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BREAKING DOWN GOITER: DEMOGRAPHIC AND DIETARY INSIGHTS

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ABSTRACT

Objective: This study aimed to identify the demographic, nutritional, and biochemical risk variables linked to the development of goiter in the plains of Sindh province.

Methodology: This case-control research was conducted at Liaquat University of Medical and Health Sciences, Jamshoro, from July 2009 to December 2009. A total of 200 participants (100 patients with goiter and 100 age- and gender-matched control individuals) were recruited for the current research. The demographic attributes and dietary history of goiter patients and control participants were examined using a standardized questionnaire designed for this purpose. Serum samples from goiter patients and control people were examined for iodine, TSH, FT3, and FT4 levels, while urine samples were assessed for iodine content.

Result: Among the 100 goiter patients, 87 were female and 13 were male. The majority (53%) of the research participants were young people aged 20 to 39 years. Odds Ratio analysis of the dietary data indicated a strong positive correlation between the intake of cabbage and pickles in mustard oil containing mustard seeds and the incidence of goiter. The intake of fish, eggs, dairy products, poultry, meat, and peas had a substantial negative correlation with goiter. In goiter patients, blood and urine iodine levels were considerably lower ($P<0.001$) than in control participants, whereas serum TSH and FT4 levels were elevated. All goiter patients had iodine deficits, with 33 percent experiencing mild deficiency and 77 percent having a substantial deficiency.

Conclusion: The consumption of groundwater, cabbage, and pickles in mustard oil containing mustard seeds, together with a low intake of animal protein, is linked to mild to severe iodine deficiency among the residents of the plains in Sindh province.

Keywords: Iodine, Goiter, Thyroid Stimulating Hormone, Free Thyroid Hormone.

INTRODUCTION

Goiter is a disorder characterized by the abnormal enlargement of the thyroid gland. This prevalent condition impacts around 200 to 300 million individuals globally. A deficiency of iodine results in

inadequate synthesis of triiodothyronine (T3) and thyroxine (T4), prompting an elevated secretion of thyroid stimulating hormone (TSH) from the pituitary gland. This subsequently induces hyperplasia and enlargement of the thyroid gland, resulting in goiter development.

Goiter occurs across all age demographics. Individuals over 40 years of age are much more predisposed to developing goiter than their younger counterparts. Goiters are more prevalent in girls than in men. In females, it is linked to pregnancy and menopause. The mountainous regions globally, especially the Himalayan arc extending from Pakistan through India and Nepal to northern Thailand and Vietnam, are among the most highly endemic goiter places in the world. Goiter is classified as endemic when its incidence exceeds 5% among children aged 6 to 12 years within a community.[1, 2].

The incidence of goiter in hilly regions of Pakistan is said to be 80-90%, whereas in flat areas it reaches up to 55%.[3]. Gilgit and Chitral in Pakistan are identified as places with a high prevalence of goiter due to iodine deficiency in their cuisine and drinking water.[4] The prevalence of goiter is reportedly rising in the flat regions of southern Sindh province, particularly in Hyderabad and its neighbouring districts.[5,6]. The cause of the increase in goiter cases is challenging to clarify since it is often believed that the drinking water and agricultural products eaten by the residents of these regions have enough iodine levels. Additionally, most staple food items used by the indigenous populace, particularly salt, are enriched with iodine. Potential demographic risk factors linked to the incidence of goiter in these regions may include tobacco use, age, gender, parity, and the consumption of substantial quantities of goitrogens in food and pharmaceuticals.[1,7,10]. The objective of the current research was to identify the demographic, nutritional, and biochemical risk variables linked to the etiology of goiter in Hyderabad and its surrounding regions.

METHODOLOGY

One hundred patients with goitre identified at the Nuclear Institute of Medicine and Radiotherapy (NIMRA) Jamshoro in Hyderabad and the surrounding areas were selected at random from the outpatient department of the institute between July 2009 and December 2009. As a control group, we also enlisted 100 people from the same area who did not have goitre, were of comparable socioeconomic standing, and did not come from a family with the condition. The participants in the trial were briefed about the study's goals, methods, and potential risks and benefits before signed informed consent was obtained. Liaquat University of Medical and Health Sciences, Jamshoro's Ethical Committee gave the research its stamp of approval.

Each participant filled out a questionnaire that included clinical and demographic information, such as their age, gender, home district, and dietary history. Patients' and controls' serum and urine iodine levels were measured using a Hitachi-220 spectrophotometer in a spectrophotometric analysis. Utilizing the Oak Field Health care Product Gamma Counter (UK) in England, serum samples were further evaluated for TSH, FT, and FT levels by radioimmuno tests.

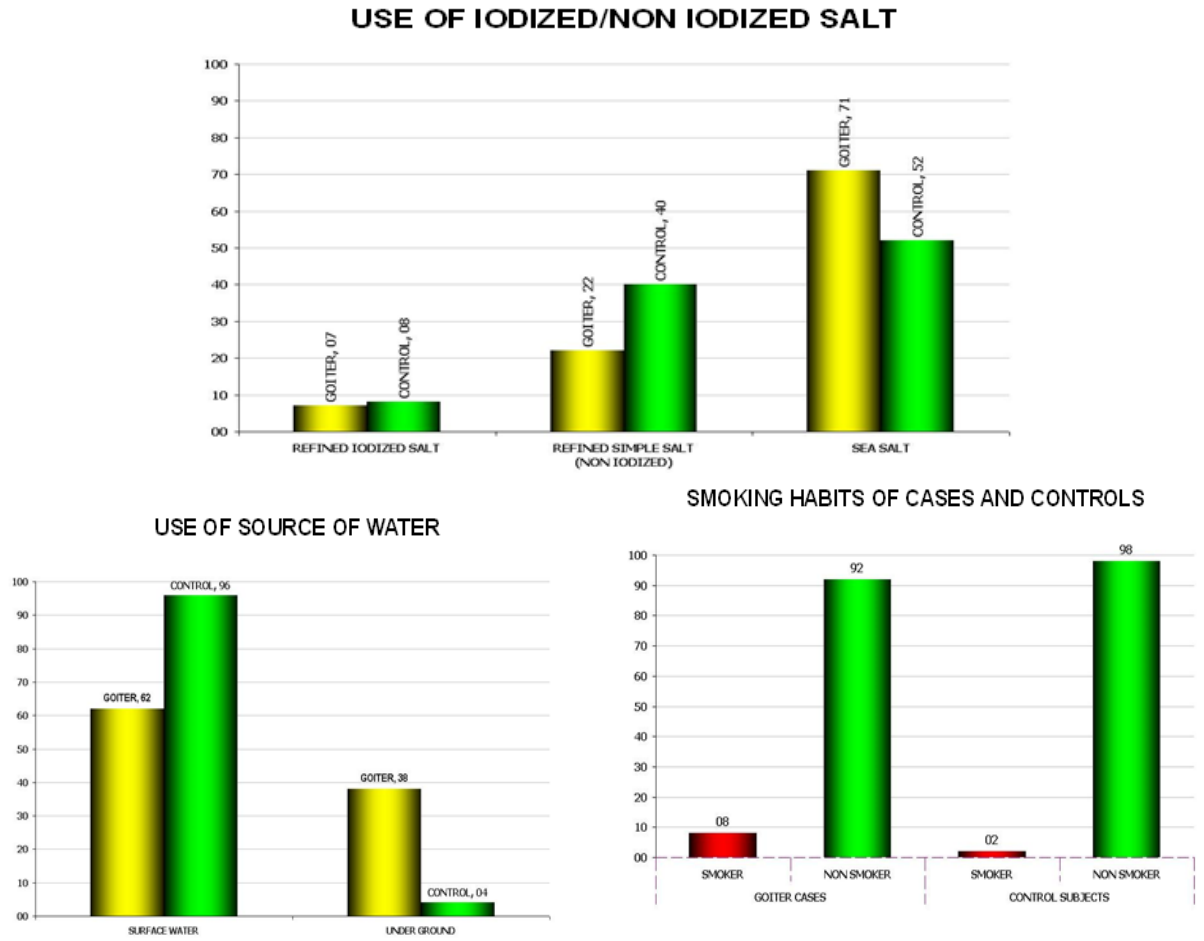
A student's t-test was used for statistical comparisons of biochemical variables, while the Odds Ratio was used to assess the dietary data of both the goiter patients and control participants. At $p \leq 0.05$, the results were deemed statistically significant, and at $p \leq 0.001$, they were deemed extremely significant.

RESULTS

Out of the 100 patients diagnosed with goiter, 53% were between the ages of 20 and 39, 87% were female, and 56% were from the Hyderabad area. Eight out of ten smokers (about 80%) in this research had goiter. People who did not eat iodized salt made up the majority of both the goiter patients (93%), and the control participants (84%). Data analysis using the Odds Ratio (OR) revealed a positive and statistically significant connection between goiter with consumption of subterranean water, cabbage, and pickles made with mustard oil that included mustard seeds. Similarly, there was a strong negative correlation between goiter with the intake of peas, eggs, milk, chicken, beef, and fish. Compared to the control group, goiter patients' blood and urine samples had considerably lower mean iodine levels ($P<0.001$). Also, when comparing goiter patients to control participants, the mean blood TSH, FT3, and FT4 levels were noticeably higher in the former. Out of the patients with goiter, 60 had euthyroidism, 25 had hyperthyroidism, and 15 had hypothyroidism, according to their thyroid

profiles.

From the data collected, we may conclude that there are only three possible iodine insufficiency levels: ideal intake, mild, and moderate. Consequently, it was discovered that all of the control participants had an ideal iodine consumption, with iodine in urine ranging from 100 to 199 µg/l. It was shown that 24% of the goiter patients had significant iodine deficit and 76% had mild iodine shortage (50-99µ g/l). Only 51% of individuals with goiter had blood iodine levels below 6µg/l. Smoking habits, source of water and use of iodinated salts by the study participants are shown in the following graphs.



DISCUSSION

Consistent with previous research showing a 2-10 times greater frequency of goiter in girls than in men, the current study found that goiter is around seven times more prevalent in females than in males.[2,7,11] It has been shown that iodine deficiency causes goitre more often in females than in men.[7] The current research found that the 20-39 age range had the highest incidence of goiter patients. Additionally, in regions with mild to severe iodine shortage, Kundsen et al. (2002) found that goitre was more common in the 30–40 age range. The peak incidence of goiter occurs around middle age in places with significant iodine deficit, suggesting that this correlation of goiter prevalence with age is based on iodine consumption.[7]

Eight of the 10 smokers who participated in this research were determined to have goitre. It has been claimed that people from iodine-deficient regions are more likely to have goitres, even though this research did not find a positive association between smoking and goitres.[7,9,12]. Tobacco smoking is not directly responsible for goiter formation, although it may exacerbate iodine deficiency. Cigarette smoke contains high concentrations of the goitrogenic compound thiocyanate, which inhibits iodine absorption and organification via competitive inhibition.[7,10,13,15] A closer look at the food habits of those with goiter and those without showed that the former consumed much less fish and animal

proteins than the latter. They drank a lot more subterranean water, pickled cabbage in mustard oil, and ate a lot more mustard seed than that. Chemical substances found in subterranean drinking water samples may be causing goiter by interfering with thyroid hormone production. Iodine deficit in goiter patients may be caused by a diet high in goitrogenic foods (such as cabbage, turnips, peanuts, strawberries, peaches, spinach, onions, sweet potatoes, mustard seeds, and rape) and low in animal and fish proteins. This is because iodine is abundant in animal and fish proteins, but not in vegetable proteins.

The current study's discovery that goiter patients had considerably lower iodine levels in their blood and urine samples compared to control participants ($P<0.001$) implies that iodine shortage may be the main reason for goiter in Hyderabad and the surrounding regions. All of the goiter patients were found to be iodine-deficient according to UNICEF criteria; 24% had mild iodine deficit and 76% had significant iodine shortage. This finding lends credence to the idea.

CONCLUSION

The findings of our study reinforce the established link between iodine deficiency and the high prevalence of goiter, particularly among females and within the 20-39 age group. The results show a significantly higher rate of goiter in females, which aligns with prior research suggesting an increased susceptibility in women. Additionally, iodine deficiency is suggested as a primary driver of goiter, with evidence showing that goiter patients have markedly lower iodine levels in blood and urine compared to control groups. This deficiency appears to be exacerbated by dietary patterns that are low in animal and fish proteins, which are rich sources of iodine, and high in goitrogenic foods such as cabbage, mustard seeds, and turnips. Although no direct correlation was found between smoking and goiter, the goitrogenic compound thiocyanate in cigarette smoke may indirectly impact iodine absorption, thereby potentially worsening iodine deficiency. Overall, our study strongly supports iodine deficiency as the main causative factor for goiter in the studied region, particularly among populations with specific dietary habits and in areas with a limited iodine supply.

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