

## RESEARCH ARTICLE



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## Assessment of Dietary Patterns and its Risk Factors Among Adults of a Rural Population of Chikkaballapur District, Karnataka

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### Abstract

Diet and nutrition play an important role in the health and disease of an individual. Familial risk factors can be modifiable if adequate knowledge and practices are inculcated very early in life. Unhealthy dietary practices can cause metabolic syndrome such as raised BMI, high blood pressure, and elevated lipid profile. This study aims to study the dietary risk factors and their effect on clinical and biochemical parameters on 44% (n=2007) of the 4576 rural population above 30 years residing in Kaiwara and Kurubur PHC of Chikaballapura District, Karnataka. The daily intake of various foods and snacks, timings, and frequency of consumption were noted using a questionnaire with four field workers. It was observed that adults in the age group 30-39 years comprised 29.6%, and risk factors for non-communicable diseases in the diet included extra salt (1.4%) fried foods (8.7%), aerated drinks (8.3%) cakes (15.1%), pickle/chutney (51.4%). Though vegetables are consumed by 82.2%, consumption of fruits is negligible. Turmeric with its anti carcinogenic properties is consumed for more than 5 days a week by 36.5%. Fish though not easily available in rural areas is consumed by 116 (2.4). Among 2007 individuals, 1198 (60%) had high BMI, and the waist-hip ratio among males was > 0.9 among 1200 (76.1%) males and > 0.85 among 53% of females. An increase in systolic and diastolic blood pressure was observed in 54% of individuals. High blood sugar levels among 341 (17%), total cholesterol (n=382, 19%) was seen in the rural population. This study highlights that dietary patterns are increasing in the rural population adding to the overall burden of non-communicable diseases.

**Keywords:** Dietary; Risk factors; Noncommunicable diseases; Clinical; Biochemical

## 1 Introduction

Nutrients in food protect the body against illness and helps in proper functioning and for the growth and development of the body. We must consume the right quality and quantity of food to maintain good health. Dietary pattern is the variety of foods a person consumes based on cultural practices, food fads, and cravings. A variety of diets are recommended such as prudent diet, dietary approaches to stop hypertension (DASH) vegan diet, and Mediterranean diet.<sup>(1)</sup> Culinary cultures are different in various parts of India and indigenous food practices are still followed. In the event of a nutrition transition, there may be serious consequences on the health of an individual.

The measurement of body mass index, waist circumference, and the waist-hip ratio is associated with an increased risk of obesity which is modifiable risk factor leading to diabetes.<sup>(2)</sup> It is also observed that age-related biological risk factors are also associated with behavioral lifestyle risk factors (a diet high in salt, fat, sugar and low in fruits and vegetables, physical inactivity with advancing age increases the risk of NCD's.<sup>(3)</sup> Unhealthy diets are a key modifiable behavioral risk factor for non-communicable diseases (NCDs). They contribute to the occurrence of a cluster of disorders known as the metabolic syndrome- abdominal obesity, hypertension, dyslipidaemia, and disturbed metabolism of glucose or insulin which in turn account for a significant share of the global burden of disease.<sup>(4)</sup> The presence of metabolic syndrome increases the risk of developing NCDs such as cardiovascular diseases, diabetes, chronic respiratory diseases, and cancer.<sup>(5)</sup>

Identifying robust and plausible associations between diets and health outcomes could help to guide agriculture, nutrition, and public health policy development. Diets in India are however extremely diverse due to various geographic, cultural, social, and economic

factors, making it more appropriate to define and study sub-national dietary patterns rather than a national average diet.

Various methods have been used for the assessment of dietary consumption including the 24-hour recall method, weighing of raw foods, per capita consumption of foods by the family, one diet cycle, self-reporting of diet history, and food frequency questionnaire. However, each method has its inherent fallacies. This research attempts to aim against this background with the following objectives:

1. To determine the prevalence and distribution of dietary patterns for select non-communicable diseases in the adult population.
2. To study the effect of dietary risk factors on clinical and biochemical parameters among the adult population.

## 2 Methodology

This randomized community study was initiated in 2017 at the Kaiwara and Kurubur Primary Health centers of Chintamani Taluk, Chikballapur District, Karnataka, India. The study groups included 4576 adults aged  $\geq 30$  years, who were residents of the area for a minimum of six months. IERB approved the study. Food frequency questionnaire by 24-hour recall on 2 separate non-consecutive days was recorded through a house-to-house survey by the field workers. Flashcards of locally available foods and servings using cups and spoons were shown to the respondents to calculate the food intake. Frequency of intake  $\times$  serving size  $\times$  total number of servings  $\times$  weight of food in one serving was averaged and noted. Following the questionnaire, junior doctors would measure the blood pressure and take anthropometric measurements. Blood pressure was measured by the mercury sphygmomanometer with an average of two readings about 5 minutes apart.

Height was measured using a stadiometer, weight with a bathroom scale, and waist and hip circumference with plastic, nonstretchable tailors measuring tape<sup>(6)</sup>. Asian Indian cut-offs were adopted for the values obtained. Due to logistics and financial implications about 2007 (48%) of the respondents were instructed to come fasting for collection of blood samples at the village school. The lab technicians, medico-social workers, and investigators reached the venue in the early morning on two Sundays. The lab technician from the medical college collected the fasting blood samples and centrifuged them at the site itself. The centrifuged samples were stored in ice boxes and transported to the biochemistry laboratory for analysis. Cobas 6000 c501 RXL MAX<sup>TM</sup> fully automated analyzer was used for the study and was tested for FBS and lipid profile.<sup>(7)</sup> A separate register was maintained for the results. The copy was handed over to the respondent during counselling. Based on the lab results, individual and group counselling on a healthy diet was given.

### 3 Results

The majority of adults were in the age group of 30-39 years (29.6%) females, studied up to intermediate with occupation as skilled workers/ shop owners or farmers (Table 1). The items considered as risk factors for non-communicable diseases are listed in Table 2. It was observed that 64 (1.4%) consumed extra salt, 120 (8.7%) fried foods, 25.6% chips and 51.4% pickles. All these contribute to high salt intake which can be a modifiable risk factor for hypertension in later life. Sweetened foods or drinks contributed to 8.3% and 15.1% respectively for later development of diabetes. It was also observed that only 8.3% and 15.1% consumed fruits and vegetables more than five days a week (Table 3).

Among the population studied, 114 i.e. 2.5% had a BMI > 30 (obese category), 1200 (76.1%) men had a high waist-hip ratio, and 835 (53%) women had a waist-hip ratio of > 0.89. There were 771 individuals (16.5%) with stage I systolic hypertension and above and 1058 (22.2%) with stage I diastolic hypertension. NFHS 5 observed the prevalence among the rural population was 21% and higher in men than women.<sup>(8)</sup>

The high biochemical parameters observed in the study were: diabetes mellitus (n=177, 8.8%), high serum cholesterol (n=70, 3.5%) high triglycerides (n=6, 0.5%), and LDL (n=31, 7.5%). This is in contrast to a study among 2171 rural individuals aged above 45 years where the prevalence of metabolic syndrome was 46.2%.<sup>(9)</sup>

### 4 Discussion

In the present study, 4576 adults above 30 years were assessed for their food frequency questionnaire by 24-hour recall on two separate occasions. It was observed that consumption of fruits and vegetables for five days a week was much below

**Table 1. Sociodemographic details of the population studied**

	Variables	Total (n, %)
Age (in years N=4576)	30-39	1355 (29.6)
	40-49	1229 (26.8)
	50-59	803 (17.5)
	>=60	1189 (26.0)
Gender (N=4576)	Males	2087 (45.6)
	Females	2489 (54.4)
Education (includes 5 years and above N=9940)	Not literate	2,839(28.5)
	Primary or literate	1722(17.3)
	Upto Intermediate	4616(46.4)
	Graduate and above	756(7.6)
Occupation (N=7532)	Unemployed	559(7.4)
	Housework	1400(18.6)
	Unskilled to skilled	2401(31.9)
	Clerical/shop owner/Farmer	2856(38)
	Semi-professional to professional	316(4.2)
	Hindu	2206(93.4)
Religion(N=2361)	Muslim	155(6.6)
	Nuclear	1092(70.4)
Family type (N=1550)	Joint	455(29.3)
	3 generation family	03(0.2)
	Single	78(1.7)
Marital status (N=4576)	Married	3775(82.5)
	Divorced/separated	29(0.6)
	Widow/Widower	694(15.2)

the recommended allowance among these adults whereas in a study among rural households with a family size of 4.7, the fruit intake was nil, and vegetables was less in 50%.<sup>(10)</sup>

A multicentric study was done in Bangalore among 1432 individuals on major dietary patterns such as cereal savory, western cereals, snacks, sweets, and animal foods and their association with blood lipids, fasting blood sugar, and blood pressure. The mean and SD for FBS (mmol/l) was 5.5 (1.7) TC4.9 (1.1) LDL 3.1 (0.9) HDL1.1 (0.2) and TG1.5 (0.9).<sup>(11)</sup>

In the present study, almost three-fourths (73.8%) consumed three daily meals, and 82.2% had vegetables for more than five days a week. However, only 4.6% consumed seasonal fruits. It was also observed that 15% consumed pastries, snacks and 8% consumed sweetened drinks for 5 days a week.

**Table 2. Distribution of study population based on dietary patterns contributing to NCD risk factors (N=4576)**

Food Item	Frequency	Total Number
Extra salt	Once/week	4512 (48.6)
	More than 5days/week	64 (1.4)
Consumption of Butter/Ghee	Once/week	145 (3.2)
	More than 5days/week	55 (1.2)
Average no of meals eaten from outside in a week	1-7 times/week	484 (96.8)
	More than 7 times/week	16 (3.2)
Consumption of fried local food	A least once in a week	120 (8.7)
	Once in a month	506 (49.5)
Consumption of red meat	Daily or once in a week	539 (11.8)
	Once in a month	2316 (50.6)
Consumption of Aerated drinks	Daily, once in a week, or Once in a month	382 (8.3)
	Occasionally or rarely	3707 (81.0)
Consumption of Sweetened drinks	Daily, once in a week, or Once in a month	382 (8.3)
	Occasionally or rarely	3076 (67.2)
Consumption of Chips, Namkeen	Daily, once in a week	1171 (25.6)
	Once in a month	298 (6.5)
Consumption of Cakes or other bakery items	Daily, once in a week	693 (15.1)
	Once in a month	682 (14.8)
Consumption of pickle/chutney/gojju	Daily, once in a week	2361 (51.4)
	Once in a month	616 (13.4)
No. of meals in a day	Twice in a day	361 (26.2)
	Thrice a day	1015 (73.8)
Timings of meals	3pm-6 pm	40 (0.9)
	9pm -12 midnight	136 (3.0)

**Table 3. Distribution of study population based on dietary patterns contributing to non NCD risk factors (N=4576)**

Food Item	Frequency	Total Number
Fruits	Once/week	2407 (74.7)
	More than 5 days / week	148 (4.6)
Vegetables	Once / week	25 (0.6)
	More than 5 days / week	3760 (82.2)
Turmeric	Once / week	1213 (26.5)
	More than 5 days / week	1672 (36.5)
Oil used	Groundnut oil	1208 (26.5)
	Sunflower oil	3328 (73.1)
Consumption of Eggs	At least once in a week	348 (25.3)
	Once in a month	615 (44.7)
Consumption of Chicken	At least once in a week	548 (39.8)
	Once in a month	470 (34.2)
Consumption of fish	Daily, once in a week, or Once in a month	116 (2.4)
	Occasionally	3923 (85.8)
No. of meals in a day	Once in a month	616 (13.4)
	Twice in a day	361 (26.2)
Timings of meals	Thrice a day	1015 (73.8)
	3 pm - 6 pm	40 (0.9)
	9 pm -12 midnight	136 (3.0)

among rural and urban homemakers of Tripura, consumption of 5-10 g/day of salt is practiced. <sup>(13)</sup>

Though diverse micronutrient-rich foods are available in the market, they may not be easily accessible. It is also observed that unhealthy foods with trans fats, high sugars and salt are cheap and easily available.

In a study among 6849 Chinese adults aged 21–70 years the vegetable-rich pattern, animal-food pattern, and prudent dietary pattern were identified. Prudent dietary pattern was associated with lower SBP and DBP among Southwest Chinese and this association was partially explained by body composition. <sup>(12)</sup>

In the present study, 64 (1.4 %) add salt to their food for more than five days a week. In a community-based study

**Table 4. Distribution of study population based on clinical parameters (N=4576)**

	Values	Total (n, %)
BMI	<18.5	1209 (26.4)
	18.5-22.9	2169 (47.3)
	23-29.9	1084 (42.1)
	>=30	114 (2.5)
Waist hip ratio	<0.9 no risk	587 (37.2)
	>=0.9 subs increased risk	1200 (76.1)
	<0.85 no risk	1954 (41.1)
	>=0.85 subs increased risk	835 (53.0)
BP readings (Systolic)mm Hg	<120 Normal	2012 (42.3)
	120-139 Prehypertensive	1793 (38.0)
	140-159 Stage1 Hypertension	423 (9.2)
	> 160 Stage 2 Hypertension	348 (7.3)
BP Readings (Diastolic) mmHg	<80 Normal	1974 (41.5)
	80-89 Prehypertension	1544 (32.5)
	90-99 Stage 1 Hypertension	641(13.5)
	> 100 Stage 2 Hypertension	417 (8.7)

**Table 5. Distribution of study population based on biochemical parameters (N=2007)**

	Values	Total (n, %)
Diabetes	Normal	1666 (83.0)
	IFG	164 (8.2)
	Frank Diabetes	177 (8.8)
	Desirable	1625 (80.9)
Total cholesterol	Borderline high	312(15.5)
	High	70 (3.5)
Triglycerides	Normal < 150 mg/dl	1414 (70.4)
	Borderline high 150 -199 mg/dl	278 (13.8)
	High TG 200-499 mg/dl	279 (14.0)
	Very high >=500 mg/dl	06 (0.3)
HDL Cholesterol	Low HDL<40 MG/dl	847 (42.2)
	Normal 40-59 mg/dl	971 (48.4)
	High HDL	189 (9.4)
	Optimal <100 mg/dl	735 (37.0)
LDL Cholesterol	Near/above optimal 100-129 mg/dl	388 (19.3)
	Borderline high 130-159 mg/dl	734 (36.5)
	High 160-189 mg/dl	119 (6.0)
	Very high >=190 mg/dl	31(1.5)

## Limitations of the study

In the present research the nutrients in the food frequency questionnaire were not analysed. An in-depth analysis of socioeconomic and cultural factors in the diet could not be explored. Hence multivariate and logistic regression analysis could not be done for the entire population and the biochemical tests not done due to financial constraints. Though it was a randomized community-based trial, all the respondents were included in the trial.

## 5 Conclusion

The majority of adults were of working age and belonged to nuclear families employed as shop owners/farmers. They partake in vegetables more frequently than fruits. The studied population eats more fried foods with added salt ingredients. High BMI and raised blood parameters along with high biochemical parameters were observed in the rural population. Health promotional activities on avoiding saturated fats, excessive use of oil/ghee, fried foods, eating fish, and avoiding the skin of chicken were stressed. Respondents with diabetes mellitus were advised to avoid refined carbohydrates, and foods with high glycaemic index, and regular spaced eating was emphasized. Further studies on health intervention and lab parameters will identify the positive outcomes such as a decrease in waist circumference, reduced incidence of prediabetes/diabetes, prehypertension/hypertension, and metabolic syndrome.

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