Pervalence of NCDs and Risk Factors among Tribal Population of Edamalakudi Panjayath, IDUKKI District, Kerala, India

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Abstract:- **BACKGROUND &OBJECTIVE: Non-communicable diseases (NCDs) pose a significant burden on global health with increasing prevalence in rural and tribal communities. The tribal communities in India are the most disadvantaged regarding their health indicators. Although the prevalence of lifestyle diseases, including hypertension, diabetes etc is lower among tribal groups than the general population in the country, the rate of risk factors, including tobacco and alcohol use, is significantly higher among tribals than the general population. This study explores NCD prevalence and risk factors among the indigenous population in Edamalakudi tribal panjayath, Idukki district in Kerala.**

METHOD: The survey was conducted among the tribal population of Edamalakudi Panjayath. The sample size selected was 1543 (included only people above 30 years of age) reside in 661 households. The survey was conducted using the WHO stepwise framework for surveillance of NCD prevalence and risk factors.

RESULTS: The rate of hypertension is 7.6%, and the rate of prevalence of Type 2 diabetes is 3.8% among the Edamalakudi tribal population, which is lower than the other tribal and general population in the country. However, the risk factors, including tobacco use and alcohol use, are found to be slightly higher among the study participants than the rest of the population. Regarding the BMI ratio, the main issue among the study tribals is underweight among women (42%), which is higher than other tribal and general population.

CONCLUSION: The Edamalakudi tribal population was found to have a higher rate of alcohol and tobacco use than other tribal and Non-tribal populations in Kerala and India. However, the key observation in this study is that the rate of hypertension and Type 2 diabetes is comparatively lower in the study population than the other tribal population in the state. Since Edamalakudi Panchayath is remotely situated in the high terrain forest area and completely excluded from the mainstream area in the state, people may be leading a physically demanding life, which somehow turns into an active lifestyle among the population.

Key Words: **NCDs, Hypertension, Type 2 Diabetes, BMI Ratio -+.**

INTRODUCTION

Non-communicable diseases (NCDs) also known as chronic diseases tend to be long duration and are the result of the combination of genetic, physiological, environmental, and behavioral factors. NCDs encompass a vast group of diseases such as cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases. NCDs are one of the major challenges for public health in the 21st century, not only in terms of human suffering but also harm/burden, they inflict on the socio-economic development of the country. According to WHO (2023)[1] report Non-communicable Diseases kill 43 million people globally each year equivalent to 74% of all death globally. The global disease burden has continued to shift away from communicable to non-communicable diseases and from premature deaths to years lived with disability. (MURRAY CJ et al, 1997).[2] NCD is a real health challenge for developing countries especially India which is the second most populous country in the world. Lack of health awareness among the population, lack of adequate health coverage, and shortage of adequate fund allocation for health services aggravate problems in these areas. The economic and social impacts of NCDs in India are profound. These diseases impose a significant financial burden on individuals and households, leading to a heightened risk of catastrophic out-of-pocket health expenditure, loss of household income, and increased financial insecurity, all of which can exacerbate poverty and inequality.(Thakur J et al.,2011).[3] Moreover, the economy of India is experiencing a rapid transition with a rising burden of Non-communicable Diseases (NCDs)

surpassing the burden of communicable diseases like water-borne or vector-borne diseases. Lack of adequate income for the households and seeking high-cost treatment from the private sector for NCDs push them into chronic poverty and financial instability. Non-communicable diseases (NCDs) are a major health issue for men and women in most countries and a major challenge for all healthcare systems.

LITERATURE REVIEW

'Tribals' refers to a group of people who live in isolated areas, especially in remote forest surroundings, away from mainstream society. They are the most oppressed and depressed people in the country often referred to as 'Indigenous' people academically or 'Adivasis' locally. Language and cultural barriers pose significant challenges to healthcare delivery in tribal areas in India. Death rates due to NCDs were reported to be higher among people living in poor or marginalized communities. The tribal population in India is considered the most disadvantaged regarding health indicators. For example, the under-five mortality rate was highest among tribes (95.7) compared to schedule caste (88.1), other backward castes (72.8), and forward cast. (59.8) · India has the second-largest concentration of tribal population in the world. Indian tribes constitute around 8.3% of the nation's total population Krishna 4. Many tribal individuals and families are unable to reach healthcare facilities promptly. Moreover, the lack of awareness about preventive healthcare measures further exacerbates the health disparities experienced by tribal populations. Without proper education and information about disease prevention, tribal communities are more susceptible to preventable illnesses. The combination of socioeconomic challenges and limited healthcare resources creates a complex landscape in which providing equal healthcare to tribal populations becomes exceptionally challenging. (DEB ROY)[5]. The health status and health-seeking behaviour of the tribal population is poor than the general population (NARAIN J)[6]. It is believed that the prevalence of hypertension among the tribal population is lower than that of the general population, and has fewer risk factors such as physical inactivity, mental stress, and unhealthy habits (KUSUMA)[7]. However, in the Indian context, it was reported that the hypertension prevalence among the tribal population is as high as that of the general population. (Hzarika C.R)[8].

The state of Kerala stands out as having the highest prevalence of diabetes and coronary artery disease in comparison to other states within India. This observation positions India as the global epicenter for noncommunicable diseases (NCDs), specifically diabetes, and cardiovascular ailments. Kerala is in a highly advanced stage of epidemiological transition, surpassing other states in India. This transition is characterized by factors such as an aging population, a high incidence of NCDs, and elevated levels of morbidity. (Menon)[9]. The tribal population consists of 1.5% of the total population in Kerala .(2011 CENSUS).[10]. Alcohol and tobacco use are found to be higher among the tribal population in Kerala than the general population, which is a main contributing factor for higher blood pressure rates among tribals in Kerala. A study done by Priyanka Sajeev et al (2018)[11] among Kani tribes in Kerala shows that obesity rates are higher among the community than the other tribal communities in other states in India. It has been reported that the use of tobacco (both smoking and smokeless forms), is more common among tribal communities in India compared to the general population. Also, in tribal communities, tobacco and alcohol usage is considered socially acceptable which are the common predicting habits for elevated blood pressure, cardiovascular diseases, lung and mouth cancers, and liver diseases. (M.G Aswin)[12]

SIGNIFICANCE OF THE STUDY

There have been several studies on the tribes, their culture, and the impact of acculturation on the tribal society. However, studies relating to tribal health, the concept of disease, and health beliefs and practices are rather scanty, and specific studies on this topic with reference to the tribals, covering the different facets are practically non-existent. Kerala, a small state in India comprising 1.5% of its population is tribal people, is in a more rapid state of epidemiological transition than any other state in India. It has been observed that since tribal communities engage in active and nomadic lifestyles more than the general population, the prevalence of non-non-communicable diseases and Lifestyle diseases like diabetes and high blood pressure are relatively non-existent among tribals in Kerala. However, many sources and data collected by the health and tribal department as well as some studies clearly indicate that NCDs are common among tribals like the general population. This study among tribal communities living in the Idamalakudi tribal setting

is very relevant as it is the only panchayath in Kerala that is completely isolated from the mainstream settings. The development of Edamalakudy faced significant obstacles due to its inaccessibility, lack of road connectivity, absence of internet, and unavailability of Record of Rights (RoR). The isolation hindered the progress and empowerment of the tribal community residing there.

The area is isolated, remote, and lacks road and no connectivity including public or private transport system from the external area.

OBJECTIVE OF THE STUDY

To study the prevalence of Non communicable diseases among the tribal population in Edamalakudy Tribal settings, Idukki Kerala.

MATERIALS AND METHODS

The study was carried out among the Tribal population of Edamalakudy tribal population Devikulam Thaluk of Idukki district. Edamalakudi tribals are primarily settled in forests in Idamalakudi panchayath of Idukki district. It is the only panchayath in Kerala where all inhabitants are exclusively tribals. The total population of the panchayat is 2342 where men are 1155 and women are 1187.

TARGET AUDIENCE AND DATA COLLECTION

The survey was conducted among the tribal population of Edamalakudi panjayath. The total population of the panjayath was 2342. (data collected from the tribal and Health department and through a direct survey) resides in 661 households. The survey excluded a population below 30 years. So, the total number of samples including men and women was above 30 years and counted to 1785. The survey was conducted with the help of Anganwadi workers and ASHA workers. (Accredited Social Health Activist). A detailed Performa was given to obtain information about the status of individuals regarding NCDs, smoking, and drinking habits The survey was conducted from the second week of December 2024 to the Third week of January 2025 A structured interview schedule, based on WHO stepwise approach for surveillance of NCD risk factors Version 3 was used for this study. The questionnaires included tobacco use, alcohol use, dietary habits, physical inactivity etc. The interviews were done in the presence of an ASHA worker who belongs to the same community. Details of Individuals who undergo treatments for various issues like high blood pressure, and diabetes are collected from the local primary health center. BP measurements, MEDTECH digital BP monitor were used. BP readings were taken in morning and evening in two days and average readings have been used for analysis. To estimate the sugar level ONETOUCH glucometer was used. To get a fasting blood sugar level, arrangements have done through local healthcare workers to conduct screening before having food in the morning. For measuring height and weight MCP height measuring scale and Health sense weighing machine were used. Out of 1785 total sample size, 242 people were excluded due to various reasons of non-availability or non -cooperative attitude. So, the total sample size for the survey was fixed to 1543. Out of this, 795 were women and 748 were men

Smokers in India consume tobacco in various forms; rolled tobacco leaves *(bid*i), Indian pipe *(chillum, hooka*h), cigarettes, and chewing tobacco, and more than one form is used by many, making it difficult to accurately measure the amount of tobacco consumed. Therefore, users of all types of tobacco products, including present and past smokers, were included in the smoker's category. Drinking alcohol habits were assessed by consuming ethyl alcohol in any form within 30 days of the survey. Regular use of alcohol was assessed by using validated questionnaires and show cards and defined those who drink more than five (for women four) standard drinks (10 grams of ethanol) every day [. Physical activity was assessed by assessing the activity at work, home, transport, and discretionary time. Physical inactivity was defined as doing no or very little activity at work, home, transport, and discretionary time. Hypertension was diagnosed if the systolic blood pressure was ≥140 mmHg and diastolic blood pressure ≥ 90 mmHg or if the person was a known hypertensive. Body mass index (BMI) was calculated as weight in kg divided by the square of height in meters and overweight and obesity were defined as BMI of ≥ 25 and ≥ 30, respectively. For more reliability, including a sample population with risk factors following criteria(WHO standards) had been adopted

The inclusion criteria of the sample were based on available and relevant survey and study results available in public domain. Extensive review had

done on routine household surveys across various States and Union Territories (UTs) of India, like the NFHS, GATS, District Level Household and Facility Survey (DLHS), Integrated Disease Surveillance Program (IDSP) and Indian Council of Medical Research (ICMR), which revealed performed between 1998-2022

- The criteria for data selection, obtained from the search above, was as follows:

» Inclusion Criteria – studies/surveys which are national (representative of states or nationally representative), multiple-state representative or single state representative; surveys following the WHO indicator definitions for each risk factor; surveys covering both rural and urban population; manuscripts in English language:

1. Tobacco use - of any tobacco form in last 30 days (WHO, 2008)[13]
2. Alcohol use - at least once previously in 30 days (WHO, 2008).[14]
3. Physical inactivity - adults aged 18+ years not meeting any of these criteria: 150 minutes of moderate-or 75 minutes of vigorous or an equivalent combination of both types of physical activity accumulating at least 600 MET (Metabolic Equivalent - ratio of a person's working metabolic rate relative to the resting metabolic rate) minutes per week (WHO, 2013).[15]
4. Salt Intake – >5 gm (2 gm sodium) (WHO, 2012).[16]
5. Low fruit and/or vegetable consumption - <5 servings (400 grams) per day (WHO, 2013).[17]
6. Raised blood glucose - an adult aged 18+ years with fasting plasma glucose value ≥7.0 mmol/L (126 mg/dl) or on medication for it (WHO, 2024).[18]
7. Overweight and Obesity- Body mass index (BMI) ≥25 kg/m2 denotes overweight and ≥ 30 kg/m2 denotes obesity in adults aged 18+ years (WHO, 2024).[19]

RESULTS

Table-1

Socio-demographic profile of Tribal population of Edamalakudi Panjayath in the sample population		
Variable-Age group	N= 1543	Percentage
Age Group 31- 40	481	31.5%
Age Group 41-50	383	23.8%
Age group 51-60	333	18.4%
Age Group 60 and above	346	20.3%
Marital Status	1436	93.3%
Educational Qualification		
Illiterate	1111	72%
Up to 4th STD	282	18.3%
Up to 12th STD	145	9.4%
12th and above	5	0.3%
Graduate or Professional		NIL
Occupation		
Unemployed	493	32%
Daily/ Casual Labour	818	53%
Farmer	231	15 %
Regular Wage Labour	1	0.001%

Table -1 shows the demographic profile of the surveyed population. A total of 1543 tribal participants were interviewed during the study. Seven hundred and ninety-five (52% were females as compared to seven hundred and forty-eight (48%) males. The majority of them, 1062 out of 1543 (69%) were in the age group of 41 years and above, and 78% were illiterate. Only 18.3% of the population has primary education. 9.3% of the population has gone up to the high school level. 32% of the population is unemployed. 53% of the population engaged in daily or casual wage labour or followed their traditional livelihood., such as gathering minor forest products (honey and medicinal herbs and plants) and so on. 15% of the population engaged in farming. Most men are involved in unorganized labour work and rubber tree tapping. Women are mostly engaged in homemaking.

Table-2

Prevalence of NCD and risk factors among tribal population of Edamalakudi panjayath		
variable	Frequency (N=1543)	percentage
Hypertension Male Female People under treatment Male female	118 74 (N=748) 44 (N=795) 75 56 19	7.6% 9.9% 5.8%
Diabetes. Male Female People under treatment Male Female	58 17 (N=748) 41 (N=795) 10 3 7	3.8% 2.3% 5.1%
Current Tobacco Use (Smoking Form) Male Female	790 (N= 1543) 694 (N=748) 96 (N=795)	52% 92% 12.2%
Tobacco uses in chewing form. (Along with Betel Leaves). Male Female	1383 (N=1543) 632 (N=748) 752 (N=795)	89.5% 84.1% 88%
Alcohol use Male Female	755 (N=1543) 711 (N=748) 44 (N=795)	48% 94% 5%
BMI Ratio Over Weight (BMI Ratio 25-29.9) Underweight (BMI Ratio <18.5). Normal Weight (BMI Ratio 18.5-24.9). Obesity (BMI Ratio > 30)	 170 648 586 139 (N=1543)	 11% 42% 38% 9%

Table -2 shows the prevalence of NCDs and risk factors among the surveyed population. Based on the findings, 118 (7.6%) participants had elevated blood pressure levels. (systolic and diastolic reading as > 140/90). Out of these, 14 cases were newly detected cases. 75 cases were known hypertensive cases who are regularly taking medication. Out of these, 19 cases are women and 56 cases are men. Among women participants who are under medication, 29 people have known cases of hypertension who either didn't start treatment or discontinued/irregularly seeking treatment.

The prevalence of diabetes among the Edamalakudi tribal population is 3.8%. (58 cases). (Fasting Blood Sugar- FBS > 126 mm/dl) Out of these, 41 cases are females, and 17 cases are males. People who seek active treatment or are on regular medication are only 10. (female 7 and male 3). Around 42% of the population was suffering from underweight, and the majority are women of less than 40 years of age. 38% of the population has a normal weight. 11% of the population was overweight, and only 9% was obese, according to WHO standards. Abdominal obesity was higher among women (32%) than men (22.3%). Hypertension and diabetes were found more in overweight participants than in normal or underweight participants. (78% of diagnosed cases of hypertensive and diabetic participants had a BMI Ratio>26). The survey also found that 88 % of BP and Diabetic cases were above 50 years, 12% were between 31 and 40 years of age among the participants

The majority (93%) use tobacco in the form of smoking or in a smokeless form. More men (694) use smoking forms of tobacco (92% N= 748) as compared to 96 women. (12.2%- N= 795). Women who engage in smoking are mainly the older age group, generally above fifty Years of age. Among men, the smoking habit starts at a very young age. Most women use tobacco in the form of chewing with

betel quids. The use of smokeless forms of tobacco among the population is 89.5%, which is higher among women (88%) compared to men. (84.1%)

The alcohol consumption rate is 48% among the population, many fold among men 94% compared to women (5%), and they are very accustomed to modern forms of spirits like brandy rum, etc, rather than traditional coconut toddy and locally distilled spirits. Around 72% of male participants were included in the high-risk category of drinking (more than 5 units per day without giving a break). No cases of high-risk drinking patterns were found among women population

The regular intake of fruits and vegetables was very low among study participants, mainly due to a lack of availability and accessibility. They mostly consumed locally available seasonal fruits. Only a few of them habitually brought fruits from shops. The questions related to regular intake of fruits were not appropriately answered and they could not be analyzed. Questions were asked about the use of extra salt in food before eating, during cooking, and the habit of eating processed food containing extra salt. Nearly 30.1% of participants used extra salt to food before eating, 27.2% during cooking and 25.75 reported the habit of eating processed food containing extra salt. Physical inactivity was mainly observed in women who do only homemaking. The majority of the surveyed population is somehow led or compelled to have a physically demanding daily routine due to the high terrain nature of their habitat.

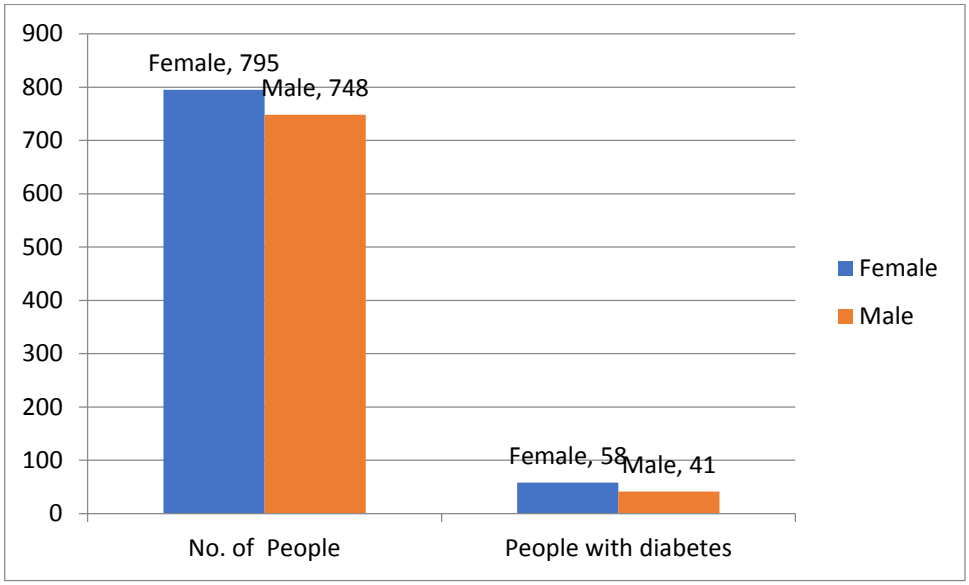

Figure- 1 Genderwise prevalence of diabetes among study population (N = 1543)

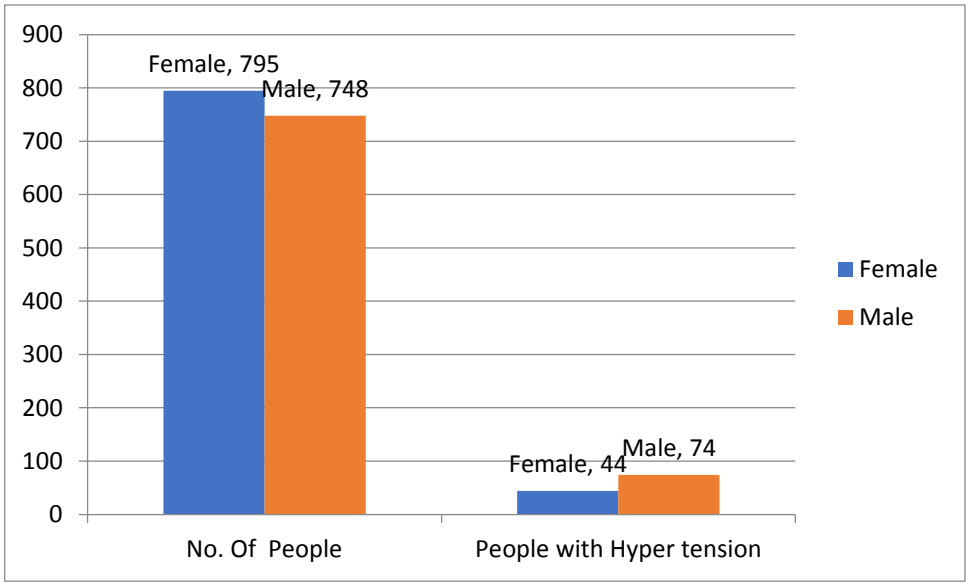

Figure - 2 Gende rwise prevalence of Hypertension among study population (N = 1543)

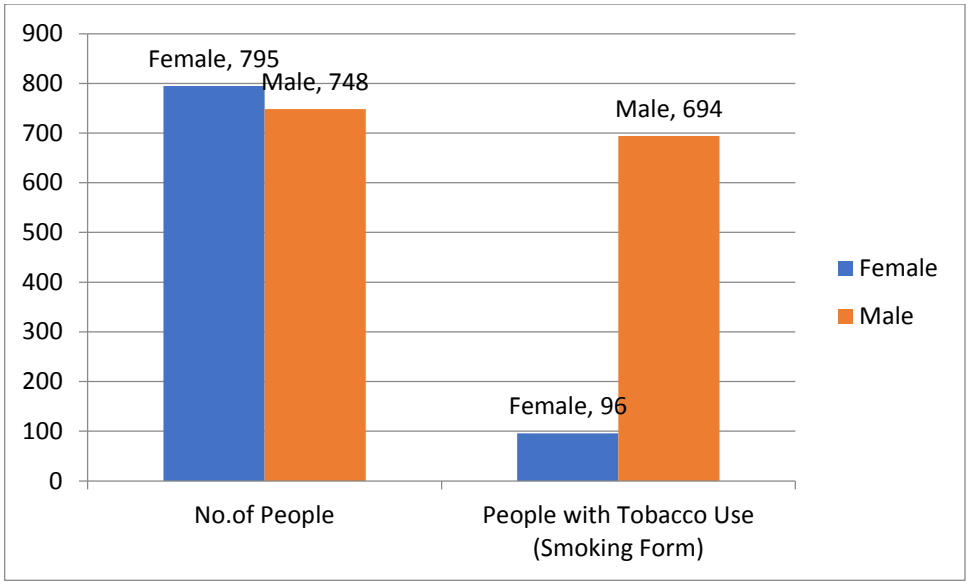

Figure - 3 Gender wise prevalence of Tobacco Use (Smokiing form) among study population (N = 1543)

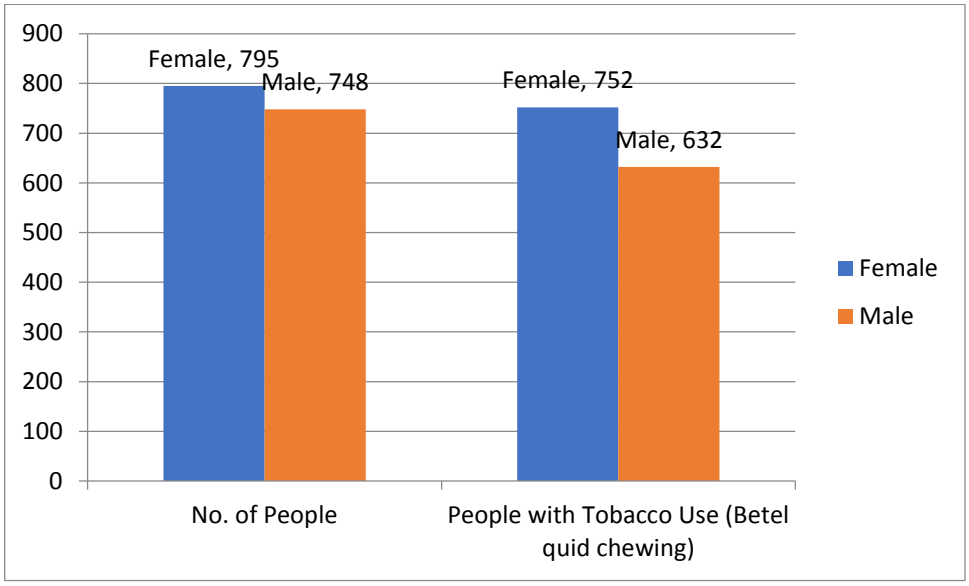

Figure -4 Gende rwise prevalence of Tobacco use (smokeless form) among study population (N = 1543)

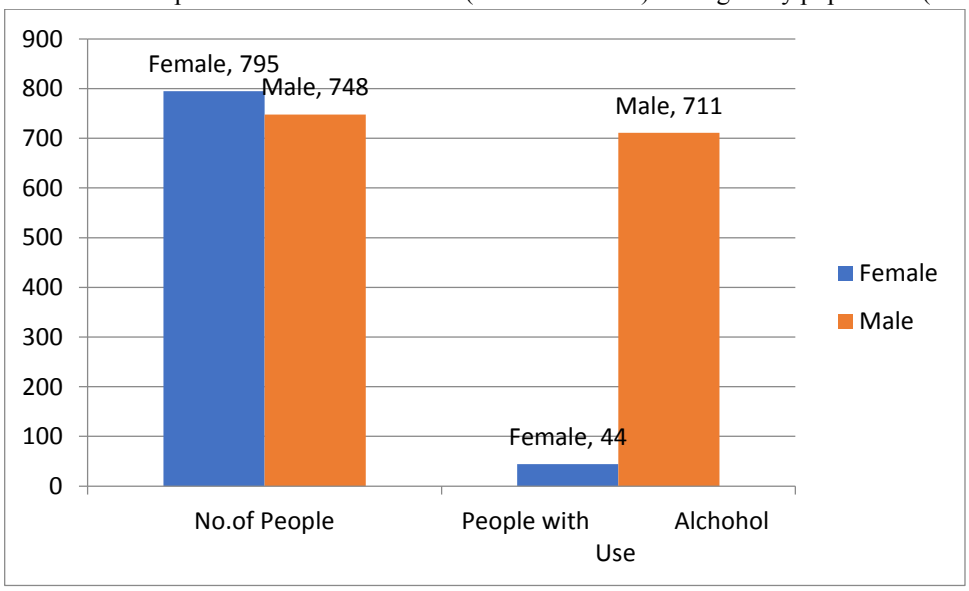

Figure - 5 Gender wise prevalence of Alcohol use among study population (N = 1543)

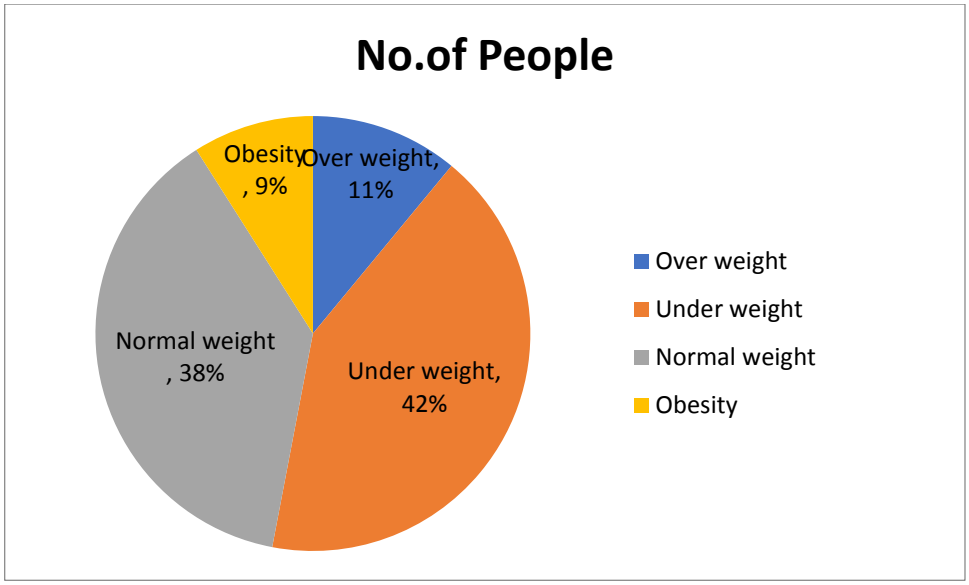

Figure- 6 BMI Ratio among study population (N=1543)
Source- Author's field study analysis.

DISCUSSION

The study among the Edamalakudi tribal community showed that the prevalence of hypertension and diabetes is comparatively lesser than other tribal groups in Kerala, the general public, and other populations in India. This conclusion was made by reviewing studies and research available in the public domain. The Kani tribe is one of the prominent tribal communities in the Thrissur district of Kerala. A study done by M.G Aswin et al. among Kani tribes in Thrissur district reported that Hypertension prevalence was 47.6% among the Kani tribes' population in the Thrissur district- (M.G ASWIN et al[20]), which is significantly higher than the Hypertension prevalence among the Edamalakudi Tribal population. The overall prevalence of Cross-sectional studies across six districts of tribal majority in India showed that the prevalence of type 2 diabetes based on FBG (Fasting Blood Sugar) was 6.80%, which is comparatively lower than the national average (7.8%). (Babu AV et al.)[21] Another study using the WHO STEPs approach was conducted among a total of 332 individuals of the *Mishing* tribe from Tinsukia district, Assam. Overall, tobacco use was 84% (men 94%; women 73%), and alcohol use was 67% (men 82%; women 50.) Eleven percent had abdominal obesity, 16% were overweight, and 26% had hypertension. (Mishra and Thankappan)[22]

This study reported that the prevalence of Type 2 diabetes, based on FBG, is 3.8% among Edamalakudi tribals, which is much lower than the data presented among other tribal populations in the country. gender, Illiteracy, BMI, and waist-hip ratio show significant association with diabetes. The rate of Type 2 diabetes of Edamalakudi tribals is lower than the other tribal groups in Kerala, which is evident in various studies published by Priyanka Sajeev[23] and M.G Aswin[24]. The women participants have a higher rate of high blood sugar levels than men in the Edamalakudi tribal population, which is a common trend across the country among tribals and non-tribals. The prevalence of diabetes among the Edamalakudi population is 3.8%. Among the female population, the rate is 5.1%, and among men, the rate of type 2 diabetes is 2.8%. 80% of the confirmed cases of diabetes were above 50 years of age, and 73% had an abnormal waist-hip ratio, confirming the general risk factors and gender risk associated with diabetes, which is similar to the general public and other tribal groups in the state.

The rate of hypertension among Edamalakudi tribes is found to be 7.6%, which is higher in men (9.9%) than among the women population (5.8%). which is much lower than other tribal populations and the general population in the state. Priyanka Sajeev[25] has done comprehensive research on non-communicable disease prevalence among Kani tribal populations in the Thiruvananthapuram district in Kerala. Her study reported that the prevalence of hypertension (48.3%), use of tobacco (81.5%), and alcohol consumption (36.2%) were found to be higher in the Kani tribe compared to the general population in Kerala. Abdominal obesity (22.1%) is found to be higher in Kani tribes compared to other tribal groups in India. The physical inactivity level

(9.7%) was similar to urban Kerala and higher than many other tribes in India. Age, Use of tobacco, and alcohol consumption were found to be the prominent risk factors for hypertension, and Type 2 Diabetes Studies among Kani tribes in Kerala show that the prevalence of hypertension among them is 48.3%, which is significantly higher than the Edamalakudi tribal population. The rate of alcohol consumption among the Edamalakudi population is 48%, which is higher than the Kani tribe population (36.2%). At the same men are at more risk of the onset of high blood pressure, which is a general trend among all populations. Hypertension was significantly associated with higher age, male sex and tobacco intake, (80% of hypertension cases were above 50 years of age and 89% were tobacco users among the participants of this study). which is. At the same time, concrete evidence could not be found on the association between BMI ratio and elevated blood pressure among the study population. The prevalence rate of alcohol use (26%), betel quid chewing (36%), and smoking (25%) were higher among the Tribes, as compared to 9%, 19%, and 18% prevalence rates reported for non-Tribal populations in India. (Subramanian et al.)[26]

The average rate of raised blood pressure among the general population in Kerala is 30.4%' and elevated FBG is 19.2%. the use of tobacco and alcohol is 39.1 and 28.9% respectively (P.S Sarma etal)[27], (NCD Bulletin Health and FW dept)[28]. So, it is very clear that the rate of hypertension and diabetes is much lower in Edamalakudi tribals, but the prevalence of substance abuse, including tobacco and alcohol, is significantly higher among them.

Another study conducted by Anwar Sadat et al. [29] among tribal groups in the Wayanad district in Kerala found that 60% of the study population had the habit of using tobacco (smoking and smokeless form), and the alcohol consumption rate was 49%. This study found that the rate of alcohol use is 48% and tobacco use is 63% (both smoking and smokeless forms among the population in Edamalakudi Panjayath, which is higher than other tribal groups and the general population in the country and state. Even though the prevalence of tobacco use is comparatively high, the rate of hypertension is generally lower among Edamalakudi tribals compared with other tribal and non-tribal populations in India. Regarding body mass index, most of the tribal population suffers from under body weight, especially young women. In India, where 13% of reproductive-aged women were underweight based on the fifth round of the National Family Health Survey (NFHS)[30], the situation is particularly concerning for women from marginalized communities such as Scheduled Tribes (ST) who bear a disproportionately heavy burden, with a staggering 25.5% women experiencing underweight. This study found that among the study participants, 42% of the population is underweight (>18.5 BMI where females account for 33%), which is higher than the national average of 25.5%. As per the National Family Health Survey 4 reports, in Kerala, undernutrition is particularly common among women from scheduled tribes, 20%. A study done by Sreelakshmi Mohandas[31] among Tribal women in Kinatti village, Wayanad District in Kerala, reported that 53.8% of the women population in the study area were undernourished (<18.5 kg/m^2), with 25% severely underweight. This mainly occurs due to lack of availability and accessibility to proper nutrition especially to females who are more vulnerable in a financially deprived marginalized society like tribals in the country.

Unhealthy diet and poor nutrition represent significant risk factors for NCDs like cardiovascular diseases, diabetes, and cancer. Consequent to this development, there is, of course, the pressing issue of healthcare service availability, quality, and access. Health services are abysmally poor in tribal areas, partly due to the fact that no one – be it doctors, specialists or laboratory technician or male health workers want to serve in a remote tribal area. The per capita expenditure on health is low; consequently, health centres do not have enough supply of health technologies and lifesaving medicines. (Narrain J)[32]

The study shows that there is a severe lack of awareness of NCDs among the tribal population of Edamalakudi Panjayath, of Idukki District of Kerala. Although infectious diseases and trauma were presumed to be predominately health aliments among the tribals, NCDs are making their mark in recent times. (Narain JP.)[33]

Only 10% of the study participants had information about the risk factors of consumption of tobacco and alcohol. Regarding abdominal obesity, the study shows that the women population outnumbering the men population, which trends similar to that found in the study by Ramamoorthy et al[34].

CONCLUSION

The Edamalakudi tribal population was found to have a higher rate of alcohol and tobacco use than other tribal and non-tribal populations in Kerala and India. However, the key observation in this study is that the rate of hypertension and Type 2 diabetes is comparatively lower in the study population than the other tribal population in the state. Since Edamalakudi Panchayath is remotely situated in the high terrain forest area and completely excluded from the mainstream area in the state, people may be leading a physically demanding life, which somehow turns into an active lifestyle among the population.

REFERENCES

[1] *WHO 2023.* https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseasesGlobal mortality, disability, and the contribution of risk factors: Global Burden of Disease Study.

[2] C. J Murray and A. D Lopez et al. 1997.GlobalMortality, Disability and the Contribution of Risk Factors: Global Burdon of Disease study. DOI: 10.1016/S0140-6736(96)07495-8 . https://pubmed.ncbi.nlm.nih.gov/9164317

[3] Thakur J, Prinja S, Garg CC, Mendis S, Menabde N. Social and Economic Implications of Noncommunicable diseases in India. Indian J Community Med. 2011 Dec;36(Suppl 1): S13-22. Doi: 10.4103/0970-0218.94704. PMID: 22628905; PMCID: PMC3354895..

[4] Krishna V Krishna, V. (2011). Indigenous Communities and Climate Change Policy: An Inclusive Approach. In: Leal Filho, W. (eds) The Economic, Social and Political Elements of Climate Change. Climate Change Management. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-14776-0_3. https://link.springer.com/chapter/10.1007/978-3-642-14776-0_3#citeas

[5] Deb Roy A, Das D, Mondal H. The Tribal Health System in India: Challenges in Healthcare Delivery in Comparison to the Global Healthcare Systems. Cureus. 2023 Jun 2;15(6): e39867.. PMID: 37404413; PMCID: PMC10315066. Doi: 10.7759/cureus.39867. https://pmc.ncbi.nlm.nih.gov/articles/PMC10315066/

[6] Narain JP. Health of tribal populations in India: How long can we afford to neglect? Indian J Med Res. 2019 Mar;149(3):313-316. Doi: 10.4103/ijmr.IJMR_2079_18. PMID: 31249192; PMCID: PMC6607830. https://pubmed.ncbi.nlm.nih.gov/31249192/

[7] Kusuma YS, Babu BV, Naidu JM. Blood pressure levels among cross-cultural populations of Visakhapatnam district, Andhra Pradesh, India. Ann Hum Biol. 2002 Sep-Oct;29(5):502-12. Doi: 10.1080/03014460110117876. PMID: 12396370. https://pubmed.ncbi.nlm.nih.gov/12396370/

[8] Hazarika CR, Babu BV. Prevalence of Hypertension in Indian Tribal Population: A Systematic Review and Meta-analysis. J Racial Ethn Health Disparities. 2024 Feb;11(1):451-467. Doi: 10.1007/s40615-023-01532-6. Epub 2023 Feb 8. PMID: 36752902. https://pubmed.ncbi.nlm.nih.gov/36752902/

[9] Menon, Jaideep C.; Sreedevi, Aswathy; Janakiram, Chandrashekar. Consequences of the Epidemiologic Transition in Kerala, India – A Public–Private-Partnership Model of Health Care: A Critical Analysis. Archives of Medicine and Health Sciences 11(2): p 287-290, Jul–Dec 2023. | DOI: 10.4103/amhs.amhs_2_23. https://journals.lww.com/armh/fulltext/2023/11020/consequences_of_the_epidemiologic_transition_in.27.aspx

[10] https://censusindia.gov.in/nada/index.php/catalog/43031.

[11] Sajeev P, Soman B. Prevalence of noncommunicable disease risk factors among the Kani tribe in Thiruvananthapuram district, Kerala. Indian Heart J. 2018 Sep-Oct;70(5):598-603. Doi: 10.1016/j.ihj.2018.01.022. Epub 2018 Jan 11. PMID: 30392494; PMCID: PMC6204451. https://pmc.ncbi.nlm.nih.gov/articles/PMC6.

[12] M.G. Aswin , Marthanda Pillai Anand Prabhakar Jessy , Jinbert Lordson A, Job. Prevalence and associated risk factors of hypertension among tribal population in Thrissur District: Across sectional study in South India. Nazar Asmi , G.K. Mini [a] [c]https://doi.org/10.1016/j.cegh.2024.101563.Health. Volume, March–April 2024, 101563.

[13] https://www.who.int/health-topics/tobacco#tab=tab_1

[14] https://www.who.int/teams/mental-health-and-substance-use/alcohol-drugs-and-addictive-behaviours/alcohol/

[15] https://www.who.int/initiatives/behealthy/physical-activity#
[16] https://www.who.int/data/gho/indicator-metadata-registry/imr-details/3082
[17] https://www.who.int/tools/elena/interventions/fruit-vegetables-ncds
[18] https://www.who.int/news-room/fact-sheets/detail/diabetes
[19] https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
[20] M.G. Aswin a, Marthanda Pillai Anand b Prabhakar Jessy, Jinbert Lordson A, Job PJ. Jibin, A.P. Nizam, M.S. Adarsh, Fathima Nazar Asmi, G.K. Mini a c https://www.sciencedirect.com/science/article/pii/S2213398424000599
[21] Babu BV, Hazarika CR, Raina SK, Masoodi SR, Basappa YC, Thomas N, Kerketta AS, Menon NK, Jebasingh FK. Prevalence of type 2 diabetes among tribal population of India: a multi-centric cross-sectional study. J Natl Med Assoc. 2024 Apr;116(2 Pt 1):153-164. Doi: 10.1016/j.jnma.2024.01.004. Epub 2024 Jan 29. PMID: 38290904. https://pubmed.ncbi.nlm.nih.gov/38290904/
[22] Misra PJ, Mini GK, Thankappan KR. Risk factor profile for non-communicable diseases among Mishing tribes in Assam, India: results from a WHO STEPs survey. Indian J Med Res. 2014 Sep;140(3):370-8. PMID: 25366204; PMCID: PMC4248383. https://pmc.ncbi.nlm.nih.gov/articles/PMC4248383/
[23] Sajeev P, Soman B. Prevalence of noncommunicable disease risk factors among the Kani tribe in Thiruvananthapuram district, Kerala. Indian Heart J. 2018 Sep-Oct;70(5):598-603. Doi: 10.1016/j.ihj.2018.01.022. Epub 2018 Jan 11. PMID: 30392494; PMCID: PMC6204451. https://pubmed.ncbi.nlm.nih.gov/30392494/
[24] Prevalence and associated risk factors of hypertension among tribal population in Thrissur District: A cross-sectional study in South India. M.G. Aswin, Marthanda Pillai Anand, Prabhakar Jessy, Jinbert Lordso PJ. Jibin, A.P. Nizam, M.S. Adarsh, Fathima Nazar Asmi, G.K. Mini. https://doi.org/10.1016/j.cegh.2024.101563. https://www.sciencedirect.com/science/article/pii/S2213398424000599.
[25] Sajeev P, Soman B. Prevalence of noncommunicable disease risk factors among the Kani tribe in Thiruvananthapuram district, Kerala. Indian Heart J. 2018 Sep-Oct;70(5):598-603. Doi: 10.1016/j.ihj.2018.01.022. Epub 2018 Jan 11. PMID: 30392494; PMCID: PMC6204451. https://pubmed.ncbi.nlm.nih.gov/30392494/
[26] Subramanian, S. V., Davey Smith, G., & Subramanyam, M. (2006). Indigenous health and socioeconomic status in India. *PLoS Medicine*, *3*(10), e421. https://doi.org/10.1371/journal.pmed.0030421.
[27] Sarma PS, Sadanandan R, Thulaseedharan JV, Soman B, Srinivasan K, Varma RP, Nair MR, Pradeepkumar AS, Jeemon P, Thankappan KR, Kutty RV. Prevalence of risk factors of non-communicable diseases in Kerala, India: results of a cross-sectional study. BMJ Open. 2019 Nov 10;9(11): e027880. Doi: 10.1136/bmjopen-2018-027880. PMID: 31712329; PMCID: PMC6858196. Doi: 10.1136/bmjopen-2018-027880. https://pmc.ncbi.nlm.nih.gov/articles/PMC6858196/
[28] NCD Bulletin, January 2021. DHS Kerala. /https://dhs.kerala.gov.in/wp-content/uploads/2021/01/NCD-BULLETIN-latest-
[29] Sadath A, Kabir Z, K M J, G R, Uthaman SP. Smoking, betel quid chewing, and alcohol use among an indigenous primitive Tribal group in the Kerala State of India: Secondary analysis of a Tribal household survey. J Ethn Subst Abuse. 2025 Jan-Mar;24(1):137-152. Doi: 10.1080/15332640.2023.2185721. Epub 2023 Mar 22. PMID: 36946893. https://doi.org/10.1080/15332640.2023.2185721. https://www.tandfonline.com/doi/full/10.1080/15332640.2023.2185721
[30] International Institute of Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS– 5), 2019-21 [Internet]. Mumbai, India. 2022. Available from: http://rchiips.org/nfhs/NFHS-5Reports/NFHS-5_INDIA_REPORT.pdf.
[31] Mohandas S, Amritesh K, Lais H, Vasudevan S, Ajithakumari S. Nutritional Assessment of Tribal Women in Kainatty, Wayanad: A Cross-Sectional Study. Indian J Community Med. 2019 Oct;44(Suppl 1): S50-S53. Doi:

10.4103/ijcm.IJCM_39_19. PMID: 31728091; PMCID: PMC6824176. Doi: 10.4103/ijcm.IJCM_39_19. https://pmc.ncbi.nlm.nih.gov/articles/PMC6824176/

[32] Dawa, Natasha; Narain, Jai Prakash. Noncommunicable diseases among tribal populations in India: A case of double jeopardy. International Journal of Noncommunicable Diseases 8(1): p 1-3, Jan–Mar 2023. | DOI: 10.4103/jncd.jncd_24_23. *DOI:* 10.4103/jncd.jncd https://journals.lww.com/ijnc/fulltext/2023/08010/noncommunicable_diseases_among_tribal_populations.1.

[33] Narain, Jai Prakash. Health of tribal populations in India: How long can we afford to neglect? Indian Journal of Medical Research 149(3): p 313-316, March 2019. | DOI: 10.4103/ijmr.IJMR_2079_18. 10.4103/ijmr.IJMR_2079_18. https://pmc.ncbi.nlm.nih.gov/articles/PMC6607830/

[34] Ramamoorthy K, Muthunarayanan L, Sundaram MP, Devivaraprasad M, Anantharaman VV. Association of Abdominal Obesity and Diabetes among the Adult Tribal Population in Tamil Nadu. Indian J Community Med. 2024 Nov-Dec;49(6):826-830. Doi: 10.4103/ijcm.ijcm_899_22. Epub 2024 Oct 17. PMID: 39668928; PMCID: PMC11633279 DOI: 10.4103/ijcm.ijcm_899_22. https://pubmed.ncbi.nlm.nih.gov/39668928/