Original Article

DOI: 10.7860/JCDR/2023/60515.17444

Community Section

Exposing the Iceberg: A Study on Risk Assessment and Chronic Morbidity due to Non Communicable Diseases among Rural Population of Kerala using STEPS Survey

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ABSTRACT

Introduction: Non Communicable Diseases (NCDs) (heart diseases, chronic respiratory disease, stroke, diabetes, cancer) pose a significant public health burden especially in low and middle income countries. The increasing prevalence of NCDs will have significant implications in socio-economic and health sector and hence, needs immediate attention.

Aim: To see the prevalence of NCDs and its risk factors among residents in a rural population of Pathanamthitta district.

Materials and Methods: This cross-sectional survey was conducted among 2236 adults of both gender residing in Konni Block, Pathanamthitta over a period of six months using the World Health Organisation STEPwise approach to surveillance (WHO STEPS) survey, the Achutha Menon Centre Diabetes Risk Score (AMCDRS) and risk score to predict hypertension in primary care settings. Variables were expressed using proportions with 95% Confidence Intervals (CI). Chi-square test was used for comparison of proportions across groups. Logistic regression analysis were used to determine the predictors of morbid conditions.

Results: Total of 2236 study participants consisted of 53.8% females and 46.2% males with the mean age 47±17.5 years was included. Among them, 683 (30.7%) suffered from one or more morbidity. Around 18.1% and 19.9% of study participants suffered from diabetes and hypertension, respectively. More than 25% of the study population was at risk of developing hypertension and diabetes. Substance abuse, obesity and family history of diabetes were found to be risk factors for the development of morbidity.

Conclusion: The present study provides evidence of the growing burden of morbidity from NCDs. Increasing prevalence of multimorbidity and clustering of risk factors demand urgent and co-ordinated attention.

Keywords: Diabetes risk score, Morbidity, Risk factors, Risk score to predict hypertension, STEPwise approach

INTRODUCTION

The NCDs pose a significant public health burden especially in low and middle income countries. The increasing prevalence of NCDs will have significant implications in socio-economic and health sector and hence needs immediate attention. As per the World Health Organisation (WHO), NCDs contribute towards 71% of the total number of deaths each year. Among the NCDs, cardiovascular diseases are responsible for the highest number of deaths (17.9 million deaths annually), followed by cancers (9.0 million), respiratory diseases (3.9 million), and diabetes (1.6 million) [1]. Because NCDs are largely preventable, these deaths can be significantly reduced. According to the Global Monitoring Framework for NCDs to prevent and control NCDs by 2025 adopted by the World health assembly, primary prevention is the key to control the global epidemic of NCDs [2].

The WHO initiated the STEPwise approach to NCD risk factor surveillance (STEPS) in 2002 to guide the establishment of risk-factor surveillance systems in countries by providing a framework. The methodology of the approach consists of three steps namely questionnaire, physical measurements, and biochemical measurements. Each of the steps is divided into core items, core variables, and optional modules. These modules mostly cover demographics, health data and health related behaviour. Surveys are conducted under the approach to assess the burden of socio-economic, metabolic, nutritional and lifestyle risk factors [3,4].

In a resource constraint setting like that of India, regular blood investigations may not be always feasible. Here lies the importance of cheaper screening tools to identify individuals at risk of contracting diabetes. The AMCDRS, is a risk score used in screening for Diabetes [5,6]. The AMCDRS consists of three variables- age, family history of diabetes, and waist circumference. Another example of a low cost screening tool is a risk score to predict hypertension in rural India. It is simple and can be easily administered by healthcare workers in primary healthcare settings [7]. The score evaluates an individual's risk of developing hypertension in future so that primary and secondary preventive measures like adoption of healthy lifestyle, quitting smoking, reducing waist circumference and regular blood pressure monitoring can be applied for the prevention/early diagnosis of hypertension.

According to the India state-level disease burden initiative, over 90% of mortality in the 15-69 years age group in Kerala could be attributed to NCDs. The higher proportion of population above the age of 65 years and lifestyle changes could have led to the present increase in NCDs. Compared to other states in India, Kerala is in an advanced stage of epidemiological transition [8]. The increasing proportion of elders (12.6%) and the adoption of sedentary lifestyles in Kerala might have contributed to the increase in NCDs [9]. Assessment of the burden of morbidity and risk factors could be useful in planning and allocation of health resources to ensure prevention and management of NCDs. The present study was done to evaluate the burden of morbidity due to NCDs among the adult population of Konni Block, Pathanamthitta and the prevalence of risk factors for the same.

MATERIALS AND METHODS

This cross-sectional survey was conducted by the Department of Community Medicine, Believers Church Medical College Hospital,

Thiruvalla, Kerala, India among 2236 permanent resident adults of Konni Block of Pathanamthitta district from January 2021 to December 2021. Ethical Clearance was obtained from the Institutional Ethics Committee (IEC/2020/02/121) along with consent. Sample size for the study was estimated using the formula:

$$N=(1.96)^2 pq/L^2$$

using the prevalence (19.2%) from a similar study [10].

Data was collected using the following instruments:

1. A short demographic questionnaire about age, gender, education, occupation of study participants.
2. A structured interview schedule based on the Malayalam version of WHO STEPS questionnaire was used to collect Socio-demographic details of the study population data regarding the use of tobacco, alcohol, vegetable and fruit intake and physical activity was also elicited [3]. Anthropometric measurements taken were height, weight, waist circumference. Blood pressure was also measured using a Sphygmomanometer.
3. **The Achutha Menon Centre Diabetes Risk Score (AMCDRS)-** it is score used to screen for Diabetes. The score consists of eliciting information on the age and family history of the respondent along with measurement of waist circumference [6]. If the total score is ≥4, he/she is at a high-risk of having diabetes and needs further follow-up and management. If the score is <4, he/she is at low risk of contracting diabetes.
4. A risk score to predict hypertension in primary care settings in rural India. This is a risk score developed to screen for hypertension. It can be administered at the grass root level by primary healthcare workers [7].

The operational definitions used in the study are given in [Table/Fig-1]: [3,11-15].

Community surveys were done to collect data. Information on the use of tobacco, alcohol, fruit and vegetable intake, amount of physical activity, the pattern of chronic morbidity etc., was collected. Anthropometric data on height, weight, waist circumference, blood pressure etc., were recorded.

Term	Definition
Hypercholesterolaemia	Serum cholesterol levels >200 mg/dL [11].
Hypertriglyceridaemia	Serum triglyceride levels >150 mg/dL [11].
Dyslipidaemia	Either hypercholesterolaemia (>200 mg/dL) or hypertriglyceridaemia (>150 mg/dL) [11].
Diabetes	Those persons already diagnosed by a physician and on anti-diabetic medications and/or those whose fasting blood glucose >126 mg/dL [12].
Hypertension	Those persons already diagnosed by a physician and on anti-hypertensive medications and/or those whose systolic blood pressure >140 mmHg and/or diastolic blood pressure >90 mmHg- Joint National Committee 8 (JNC 8) Criteria [13].
Obesity	Body Mass Index (BMI) >25 kg/m^2 Abdominal obesity-waist >90 cm (males), >80 cm (females) using Asia-Pacific guidelines for south Asians [14].
Physical activity	Atleast 150-300 minutes of moderate-intensity aerobic physical activity per week; or atleast 75-150 minutes of vigorous-intensity aerobic physical activity per week; or an equivalent combination of moderate- and vigorous-intensity activity per week [15] was considered as adequate.
Adequate fruit and vegetable intake	Eat atleast 1 cup/1 serve per day of fruit (chopped or cooked fruit/1 medium size piece) and 2 cups per day of vegetables [3].

[Table/Fig-1]: Operational definitions used in the study [3,11-15].

STATISTICAL ANALYSIS

Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS) version 20.0. Variables were expressed using proportions with 95% CIs. Chi-square test was used for comparison of proportions across groups. Binary logistic regression analysis was done to determine the predictors of morbidity. A 95% CI and a 5% level of significance were used to interpret statistical significance. A p-value <0.05 was considered to be significant.

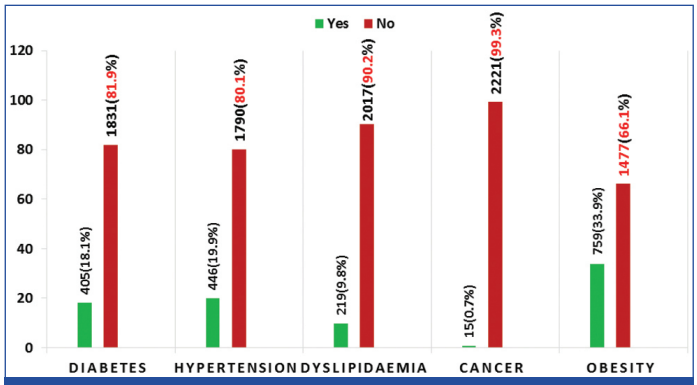
RESULTS

Socio-demographic data: The study sample consisted of 2400 participants. Out of the data collected, 164 responses were discarded due to data quality issues leaving a sample size of 2236 study participants. Mean age of the study participants was 47±17.5 years. The study participants consisted of 53.8% females and 46.2% males. The socio-demographic data of the study participants is given in [Table/Fig-2].

S. No.	Variables	n (%)
1.	**Gender**	
	Male	1032 (46.2)
	Female	1204 (53.8)
2.	**Age group (in years)**	
	18-30	478 (21.4)
	31-45	591 (26.4)
	46-60	634 (28.4)
	Above 60	533 (23.8)
3.	**Type of family**	
	Nuclear	1519 (67.9)
	Joint	717 (32.1)
4.	**Socio-economic status (ration card)**	
	Above poverty line	1397 (62.5)
	Below poverty line	839 (37.5)
5.	**Educational status**	
	Illiterate	51 (2.3)
	<10th standard	963 (43.1)
	Upto 12th standard	427 (19.1)
	Diploma	152 (6.7)
	Graduate	482 (21.6)
	Postgraduate	161 (7.2)
6.	**Occupational status**	
	Student	223 (9.97)
	Housewife	570 (25.5)
	Manual labourer	382 (17.13)
	Self-employed	305 (13.6)
	Private job	346 (15.5)
	Government job	300 (13.4)
	Retired	110 (4.9)
7.	**Smoking**	
	Yes	126 (5.6)
	No	2110 (94.4)
8.	**Alcohol consumption**	
	Yes	198 (8.9)
	No	2038 (91.1)
9.	**Daily intake of fruits and vegetables**	
	Yes	2178 (97.4)
	No	58 (2.6)
10.	**Adequate physical activity**	
	Yes	292 (86.9)
	No	1944 (13.1)
11.	**Family history of diabetes**	
	Yes	457 (20.4)
	No	1779 (79.6)
12.	**Family history of hypertension**	
	Yes	456 (20.4)
	No	1780 (79.6)

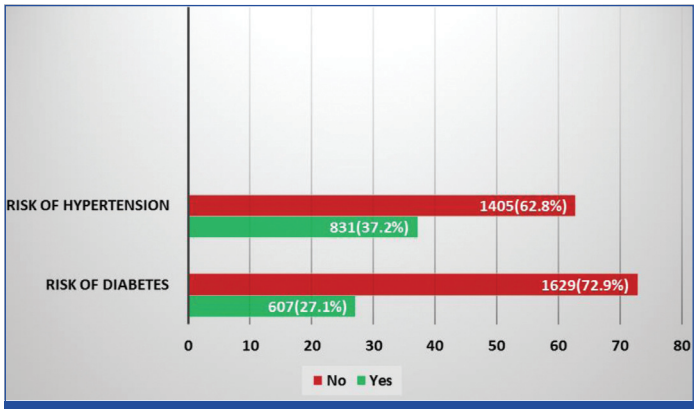
[Table/Fig-2]: Socio-demographic data of the study population (N=2236).

Morbidity pattern: A survey of the study participants to assess the morbidity pattern revealed that 686 out of 2236 study participants (30.7%) suffered from one or more morbidity. Approximately, 18% of study participants suffered from diabetes. The proportion of obesity among the study participants was 34%. The detailed morbidity pattern of the study population is depicted in [Table/Fig-3].



[Table/Fig-3]: The morbidity pattern of the study population.

Risk of diabetes and hypertension: The study participants were assessed using AMCDRS to assess the risk for diabetes. The study population was also surveyed using the risk score to predict hypertension [7]. The survey found that 27.1% (607) of the study population were at risk of developing hypertension and diabetes [Table/Fig-4].



[Table/Fig-4]: The risk of diabetes and hypertension among the study population.

Factors associated with morbidity among study population: Chi-square test was done to assess the association between the study variables and presence of morbidity among study population. Among the factors tested, family history of diabetes, hypertension and smoking were found to be significantly associated with morbidity. The results of Chi-square analysis are given in [Table/Fig-5].

S. No.	Study variables	Morbidity		Chi-square	p-value
		No	Yes		
1.	Male gender	730	302	1.8	0.2
2.	Nuclear family	1063	456	0.97	0.3
3.	Low socio-economic status	601	238	3.4	0.06
4.	Family history of diabetes	291	166	8.6	0.003
5.	Family history of hypertension	298	158	4.2	0.03
6.	Inadequate fruit and vegetable intake	40	18	0.46	0.7
7.	Inadequate physical activity	1357	587	1.6	0.2
8.	Smoking	97	29	3.7	0.05
9.	Alcohol consumption	132	66	0.7	0.3
10	Obesity	440	319	41.7	0.001

[Table/Fig-5]: Chi-square analysis of factors associated with morbidity.
A p-value <0.05 was considered to be significant

Binary logistic regression of the study data was done to find out the risk factors for morbidity among the study population. Analysis revealed that family history of diabetes, smoking and alcohol consumption were risk factors for morbidity among the study population [Table/Fig-6].

S. No.	Study variables	Unadjusted odds ratio	95% CI	Adjusted odds ratio	95% CI
1.	Male gender	1.132	0.945-1.356	1.206	0.988-1.471
2.	Nuclear family	1.101	0.909-1.333	1.099	0.906-1.332
6.	Low socio-economic status	0.839	0.695-1.012	0.850	0.704-1.028
4.	Family history of diabetes	1.381	1.113-1.715	1.316	1.030-1.683
5.	Family history of hypertension	1.257	1.011-1.564	1.133	0.884-1.451
6.	Inadequate fruit and vegetable intake	1.042	0.587-1.852	1.111	0.622-1.984
7.	Insufficient physical activity	1.186	0.913-1.539	1.188	0.905-1.559
8.	No tobacco use	0.661	0.432-1.011	0.606	0.381-0.963
9.	Alcohol consumption	1.144	0.839-1.559	1.418	1.001-2.010
10.	Obesity	1.847	1.532-2.228	1.841	1.526-2.220

[Table/Fig-6]: Case-control analysis of factors associated with morbidity.

DISCUSSION

The prevalence of diabetes among the study participants in the current study was 18.1%. According to the The Indian Council of Medical Research–India Diabetes (ICMR-INDIAB) study, the prevalence of diabetes in urban areas was nearly 25% and nearly 10% in rural areas [16]. Such high prevalence from a rural population in central Kerala is alarming. Another similar study found that only one-third of the diabetic patents were aware of their condition thereby, underscoring the need for screening camps [17]. The present study found family history of diabetes to be a strong predictor of morbidity. Previously published studies also found older age, family history of diabetes, obesity and hypertension to be positively related with Diabetes (p-value <0.001) [18,19]. Another factor, which was found to significantly increase the risk of morbidity is obesity. This finding is supported by other studies which found that individuals with abdominal obesity had two times higher risk of diabetes (OR 2.10; CI 1.63, 2.68). Studies showed that abdominal obesity had a higher increase than generalised obesity in all the populations and its association with diabetes was more significant [20,21].

The present study revealed that the prevalence of hypertension among 2236 study participants was 19.9%. Another similar study from rural India revealed a prevalence of hypertension to be 31.5% (95% CI: 27.1-35.9) [22]. Another reason for the increased risk of cardiovascular events among the Indian population is dyslipidaemia. The prevalence of dyslipidaemia among the study population was found to be 9.8%. The ICMR-INDIAB Study to assess the prevalence of dyslipidaemia in urban and rural India revealed that 13.9% had hypercholesterolaemia and 29.5% had hypertriglyceridemia [23]. A lower prevalence of dyslipidaemia in the present study could be due to the fact that the study population was a rural community following a healthy lifestyle. Approximately, 86% of the study participants were involved in regular physical activity and fruits and vegetables were a part of the daily diet among 97% of the study population. Previously published study findings involving 8 year follow-up data of healthy middle-aged men and women, were found to be associated with an increased risk of death from any cause (relative risk among men 3.4, 95% CI 2.0 to 5.8, and among women 4.7, 95% CI 2.2 to 9.8) [24].

Another important finding of the present study was that smoking and alcoholism increased the risk of developing morbidity. This finding is in line with the data from a similar study which found that compared to men who only smoked but did not drink, men who

smoked and drank more than 15 units a week had high all-cause mortality {relative rate=2.71 (95% CI 2.31-3.19)} [25]. Assessment of risk using AMCDRS and risk score to predict hypertension reported that 27.1% and 37.2% of study participants were at risk of developing diabetes and hypertension, respectively. Hence, primary prevention has become the need of the hour. Randomised Controlled Trials (RCTs) have tested array primary prevention strategies, including lifestyle modifications and pharmacotherapy for those at risk, which have proven efficacious [26]. Such risk assessment scales enable effective screening of individuals at the primary care level and ensure timely identification of 'at risk' individuals and appropriate follow-up and treatment.

Limitation(s)

Due to resource constraints, the quantification of risk factors could not be done (for example: number of cigarettes smoked). Social desirability bias may have underestimated the prevalence of behavioural risk factors in the study population.

CONCLUSION(S)

The present study provides evidence of the growing burden of morbidity from NCDs. Increasing prevalence of multimorbidity and clustering of risk factors demand urgent and co-ordinated attention. An integrated approach consisting of health promotion, risk reduction, regular screening programmes, and provision of effective care would be a sustainable and cost effective method to reduce the morbidity due to NCDs.

Acknowledgement

The authors express sincere thanks to the Institution for its support, to all teaching and non teaching staff of the Department of Community Medicine and Rural Health Centre who helped in the implementation of this project.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 04, 2022
- Manual Googling: Nov 25, 2022
- iThenticate Software: Dec 05, 2022 (25%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Sep 29, 2022**
Date of Peer Review: **Nov 08, 2022**
Date of Acceptance: **Dec 06, 2022**
Date of Publishing: **Feb 01, 2023**