8% in urban populations, reflecting the positive impact of iodine supplementation efforts [7].

It is comparison between the two healthcare facilities revealed a higher number of hyperthyroidism cases at NIMRA Hospital 56 cases (40 females and 16 males) compared to LUMHS 39 cases (30 females and 9 males). A similar pattern was noted for goiter, with NIMRA reporting 16 cases (9 females, 5 males, and 2 children) compared to 9 (6 females and 3 males) at LUMHS. These variations may be attributed to differences in patient load, accessibility of services, or referral patterns between the institutions. Overall, the study highlights a significant public health concern, with 120 participants collectively in both hospitals presenting 95 hyperthyroidism cases and 25 goiter cases, as shown in (Table. 1).

Table No: 1. Showing number of Hyperthyroidism and Goiter of mixed population in both hospitals of Jamshoro LUMHS and NIMRA.

No: of Participants	LUMHS	NIMRA	TOTAL
HYPERTHYROIDISM	**39**	**56**	**95**
Female	30	40	70
Male	9	16	25
GOITER	**9**	**16**	**25**
Male	3	5	8
Female	6	9	15
Children	00	02	2
Total	**48**	**72**	**120**

According to the Rafi, et al. (2016), goiter was significantly more prevalent among individuals consuming surface water (80.75%) compared to those using groundwater (19.25%). Similarly, goiter occurred more frequently in participants consuming mine salt (67.54%) than sea salt (32.46%), indicating a possible link to lower iodine content in locally used salt and water sources. Overall, both environmental and hereditary factors are contributors. [5].

The gender distribution shows a predominance of female participants, with 85 females (70.8%), followed by 33 males (27.5%), and a small proportion of children (2 participants; 1.7%). Regarding age distribution, participants were grouped into three categories. Ten individuals (8.3%) were around 15 years of age, 50 participants (41.7%) were approximately 40 years old, and the largest group consisted of 60 participants (50.0%) who were around 55 years of age. The

overall mean age of the study population was 45.42 years with a standard deviation of 11.63 years, indicating moderate variability in age. The age of participants ranged from 18 to 65 years, reflecting a broad adult age spectrum in the study sample, as shown in (Table. 2).

Table 2: Presents the demographic characteristics and age distribution of the study participants (n = 120).

Variable	Category/Value	Frequency (n=120)	Percentage (%)
Gender	Female	85	70.8%
	Male	33	27.5%
	Children	2	1.7%
Age (years)	15	10	8.3%
	~40	50	41.7%
	~55	60	50.0%
Mean ± SD	—	45.42 ± 11.63	—
Age Range	18–65	—	—

These findings underscore the significant public health relevance of thyroid diseases. The high prevalence of thyroid disorders, coupled with low water iodine levels, underscores the need for strengthened iodine supplementation programs, routine community-level thyroid screening, and improved awareness regarding thyroid health. Further research is recommended to explore environmental, nutritional, and genetic risk factors contributing to the elevated burden of thyroid diseases in this region.

Conclusion

Thyroid disorders are relatively common in the general population, this is global evidence suggesting a higher susceptibility of women to thyroid dysfunction due to hormonal and autoimmune factors compared to males. Their prevalence is influenced by multiple factors, including dietary habits, iodine intake, environmental exposure, and hereditary predisposition. Thyroid function tests (FT3, FT4, and TSH) provide a reliable means of evaluating thyroid status, while biopsy remains an important diagnostic tool in specific cases. Both hyperthyroidism and goiter are clinically significant conditions that require timely medical intervention.

Strengths of Study

The present study has several notable strengths. It utilized reliable laboratory indicators, including TSH, T3, and T4 levels, which allowed for a precise assessment of thyroid function and clearer differentiation between hyperthyroidism, goiter, and other related conditions. The inclusion of participants from various age groups and both genders within the population of Jamshoro strengthened the representativeness of the sample and enhanced the external validity of the findings. In addition to estimating prevalence, the study also explored important associated factors such as dietary iodine intake, family history, and socio-environmental influences, thereby providing a more comprehensive understanding of the determinants of thyroid disorders in the region. Given that thyroid diseases are highly prevalent in developing countries, the findings offer valuable insights for local public health authorities and can contribute to the development of

targeted prevention, early detection, and awareness programs.

Limitations of Study

This study has certain limitations that should be acknowledged. Its cross-sectional design restricts the ability to establish causal relationships between the identified factors and the occurrence of hyperthyroidism or goiter. The findings are also limited in generalizability, as the study was conducted only in the district of Jamshoro, representing a relatively small geographic area. Additionally, some information, such as dietary habits, family history, and previous diagnoses was based on self-reported data, which may be affected by recall or reporting bias. The absence of imaging techniques, including thyroid ultrasound or radioiodine uptake scans, may have reduced diagnostic accuracy, particularly in distinguishing different types of goiter. Furthermore, potential confounding factors such as medication use, comorbidities, iodine supplementation history, and environmental exposures were not fully controlled. Lastly, the lack of longitudinal follow-up limits understanding of the long-term progression of thyroid disorders in the study population.

Future Research Directions

1. Longitudinal Cohort Studies: Future studies should follow individuals over time to determine the incidence, progression, and long-term outcomes of hyperthyroidism and goiter, allowing stronger causal inferences.
2. Expanded Geographic Coverage: Conducting similar studies across multiple districts or provinces would help create more comprehensive national database on thyroid disorders.
3. Incorporation of Thyroid Ultrasound and Imaging: Using ultrasound, radionuclide scans, would improve diagnostic accuracy, especially in differentiating between toxic goiter, multinodular goiter, Graves' disease, and other thyroid pathologies.
4. Assessment of Environmental and Nutritional Factors: More detailed investigations into iodine levels in water, salt iodization practices, soil composition, and dietary patterns could clarify environmental contributions to thyroid disease.
5. Evaluation of Public Health Interventions: Future research should assess the effectiveness of iodine supplementation programs, awareness campaigns, and screening strategies in reducing goiter and thyroid disorders.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No animals were used in this study. The study on humans was conducted in accordance with the ethical rules of the Helsinki Declaration and Good Clinical Practice.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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