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Impact of Alcoholism on Thyroid Hormones With Special Reference to Age, Frequency and Quantity of Alcohol Consumption

Alcoholism and Thyroid Hormone Imbalance

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Abstract: Alcoholism has been implicated in disrupting endocrine function, including alterations in thyroid hormone levels, which play a vital role in metabolic regulation. This study investigates the impact of alcohol consumption on thyroid hormone profiles—specifically triiodothyronine (T_3), thyroxine (T_4), and thyroid-stimulating hormone (TSH)—with a special focus on age, frequency, and quantity of alcohol intake. A total of 160 male participants, categorized based on their age groups and drinking patterns, like quantity and frequency, were analyzed using blood assays to assess thyroid function. The findings indicate a significant correlation between chronic alcohol use and altered thyroid hormone levels, with more pronounced effects observed in older age groups and in individuals with higher frequency and quantity of alcohol intake. Hypothyroid-like patterns, including elevated TSH and reduced T_3 and T_4 levels, were more prevalent among heavy and long-term alcohol consumers. These results suggest that age-related physiological changes, combined with the intensity of alcohol exposure, may exacerbate the risk of thyroid dysfunction. There is a need for early endocrinological evaluation in individuals with chronic alcohol use to prevent or mitigate thyroid-related complications. This research contributes to a better understanding of the physiological consequences of alcoholism and may inform more targeted approaches to managing thyroid disorders in individuals with alcohol use disorders.

Keywords: *Alcoholism, Thyroid Dysfunction, Endocrinology, Thyroid, Alcoholics, Hypothyroidism.*

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I. INTRODUCTION

Alcoholism poses a substantial burden on public health, impacting nearly every organ system in the body, including the endocrine system. The consumption of alcohol has severe negative impacts on various aspects of health, ranging from cardiovascular issues to hepatic disorders and compromised immune function. Alcoholism leads to deterioration in physical psychological social and economic conditions, yet individuals continue to drink despite these adverse effects (J. Santamaria, 1972). A National Survey on Extent and Pattern of Substance use in India revealed that nationally, about 14.6% of the population (between 10 and 75 year of age) uses alcohol.

In 2019, alcohol use was the leading risk factor for disease burden in people ages 25 to 49, and the second-leading risk factor for people ages 10 to 24 (WHO report 2019). A study by Valeix et al. (2007), found a dose-response relationship between alcohol intake levels and odds ratios for thyroid enlargement in both males and females. Additionally, alcohol intake was associated with lower free t4 levels in male drinkers, independent of TSH levels (Valeix et al., 2007).

The thyroid is an endocrine gland located in the inferior anterior region of the neck. It plays a vital role in iodine homeostasis and in the synthesis and secretion of thyroid hormones (THs)—primarily thyroxine (T4) and triiodothyronine (T3). These hormones act as crucial signaling molecules that regulate a wide range of physiological processes (Chen et al., 2024). Thyroid hormones are essential for maintaining metabolic homeostasis. They facilitate the metabolism of lipids and glucose, regulate adaptive metabolic responses, respond to changes in energy intake, and control thermogenesis (Severo et al., 2019). Even at rest, THs

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regulate oxygen consumption and energy expenditure, releasing energy in the form of heat (Tsibulnikov et al., 2020).

The relationship between thyroid hormones and alcoholism is complex, involving alterations in the hypothalamic-pituitary-thyroid (HPT) axis and thyroid hormone levels, which may influence alcohol dependence and craving. Alcoholism is associated with reduced levels of peripheral thyroid hormones, such as thyroxine (T4) and triiodothyronine (T3), particularly during early abstinence and withdrawal periods (D. Hermann et al., 2002, S. Ozsoy et al.2006, Y. Balhara et al., 2013). This reduction may be due to the toxic effects of alcohol on the thyroid gland and its metabolism (Y. Balhara et al., 2013). A blunted TSH response to thyrotropin-releasing hormone (TRH) is observed in some alcoholics, indicating possible central compensatory mechanisms or defects in pituitary function (D. Hermann et al., 2002, E. Aoun et al., 2015).

Alcoholics often experience abnormalities in thyroid function, with reduced T3 levels being the most common issue. Hypothyroidism in alcoholics is common and can be effectively treated with desiccated thyroid or l-triiodothyronine, improving hypometabolic symptoms and drinking patterns in a significant number of patients. (M. Goldberg, 1960).

Alcohol may directly suppress thyroid function through cellular toxicity and indirectly by affecting TRH response, leading to decreased peripheral thyroid hormone levels (R. Teschke et al., 2007, Y. Balhara et al., 2013). The liver plays a crucial role in alcohol metabolism and detoxification. It becomes sensitized through the induction of Cytochrome P450, particularly Cytochrome P II E, which is responsible for breaking down alcohol during the detoxification process. As Cytochrome P450 metabolizes alcohol, it generates reactive oxygen species (ROS) in higher quantities.

Understanding this complex relationship may offer insights into the pathophysiology of alcohol addiction, diagnostic biomarkers, and treatment strategies. Thyroid dysfunction in alcoholics may influence craving and disease progression. Hence, thyroid hormone monitoring should be integrated into the clinical management of alcohol dependence.

The aim of the present study is to find the effects of alcoholism on thyroid hormones considering factors like age, frequency, and quantity of alcohol intake in the local population of Jabalpur, Madhya Pradesh.

II. MATERIALS AND METHODS

The present study employed a cross-sectional research design to investigate the relationship between alcoholism and thyroid hormone levels with respect to age, frequency and quantity of alcohol consumption. This study included 160 participants. It was conducted in the Victoria Hospital of Jabalpur, Madhya Pradesh for a period of 4 months, from May 2024 to August 2024. During this time 280 patients visiting the hospital, were asked about their being alcoholic, out of which 160 were diagnosed as alcoholic. Blood samples were collected from the patients admitted in the different wards of the hospitals as well as of patients visiting the hospital for routine checkups and blood tests. All the patients were given questionnaires, to analyse the status of their alcoholism. For patients already admitted in the wards, their history of alcoholism was discussed with the family accompanying them in the hospital and their medical records were also reviewed.

Inclusion Criteria: Participants aged 18 and above, who provided informed consent, and had no history of thyroid surgery were included in the study.

Exclusion Criteria: Individuals with a history of thyroid disorders, those currently on thyroid medication and other significant comorbidities like cancer, HIV and females were excluded from the study.

Informed consent was obtained from all participants prior to their inclusion in the study. Further if any participant asked for the results of their thyroid test to be shared with them, they were personally given the results of their test.

To find the general information and alcoholism related details of the participants questionnaires were administered. These fetched information like age, occupation, underlined diseases, frequency and quantity of alcohol consumption etc. During this the identity of the participants were kept concealed. The questionnaire was kept in both the languages English & Hindi and further if the participant was unable to fill it, questions were read out to them.

Data Collection: Blood samples were collected from each participant to measure the levels of T3, T4, and TSH using electrochemiluminescence assays and comparisons were made based on demographic variables.

The blood sample was collected form the patients in gel vacutainer and serum was separated. Serum sample was processed for Thyroid Stimulating Hormone (TSH), Triiodothyronine (T3) and Thyroxine (T4) by electrochemiluminescence assay on ADVIA Centaur CP Immunoassay System which used the Chemiluminescent Acridinium Technology. The system utilized electrochemiluminescence (ECL) technology for testing thyroid hormones.

This methodology offered high sensitivity and specificity for detecting thyroid-stimulating hormone (TSH) and other thyroid-related analytes. The assay employs a sandwich immunoassay format using monoclonal antibodies. For TSH detection, two monoclonal capture antibodies target specific epitopes on the TSH molecule, while a tracer polyclonal antibody labelled with acridinium ester is used for detection (Clerico et al., 2007). This design allowed precise quantification of TSH, T3 and T4 levels in the samples.

The thyroid hormone levels so measured in alcoholics were then compared to the reference levels of Thyroid Stimulating Hormone (TSH), Triiodothyronine (T3) and

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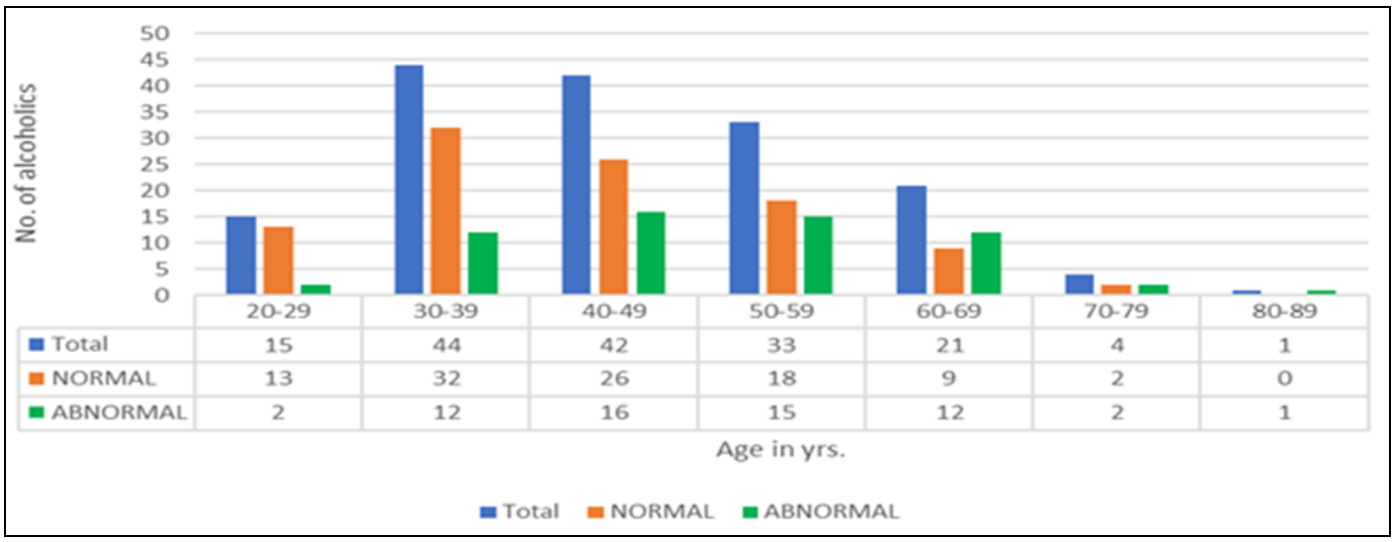
Thyroxine (T4). The alcoholics were divided into 7 age groups and then the deviation was further studied. The thyroid hormone levels were analysed with respect to the frequency and quantity of alcohol consumption.

Statistical Analysis: For statistical operations Microsoft excel 2021 was used through which descriptive statistics was applied. The same was also used for the calculations of chi square test to understand the relationship between alcoholic's age, frequency and quantity with the thyroid hormone levels.

III. RESULTS

Out of 280 individuals surveyed, 160 (57.14%) were identified as alcoholics. Among these, 60 (37.5%) showed abnormalities in thyroid hormone levels—48 cases (80%) were hypothyroidism and 12 cases (20%) hyperthyroidism, indicating hypothyroidism as the more prevalent disorder in alcoholism.

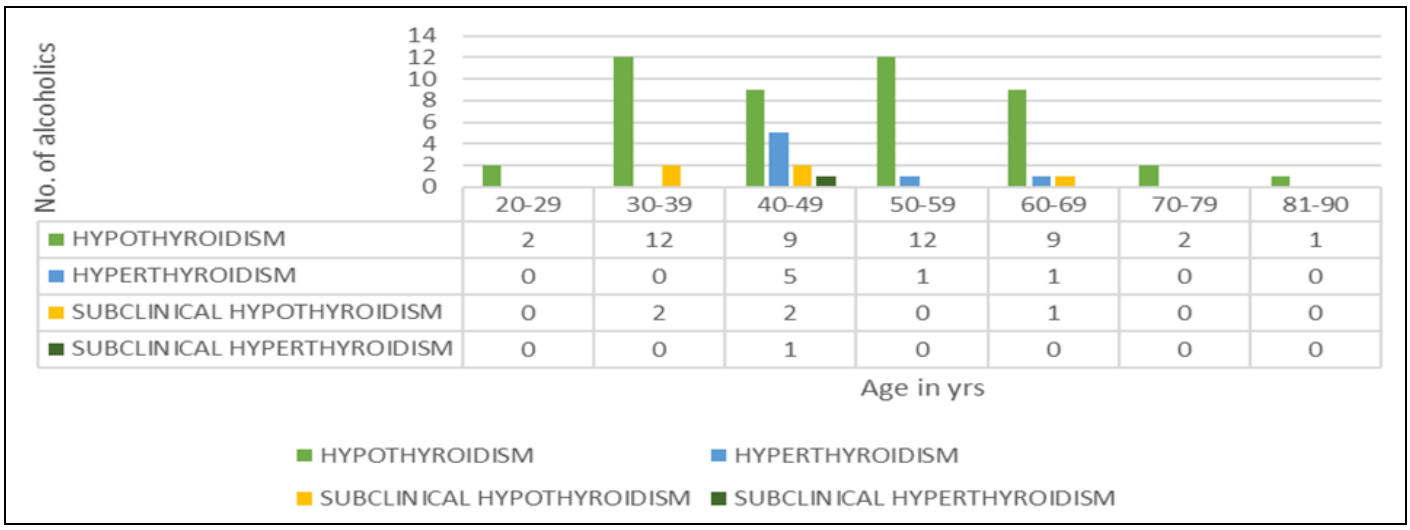
Participants were categorized into seven age groups: 20–30, 31–40, 41–50, 51–60, 61–70, 71–80, and 81–90 years. The mean age was 45.75 years (SD = 12.93; min = 20, max = 83). The highest number of alcoholics (44; 27.5%) was observed in the 31–40 age group. Thyroid hormone derangement was most prevalent in the 61–70 age group, suggesting a correlation between age and dysfunction (Table 1).



Graph 1 Distribution of Total Normal and Abnormal Thyroid Cases Across Age

➢ *Evaluation of Thyroid Abnormality by Age Group Revealed the Following Distribution:*

- 20–30 years: 100% hypothyroidism
- 31–40 years: 91.66% hypothyroidism, 8.33% hyperthyroidism
- 41–50 years: 56.25% hypothyroidism, 46.66% hyperthyroidism
- 51–60 years: 93.33% hypothyroidism, 6.66% hyperthyroidism
- 61–70 years: 81.81% hypothyroidism, 27.27% hyperthyroidism
- 71–90 years: 100% hypothyroidism (Table 2)



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Graph 2 Number of Alcoholics with Hypothyroidism and Hyperthyroid in Different Age Group

Chi-square test analysis yielded a calculated value of 21.71 (df = 12, α = 0.05; tabulated value = 21.08), indicating a statistically significant relationship between age and thyroid hormone levels (Table 3).

Table 1 Values of Thyroid Hormones Across the Different Age Groups (Chi Square Test):

Age Group	Observed Values of T3	Observed Values of T4	Observed Values of TSH
20-30	12.83	97.73	47.71
30-40	35.9	336.67	133.05
40-50	47.1	340.2	158.32
50-60	28.36	260.18	111.1
60-70	33.48	134.84	88.06
70-80	2.72	23.19	12.68
80-90	0.92	3.13	0.81

Alcohol consumption frequency was classified into four groups:

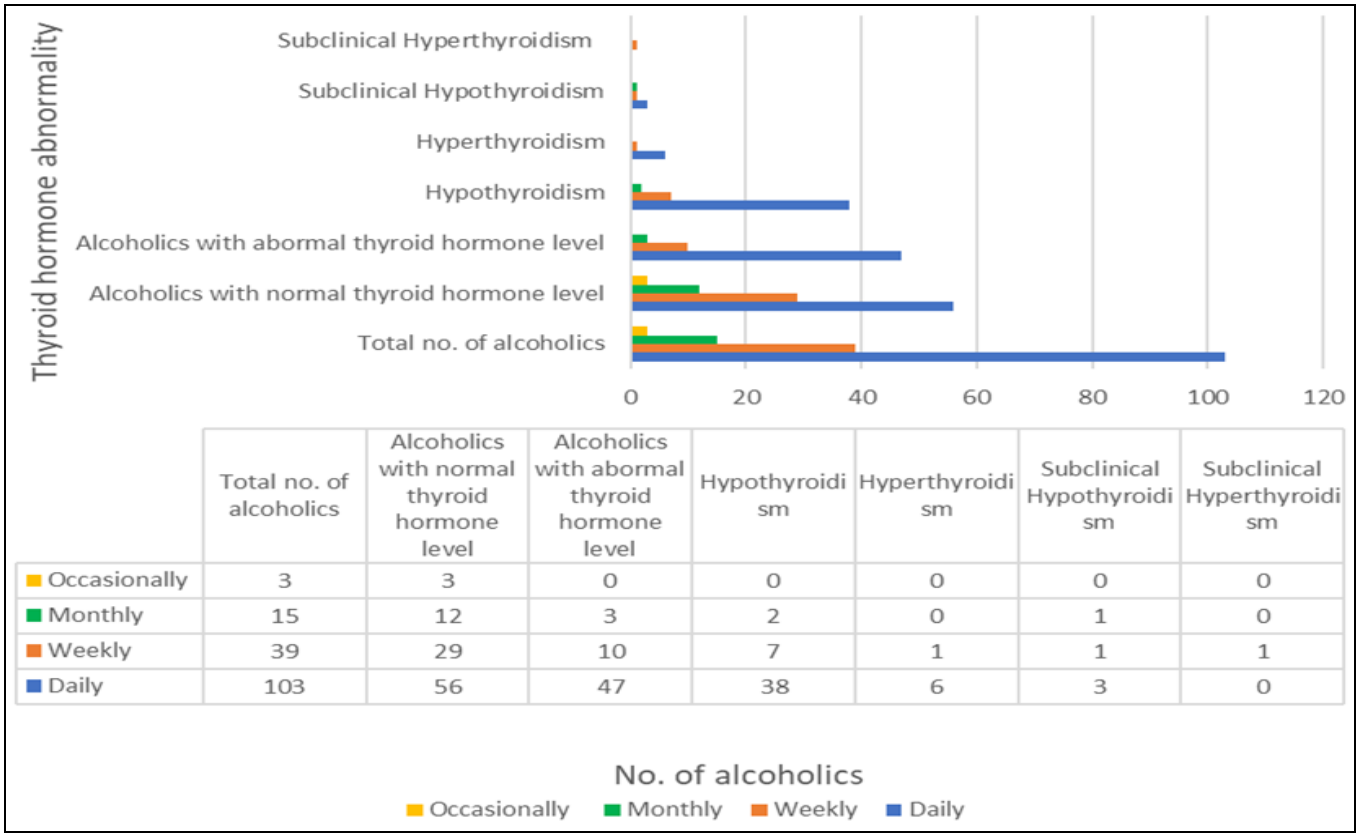
- Daily (≥1 episode/day)
- Weekly (1–4 episodes/week)
- Monthly (1–4 episodes/month)
- Occasionally (1–4 episodes/6 months)

Most alcoholics were daily drinkers (103; 64.37%), while occasional drinkers were the least (3; 1.87%). Weekly and monthly drinkers constituted 39 (24.37%) and 15 (9.37%) individuals, respectively.

Abnormal thyroid function was found in:

- 45.63% of daily drinkers
- 25.64% of weekly drinkers
- 20% of monthly drinkers
- 0% of occasional drinkers

Hypothyroidism was the most frequent abnormality across all drinking frequencies (Table 4).



	Total no. of alcoholics	Alcoholics with normal thyroid hormone level	Alcoholics with abormal thyroid hormone level	Hypothyroidism	Hyperthyroidism	Subclinical Hypothyroidism	Subclinical Hyperthyroidism
Occasionally	3	3	0	0	0	0	0
Monthly	15	12	3	2	0	1	0
Weekly	39	29	10	7	1	1	1
Daily	103	56	47	38	6	3	0

Graph 3 Thyroid Hormone Abnormalities Among Alcoholics by Drinking Frequency

Alcohol quantity was divided into 14 consumption groups (ranging from 1–29 ml to >389 ml/day). Group 7 (180–209 ml/day) had the highest number of alcoholics (39; 24.37%), followed by Group 1 (1–29 ml/day; 32 alcoholics, 20%). Group 14 (>389 ml/day) had the fewest (4; 2.5%). Several groups (5, 6, 8–12) had no participants and were included for statistical completeness. Among alcoholics, those

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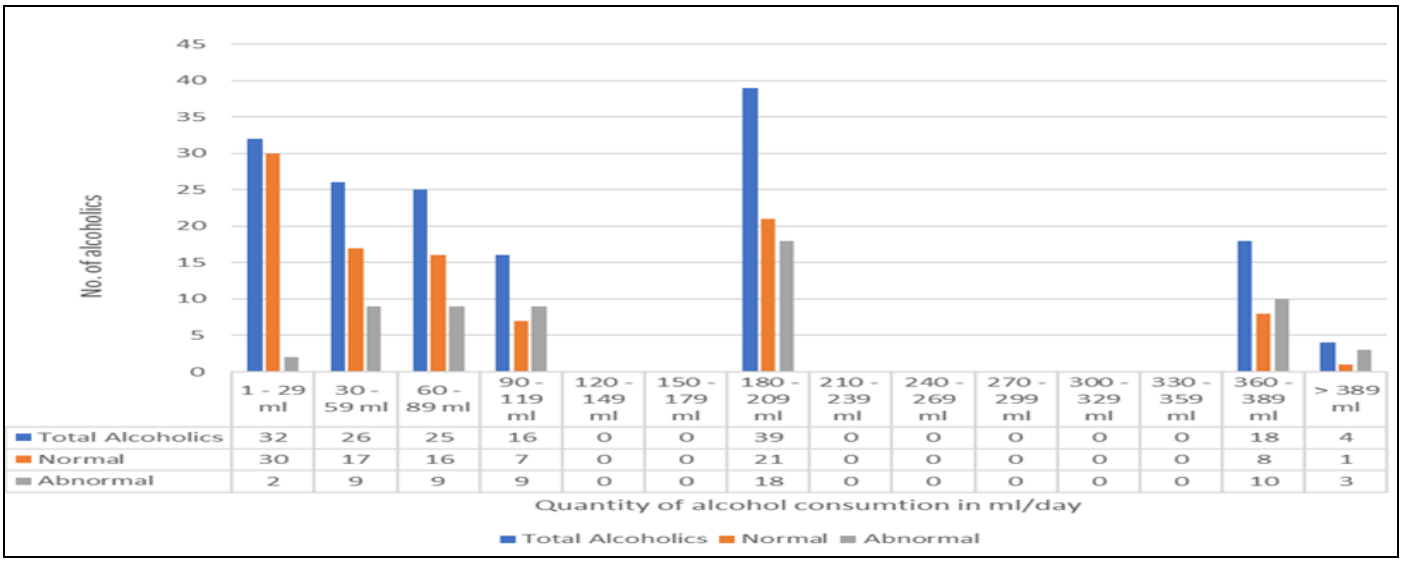
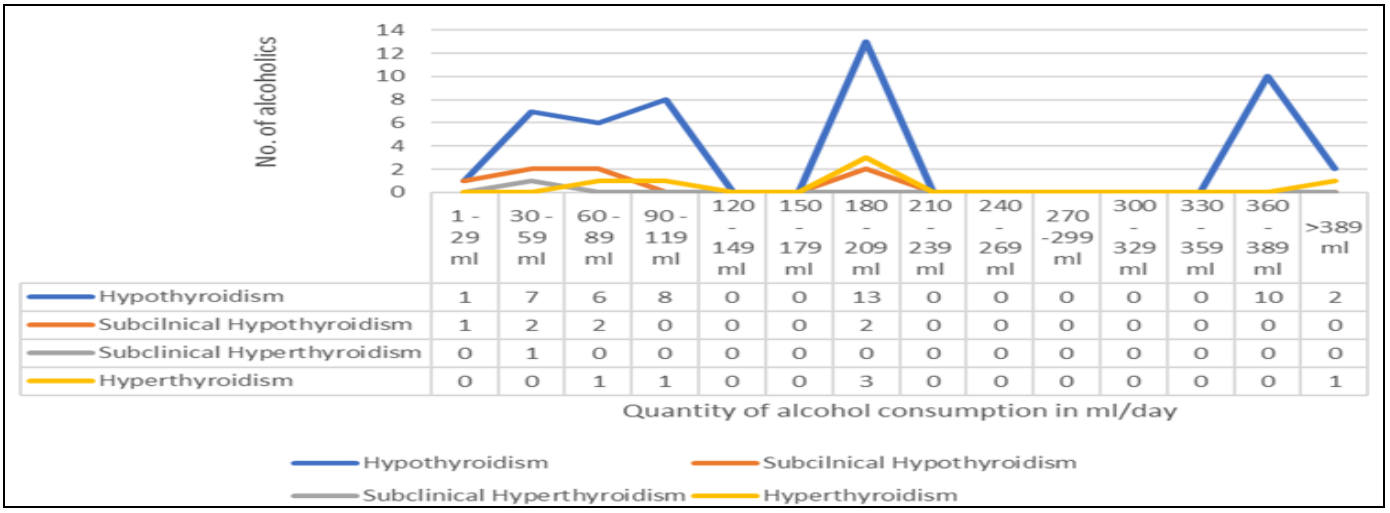
consuming >360 ml/day showed the highest rate of thyroid abnormality (55.55%) (Table 5).



Graph 4 Alcoholics with Normal and Abnormal Thyroid Hormone Levels Based on The Quantity of Alcohol Consumption

Hypothyroidism dominated all quantity groups, while subclinical hyperthyroidism was rare, appearing only once (in the 30–59 ml group) (Table 6).



Graph 5 The Different Thyroid Level Abnormalities Present in Alcoholics Consumption in Ml/Day

Chi-square analysis of quantity and frequency versus hormone levels produced a statistically significant value of 57.59 (df = 26, $\alpha = 0.05$; tabulated value = 38.88). This confirms a meaningful association between thyroid hormone levels and both frequency and quantity of alcohol consumption (Table 7).

Table 2 Observed Values of Thyroid Hormones Across the Different Age Groups (Chi Square Test):

Quantity/ Frequency in ml/day	Observed Values of T3	Observed Values of T4	Observed Values of TSH
0-29	32.4	264.93	102.96
30-59	20.46	184.22	74.33
60-89	24.99	183.57	108.45
90-119	15.59	102.75	51.93
120-149	0	0	0
150-179	0	0	0
180-209	39.1	288.47	132.64
210-239	0	0	0
240-259	0	0	0
270-299	0	0	0
300-329	0	0	0
330-359	0	0	0
360-389	12.05	126.04	59.37

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>389	16.72	22.44	21.19

IV. DISCUSSION

The mechanisms underlying the effects of alcoholism on thyroid function are multifaceted and complex. Chronic alcohol consumption exerts a broad spectrum of physiological impacts, and one of the key systems affected is the endocrine system, particularly the thyroid gland. One primary factor is the direct cytotoxic effect of alcohol on thyroid follicular cells, which impairs their ability to synthesize and secrete hormones effectively. Ethanol and its metabolites can also alter the hypothalamic-pituitary-thyroid (HPT) axis, contributing to thyroid dysfunction in alcohol-dependent individuals.

In the present study, the most frequent thyroid abnormality observed was a decrease in T3 hormone levels, a finding that aligns with prior literature. Liappas et al. (2006) similarly discovered that the vast majority of their alcohol-dependent patients exhibited marginally altered peripheral thyroid hormone levels, specifically reporting normal T4 and TSH levels, but reduced T3 concentrations. Likewise, Aiswarya C.S. et al. (2018) found that low T3 was the most common abnormality seen in individuals with chronic alcohol intake. The consistent finding of isolated low T3 levels across multiple studies may suggest that alcohol primarily affects peripheral conversion of T4 to T3 rather than the central regulation of the thyroid.

The thyroid abnormalities associated with chronic alcoholism may significantly contribute to the metabolic derangements commonly observed in individuals with alcohol use disorders (AUDs). Thyroid hormones play a critical role in regulating basal metabolic rate, thermogenesis, glucose metabolism, and lipid utilization. When disrupted, these pathways can lead to symptoms such as fatigue, weight fluctuation, cognitive decline, mood disturbances, and reduced physical performance. These symptoms often overlap with those of chronic alcohol use, making diagnosis and

management particularly challenging. Notably, such manifestations were frequently reported by the family members of alcoholic patients during this study, highlighting the observable nature of these disruptions in daily life.

Interestingly, TSH level abnormalities were infrequently observed in this study, with only 6 out of 60 cases showing abnormal TSH levels, suggesting that central regulation of thyroid function via the pituitary may be less commonly affected in the broader population of alcoholics. However, findings from Dilshana Nafisa et al. (2018) present a contrasting view, indicating that TSH abnormalities become more prevalent with prolonged duration and higher volume of alcohol consumption, particularly in those consuming more than 720 ml of alcohol daily for over 15 years. This discrepancy may be attributed to varying patterns of alcohol consumption, genetic susceptibility, or environmental influences across study populations.

An age-wise analysis revealed that in the current study, the highest prevalence of heavy alcohol use was observed among males aged 30–39 years, accounting for 44 cases (27.5%). This suggests that a significant proportion of alcohol-dependent individuals fall within the 31–40-year age bracket, a trend similarly reported by Ozsoy et al. (2006), where the majority of participants were aged between 28 and 54 years. This demographic detail is crucial as it reflects the vulnerability of individuals in their most productive years to the long-term consequences of alcohol misuse, including endocrine dysfunction.

The complex relationship between alcoholism and thyroid dysfunction underscores the need for a comprehensive and multidisciplinary approach to medical evaluation and treatment in alcohol-dependent individuals. Understanding the intricate interplay between chronic alcohol exposure and thyroid hormone regulation is vital for identifying at-risk individuals and implementing early interventions. Moreover, this knowledge should inform the development of tailored therapeutic strategies that simultaneously address both alcohol dependence and associated thyroid abnormalities, thereby improving the overall prognosis and quality of life for affected individuals.

In conclusion, recognizing thyroid dysfunction as a common yet underappreciated consequence of chronic alcohol use is essential for clinical management. Continued research into this relationship is warranted to further elucidate the mechanisms involved and optimize treatment outcomes.

V. CONCLUSION

Alcoholism is closely related to changes in thyroid hormone levels, suggesting a clear effect of alcohol on thyroid hormone production. Hypothyroidism emerged as the most common abnormality, indicating that thyroid hormone levels tend to reduce in individuals with alcohol dependence. Healthcare providers should recognize the potential for thyroid dysfunction in alcoholic patients and incorporate routine thyroid screening into their clinical assessments.

A significant relationship was observed between the age of alcoholics and their thyroid hormone levels. The 60–70-year age group exhibited the highest rate of thyroid hormone derangements, indicating that advancing age may exacerbate dysfunction. Frequency of alcohol consumption also had a notable effect. The majority of alcoholics were daily drinkers (64.37%), and this group had the highest proportion of abnormal thyroid hormone levels (45.63%), suggesting that increased frequency contributes to greater hormonal disruption.

Regarding quantity, most alcoholics consumed 180–209 ml/day (24.37%), while the fewest drank more than 389 ml/day (2.5%). However, those consuming more than 360 ml/day exhibited the highest rate of thyroid abnormalities (55.55%), reinforcing that greater quantities correlate with more severe endocrine dysfunction.

Though overt hypothyroidism was relatively rare, its identification is critical, as treatment may help alleviate mood disorders and depressive symptoms in alcoholics. Given the simplicity and affordability of thyroid function testing, routine

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screening is highly recommended in alcohol dependence syndrome. Continued research is essential to further clarify these mechanisms and support integrated, targeted treatment for affected individuals.

REFERENCES

[1]. Aiswarya CS, Sampath S, Aggarwal D, Kumar AVSA. Study of thyroid function in alcohol dependence syndrome. Int J Contemp Med Res. 2018;5(3):C6–C8.

[2]. Aoun GE, Lee RM, Haass-Koffler LC, Swift MR, Addolorato G, Aenna AG, Leggio L. Relationship between the thyroid axis and alcohol craving. Alcohol Alcohol. 2015;50(1):24–9.

[3]. Balhara YP, Deb KS. Impact of alcohol use on thyroid function. Indian J Endocrinol Metab. 2013; 17:580–7.

[4]. Chen S, Yu M, Yao Y, Li Y, He A, Zhou Z, et al. Thyroid Hormone Biomonitoring: A Review on Their Metabolism and Machine-Learning Based Analysis on Effects of Endocrine Disrupting Chemicals. Environ Health. 2024;2(6):350–72.

[5]. Goldberg M. The occurrence and treatment of hypothyroidism among alcoholics. J Clin Endocrinol Metab. 1960; 20:609–21.

[6]. Hermann D, Heinz A, Mann K. Dysregulation of the hypothalamic-pituitary-thyroid axis in alcoholism. Addiction. 2002; 97:1369–81.

[7]. Liappas I, Malitas P, Koutsis C, Spilioti M, Paparrigopoulos T, Christodoulou GN. Peripheral thyroid hormone levels in male alcohol-dependent patients. Prog Neuropsychopharmacol Biol Psychiatry. 2006;30(7):1303–7.

[8]. Nafisa D, Pinto D, Rao P, Kakunje A. Prevalence of Thyroid Function Abnormality in Admitted Male Patients with Alcohol Dependence Syndrome. J Alcohol Drug Depend. 2018;6.

[9]. Ozsoy S, Esel E, Izgi HB, Sofuoglu S. Thyroid function in early and late alcohol withdrawal: relationship with aggression, family history, and onset age of alcoholism. Alcohol Alcohol. 2006;41(5):515–21.

[10]. Santamaria JN. The social implications of alcoholism. Med J Aust. 1972;2(10):523–8.

[11]. Teschke R, Frenzel C, Schulze J, Eickhoff A, Wolff A. Clinical and biochemical characteristics in 1023 patients with alcoholic liver disease. Alcohol Clin Exp Res. 2007;31(5):824–30.

[12]. Tsibulnikov, S., Maslov, L. N., Voronkov, N. S., & Oeltgen, P. R. (2020). Thyroid hormones and the mechanisms of adaptation to cold. Hormones, 19(4), 531–537.

[13]. Valeix P, Faure P, Bertrais S, Vergnaud AC, Dauchet L, Hercberg S. Effects of light to moderate alcohol consumption on thyroid volume and thyroid function. Clin Endocrinol (Oxf). 2008; 68:988–95.

[14]. World Health Organization. Alcohol. WHO Report. 2019.