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Original Article

Community Section

Burden of Abdominal Obesity and Hypertension among Fishermen: A Cross-sectional Study from Chennai, Tamil Nadu, India

L NANCY[1], R SUBA SHREE[2], R KALAIVANAN[3], M LOGARAJ[4], K NARMATHA[5]

ABSTRACT

Introduction: Fishermen are more likely than the general population to develop hypertension due to their altered sleeping patterns as well as their high salt intake. There is a substantial correlation between obesity and the development of hypertension, in conjunction with other disorders. The primary risk factor for hypertension is Body Mass Index (BMI), which increases with BMI.

Aim: To estimate the prevalence of hypertension and abdominal obesity among the fishermen population, to determine the association between hypertension and abdominal obesity and to identify the factors associated with hypertension.

Materials and Methods: A cross-sectional study was conducted among fishermen in the Chennai district with a sample size of 310. They were selected using a multistage random sampling technique and a detailed interview was conducted with the participants using a pretested, validated, modified STEPwise questionnaire. Statistical analysis included frequency, percentages, Chi-square tests, univariate regression done for categorical variables and multivariate logistic regression for significant variables (p-value <0.05) to control for confounders.

Results: Out of the 310 respondents, the majority, 188 (60.6%) were aged 45 years or older, with 167 (53.9%) living in nuclear families. Additionally, 223 (71.9%) reported having an unhealthy diet. The prevalence of hypertension and abdominal obesity was 48.7% (151) and 64.5% (200), respectively. The majority felt that lowering salt intake was not important at all, accounting for 41.3%. Age and education level were significantly associated with hypertension.

Conclusion: The prevalence of abdominal obesity and hypertension was 64.5% and 48.7%, respectively, which was higher among fishermen. As this burden among fishermen is on an increasing trend compared to the general population, they require a multifaceted approach that addresses the unique lifestyle, environmental and occupational challenges they face.

Keywords: Epidemiology, Non communicable disease, Occupational health, Waist: hip circumference

INTRODUCTION

Fishermen are more likely to suffer from a variety of health issues, particularly Non Communicable Diseases (NCD), due to their irregular dietary patterns, tobacco use, smoking and alcohol consumption. This leads to the development of chronic diseases such as diabetes, hypertension and obesity [1]. The amount of fat in the abdomen is referred to as abdominal obesity, central obesity, or visceral obesity. It has been demonstrated that this fluctuates within a limited range of BMI and total body fat [2]. According to the National Family Health Survey 5 (NFHS-5) data, 12% of males nationwide suffer from abdominal obesity. In addition to increasing in rural regions, abdominal obesity is also spreading throughout the lower and medium socio-economic strata of society [3]. Fishing involves challenging physical conditions, seclusion and less than optimal personal habits. It continues to be a hazardous and unpleasant activity despite the lengthy hours that fishermen work and this is exacerbated by the demanding and stressful nature of their jobs. Fishermen's general health is negatively impacted by their illiteracy and lower socio-economic status [4].

The burden of NCDs worldwide remains too high. Every year, 41 million deaths are attributed to NCDs. Of these deaths, 17 million occur before the age of 30 to 70 years. The burden is highest in low- and middle-income nations, where 80% of premature deaths and 77% of all NCD fatalities occur. According to the 2016 Tamil Nadu Marine Fisheries Census, there are 45 fishing villages in Chennai, with 63,896 fishermen living there [5]. The fishing community is one of the most susceptible occupational groups, possessing unique folk cultural characteristics. Fishermen are more likely than the general population to acquire hypertension due to their altered sleeping patterns and high salt intake [6]. According to the World Health Organisation (WHO), hypertension is defined as having a systolic blood pressure of 140 mmHg or higher and a diastolic blood pressure of 90 mmHg or higher [7]. Both hypertension and abdominal obesity are significant risk factors for the onset of cardiovascular diseases. The relationship between abdominal obesity and hypertension is complex and there is a substantial correlation between obesity and the development of hypertension in conjunction with other disorders. The primary risk factor for hypertension is BMI, which increases as BMI increases [8]. The northern states of Punjab (62.5%) and Delhi (59%), as well as the southern states of Kerala (65.4%) and Tamil Nadu (57.9%), have high rates of abdominal obesity [9].

There is a lack of research on the prevalence of hypertension, abdominal obesity and related conditions within the fishing community in India, particularly in Tamil Nadu, India [10]. This gap underscores the need for the present study. The objectives of the study were to estimate the prevalence of hypertension and abdominal obesity among the fishermen population, assess the association between abdominal obesity and hypertension and determine the factors associated with hypertension. This study is part of a larger research project titled "To Estimate the Prevalence and Determinants of Selected NCDs among Fishermen in Chennai District".

MATERIALS AND METHODS

A community-based cross-sectional study was conducted among fishermen in Chennai district from September 2024 to November 2024. The study took place in coastal fishing villages located within the Tondiarpet and Mylapore zones of Chennai. Ethical approval was obtained from the Institutional Ethics Committee and the study was conducted under IEC No: SRMIEC-ST0723-556.

Inclusion criteria: Male participants aged 18 years and above, as it specifically aimed to assess fishermen who actively venture into the sea were included in the study.

Exclusion criteria: Individuals who excluded if they refused to participate or provide informed consent, or if they were unavailable after three consecutive household visits were excluded from the study.

Sample size: The sample size was calculated based on the average prevalence of key risk factors reported among the fishing community in Kancheepuram district by Annadurai K et al., which included hypertension (39.05%), abdominal obesity (13.3%) and alcohol use (61.4%) [11]. The average of these three prevalences was calculated to be 37.91%, which was used for sample size estimation. Considering a precision (d) of 7.58% and a 99% confidence level, the estimated sample size was n=273. To account for a possible 10% non response rate, the final sample size was rounded to n=300.

A multistage random sampling method was employed. In the first stage, seven fisherman villages were selected from a total of 45 villages in the two zones (Tondiarpet and Mylapore) of Chennai district using simple random sampling (lottery method). In the second stage, the number of participants to be selected from each village was determined using Probability Proportionate to Size (PPS) based on the population of each village. In the third stage, systematic random sampling was applied to select every ninth household. If a selected household did not meet the inclusion criteria, the next adjacent household was included.

Data were collected using a pretested and validated modified WHO STEPwise approach to surveillance (STEPS) questionnaire [12], which included sections on personal and socio-demographic information, smoking and alcohol use, dietary patterns and physical activity. Socio-economic status was assessed using the Modified BG Prasad classification [13]. Anthropometric measurements were taken for all participants. Height was measured using a portable stature meter, which achieves a precision of 0.1 cm when the individual is standing barefoot. Weight was determined to the nearest 100 grams using an electronic weighing scale. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2) and classified according to WHO guidelines [14]. Waist circumference was measured at the midpoint between the anterior superior iliac spine and the lowest rib, with values rounded to the nearest 0.1 cm. Hip circumference was measured at the maximum posterior extension of the gluteal region, also rounded to the nearest 0.1 cm. The Waist-Hip Ratio (WHR) was calculated. Abdominal obesity was defined as a waist-hip ratio above 0.90 for males, as per WHO guidelines [15].

After resting for at least 10 minutes while seated, blood pressure was recorded in the left arm with a correctly sized cuff. To ascertain blood pressure status, three readings were collected three minutes apart and recorded using an electronic instrument (OMRON, HEM 7156T, Omron Corporation, Kyoto, JAPAN). The three values were then averaged. Blood pressure is the force exerted by circulating blood against the walls of the body's major blood vessels. Elevated blood pressure is considered hypertension. The WHO defines hypertension as systolic blood pressure equal to or above 140 mmHg and/or diastolic blood pressure equal to or above 90 mmHg. Known hypertensives and those under treatment were also included, as the questionnaire captured history, duration and treatment details of hypertension [16]. A total daily consumption of 400 grams of fruits and vegetables was considered indicative of a healthy diet in this study [17].

Physical activity was defined as any bodily movement produced by skeletal muscles that require energy expenditure. This includes a range of activities performed during work, household chores, travel and recreational pursuits such as walking, gardening, or engaging in sports. Participants were considered physically active if they engaged in at least 150 minutes of moderate-intensity aerobic activity or 75 to 150 minutes of vigorous-intensity aerobic activity per week; those not meeting these criteria were considered physically inactive [17].

STATISTICAL ANALYSIS

Data collected were entered into Microsoft Excel 365 and analysed using Statistical Package for the Social Sciences (SPSS) version 26.0. The analysis included calculating proportions and performing Chi-square tests to assess associations between categorical variables. Binary logistic regression was used to further examine the univariate analysis in order to identify significant predictors while accounting for potential confounders. The p-value <0.05 was considered statistically significant.

RESULTS

In this study, the data shows that among the 310 respondents, the majority were over 45 years old, making up 188 (60.6%), while those aged 18 to 44 years accounted for 122 (39.4%). Most participants were married, representing 273 (88.1%). In terms of education, a significant number had completed primary school, which constituted 109 (35.2%), while only 21 (6.8%) were graduates. The family structure revealed that 167 (53.9%) lived in nuclear families. Most respondents identified as Hindu, accounting for 276 (89.%), with a small portion following other religions. In terms of socio-economic class, the largest group fell under Class IV, representing 122 (39.4%). Looking at health indicators, nearly half were overweight and a large number of participants admitted to smoking or consuming alcohol. Additionally, 223 (71.9%) reported having an unhealthy diet, highlighting important areas for health improvement in the community [Table/Fig-1].

Variables		n (%)
Age (years)	18-44	122 (39.4)
	>45	188 (60.6)
Marital status	Married	273 (88.1)
	Unmarried	28 (9)
	Divorced/Separated	4 (1.3)
	Widow	5 (1.6)
Education	Graduate	21 (6.8)
	Higher secondary	47 (15.2)
	Secondary	44 (14.2)
	Middle school	35 (11.3)
	Primary school	109 (35.2)
	Illiterate	54 (17.4)
Type of family	Nuclear	167 (53.9)
	Joint family	100 (32.4)
	Single	40 (12.9)
	Three generational	3 (1)
Religion	Hindu	276 (89)
	Muslim	3 (1)
	Christian	31 (10)

Socio Economic Scale*	I (Upper)	27 (8.7)
	II (Upper Middle)	58 (18.7)
	III (Middle)	90 (29)
	IV (Lower Middle)	122 (39.4)
	V (Lower)	13 (4.2)
Body Mass Index (BMI) (Kg/m^2)	Underweight <18.5	15 (4.8)
	Normal18.5 – 22.9	82 (26.5)
	Overweight 23 – 24.9	65 (21)
	Obese >25	148 (47.7)
Smoking	Yes	124 (40)
	No	186 (60)
Alcohol intake	Yes	276 (89)
	No	34 (11)
Physical activity	Yes	159 (51.3)
	No	151 (48.7)
Diet	Healthy	87 (28.1)
	Unhealthy	223 (71.9)

[Table/Fig-1]: Socio-demographic profiles and known risk factors among the study participants (n=310).
*Modified BG Prasad Scale 2024 is used to calculate socio-economic status of the study participants

Out of 310 participants, 151 (48.7%) were found to have high blood pressure. The remaining 159 individuals (51.3%) were not hypertensive [Table/Fig-2]. Of the total, 51.3% of individuals were recently diagnosed with hypertension and a significant number, 60.9%, had had hypertension for one to five years, suggesting that many people are managing this condition for a relatively short time, while 7.3% have had it for over 10 years. This information highlights the importance of early detection and the need for ongoing care to help those with high blood pressure lead healthier lives [Table/Fig-3].

Study population	n (%)
Hypertensive	151 (48.7)
Non hypertensive	159 (51.3)
W:H ratio high	200 (64.5)
W:H ratio normal	110 (35.5)

[Table/Fig-2]: Distribution of hypertension and abdominal obesity among the study population (n=310).

Duration of hypertension	n (%)
Newly diagnosed hypertension	42 (51.3)
1-5 years	92 (60.9)
5-10 years	6 (4)
>10 years	11 (7.3)

[Table/Fig-3]: Duration of hypertension among the study population (n=151).

Among participants with hypertensive, 50 individuals (16%) had a normal WHR, while 60 individuals (19.4%) were non hypertensive. In the hypertensive group, there were 101 individuals (32.7%) with a high WHR, compared to 99 individuals (31.9%) in the non hypertensive group. The statistical analysis showed a p-value of 0.395, indicating that these differences were not statistically significant [Table/Fig-4].

Waist-hip ratio	Hypertensive	Non hypertensive	χ^2	p-value
Normal	50 (16%)	60 (19.4%)	0.723	0.395
High	101(32.7%)	99 (31.9%)		

[Table/Fig-4]: Association of abdominal obesity with hypertension among the study population (n=310).
*p-value < 0.05 is considered statistically significant

A significant association was observed between age and hypertension, as well as education and hypertension (p-value<0.05) [Table/Fig-5,6]. Younger adults aged 19 to 44 years had lower odds of developing hypertension compared to those over the age of 45, reflecting the impact of age on health issues. Educated individuals showed a significantly reduced risk of hypertension, highlighting the importance of awareness and knowledge about health. Literate individuals were less likely to have hypertension compared to illiterate individuals, who had 2.417 times greater odds of developing hypertension (p-value=0.007) [Table/Fig-6].

Out of those surveyed, 62 (20%) believed it was very important to reduce salt intake, while 128 (41.3%) felt that lowering salt was not important at all and 11 (3.5%) had no opinion on the matter [Table/Fig-7]. These results highlight a growing awareness of the health risks associated with high salt consumption, such as high blood pressure and heart diseases.

DISCUSSION

The present study found a high prevalence of hypertension (48.7%) among the fishing population, underscoring the urgent need for regular screening and lifestyle interventions. The finding that being over 45-year-old and illiteracy were significantly associated with hypertension aligns with existing evidence that ageing and lack of awareness contribute to chronic disease risk. This corresponds with the study by Manimaran S et al., who also reported that 54% of their study population were over 40 years old, highlighting a trend where middle-aged individuals in fishing communities are at greater risk for NCDs due to cumulative lifestyle exposures [18].

In this study population, most individuals were married, accounting for a total of 273 fishermen (88.1%), which was similar to the 89.5% in a study by Annadurai K et al., and also aligns with a study by Balasundaram AK et al., where 96.5% of fishermen were married [11,19]. The similar age distribution could indicate that the fishing community predominantly consists of middle-aged individuals, potentially due to the physical demands of the profession, which might make it less common for younger or older individuals to be involved in active fishing. Likewise, the high percentage of married individuals could reflect social and cultural norms in these communities, where family structures may play a central role in the livelihoods of fishermen.

Most fishermen had basic education and only 54 (17.4%) of them were illiterate, which was comparable to a study by Kumar AM et al., where 17.8% were illiterate [20]. This similarity suggests that the level of education among fishermen in these communities might be comparable, despite geographic or cultural differences. The relatively low percentage of illiteracy in both studies could reflect broader trends in educational accessibility, with increased efforts over time to provide basic education in rural or fishing communities.

In a study by Bhondve A, alcohol and tobacco consumption was noted in 63.4% and 73.4% of fishermen, respectively, which was very similar to present study results, where 276 individuals, around 89%, consume alcohol and 124 individuals, or 40%, were smokers [21]. Although the alcohol consumption rate in this study was notably higher, both studies reveal a significant prevalence of substance use within the fishing community, indicating that alcohol and tobacco consumption may be common coping mechanisms or lifestyle habits among fishermen. The higher percentage of alcohol consumption in present study could reflect regional or socio-cultural factors that influence drinking behaviour more prominently in this sample.

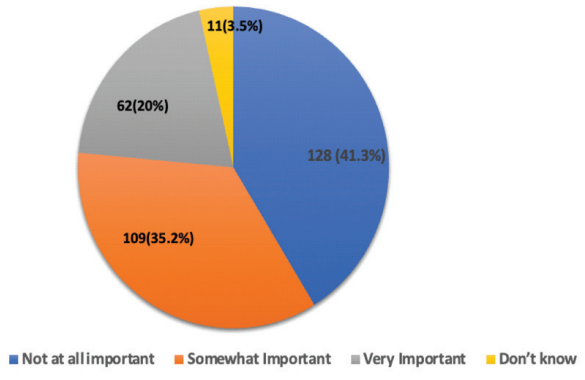
The fishermen population showed a prevalence of 46.6% for hypertension in a study by Muthukrishnan G which was similar to present study, where the prevalence of hypertension is 48.7%. However, this prevalence was higher when compared to a study by Kumar D et al., where it is only 28% [10,22]. The difference in

Variables		Hypertensive (%)	Non-hypertensive (%)	Total (310)	Odds ratio (Confidence Interval)	p-value
Age	18-44 years	47 (31.1)	75 (47.2)	122	1 1.975 (1.241-3.143)	0.004*
	>45 years	104 (68.9)	84 (52.8)	188		
Marital status	Married	136 (90)	137 (86.2)	273	1 1.456 (0.724-2.925)	0.289
	Others	15 (10)	22 (13.8)	37		
Education	Literate	115 (76.2)	141 (88.6)	256	1 2.614 (1.396-4.895)	0.002*
	Illiterate	36 (23.8)	18 (11.4)	54		
Religion	Hindu	132 (87.4)	144 (90.6)	276	1.381(0.674-2.830) 1	0.375
	Others	19 (12.6)	15 (9.4)	34		
Socio-economic scale	Class IV	63 (41.7)	59 (37.1)	122	1 1.213 (0.768-1.914)	0.406
	Others	88 (58.3)	100 (62.9)	188		
Body Mass Index (BMI)	<24.9	75 (49.7)	87 (54.7%)	162	1 1.224 (0.783-1.913)	0.374
	>25	76 (50.3)	72 (45.3)	148		
Type of family	Nuclear	84 (55.6)	83 (52.2)	167	1.148 (0.734-1.795) 1	0.545
	Others	67 (44.4)	76 (47.8)	143		
Alcohol	Alcoholic	133 (88)	143 (89.9)	276	0.826 (0.405-1.687) 1	0.601
	Non-alcoholic	18 (12)	16 (10.1)	34		
Smoking	Smoker	63 (41.7)	61 (38.4)	124	1.1501 (0.729-1.812) 1	0.546
	Non smoker	88 (58.3)	98 (61.6)	186		
Physical activity	Physically inactive	70 (46.4)	81 (50.9)	151	0.0832 (0.532-1.300) 1	0.419
	Physically active	81 (53.6)	78 (49.1)	159		
Diet	Healthy diet	42 (27.8)	45 (28.3)	87	1 1.024 (0.624-1.681)	0.924
	Unhealthy diet	109 (72.2)	114 (71.7)	223		

[Table/Fig-5]: Uni-variate regression analysis of socio- demographic factors and risk factors with hypertension (n=310)
*p-value < 0.05 is considered statistically significant.

Variable	Adjusted Odd's Ratio	95% CI		p-value
		Lower	Upper	
Education	2.417	1.267	4.612	0.007*
Age	1.812	1.112	2.952	0.017*

[Table/Fig-6]: Multi-variate regression analysis of socio- demographic factors with hypertension.
*p-value < 0.05 is considered statistically significant.



[Table/Fig-7]: Depicting knowledge regarding the importance of lowering salt intake.

prevalence could be attributed to several factors, such as regional differences in lifestyle, diet, or healthcare access, which can significantly impact the rates of hypertension.

In the study by Ramamoorthy K et al., the prevalence of abdominal obesity was 49.6% [23]. In contrast, present study reported a higher prevalence, with 200 (64.5%) fishermen classified as having abdominal obesity. A study by Rahaman SK et al., reported that 32.85% were overweight with a BMI of 23-24.9 kg/m^2, which was lower compared to present study, where only 21% were overweight and 43.09% were obese with a BMI of 25 kg/m^2 or higher; this finding was similar to present study, where 47.7% are classified as obese [24]. The discrepancy in the prevalence of overweight individuals could be attributed to regional differences in dietary habits, physical activity levels, or socio-economic factors that influence weight.

In this study, the WHR was found to be high in 64.5%, which aligns with the findings in a study by Seenivasan P et al., where the WHR was high in 66.67% of participants [25]. This could be due to several shared factors that affect the health and lifestyle of fishermen, such as improper dietary patterns, disturbed sleep and occupational stress.

Furthermore, this study showed a significant association between age over 45 years and illiteracy in developing hypertension. This finding was consistent with a study by Doddamani A et al., which also demonstrated an association with advancing age, difficulties in contacting family while at sea, poor dietary practices, substance use and increasing waist circumference in relation to the development of NCDs [26].

Limitation(s)

Seven fishermen's settlements were covered out of a total of 45. Therefore, the findings may not be fully representative of the entire fishing community. A single interviewer used a standardised interview guide to conduct all of the interviews and interviewer bias was negligible. However, factors such as stress, sleep patterns and genetic predisposition, which can significantly influence hypertension and obesity, were not addressed.

CONCLUSION(S)

The prevalence of hypertension and abdominal obesity was higher in the study population. A significant association was observed between age and hypertension, as well as between education and hypertension. Regular health check-ups should be implemented through community health screening programmes, allowing

fishermen to routinely check for signs of hypertension and monitor abdominal obesity (e.g., waist circumference measurements). Providing low-sodium alternatives would involve offering alternatives to high-sodium fish preservation methods, such as promoting the use of refrigeration or drying, which are healthier options than salting. Educating fishermen about the impact of excessive salt consumption on blood pressure could encourage them to adopt these alternatives.

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PARTICULARS OF CONTRIBUTORS:

1. Postgraduate, Department of Community Medicine, SRM Medical College Hospital and Research Centre, SRMIST, Kattankulathur, Chengalpattu, Tamil Nadu, India.
2. Postgraduate, Department of Community Medicine, SRM Medical College Hospital and Research Centre, SRMIST, Kattankulathur, Chengalpattu, Tamil Nadu, India.
3. Assistant Professor, Department of Community Medicine, Arunai Medical College and Hospital, Tiruvannamalai, Tamil Nadu, India.
4. Professor, Department of Community Medicine, SRM Medical College Hospital and Research Centre, SRMIST, Kattankulathur, Chengalpattu, Tamil Nadu, India.
5 Postgraduate, Department of Community Medicine, SRM Medical College Hospital and Research Centre, SRMIST, Kattankulathur, Chengalpattu, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. K Narmatha,
Department of Community Medicine, SRM Medical College Hospital and Research Centre, Potheri, Chengalpattu-603203, Tamil Nadu, India.
E-mail: nk1674@srmist.edu.in

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