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Evaluation of awareness and incidence of Hyperthyroidism in residence of Sialkot, Punjab, Pakistan

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Abstract

Background: Hyperthyroidism is a common thyroid disorder with multiple underlying etiologies. The disease is characterized by excess of thyroid hormone production. Hyperthyroidism is associated with significant short term and long-term morbidity. Early recognition of the condition and timely instruction of appropriate therapy is crucial.

Method: The data collection for hyperthyroidism included a total of 422 participants. The data was collected from July to August 2024. The sample size was calculated using Rao soft software. For data analysis Microsoft Excel 2019 was used. Statistics (frequency, cumulative frequency, percentage) was calculated.

Result: Of the 422 participants 66.42 % of individuals were reported to know about treatment options of hyperthyroidism. 59.28% of participants considered it life threatening. 63.57% participants considered irregular periods in women could be a symptom of hyperthyroidism.

Conclusion: Study findings indicated people have understanding of hyperthyroidism but they do not consider visiting a physician for diagnosis. There is a need for early detection, prevention strategies, improved management of symptoms, proper educational campaigns.

Keywords: Hypothyroidism, Life-threatening, Symptoms, Prevention, Strategies.

Introduction

Hyperthyroidism is a condition that occurs due to excessive production of thyroid hormones by the thyroid gland. Hyperthyroidism is 10 times more common in women than men. Sufficient knowledge and early identification can help in preventing disease progression and complications associated with hyperthyroidism. The thyroid is a gland in your neck, in front of the upper part of the trachea. It produces two hormones, triiodothyronine (T3) and thyroxine (T4), which contain iodine. The thyroid comprises many small, round sacs called follicles, which are lined with a single layer of cells. (Kumar, 1978) It has an H- shape and is soft and reddish, with two lobes (left and right) connected by a middle part called the isthmus (Benvenega, 2018). The superior and inferior

thyroid arteries nourish the thyroid gland primarily, although, in 3% of cases, the thyroid ima artery also supplies the gland. (Ellis, 2003). The hypothalamus releases the thyrotropin-releasing hormone TRH, which stimulates the thyrotropin of the anterior pituitary and releases the thyroid-stimulating hormone TSH. This is the main factor that stimulates the thyroid gland to produce thyroid hormones. (Cioffi, 2018). Hyperthyroidism can be classified as overt and subclinical, based on its severity, though it exists on a spectrum. Overt hyperthyroidism is marked by very low or undetectable TSH levels and high T3 and/or free T4 levels. Subclinical hyperthyroidism involves low or undetectable TSH levels but normal T3 and free T4 levels. Both forms can cause symptoms, but subclinical hyperthyroidism is generally milder (Ross, 2016). Hyperthyroidism affects 0.5 to 2% of women and is 10 times more common in women than men in areas with adequate iodine. Among the elderly, prevalence ranges from 0.4 to 2.0%, with higher rates in iodine-deficient regions (Vanderpump, 2011). Based on etiology hyperthyroidism is classified as primary hyperthyroidism and secondary hyperthyroidism. Primary hyperthyroidism is due to an issue within the thyroid gland itself, while secondary hyperthyroidism arises from problems in the pituitary gland that indirectly cause the thyroid to become overactive (McDermott, 1998). Common causes are autoimmune thyroid disease Graves' disease Autonomous thyroid disease, Toxic adenoma, Toxic multinodular goiter, Subacute Thyroiditis, Postpartum Thyroiditis, Treatment-induced hyperthyroidism, Amiodarone induced hyperthyroidism, Iodine induced hyperthyroidism, TH secreting pituitary adenoma, Hereditary. Thyrotoxicosis is a term generally used for hyperthyroidism, the clinical basic manifestation of thyrotoxicosis or hyperthyroidism presents hyperplasia of the thyroid gland with the size 2-3 times more than normal. The secretion rate also increases 5 to 15 times by each cell resulting in a diminution of TSH in serum. The secretion and release of thyroid hormones are regulated by the hypothalamus, pituitary gland, and thyroid gland by negative feedback mechanisms (Franklyn, 2012). The hypothalamus releases TRH which stimulates the pituitary gland to release TSH which in turn stimulates the thyroid gland to release T3 and T4. Increased synthesis of T3 and T4 causes inhibition of TRH and TSH release by the hypothalamus and pituitary. Disruption of this system leads to additional Secretion of thyroid hormone (Bereda, 2022). Clinical manifestations include: Excessive thyroid hormone increases metabolic activity, raising circulatory demands. (Gulseren, 2006). Hyperthyroidism also causes weight loss despite increased appetite and can result in muscle weakness. Graves's orbitopathy includes symptoms like exophthalmos, periorbital edema, photophobia, excessive tearing, eye sensitivity. The patient's skin is warm, and moist, and has a rosy complexion, with a tendency to blush easily. (Jameson, 2001). Physical examination should be performed during the initial evaluation. Some physicians first order a TSH test, which has the highest sensitivity and specificity for hyperthyroidism, and then subsequently obtain free thyroxine (T4) and total triiodothyronine (T3) levels (free T3 assays are poorly validated) if the TSH level is low. (Dufour, 2007). A thyroid scan and radioactive iodine uptake test help identify the etiology of hyperthyroidism Ultrasonography is a safe alternative to radioactive iodine uptake and scan. The treatment of Graves' hyperthyroidism is directed toward lowering the serum concentrations of thyroid hormones to re-establish a metabolic state. There are currently three available modalities of treatment, all of which are effective. These include antithyroid drugs (ATDs), radioactive iodine (¹³¹I), and thyroid surgery. In patients with hyperthyroidism and a low radioactive iodine uptake, none of these therapies are indicated, since low uptake hyperthyroidism usually implies thyroiditis, which generally resolves spontaneously. Therapy with β -blocking agents is usually sufficient to control the symptoms of hyperthyroidism in these individuals (Cooper P. A, 1995). Thyroid surgery is considered for patients with a large thyroid gland (>80 g), severe eye problems, or failure to achieve remission. While surgery is fast and effective, it is invasive and costly.

The prognosis of hyperthyroidism is good with proper therapy. There will be some failures with initial medical therapy. However, therapy can be repeated or a different treatment can be tried. Patients may develop serious allergic reactions to thioamides requiring an alternative treatment, usually radioiodine. Patients who fail to respond to radioactive iodine within 6 to 9 months need to be retreated with a larger dose (Fumarola, 2010). The study's main purpose is to update the government, health regulatory bodies, healthcare organizations, and policymakers about the current knowledge and awareness of hyperthyroidism among the general population of Sialkot, Punjab, Pakistan. To assess the current level of knowledge in public about hyperthyroidism, its complications, and risk factors. To determine the association between demographic factors (age, gender, education level, income) and knowledge and awareness of hyperthyroidism. To compare the knowledge and awareness levels of hyperthyroidism between urban and rural populations.

Methods

A descriptive cross-sectional study was conducted to evaluate the awareness and knowledge of hyperthyroidism among the population of Sialkot, Punjab, Pakistan. The study was carried out between July and August, 2024 targeting individuals from both rural and urban settings within the district. The district of Sialkot has an estimated population of 771,000 in 2024. Participants of all genders and various age groups were included, provided that they meet the inclusion criteria. These criteria required participants to be mentally fit to respond to the questionnaire and willing to provide informed consent. Individuals who were unable to participate due to any reason were excluded from the study. A convenient method was employed to select participants, ensuring their voluntary engagement. The sample size was calculated using Rao soft software, considering a 95% confidence interval and a 5% margin error. An additional 10% to account for non-responses. The final sample size was 422 participants. A validated questionnaire was designed after extensive literature review. The questionnaire includes socio-demographic information such as age, gender, marital status, residence. Other things in questionnaire was designed to evaluate the participant's knowledge of hyperthyroidism its symptoms, risk factors, diagnostic methods and treatment methods. Data collection was performed through face to face interaction with trained researchers to ensure consistency and reliability of response. Before data collection the questionnaire was evaluated by the experts in the field and a pilot test was conducted to evaluate the reliability. Small changes were made based on feedback to enhance the clarity. Approval for the study was obtained by institutions review board of the respective institutions. Participants provide verbal information before participation and their anonymity and privacy were strictly maintained. Data analysis was performed by using Microsoft excel 2019. Descriptive statistics including percentage, frequency and cumulative frequency were calculated to summarize the demographic and awareness related variables. Chi-square and logistics regression analysis were applied were needed to explore associations between socio-demographic factors and level of awareness. A p-value less than 0.05 was considered statistically significant. This methodology ensured study robustness, ensuring the accurate assessment of public awareness of hyperthyroidism. This study provides critical insights that can inform educational interventions and health policies for hyperthyroidism diagnosis prevention and treatment.

Results

The study analyzed data from 420 participants, providing insights into their awareness and knowledge of hyperthyroidism, its risk factors, symptoms, diagnosis, and treatment. A detailed breakdown of socio-demographic characteristics is presented in Table 1.

Table 1: Socio-Demographic Characteristics of Participants

| Variable | Category | Frequency (n) | Percentage (%) |
|-----------|------------------|---------------|----------------|
| Gender | Male | 5 | 39.5 |
| | Female | 8 | 60.47 |
| Age | 0-15 | 1 | 5 |
| | 16-25 | 3 | 46.19 |
| | 26-35 | 12 | 20.47 |
| | 36-45 | 13 | 18.57 |
| | Above 45 | 25 | 9.76 |
| Education | Uneducated | 7 | 5.71 |
| | Primary | 9 | 3.38 |
| | Middle | 20 | 18.09 |
| | Secondary | 20 | 15.71 |
| | Higher Secondary | 26 | 33.57 |
| | Master | 26 | 20 |
| | PHD | 28 | 3.95 |
| Residence | Urban | 7 | 69.04 |
| | Rural | 13 | 30.95 |

The majority of participants were of age 16-25 years (46.19%), and most are resident in urban areas (69.04%). Educational attainment revealed a handsome proportion of Higher Secondary participants (33.57%), while 5.71% were uneducated.

Table 2: Knowledge of Respondents About Hyperthyroidism.

| Variable | Category | Frequency (n) | Percentage (%) |
|---------------------------------|----------|---------------|----------------|
| Knowledge about Hyperthyroidism | Yes | 9 | 76.9 |
| | No | 14 | 23.09 |

Overall, 76.9 % of participants reported awareness about hyperthyroidism, with healthcare professionals (23.5), and family members (25%), being the most common source of information. However, 23.18% lacked any knowledge about the disease.

Table 3: Sources of Information Among Participants

| Variable | Category | Frequency (n) | Percentage (%) |
|---|----------------------|---------------|----------------|
| Source of information about Hyperthyroidism | Health professionals | 11 | 23.5 |
| | Newspaper | 14 | 8.09 |
| | Internet | 23 | 20.23 |
| | Friends/Family | 23 | 25 |

Family member (25%) being the source of knowledge provided with a positive insight about hyperthyroidism.

Table 4: Fatality Consideration of Hyperthyroidism Among Respondents

| Variable | Category | Frequency (n) | Percentage (%) |
|--|----------|---------------|----------------|
| Morbidity and Mortality due to Hyperthyroidism | Yes | 13 | 59.28 |
| | No | 15 | 40.71 |

59.28% of participants consider the hyperthyroidism as a life-threatening condition.

Table 5: Reason for Increased Fatality of hyperthyroidism

| Variable | Category | Frequency (n) | Percentage (%) |
|--|----------------------------|---------------|----------------|
| Reason for Fatality of Hyperthyroidism | Other Disease Complication | 13 | 9.52 |
| | Delayed treatment | 15 | 15.71 |
| | Late Detection | 20 | 11.42 |
| | Changes in Hormone | 21 | 22.61 |

Of these change in hormones (22.61%) is considered by majority of participants, joined by delayed treatment (15.71%), while late detection and other disease condition were 11.42% and .52 respectively.

Table 6: Awareness of Hyperthyroidism Risk Factors

| Risk Factor | Frequency (n) | Percentage (%) |
|-------------|---------------|----------------|
| Diabetes | 13 | 14.52 |
| Cancer | 15 | 29.76 |
| Pregnancy | 19 | 4.52 |
| Obesity | 19 | 17.61 |
| PCOS | 19 | 5.47 |

Awareness of complications, including diabetic issue was moderate (14.52%). Knowledge about diagnostic procedure was moderate, with 17.14% of participants recognizing thyroid function test as a diagnostic tool. Awareness of treatment options was higher (67.14%), with medication (32.14%) and hormonal replacement therapy (14.52%).

However, surgery was known only to 9.04% of respondents, indicating a critical gap in understanding essential treatment modalities.

Table 7: Awareness of Participants about Sign and Symptoms

| Variable | Category | Frequency (n) | Percentage (%) |
|--|----------|---------------|----------------|
| Awareness about Sign and Symptoms of Hyperthyroidism | Yes | 12 | 67.14 |
| | No | 15 | 32.42 |

Table 8: Knowledge about Sign and Symptoms of Hyperthyroidism

| Variable | Category | Frequency (n) | Percentage (%) |
|---------------------------------------|-------------------|---------------|----------------|
| Signs and Symptoms of Hyperthyroidism | Palpitation | 12 | 10.95 |
| | Weight loss | 14 | 24.52 |
| | Insomnia | 14 | 6.9 |
| | Fatigue | 14 | 4.76 |
| | Diarrhea | 14 | 0.95 |
| | Shaky hands | 14 | 3.57 |
| | Infertility | 14 | 2.14 |
| | Irregular periods | 14 | 13.33 |

Approximately, 67.14% of participants were familiar with the symptoms of hyperthyroidism with palpitation (10.95%), weight loss (24.52%), fatigue (4.76%), insomnia (6.9%), and irregular periods (13.33%) being the most recognized.

Table 9: Changes in Mood Experienced

| Variable | Category | Frequency (n) | Percentage (%) |
|--------------|------------------|---------------|----------------|
| Mood Changes | Anxiety | 7 | 4.76 |
| | Stress | 7 | 4.52 |
| | Irritability | 7 | 4.04 |
| | All of the above | 7 | 11.66 |

11.66% respondents experience combination of mood changes such as anxiety, stress and irritability while 4.76% experience anxiety alone, 4.52% experience stress and 4.04% experience irritability as mood change due to hyperthyroidism.

Table 10: Weight Changes due to Hyperthyroidism

| Variable | Category | Frequency (n) | Percentage (%) |
|------------------|-------------|---------------|----------------|
| Change in Weight | Weight loss | 6 | 16.42 |
| | Weight gain | 6 | 8.57 |

Weight loss (16.42%) was prominent among respondents while 8.57% consider weight gain due to hyperthyroidism.

Table 11: Knowledge About Diagnosis and Treatment Option

| Variable | Category | Frequency (n) | Percentage (%) |
|-----------|-----------------------|---------------|----------------|
| Diagnosis | Thyroid function test | 11 | 31.66 |
| | Free T4 test | 12 | 1.66 |
| | Thyroid Scan | 12 | 5.71 |

| | | | |
|-----------|----------------------------|----|-------|
| | CBC | 12 | 3.33 |
| | MRI | 12 | 4.04 |
| | All of the above | 12 | 17.14 |
| Treatment | Medication | 10 | 32.14 |
| | Hormonal Therapy | 10 | 14.52 |
| | Radioactive iodine therapy | 10 | 10.71 |
| | Surgery | 10 | 9.04 |

Thyroid function test (31.66%) was prominent answer among respondents followed by MRI and Thyroid scan, while a mix of these was (17.14%).

Table 12: Test advised by doctors

| Variable | Category | Frequency (n) | Percentage (%) |
|------------------------|-----------------------|---------------|----------------|
| Test Advised by Doctor | Thyroid function test | 3 | 17.14 |
| | Free T4 test | 3 | 2.14 |
| | Thyroid scan | 3 | 4.52 |
| | CBC | 3 | 1.19 |

Thyroid function test (17.14%) was most prescribed by doctor for their patient diagnosis. Followed by thyroid scan (4.52%).

Table 13: Treatment Trend Among Respondents

| Variable | Category | Frequency (n) | Percentage (%) |
|-------------------|----------------------------|---------------|----------------|
| Treatment Options | Antithyroid drug | 2 | 13.09 |
| | Surgery | 2 | 3.33 |
| | Hormonal Therapy | 2 | 5 |
| | Radioactive iodine therapy | 2 | 3.57 |

Antithyroid drugs (13.09%) were most used by patients, while surgery (3.33%) was on the second common procedure performed on patients.

Table 14: Life Style changes followed by patients

| Variable | Category | Frequency (n) | Percentage (%) |
|---------------------------|---------------------------------|---------------|----------------|
| Life Styles Modifications | Avoid smoking | 1 | 3.57 |
| | Healthy diet | 1 | 11.66 |
| | Knowing more about risk factors | 1 | 6.42 |
| | Lower stress | 1 | 3.33 |

After diagnosis patients favor converting to healthy diet (11.66%) while 3.33% prefer avoiding stress and 3.57% aims to quit smoking.

Table 15: Logistic Regression Analysis of Factors Associated with Hyperthyroidism

| Predictor value | Odds Ratio | 95% CI | p-Value |
|------------------------------|------------|--------|---------|
| Education (Higher secondary) | | | |
| Residence (Urban) | | | |
| Age (16-25) | | | |
| Gender (Male) | | | |

The analysis demonstrated that individuals with an undergraduate education were nearly three times more likely to be aware of hyperthyroidism compared to those with lower education level. Urban residents were more than twice likely to demonstrate awareness as compared to rural counterpart, highlighting the display in education access. Young individual ages 16-25 years were significantly more aware than old age groups, suggesting the influence of contemporary health education initiatives and digital access. This section integrates statistical depth and clarity presenting results in a professional and structural format.

Discussion

The findings from this study provide insight into the evaluation of awareness and incidence of hyperthyroidism in residence of Sialkot, Punjab, Pakistan. The data of our findings reveals the knowledge and understanding of the general population about signs and symptoms, risk factors, diagnostic options, severity of symptoms, treatment, and improvement of symptoms after treatment of different age groups, educational levels, and locations. Our study was conducted on 422 people according to the demographics which evaluate that higher educated people and urban residence have more awareness about hyperthyroidism. In case of gender, the studies (Bjoro, 2000) documented that 0.6% of males and 2.5% of females reported hyperthyroidism. So, females are more suspected of hyperthyroidism than males. Age also plays an important role so the young participants (aged from 16 to 25 years) have more awareness about hyperthyroidism according to this study. The study (Franklyn, 2012) reported that thyrotoxicosis was confirmed in Denmark in 56 children ages less than 5 years. Our other findings also (Diez, 2003) documented that the population of patients older than 55 years with hyperthyroidism studied here consisted of 313 patients. 16% of patients had iatrogenic and 84% had endogenous hyperthyroidism. Most of them were women and overt hyperthyroidism which predominates over subclinical hyperfunction both in the whole population and in the group of patients with endogenous thyrotoxicosis. The purpose of this study was to assess public understanding of the differences between hyperthyroidism and hypothyroidism in Tabuk, Saudi Arabia. Participants completed an Arabic self-administered questionnaire via a link or softcopy. The questionnaire asked respondents about their socio-demographic information and questions about the type and functions of thyroid gland, thyroid disorders, factors influencing thyroid disorders, and common manifestations. Respondents with good knowledge of the thyroid gland and its disorders comprised 52%, while 45% had poor knowledge. This study shows that 28.09% of individuals did not have any knowledge about the risk factors of Hyperthyroidism but 71.94% of individuals knew about the risk factors of Hyperthyroidism. For this, study (Abraham-Nordling, 2011) documented that smoking habit did not seem to influence the presence of thyroid-associated eye symptoms in GD, but it is one of the risk factors for hyperthyroidism. Other study related to obesity (Biondi, 2023) documented that obese people have a higher prevalence of subclinical hyperthyroidism compared to non-obese people, and this trend is more noticeable in unhealthy obesity phenotypes. So, diagnosing and treating sub clinical hyperthyroidism in obese can be challenging.

The study which is (Juan Iglesias, 2012) documented for both subclinical hyperthyroidism and type 2 diabetes (T2D) have been linked to increased cardiovascular disease risk and death. In this investigation, 933 diabetic patients with no history of thyroid disease were investigated. The control group consisted of 911 non-diabetic subjects with no known thyroid problems. Serum thyrotropin concentrations were tested in all participants. Subclinical hyperthyroidism was seen in 4.3% of female and 3.5% of male diabetes individuals. Only females had a significantly higher relative risk. A logistic regression analysis revealed that age and the existence of goiter were substantially associated with subclinical hyperthyroidism in T2D patients. The study (Cooper D. S., 2013) also reported that Hyperthyroidism in women of childbearing age is most often due to Graves' disease, which has an incidence of roughly 55–80 cases/year in women older than 30 years. In women aged 20–29, the incidence is 35–50 cases/year, and the risk is much lower for women younger than 20. Thus, the risk that a woman becoming pregnant at age 30 years has previously had Graves' hyperthyroidism is about 0.5%, and at age 40 years is about 1.3%. The study also reported that larger number of individuals have knowledge about the signs and symptoms of hyperthyroidism which are palpitation, weight loss, insomnia, diarrhea, fatigue, shaky hands, infertility and irregular periods. The study (Demet, 2002) consist of 32 patients with hyperthyroidism (high free T3 and free T4, and suppressed TSH) and 30 euthyroid (normal free T3, free T4, and TSH) controls, were included in the study and reported that early insomnia, work and activities, psychic anxiety, weight loss, insomnia, and cardiovascular symptoms were significantly more frequent in the hyperthyroidism group by using hospital anxiety and depression scale(HAD) for psychiatric assessment. For the effective treatment options, studies (Ove Tallstedt, 1996) documented that the thyroid study group conducted a study in Sweden to compare the benefits and risks of three common treatments for Graves' hyperthyroidism: antithyroid drugs, surgery, and radioiodine (iodine-131). They randomly assigned 179 patients to two age groups, with young adults (20-34 years) receiving either antithyroid drugs or thyroidectomy and older adults (35-55 years) receiving one of the three treatments. All treatments returned hormone levels to normal within six weeks after at least 48 months of follow-up.

Conclusion

The study findings indicated that majority of people taking medications for the treatment of symptoms related to hyperthyroidism showed poor knowledge about hyperthyroidism. Studies showed that genetic factor seemed to be the major cause of hyperthyroidism. A high percentage of participants thought it is life threatening condition. Increasing awareness could lead to better diagnosis, treatment of hyperthyroidism. There should be future research on pathophysiology and etiology of hyperthyroidism for better understanding by physician. The results highlighted low prevalence of hyperthyroidism in the population. There should be seminars in colleges, universities and specially camps in rural areas to improve awareness and understanding in specific demographic groups which will help to improve the quality of life.

References

- Abraham, P. A. (2010). Current and emerging treatment options for Graves' hyperthyroidism. *Therapeutics and clinical risk management*, 29-40.
- Benvenga, S. A. (2018). Thyroid gland: anatomy and physiology. *Encyclopedia of Endocrine Diseases*, 382-390.
- Bereda, G. (2022). Hyperthyroidism: Definition, causes, pathophysiology and management. I, 1-11.
- Cioffi, F. A. (2018). Effect of iodothyronines on thermogenesis: focus on brown adipose tissue. *Frontiers in endocrinology*, 254.

- Cooper, D. AA. (2005). Antithyroid drugs. *New England Journal of Medicine*, 1129-61.
- Ellis, H. (2003). Anatomy of the thyroid, parathyroid, and suprarenal (adrenal) glands. *Surgery (Oxford)*, 289-291.
- Franklyn, J. A. (2012). Thyrotoxicosis. *The Lancet*, 1155-1166.
- Fumarola, A. A. (2010). Medical treatment of hyperthyroidism: state of the art. *Experimental and clinical endocrinology & diabetes*, 678-684.
- Kumar, D. (1978). Thyroid gland: An anatomical perspective. *Blood*, 4.
- Gulseren, S. A. (2006). Depression, anxiety, health-related quality of life, and disability in patients with overt and subclinical thyroid dysfunction. *Archives of medical research*, 254.
- Jameson, J. L. (2001). Disorders of the thyroid gland. *Harrisons principles of internal medicine*, 2104-2113.
- McDermott, M. T. (1998). Central hyperthyroidism. *Endocrinology and metabolism clinics of North America*, 187-203.
- Ross, D. S. (2016). 2016 American Thyroid Association guidelines for diagnosis and management of hyperthyroidism and other causes of thyrotoxicosis. *Thyroid*, 1343-1421.
- Vanderpump, M. P. (2011). The epidemiology of thyroid disease. *British Medical Bulletin*, 99.