ORIGINAL ARTICLE

A cross-sectional descriptive study assessing minimum dietary diversity among women desiring pregnancy in tribal and non-tribal blocks in rural area of a north Maharashtra district, India

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CITATION

Doke PP, Chutke AP, Palkar SH. A cross-sectional descriptive study assessing minimum dietary diversity among women desiring pregnancy in tribal and non-tribal blocks in rural area of a north Maharashtra district, India. Indian J Comm Health. 2025;37(3):380-387. https://doi.org/10.47203/IJCH.2025.v37i03.005

ARTICLE CYCLE

Received: 29/04/2025; Accepted: 21/05/2025; Published: 30/06/2025

ABSTRACT

Introduction: Minimum Dietary Diversity reflects the consumption of micronutrients and is measured by assessing consumption items from various food groups. The preconception phase is crucial in women's reproductive cycle. **Objectives:** to estimate the proportion of women having minimum dietary diversity in desiring to conceive within one year in tribal and non-trial blocks, to compare the proportion in tribal and non-tribal blocks, and to identify associated risk factors. **Methods**: A cross-sectional descriptive study of two tribal and two non-tribal blocks in the Nashik district of Maharashtra. All women desiring pregnancy in a year were enrolled. The consumed items in 24 hours were grouped into ten. The study gave one score for each consumed group. The study considered accomplished minimum dietary diversity when the woman scored five or more. **Results:** The study enrolled 7,794 women. The mean age of the women was 23.19 years (SD=3.72). The mean dietary diversity score of the women was 4.73 (SD=0.7), 68.8% had minimum dietary diversity, and there was no difference between tribal and non-tribal blocks. Starchy food consumption was 100%, and fruit and vegetable consumption were minimal. Lower parity had a positive effect (AOR =0.90; CI 95%= 0.81-0.99). Unemployed women (AOR =1.12; CI 95% =1.01-1.24), consumption of tobacco in any form (AOR=1.38; CI 95% =1.11-1.70), and substantially less protein intake (AOR=2.49; CI 95%=1.61-3.84) had a negative effect. **Conclusions:** About two-thirds of women had minimum dietary diversity. Residence in tribal areas did not affect, but **s**ocio-demographic factors, tobacco, and less protein consumption affected minimum dietary diversity.

KEYWORDS

Preconception; Tribal; Dietary Diversity Score; Minimum Dietary Diversity; Food Groups

INTRODUCTION

Optimal growth and development in children undoubtedly depend on adequate and quality food intake. UNICEF and WHO jointly developed the concept of minimum dietary diversity (MDD) to assess the variety of food intake in children. (1) It was practiced for assessing and modifying Infant and Young Child Feeding. Later, in the nineteen-twenties, the concept of minimum dietary diversity assessment was extended to women in various phases of life, and the guidelines were developed. (2) The guidelines have been updated in 2021. (3) As per the guidelines, for MDD women, the food items are classified into ten. Few studies changed the number of food groups and then their consumption by women was assessed. The primary food groups can be further sub-classified for more clarity. MDD is supposed to reflect the quality of

food intake particularly the consumption of micronutrients like iron, zinc, etc. Usually, the dietary diversity score and then minimum dietary diversity are calculated. Iron is the most critical micronutrient, and its suboptimal intake results in iron deficiency anemia. In India, the proportion of women with anemia has consistently been above 50%. The proportion of anemia in the National Family Health Survey-5 (NFHS) was 57% which showed an increase from 53% in NFHS-4. (4) Mostly, it is due to iron deficiency resulting from due to improper nutrition.

Several studies have assessed minimum dietary diversity among children, (5–7) a few among pregnant women, (8–10) and several among women of reproductive age. Many studies are from developing countries. However, dietary diversity among tribal and rural women is rarely assessed. Few studies suggest that the nutritional status of women in tribal areas is suboptimal. (11–15) WHO for Maternal and Child Health has advocated the universal implementation of preconception care, which identified 13 areas that needing attention. The nutritional condition of the woman is one of the components. (16) The preconception period represents a crucial phase in woman's reproductive life cycle. The evidence about dietary diversity among women during the preconception phase is sparse. They are expected to take more care during this period, including better food intake. Besides anemia, the absence of minimum dietary diversity will likely result in adverse pregnancy outcomes. The appropriate last chance to modify MDD is the preconception period.

In collaboration with the Health Department, Government of Maharashtra, and with support from UNICEF, our institute implemented a preconception care project in Nashik district. The present study analyzes the initial survey conducted under this large project. The objectives of the current study were to estimate the proportion of women having minimum dietary diversity among women desiring to conceive within one year in tribal and rural study blocks, to compare the proportion in tribal and non-tribal blocks, and to identify associated risk factors for minimal dietary diversity.

Material & Methods

Study design

It was a cross-sectional descriptive study.

Study setting

We conducted the current study in rural areas in Nashik district, Maharashtra, India. The district is a notified tribal district. The exact geographical area of the district lies between 18.33 degrees and 20.53 degrees North Latitude and 73.16 degrees 75.16 degrees East Longitude. The district has 15 blocks, including nine that are notified as tribal. The study included two adjacent tribal and two adjacent non-tribal blocks in the district. The first block in each pair (tribal or non-tribal) was selected randomly, and the adjoining block was chosen purposely. The population of two tribal blocks is 288,261, scattered into 268 villages. The population of two non-tribal blocks is 774,342, which reside in 267 villages. Figure 1 depicts the geographical location of the study blocks in Nashik district, Maharashtra.

Study period

We conducted the study in July-August 2018.

Data collection

The authors prepared an interview schedule. The tool was validated by faculty from the Community Medicine Department and by an experienced and qualified nutritionist. The schedule was pre-tested in a rural area in the Pune district. The ASHA, Auxiliary Nurse Midwives, Health Assistant (HA) female, medical officers, and data entry operators were trained. Accredited Social Health Activists (ASHAs) conducted the house-to-house survey. The data were entered manually on printed forms. The authors, senior government officers, UNICEF technical officers, and health workers from concerned primary health centers supervised the data collection. All the forms were collected and scrutinized in the authors' medical college. Inadequately filled or with some lacunae were returned for corrections and, after rectification, were accepted.

Participants

The present study population consisted of all the women of the reproductive age group in the four study blocks. All women desiring pregnancy within one year and residing or intending to stay in the area for more than six months were included. Women who did not understand English or Hindi or Marathi (the local language), having psychological problems that might lead to ineffective communication, or critically ill were excluded.

Variables

The study collected information about areas of residence, age, parity, education, occupation, and consumption of alcohol and tobacco in any form. The ASHAs took Anthropometric measurements (weight and height) using customary guidelines and instruments at the nearest facility (sub-center, PHC, or Anganwadi). Details of all food items that were consumed on the previous day (24-hour recall) were compiled. The study calculated the dietary diversity score (number of food groups consumed) and the minimum dietary diversity. Nutritionists also calculated the calorie and protein intake proportion of according to the recommended dietary allowance. Consumption of proteins and

calories <50% of the daily recommended allowance was considered substantially less.

Data source/measurement

The physically filled forms were collected and entered into a Microsoft Excel sheet. The study used ten food groups to calculate minimal dietary diversity (MDD), as recommended by FAO. (3) We gave one score if an item from a specific group was eaten and the number of food groups from which the items were eaten denoted the dietary diversity score (DDS). A score less than five was considered not to have minimum dietary diversity, and a score of five or higher was deemed to achieve MDD.

Sample size

The estimated sample size, assuming 77.1% of women had dietary diversity (17) with 95% confidence and an acceptable difference of 3.85%, was 458. The number of women participating in the study was far higher than the required number.

Statistical methods

The data entry operator entered the data in a Microsoft Excel spreadsheet. The study analyzed the data using the Statistical Package for Social Sciences (version 26). We calculated and presented nominal/ordinal data in proportions/percentages and quantitative data as mean and standard deviation; median and interquartile ranges were calculated for non-normally distributed data we calculated. The study used the $\chi 2$ test to assess differences between two groups having minimum and no dietary diversion. We calculated the adjusted odds ratio using multiple logistic regression analysis if the difference was significant in the bivariate analysis. A probability < 0.05 was considered significant.

Ethical aspects

After presentation and discussion, the institutional ethics committee approved the project via letter BVDUMC/IEC/11 dated 30/04/2018. The study was registered with CTRI (No. : CTRI/ 2018/06/014657 dated 28/06/2018). The study obtained informed written consent from all the women for participation and publication.

RESULTS

The study enrolled 7,794 women. The missing data for the variables varied between 1 to 10%. The mean age of the women was 23.19 years (SD=3.72), and the mean age at marriage was 19.41 years (SD=2.38). The average BMI of the women was 19.73 (SD=3.51). Some socio-demographic, nutritional, and substance use characteristics are shown in Table 1. Regular alcohol consumption and tobacco addiction, except for the use of Mishri, was less than 1%. The study observed that the proportion of consumption of less than 50% of the recommended daily allowance of calories and proteins was less than 1.5%. The mean dietary diversity score was 4.71 (SD= 0.64) among women from tribal areas and 4.74 (SD=0.73) among non-tribal areas. There was no statistically significant difference. The overall mean dietary diversity score was 4.73 (SD=0.70). The distribution was not normal (Kolmogorov-Smirnov, t= 0.33, p<0.001). The median intake of food groups was 5 (IQR=4 to 5). The proportion of women having dietary diversity in tribal blocks was 68%, and in non-tribal blocks was 69%. The difference was not significant. The overall minimum dietary diversity was 68.8% of the women. The proportion of consumption of the ten groups is given in Table 2. The proportions of the six food groups were significantly different among tribal and non-tribal areas (Table 2). The proportion of consumption of different food groups (except pulses) was higher in non-tribal areas.

Every woman consumed starchy food (tubers, roots, and grains); the Vitamin A-rich vegetables and fruits group was least consumed (Table 2). A bivariate analysis is given in Table 3. It shows that dietary diversity score was associated with parity, employment, calorie consumption, protein intake and tobacco in any form (Table 3). In multiple logistic regression (Table 4) the association between MDD and above-mentioned factors was consistent except calorie consumption. The highest adjusted odds ratio for non-diversity (2.49) was observed with substantial low intake of protein.

Table 1 Socio demographic characteristics of the women desiring pregnancy in Nashik district, India, 2018 (N= 7,794)

	Category	Number (%)
Age Group	<20	1,243 (16.1)
	20-30	6,001 (77.9)
	30-40	447 (5.8)
	40+	11 (0.1)
Parity	>3	3,852 (49.4)
	0-2	3,942 (50.6)
Education	<10th	2,816 (36.13)
	>10th	4587 (63.9)
Occupation	Formally employed	4,629 (63.5)

	Category	Number (%)
	Not	2,659 (36.5)
Religion	Hindu	6,611 (84.8)
	Muslim	269 (3.5)
	Buddha	218 (2.8)
	Other	331(4.3)
Caste	ST	2,564 (40.3)
	Non-ST	3,802 (59.7)
Family type	Nuclear	998 (14.4)
	Non-nuclear	5,926 (85.6)
Residence	Tribal area	2,963 (38.0)
	Non-tribal area	4,831 (61.8)
BMI Group	<18.5	2,720 (38.3)
	18.5-24.9	3,917 (55.2)
	25-29.9	367 (5.2)
	>30	93 (1.3)
Calorie intake	<50%	110 (1.4)
	> 50%	7,683 (98.6)
Protein intake	<50%	103 (1.3)
	> 50%	7,690 (98.7)
Tobacco	Smoking	10 (0.1)
	Gutkha*	18 (0.2)
	Tapkir/Nas#	61 (0.8)
	Mishri$	381(4.9)
	Passive smoking	83 (1.1)
Regular alcohol intake	Yes	48 (0.6)
	No	7,746 (99.4)

**Having tobacco as a constituent, # Rosted tobacco use in nostrils, $ Roasted tobacco use on gums*

Table 2 Food groups consumption among women, rural area Nashik district, India, 2018

Food groups	Tribal, N=2963 Consuming (%)	Non-tribal, N=4831 Consuming (%)	Overall N=7794 Consuming (%)	χ2 (p)
Grains, roots, and tubers	2963 (100.00)	4830 (99.98)	7793 (99.99)	0.61 (0.43)
Pulses	2927 (98.79)	4283 (88.66)	7210 (92.50)	271.8 (<0.001)
Nuts and seeds	56 (1.89)	246 (5.09)	302 (3.87)	50.56 (<0.001)
Dairy products	2731 (92.17)	4761 (98.57)	7492 (96.13)	200.76 (<0.001)
Meat, poultry, and fish	224 (7.56)	369 (7.64)	593 (7.61)	0.02 (0.90)
Eggs	75 (2.53)	193 (4.00)	268 (3.44)	11.85 (0.001)
Greens leafy vegetables	2201 (74.28)	3564 (73.77)	5765 (73.99)	0.25 (0.62)
Other colorful fruits and vegetables	26 (0.88)	91 (1.88)	117 (1.50)	12.58 (<0.001)
Other vegetables	2697 (91.04)	4423 (91.56)	7120 (91.33)	0.66 (0.42)
Other fruits	51 (1.72)	162 (3.35)	213 (2.73)	18.41 (<0.001)

Table 3 Socio-demographic characteristics of women and MDD* rural area Nashik district, India, 2018

	Variable	MDD		Total	χ2 (p)
		No	Yes		
Age Group (N=7,702)	<20	403 (32.4%)	840 (67.6%)	1,243	2.05 (0.56)
	20-30	1,860 (31.0%)	4,141 (69.0%)	6,001	
	30-40	142 (31.8%)	305 (68.2%)	447	
	40+	5 (45.5%)	6 (54.5%)	11	
Parity (7,794)	0-2	1,181 (30%)	2,761 (70.0%)	3,942	5.40 (0.02)
	>3	1,248 (32.4%)	2,604 (67.6%)	3,852	
Education (7,403)	<10th	915 (32.5%)	1,901 (67.5%)	2,816	3.29 (0.07)
	>10th	1,398 (30.5%)	3,189 (69.5%)	4,587	

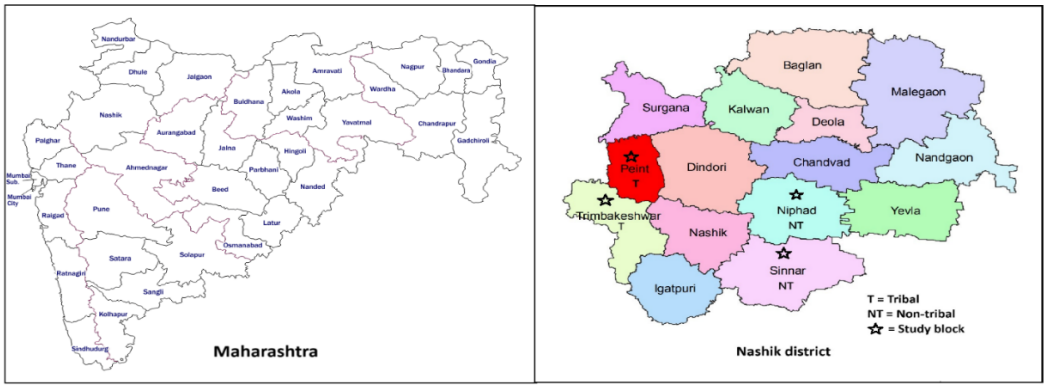
	Variable	MDD		Total	χ2 (p)
		No	Yes		
Occupation (N=7,288)	Not	879 (33.1%)	1,780 (66.9%)	2,659	4.03 (0.05)
	Formally employed	1,425 (30.8%)	3,204 (69.2%)	4,629	
Family Type (N=6,924)	Nuclear	322 (32.3%)	676 (67.7%)	998	0.293 (0.58)
	Non-nuclear	1,861 (31.4%)	4,065 (68.6%)	5,926	
Religion (N=7,429)	Hindu	2,084 (31.5%)	4,527 (68.5%)	6,611	4.37 (0.22)
	Muslim	94 (34.9%)	175 (65.1%)	269	
	Buddha	67 (30.7%)	151 (69.3%)	218	
	Other	90 (27.2%)	241 (72.8%)	331	
Caste Category (N=6,366)	ST#	814 (31.7%)	1750 (68.3%)	2,564	0.071 (0.79)
	Non-ST	1,195 (31.4%)	2,607 (68.6%)	3,802	
Residence (N=7,794)	Tribal area	947 (32.0%)	2016 (68.0%)	2,963	1.41 (0.23)
	Non-Tribal	1,482 (30.7%)	3,349 (69.3%)	4,831	
BMI Group (N=7,097)	<18.5	859 (31.6%)	1861 (68.4%)	2,720	1.06 (0.78)
	18.5-24.9	1,194 (30.5%)	2,723 (69.5%)	3,917	
	25-29.9	113 (30.8%)	254 (69.2%)	367	
	>30	27 (29.0%)	66 (71.0%)	93	
Calorie intake (N=7,793)	< 50%	46 (41.8%)	64 (58.2%)	110	5.91 (0.02)
	> 50%	2,382 (31.0%)	5,301 (69.0%)	7,683	
Protein intake (N=7,793)	< 50%	54 (52.4%)	49 (47.6%)	103	22.01
	> 50%	2,374 (30.9%)	5,316 (69.1%)	7,690	(<0.001)
Tobacco, any form (N=7,724)	Yes	164 (39.1%)	255 (60.9%)	419	12.73
	No	2,252 (30.8%)	5,053 (69.2%)	7,305	(<0.001)
Regular alcohol (N=7,724)	Yes	11 (22.9%)	37 (77.1%)	48	1.57 (0.21)
	No	2,405 (31.3%)	5,271 (68.7%)	7,676	

*** MDD= Minimum dietary diversity, # Scheduled tribe**

Table 4 Socio-economic factors and minimum dietary diversity (MDD), Nashik, district, India, 2018

Variable (N)	Cat	MDD		Total	AOR for no diversity	95% CI
		No	Yes			
Parity (N=7,794)	0-2	1,181	2,761	3,942	0.9	0.81-0.99
	3+	1,248	2,604	3,852	1	
Occupation (N = 7,288)	Not employed	879	1,780	2,659	1.12	1.01-1.24
	Formerly employed	1,425	3,204	4,629	1	
Tobacco, any form (N = 7,724)	Yes	164	255	419	1.38	1.11-1.70
	No	2,252	5,053	7,305	1	
Calorie intake (N = 7,793)	<50%	46	64	110	1.05	0.68-1.62
	>=50%	2,382	5,301	7,683	1	
Protein intake (N = 7,793)	<50%	54	49	103	2.49	1.61-3.84
	>=50%	2,374	5,316	7,690	1	

Figure 1 Selected study blocks for Minimum Dietary Diversity assessment in Nashik district, Maharashtra



DISCUSSION

About two-thirds of women in the present study had minimum dietary diversity. The idea of minimum dietary diversity in women has emerged during the last 12 years. Although many food groups having 9 to 21 categories have been used and documented, (1) a minimum diversity of five or more has been found to be the most suitable. (18) As recommended by FAO, most of the studies have utilized ten food groups like the present study. (19–27) However, four, (28) seven, (24) nine, (29–33) 11 (for households) (34) and even 22 (made subcategories) (19) food groups have been studied. Whilst various studies have used different recall periods from 24 hours to seven days or both, (31,34) the 24 hours short period recall method is most commonly used, as the present study. (19,20,35,36,21,22,24,27–30,34) Shorter duration history is likely to have less recall bias. However, seven-day dietary recall may capture greater dietary variation, yielding higher diversity mean than a 24-hour recall (4.3 to 7.6). (37) Only one study had used a one-month recall. (25)

Globally, starchy food group is consumed by almost all women, (3,17,39,20–22,30–33,38) while eggs, (17,19,22,30) nuts and seeds (40) are consumed minimally, similar to our study findings. Even a narrative review from six indigenous communities showed high proportion of starchy food consumption and other food items quite low. (14) Socio-cultural factors also determine the consumption of meat group of food. One Indian study reported 0% meat consumption in Gujrat and 4% in Haryana. (20) In Gujrat, people are vegetarian. On the other hand, studies from African countries and Bangladesh show substantial consumption flesh group. (21,26,29)

The proportion of women having minimum dietary diversity varies widely from 8 to 84.6%. (13,17,41–44,19,21–23,26,28,32,36). Notably, the three studies including one from tribal women showing high proportion of less dietary diversity in women used cut-off four out of nine food groups. (28,29,33) On the contrary, one secondary data analysis of Indian states observed a range of 0.11% for Rajasthan to 7.08 % for Goa. (31) The low proportion might be attributable to nine food groups, with meat-based group being more preponderant. Overall, the food group categorization in that study included fried items, aerated drinks etc. hence the results are not comparable. There may be considerable improvement after imparting health education for some months.(28,45)

Many studies reported mean DDS ranging from 2.6 to 6.35. (13,17,22,26,27,33–35) There may be seasonal variation in winter, showing higher diversity than Monsoon, (35) which may be associated with availability of various food groups. The present study observed that the minimum dietary score is not normally distributed. Only one study also described a median DDS of four which matches present study. (26) One study observed higher household MDS than women. (34)

The diversity is associated with socio-cultural factors, (22) age, (25,40,41) woman's education, (31,40,41,44) husband's education, (25) and, wealth quintile. (31,40) The present study observed that formally employed women had higher score of dietary diversity. Usually, employment is associated with income and education. In one study SC and OBC have better score,(31) MDS is inversely to the number of family member; it is better among Muslim women and those residing in urban areas have reported better dietary scores that their counterparts. (31) Muslims are predominantly non-vegetarian thus scoring higher for flesh and egg category.

The present study observed an association of MDDs score with parity, similar to other studies. (22,40) Many Indian women, for religious reasons, observe fasting; the proportion of women having high dietary diversity is higher (as high as 74%) among women not observing fast. (22) Inadequate dietary diversity may give rise to low BMI and anemia. (44) Crop diversity may be proportionate to dietary diversity. (17) The core component remains availability and affordability. The intake of protein less than 50% of the Recommended Daily Allowance ought to be associated with low dietary diversity. Though the tobacco consumption in any form is not directly related to intake of food groups the present study observed that women consuming tobacco have higher proportion of inadequate dietary diversity.

The present study is conducted with the largest sample size among all the referred studies. A team of qualified and experienced dieticians was involved. The present study is probably the first among women desiring pregnancy soon in rural and tribal areas.

CONCLUSION

During the crucial preconception phase about two thirds of women have MDD. Although women from non-tribal area ate five food groups more frequently than women from tribal area but consumption of pulses was more among tribal women. However, there was no difference between proportion of women having minimum dietary diversity between the two areas.

RECOMMENDATION

The only feasible solution is frequent nutrition education campaigns for women of reproductive age, preferably using different media in the local language. Existing health workers like ANMs and ASHAs may be adequately trained to impart such education.

LIMITATION OF THE STUDY

The study has a few limitations. The names of locally available vegetables and fruits reported in dietary recall were uncommon; hence, the classification in conventional food groups was sometimes challenging. ASHAs collected data during the monsoon season, which captured seasonal variation, leading to limitations in food availability.

RELEVANCE OF THE STUDY

WHO recommends uniform implementation of preconception care. Accordingly, Maharashtra has resolved to implement preconception care across the State. WHO expects to address nutritional condition of the women during preconception phase. Minimum dietary diversity assessment becomes crucial component for giving appropriate nutritional advise.

AUTHORS CONTRIBUTION

All authors have contributed equally.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

ACKNOWLEDGEMENT

We sincerely thank Directorate of Health Services, Government of Maharashtra and Health Department Zilla Parishad, Nashik, Shri. Mayur Shinde Statistician for their support. The authors also thank UNICEF Mumbai office for the financial support extended to the project. We acknowledge the cooperation of the women who provided valuable information about the intake of food.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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