

# Association of Dietary and Physical Activity Patterns and Hypertension in Western Rajasthan, 2022

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## Abstract

**Introduction:** Hypertension (HTN) is a modifiable risk factor for coronary artery disease, heart failure, cerebrovascular disease and chronic renal failure. HTN affects about 1 billion people globally; by 2025, up to 1.58 billion adults worldwide are likely to suffer from complications of HTN. This study was done to know the diet and physical activity patterns and HTN among the population of three districts of Western Rajasthan.

**Objectives:** To study the dietary and physical activity patterns among the population of Western Rajasthan. and to compare key findings among three districts Pali, Jodhpur and Barmer so that lifestyle changes can be recommended.

**Methods:** A case-control study was done among attendees of NCD clinics of tertiary-level centers in Pali, Barmer and Jodhpur. Hospital controls were matched to age ( $\pm 5$  years) and gender considering the prevalence of HTN to be 20%\*, the proportion of exposure in the general population as 0.2, odds ratio to be 2.2, power =80%, alpha=5% sample size is estimated to be 102 cases & 102 controls (from each district).

**Results:** Overall 'being married' (OR= 3.3), having diabetes/Cardiac disease(OR= 2.6), excessive salt consumption (OR= 2.7), moderate physical exercise less than 30 minutes (OR=1.9), using oil other than vegetable oil(OR=1.8) , Age >60 years (OR =1.4) were the key risk factors. It was found that high BMI (BMI>27), consumption of non-vegetable oils (12.7%) was highest in Jodhpur, lack of moderate exercise for at least 30 minutes (81%), lack of sports activity (92%) was highest in Pali, least number of days/week of fruits and vegetables consumption (~1.64 days) was seen in Barmer.

**Conclusions:** Change in quantity of salt consumption and incorporation of moderate physical exercise for >30 minutes was most followed in control of HTN among the attendees of NCD Clinics from the multiple advise given.

**Keywords:** Humans, Adult, Child, Preschool, Middle Aged, Vegetables, Prevalence, Odds Ratio, Coronary Artery Disease, Fruit, Case-Control Studies, Plant Oils, Sample Size, Body Mass Index, Noncommunicable Diseases, Hypertension, Life Style,

## INTRODUCTION

Hypertension (HTN) is one of the most common cardiovascular diseases and an important worldwide cause of morbidity and mortality. HTN is a modifiable and major risk factor for coronary artery disease, heart failure, cerebrovascular disease

and chronic renal failure.<sup>[1-3]</sup> HTN affects about 1 billion people worldwide and it is estimated that by 2025, up to 1.58 billion

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adults worldwide will suffer from complications of HTN.<sup>[5]</sup> The high prevalence of HTN makes it a significant factor for mortality and morbidity. Adequate management of HTN can effectively reduce the risks of stroke, myocardial infarction, chronic kidney disease and heart failure. HTN is a major public health problem in India. HTN accounts for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India.<sup>[2]</sup>

The prevalence of HTN varies widely across countries. A recent systematic review estimated that the overall worldwide prevalence of HTN is approximately 26% in the adult population

Previous studies have shown that the prevalence of HTN among urban and rural populations in Rajasthan was 32.7 and 18.4%, respectively.<sup>[3]</sup> People with HTN possess two fold higher risk of developing coronary artery disease, four times higher risk of congestive heart failure and seven times higher risk of cerebrovascular disease compared to normotensive people. As it is well known that dietary factors influence HTN it is important to study the association of the dietary patterns of urban and rural population of Western Rajasthan and HTN.<sup>[4]</sup> This study aimed to study the dietary and physical activity patterns among diagnosed hypertensives.

There are no previous studies done in Western Rajasthan on the underlying dietary and physical activity patterns among newly diagnosed hypertensives.<sup>[5]</sup> Prevalence of HTN is, however, high in this area and diets are high in saturated fats. It is important to generate base line information on these patterns to initiate any intervention study to bring about a behavioral change in lifestyle among hypertensives in a selected area over time.

## OBJECTIVES

1. To study the dietary and physical activity patterns among the population of Western Rajasthan.
2. To compare key findings among three districts Pali, Jodhpur and Barmer and recommend changes to health authorities and stakeholders

## METHODS

**Study design:** Case-control study.

**Study area:** We conducted this study among diagnosed hypertensives in NCD clinic of district hospitals Pali, Barmer and Jodhpur. Controls were taken from among OPD patients matched to age ( $\pm$  5 years) and gender.

**Study Period:** 8 months

**Sample size:** Considering the prevalence of HTN to be 20%(5), the proportion of exposure in general population as 0.2, odds ratio to be 2.2, power=80%, alpha=5% sample size came to be 102 cases & 102 controls from each of the three districts.

**Inclusion criteria:** Cases-Participants above 30 years of age attending NCD clinic and diagnosed within last one month who gave their consent

**Table 1:** Demographic characteristics of participants

Variables	Total(n=600)	Hypertensive	
		Yes(n <sub>1</sub> =300)	No(n <sub>2</sub> =300)
Age(years)	48.63 $\pm$ 16.24	49.78 $\pm$ 15.47	47.48 $\pm$ 16.92
Gender(Male)	357(59.5%)	177(59.0%)	180(60.0%)
Rural	258(43%)	59(19.67%)	199(66.33%)
Occupation			
Sedentary	408(68%)	216(72.0%)	192(64.0%)
Moderate activity	156(26%)	80(26.7%)	76(25.3%)
Heavy Activity	36(6%)	4(1.3%)	32(10.7%)
Income			
Low SES	60(10%)	6(2.0%)	54(18.0%)
Middle SES	396(66%)	211(70.3%)	185(61.7%)
High SES	144(24%)	83(26.7%)	61(20.3%)
Diet type (Non veg)	72(12.0%)	44(14.7%)	28(9.3%)
Milk consumption	426(71%)	238(79.3%)	188(62.7%)

**Controls:** Participants above 30 years of age attending Medicine OPD matched to age and gender who gave their consent

**Exclusion criteria:** We excluded NCD clinic attendees who refused consent.

**Data collection tool:** A pre-validated and pre-tested semi-structured questionnaire was used for data collection by trained volunteers. The original questionnaire was translated to Hindi and back-translated to English.

**Data analysis:** Data collected from participants during the stipulated period was analyzed using MS excel and SPSS 22 version software in terms of proportions, percentages and appropriate tests of significance will be used for comparisons. Also logistic regression was further applied to analyze the risk factors.

**Ethical considerations:** Ethical clearance was taken from the Institutional Ethics Committee of GMC Pali. We gave each study participant a written informed consent before administering the questionnaire.

## RESULTS

Among the hypertensives, Age >60 years, being married, having a co-morbidity like Diabetes and Cardio vascular disease and exercising <30 minutes /day were statistically significant risk factors among the cases (Table 1).

Overall 'being married' (OR= 3.3), having diabetes/ Cardiac disease (OR= 2.6), excessive salt consumption (OR= 2.7), moderate physical exercise less than 30 minutes (OR=1.9), using oil other than vegetable oil (OR=1.8), Age >60 years (OR =1.4) were the key risk factors. It was found that high BMI (BMI>27), consumption of non-vegetable oils (12.7%) was highest in Jodhpur, lack of moderate exercise for at least 30 minutes (81%), lack of sports activity (92%) was highest in Pali, least number of days/week of fruits and vegetables consumption (~1.64 days) was seen in Barmer (Table 2-4).

**Table 2:** Comparison of dietary patterns between three districts of Western Rajasthan

Variables	Total(n=600)	District			p-value
		Pali(n <sub>1</sub> =200)	Jodhpur(n <sub>2</sub> =200)	Barmer (n <sub>3</sub> =200)	
Dietary patterns					
Age(years)	48.63 ± 16.24	59.4 ± 13.43	48.42 ± 12.31	38.07 ± 15.27	0.000
Eating Fruit(No. of Days)	2.32 ± 1.9	3.03 ± 2.32	3.33 ± 1.82	1.64 ± 1.48	0.000
Eating vegetables (No. of days per week )	5.07 ± 1.19	4.85 ± 1.35	5.00 ± 1.54	5.15 ± 0.97	0.342
Eating roti (Jowar and bajra )	71(11.8%)	10(5.0%)	57(28.5%)	4(2.0%)	0.000
Eating rice	65(10.8%)	11(5.5%)	49(24.5%)	5(2.5%)	0.000
Excessive salt intake	214(35.7%)	32(16%)	140(70%)	42(21%)	0.000
Oil other than Veg Oil	38(6.3%)	7(3.5%)	24(12.0%)	7(3.5%)	0.000
Eating out (No. of Days)	0.55 ± 1.27	0.125 ± 0.59	0.29 ± 0.86	1.24 ± 1.74	0.000
h/o Diabetes	92(15.3%)	28(14.0%)	28(14.0%)	36(18.0%)	0.440
h/o CVS disease	62(10.3%)	8(4.0%)	29(14.5%)	25(12.5%)	0.001
Average BMI	24.57 ± 3.99	24.13 ± 3.4	27.67 ± 3.03	21.9 ± 3.19	0.000

The most common advise given was to decrease salt in diet and to adhere to the medication prescribed and the least common advise given was regarding Yoga and use of herbal /alternate medications (Figure 1).

In this study, among the methods to decrease salt in diet, less than 10% advised on reading food labels to advise on packaged foods. The most common advise was reducing processed food consumption and avoiding extra salt while eating (Figure 2).

## DISCUSSION

HTN is responsible for 57% of stroke deaths and 24% of coronary heart disease deaths in India.<sup>[6]</sup> The current changing lifestyles are causing a steady increase in HTN in rural and urban India. The nature of genetic contribution and gene-environment interaction in accelerating the HTN epidemic in India.<sup>[7]</sup> Pooling of epidemiological studies shows that HTN is present in India's 25% urban and 10% rural subjects. Our study being a case-control study studied the dietary and physical activity patterns in the case versus controls.

In our study the average age for diagnosis of HTN at NCD clinics was 48.63 ± 16.24 years, more males were hypertensives, urban areas had higher proportions of visitors to NCD clinic and among hypertensives sedentary lifestyle and moderate income were in higher proportions. The mean age of HTN is higher compared to other studies.<sup>[7]</sup> Other studies of Rajasthan by Mangal *et al.* have also shown high prevalence of HTN among men than among women as in the present study.<sup>[8,9]</sup>

Being married has a higher odds (OR =3.3) of being associated with HTN in our study, very similar to a detailed NFHS -4 analysis of hypertensives (OR =1.8) by Manapurath *et al.* done in 2022<sup>[9]</sup>

Among the dietary patterns seen eating fruits was the least in Barmer followed by Pali and Jodhpur. Similarly eating vegetables was found to be least in Pali district. In the dietary approach to stop HTN (DASH diet), 4–5 servings of seasonal fruits and vegetables are recommended in Rajasthan. Due to non-availability of fresh fruits and vegetables, only desiccated versions of vegetables are taken like sangri, kair, kathchara, gwar beans, kumbhtiya are consumed throughout the year. In India, despite being the second-largest producer of fruits and vegetables, low intake of fruits and vegetables is highly prevalent across states ranging from 76% in Maharashtra to 99% in Tamil nadu. Lower levels of intake of fruits and vegetables observed in the study is also consistent with findings from other Indian studies like in Central India by Prem kumar *et al.*<sup>[6]</sup>

Our study found that some occupations (housewives, professionals, business, retired) have high risk of prevalence of HTN in both urban and rural areas. All these occupations have sedentary type of job and higher mental stress as a common factor which may a contributory factor in the development of HTN. In both urban and rural areas, the prevalence of HTN was low in people involved in the agricultural sector and labor because of high physical activity. Similar to our study, Bhalla and Tandon *et al.* at Lucknow and Ghosh *et al.* at Shimla found the prevalence of HTN to be more among professionals, executives and traders as compared to the low occupation such as semi-skilled and unskilled persons.<sup>[10]</sup>

Also for physical activity patterns it was seen that Pali showed the least number of participants indulging in physical activity for even less than 30 minutes. Although heavy sports activity was least in Jodhpur more participants reported being involved in walking, or cycling for at least 30 minutes

**Table 3:** Comparison of physical activity patterns between three districts of Western Rajasthan, 2022:

Variables	Total(n=600)	District			p-value
		Pali(n <sub>1</sub> =200)	Jodhpur(n <sub>2</sub> =200)	Barmer (n <sub>3</sub> =200)	
Per day (<30 Min) Walk/cycle	380(63.3%)	162(81.0%)	104(52.0%)	114(57.0%)	0.000
Per day (< 30 min) of moderate exercise	260(43.3%)	16(8.0%)	127(63.5%)	117(58.5%)	0.000
Per day (<30Min) of heavy physical exercise	152(25.3%)	10(5.0%)	87(43.5%)	55(27.5%)	0.000
At least 10min heavy physical exercise	175(29.2%)	10(5.0%)	102(51.0%)	63(31.5%)	0.000
Average No. of Days of heavy sports activity	3.26 ± 1.91	3.18 ± 2.14	2.83 ± 1.66	3.95 ± 2.06	0.001

**Table 4:** Risk factors among hypertensive:

Variables	Odds ratio	95% Ci		P-value
		Lower	Upper	
Age (>60 years)	1.477	0.953	2.289	0.081
Marital status (married)	3.33	1.377	8.168	0.008
Use oil other than veg oil	1.896	0.828	4.345	0.130
Eating outside	1.065	0.602	1.883	0.830
Having diabetes	2.687	1.602	4.509	0.000
Having cvd	2.789	1.453	5.351	0.002
Exercise<30 minutes	1.963	1.099	3.507	0.023

five times a week. Recent evidence also present a positive correlation between urbanization and the prevalence of NCD risk factors such as physical inactivity, raised BMI, and low intake of fruits and vegetables.

The cooking medium used was mostly single vegetable oil, most common being ground nut oil followed by sesame oil in all three districts. Use of cooking medium other than vegetable oil was highest in Jodhpur where pure ghee was preferred. Eating out in hotels and restaurants as a trend was reported highest in Barmer but overall <2% among the cases.

Overall, the risk factors with the highest to least odds being married were having co-morbidities like diabetes and CVS and, physical activity less than 30 min /day age >60 years, consuming oils other than vegetable oil.

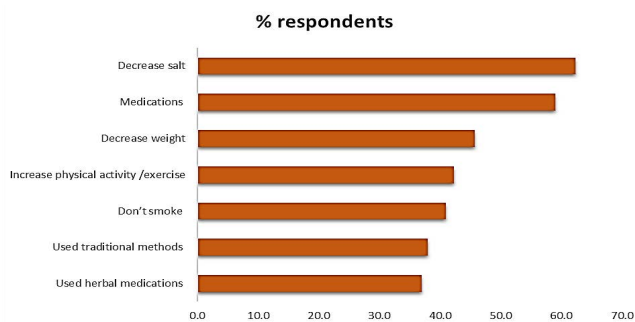
The rising affluence of urbanization has led to change in lifestyle and has modified the dietary pattern characterized by increased consumption of diets rich in fat, sugar, and calories. The diet significantly affects blood pressure, and there is a reduction of 4 to 5 mmHg of systolic BP with dietary modification.<sup>[11]</sup> The dietary pattern in Western Rajasthan mainly consists of milk and milk products with vegetables. The same was observed in our study also with the consumption of tea, green leafy vegetables, millets like jowar & bajra, fruits, buttermilk (Chaaaj), seasonal vegetables like potato, gwar beans and besan (yellow gram flour) preparations and pulses in their daily diet. Milk consumption was seen among 71 and 97% were taking tea once or twice a day.

Although fruit and vegetable consumption was less, almost all the subjects were consuming green leafy vegetables and other vegetables daily with only 12.5% of the population being non-vegetarian. Salt consumption was more than a teaspoonful/person /day as it was used in the cooking, salt added at the table directly, and in the form of pickles, pappads, etc. Only 26 and 8.6% of the participants consumed pickles and ketchup, respectively. Out of the total 600 participants studied, 29% were taking normal salt intake and 71% were found to be taking excess intake of salt. These findings were in excess of a similar study done in Western Rajasthan and Barmer as we had considered newly diagnosed patients who had just started regular visits to the NCD clinics.<sup>[2,12]</sup>

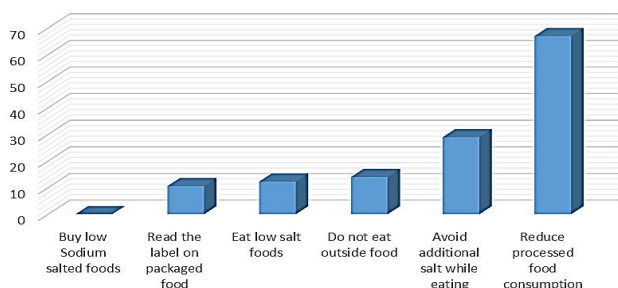
Though people are now aware of the role of salt reduction and reduction of ghee and oil in controlling hypertensives, the use of blended or a combination of oils is less known. Studies have shown a combination of sesame oil and rice bran oil can reduce blood pressure.<sup>[13]</sup> In physical activity importance of duration and intensity and the critical role of co-morbidities like Diabetes in precipitating HTN are less known and not taken seriously.<sup>[14]</sup>

Even in NCD clinics salt intake and dietary changes like reduction in 'ghee -tel- namak' are told but not enough emphasis is given for exercise, yoga and meditation. When respondents were asked about the steps they were ready to take for salt reduction. They were most ready to decrease processed food consumption and avoid the addition of salt but were not ready to consume low salt or low sodium or potassium foods and less than 10% were in the habit of reading food labels.

In a study on salt intake of South Asian countries, it was found to be approximately twice (10 g/day) compared to the WHO recommended intake (< 5 g/day). A significant proportion of salt intake is derived from salt additions during cooking and/or discretionary use at the table and less than 10% of HTNs consciously read food labels. Like in our study, in most South Asian countries, there is limited data on population sodium intake based on 24 hours urinary methods and sources of dietary salt in the diet. These modifiable risk factors precede the development of metabolic risk factors and then progress to HTN in populations.<sup>[15]</sup> There is evidence as per the study that a salt reduction program in combination with a healthy diet had a synergistic effect on reducing systolic



**Figure 1:** Lifestyle-related advise given in NCD clinics as per respondents



**Figure 2:** Responses among cases on reducing salt consumption

BP. A significant reduction in blood pressure was seen in those who eat lower sodium containing foods compared to those who eat foods with higher sodium levels in a study by Sacks FM *et al.*<sup>[16]</sup>

The advice given and monitoring of dietary and physical activity patterns by staff of NCD clinic to the attendees can be an effective added intervention to improve lifestyle and adherence to diet modifications and prescribed therapies by repeated reminders in one-to-one health education to control HTN and other NCDs. Also by, training ASHA workers in recently adopted e-health technology can assist in the screening and management of HTN<sup>[9]</sup> to decrease the workload on physicians.<sup>[8]</sup> Diabetes was associated with double the odds [1.9, (1.7–2.0)] of IHD mortality and increased odds of stroke mortality [1.6, (1.4–1.7)]. HTN is associated with an unexpectedly high cardiovascular mortality burden, contributing to an increasing proportion of IHD deaths and a decreasing proportion of stroke deaths. Better management of HTN and diabetes is urgently required to reduce premature cardiovascular mortality.<sup>[17]</sup>

The million hearts initiative in the US is focused on increasing HTN control using policy at population level for public education on screening, reduced salt, alcohol, smoking intake and to improve dietary and physical activity patterns. Individual level clinical intervention include customized lifestyle change, healthy diet promotion and physical activity facilitation.<sup>[18,19]</sup> The recent 'Eat Right India' and 'Fit India' campaigns aimed at ensuring multi-sectoral, multilevel and multi-pronged interventions to reduce salt. Promote dietary intake of fruits and vegetables, to streamline supply chain to enhance the 'availability and affordability' of fruits and

vegetables across India and to make physical activity an integral part of daily routine of Indians to prevent NCDs should continue to engage the masses.<sup>[20,21]</sup>

## CONCLUSIONS

Overall 'being married' (OR= 3.3), having diabetes/Cardiac disease (OR= 2.6), excessive salt consumption (OR= 2.7), moderate physical exercise less than 30 minutes (OR=1.9), using oil other than vegetable oil (OR=1.8), Age >60 years (OR =1.4) were the key risk factors

It was found that high BMI (BMI>27), consumption of non-vegetable oils (12.7%) was highest in Jodhpur, lack of moderate exercise for at least 30 minutes (81%), lack of sports activity (92%) was highest in Pali, least number of days/week of fruits and vegetable consumption (~1.64 days) was seen in Barmer. Health consciousness towards physical activity was least in Pali compared the other two districts this is a wake-up call for the public of Pali where fruits and vegetable consumption, as well as physical activity, was also low change in quantity of salt consumption and incorporation of physical exercise for >30 minutes was most followed in control of HTN among the attendees of NCD Clinics from the multiple advise given.

## RECOMMENDATIONS

Besides population-based cost-effective HTN control strategies, in NCD clinics advise on eating seasonal fruits and vegetables should be emphasized. Advise on use of blended oils (mix of saturated and unsaturated oils) should be given. Habit of reading labels on packaged food for salt content should be encouraged and more specific advice on duration and type of physical activity should be given. Yoga and meditation as a way of life also need to be emphasized.

## DECLARATIONS

Declaration of patient consent The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## CONFLICTS OF INTEREST

There are no conflicts of interest.

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