

Health risks among women desiring pregnancy within one year: a cross-sectional study in Maharashtra India

Jayashree Sachin Gothankar (✉ jayashreesg@rediffmail.com)

Bharati Vidyapeeth University Medical College Pune <https://orcid.org/0000-0003-2088-677X>

Prakash Doke

Bharati Vidyapeeth Deemed University Medical College

Sonali Palkar

Bharati Vidyapeeth Deemed University Medical College

Amruta Chutke

Bharati Vidyapeeth Deemed University Medical College

Archana Patil

State Family Welfare Bureau Maharashtra

Prasad Pore

Bharati Vidyapeeth Deemed University Medical College

Arvinder Pal Singh Narula

Bharati Vidyapeeth Deemed University Medical College

Aniruddha Deshpande

State Family Welfare Bureau Maharashtra

Khanindra Bhuyan

UNICEF Maharashtra

Madhusudan Kamataki

UNICEF Maharashtra

Aparna Shrotri

UNICEF Maharashtra

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Abstract

Background Health of women during preconception phase though critical is comparatively ignored period in her life cycle. Presence of health risks are judged as hazardous to well-being of women and her forthcoming progeny. The objective of the study was to measure the prevalence of health risks and its comparison between blocks.

Methods A cross sectional study was conducted in two tribal and two non-tribal blocks in Nasik district, Maharashtra, India. Currently married women desiring conception within one year were included as study participants. Sample size was estimated to be 6,951. Data was collected by trained Accredited Social Health Activists using validated interview schedule. Anthropometric measures of women were recorded in standard manner. Body Mass Index criteria were used to assess the nutritional status.

Results Mean age of women was 23.19 ± 3.71 years and 16% of them were adolescents. Illiteracy rate was higher in tribal than non-tribal women. Commonest reported occupation was farming. Despite being high parity and gravida status more tribal women desired pregnancy. Substance abuse was high among tribal women. Majority of women consumed meal with family members or with husband. Although 35% of women had low consumption of protein and calorie, yet most of them perceived to have abundant food.

Conclusion Health risks namely younger age, illiteracy, farming with moderate to high-intensity work, high parity, low consumption of protein and calories and undernutrition were found to be prevalent and the risks were significantly more among tribal women. "Continuum of care" must include preconception care.

Introduction

Preconception health refers to the health and wellbeing of reproductive age women and men prior to, or between, pregnancies. It is critical time during which the overall health can influence reproductive health, fertility, maternal and neonatal outcomes as well as the health of future generations [1]. By the time many women seek prenatal care it is often too late. Crucial steps in organogenesis happen early in fetal development [2].

The positive links between the health of women before pregnancy and maternal and child health outcomes are established [2]. The health of women throughout their childbearing age should be addressed to improve their obstetrical and perinatal outcomes [3]. In countries with cultural and gender norms where women and adolescent girls eat last and inadequate food, they may have long-term adverse outcomes for their children [4].

Studies focusing exclusively on women in preconception phase are not common. Most studies on preconception care are hospital-based with emphasis on the effectiveness of preconception care, management of chronic diseases, diabetes control and folic acid supplementation only [5].

The women in need of preconception health promotion are more likely to be with poor education, and low-income, poor health before or during pregnancy and it can lead to adverse maternal, fetal and childhood health [6].

The women are considered to have health risk if their medical, social, environmental, physical, financial, educational or any other socioeconomic factor is judged as hazardous to the well-being of the women or her future fetus or children [7].

A preconception care (PCC) intervention has been planned and is being implemented in Nashik district. The project comprised four stages; identification of women desiring conception within a year, assessment of their health

status specially risk factors, provision of preconception care, assessment of outcomes and comparison with the control group. This community-based cross-sectional study describes the first two stages. The objectives were to determine the prevalence of various health risks among women in the preconception period and to compare the health risk between study and comparison groups as well, tribal and non-tribal areas. Results of this may help to initiate appropriate steps for primary prevention of adverse pregnancy outcomes at diverse places also.

Methodology

Study population

This study is a part of intervention study, carried out in rural population of Nashik district, Maharashtra, India. About 57.5% of district population is rural, 25.6% is tribal and nine out of 15 blocks are notified as tribal. Fifty-two of 106 Primary Health Centers (PHCs) are notified as tribal PHCs. We randomly selected one tribal (Peint) and one non-tribal (Sinnar) block for intervention and one adjacent tribal (Trimbakeshwar) and one adjacent non-tribal (Niphad) block for comparison was assigned purposively (Fig. 1). The study area covered 28 PHCs. This study used observational cross-sectional study design. Sample size was estimated considering lowest prevalence of alcohol consumption as 0.7%, [8] an absolute error of 0.2% and was estimated to be 6,951 women. Review of Health Management Information System (2017-18) indicated that the desired sample size will be certainly available in these four blocks. Currently married women in reproductive age group and desiring to conceive within one year, residing in the area (or intends to reside for more than six months) were included and enrolled in the study. Women unable to understand Marathi, Hindi, or English and unable to respond due to psychotic illness were excluded (Fig. 2). Informed consent was sought from all participants before enrolment in the study. The study was conducted through April to December 2018. Actual enrollment and assessment of desiring women completed in two months, July to August 2018. Approval of the Institutional Ethics Committee of Bharati Vidyapeeth Deemed to be University Medical College was obtained before the start of study vide letter no. BVDUMC/IEC/11 dated 30th April 2018.

Data Collection

The validated and pretested interview schedule including sections on socio-demographic variables, obstetric history and nutritional information and physical assessment in the form of height and weight was used. The data was collected by Accredited Social Health Activists (ASHAs) who were specially trained. They are community health workers in India's public health system. Height, weight measurements were obtained using standardized calibrated equipment at home or Anganwadi or the nearest health facility (sub-center or PHC). Women were lightly clothed without footwear. Height was recorded to the nearest 0.1 cm and weight to the nearest 0.1 kg. A unique identification code was allotted to each participant. All forms were collected at the respective PHC and sent to the nodal institution at every fortnightly. The received forms were reviewed and verified by the centrally trained supervisory staff for completeness, legibility, and accuracy before data entry. Simultaneous data entry was carried out during data collection, consistency and range checks were carried out through data cleaning process.

Variables And Data Analysis

Health risk profile included age, educational status, nutritional status, food intake pattern, obstetric history, consanguineous marriage, and tobacco and alcohol consumption. The nutritional status was calculated using the World Health Organization (WHO) Body Mass Index (BMI) criteria. The outcome was assessed using the percentage of Underweight women (BMI < 18.5), Normal Weight (BMI = 18.5 < 25.0), Overweight (BMI ≥ 25), Obese (BMI ≥ 30). Information regarding parity and history of consanguinity were collected as part of obstetric history. The 24-hour dietary recall method was used to calculate energy and protein intake. Data analysis was done using the Statistical Package for Social Sciences (SPSS) software 25.0 version. Data is presented as absolute numbers and proportions. The significance between two variables was tested using chi-square test at < 0.01 level.

Results

A total of 7,875 women participated in the study. The majority (88.6%) were Hindu. The minimum age of desiring women was 14.42 and the maximum age was 45.50 (23.19 ± 3.71). Out of the total women, 37.8% belonged to tribal blocks. The difference between distribution of all five variables was highly significant among tribal and non-tribal populations. Middle-aged women (25–35 years) desiring pregnancy were more among the non-tribal population. There were more illiterate women in the tribal block than non-tribal blocks. Overall the most common occupation among women was farming (48.0%). The highest formally unemployed women belonged to non-tribal blocks (45.8%). Joint families are more common in non-tribal blocks (Table 1).

Table 1
Demographic characteristics of women in Nashik District, India, 2018-19

Demographic characteristics	Study	Control	χ^2 (p)	Tribal	Non-tribal	Total (%)	χ^2 (p)
Age group							
≤ 19 years	602(16.8)	654(15.2)	10.73 (0.03)	561(18.9)	695(14.2)	1256(15.9)	65.65 (0.001)
20–24 years	1915(53.6)	2235(52.0)		1581(53.1)	2569(52.4)	4150(52.7)	
25–29 years	841(23.5)	1074(25.0)		625(21.0)	1290(26.3)	1915(24.3)	
30–34 years	140(3.9)	208(4.8)		101(3.4)	247(5.0)	348(4.4)	
≥ 35	58(1.7)	56(1.3)		57(1.9)	57(1.2)	114(1.4)	
Missing Data	18(0.5)	74(1.7)		50(1.7)	42(0.9)	92(1.2)	
Education of Women							
P. G./Professional degree	105(2.9)	134(3.1)	2.47 (0.87)	31(1.0)	208(4.2)	239(3.0)	995.49 (0.001)
Graduate	241(6.7)	294(6.8)		52(1.7)	483(9.9)	535(6.8)	
HSC/ ITI	879(24.6)	1002(23.3)		487(16.4)	1394(28.4)	1881(23.9)	
SSC	915(25.6)	1072(24.9)		471(15.8)	1416(28.9)	1987(25.2)	
7th pass	590(16.5)	722(16.8)		590(19.8)	722(14.7)	1312(16.7)	
< 7th Pass	372(10.4)	423(9.8)		497(16.7)	298(6.1)	795(10.1)	
Illiterate	325(9.1)	408(9.5)		490(16.5)	243(5.0)	733(9.3)	
Missing Data	147(4.1)	246(5.7)		257(8.6)	136(2.8)	393(5.0)	
Occupation of Women							
Professional	36(1.0)	97(2.3)	197.17 (0.001)	15(0.5)	18(0.4)	133(1.7)	1225.03 (0.001)
Semi professional	13(0.4)	12(0.3)		2(0.0)	23 (0.5)	25(0.3)	
Clerical	3(0.1)	17(0.4)		2(0.0)	18(0.4)	20(0.3)	
Shop Owner	57(1.6)	89(2.1)		30(1.0)	116(2.4)	146(1.9)	
Farmer	2032(56.9)	1747(40.6)		2103(70.7)	1676(34.2)	3779(48.0)	
Skilled worker	77(2.2)	125(2.9)		19(0.6)	183(3.7)	202(2.6)	
Semiskilled worker	42(1.2)	54(1.3)		27(0.9)	69(1.4)	96(1.2)	
Unskilled worker	110(3.1)	160(3.7)		53(1.8)	217(4.4)	270(3.4)	
Unemployed	1027(28.7)	1666(38.7)		449(15.1)	2244(45.8)	2693(34.2)	

Demographic characteristics	Study	Control	χ^2 (p)	Tribal	Non-tribal	Total (%)	χ^2 (p)
Missing Data	177(5.0)	334(7.8)		275(9.2)	236(4.8)	511(6.5)	
Caste							
Scheduled Caste	495(13.9)	804(18.7)	160.37	556(18.7)	743(15.2)	1299(16.5)	2127.42
Scheduled Tribe	1493(41.8)	1097(25.5)	(< 0.001)	1716(57.7)	874(17.8)	2590(32.9)	(< 0.001)
OBC	3(0.1)	10(0.2)		1(0.0)	12(0.2)	13(0.2)	
Open	462(12.9)	546(12.7)		65(2.2)	943(19.2)	1008(12.8)	
Other	675(18.9)	852(19.8)		48(1.6)	1479(30.2)	1527(19.4)	
Missing Data	446(12.5)	992(23.1)		589(19.8)	849(17.3)	1438(18.3)	
Type of Family							
Nuclear	446(12.5)	559(13.0)	13.32	399(13.4)	606(12.4)	1005(12.8)	43.81
Joint	2723(76.2)	3128(72.1)	(0.001)	2117(71.2)	3734(76.2)	5851(74.3)	(< 0.001)
Other	42(1.2)	92(2.1)		14(0.5)	120(2.4)	134(1.7)	
Missing Data	363(10.2)	522(12.1)		445(15.0)	440(9.0)	885(11.2)	

Despite having higher gravida status and parity, the desire to have a child was higher among women from tribal areas. The differences between tribal and non-tribal were profound regarding substance abuse. Amongst the type of tobacco consumption; the use of snuff (inhalation of roasted tobacco powder) use was exclusively observed among women from to tribal areas (1.5%) and *Mishri* (application of roasted and powdered tobacco to gums/teeth) was commonest tobacco addiction in all blocks together (48.0%). Overall alcohol consumption was reported to be minimum. The majority of the women perceived that they consume abundant food ($p > 0.05$). More non-vegetarian food was consumed by tribal women. Around 52.0% and 39.8% of women consumed less than 70% of the expected calories and protein requirement respectively (Table 2).

Table 2
Health risks among women in Nashik District, India, 2018-19

Characteristics	Study	Control	χ2 (p)	Tribal	Non-tribal	Total (%)	χ2 (p)	
Consanguineous marriage								
Yes	613(17.2)	879(20.4)	20.36	592(19.9)	900(18.4)	1492(18.9)	7.08	
No	2689(75.2)	2956(68.7)	(< 0.001)	2029(68.2)	3616(73.8)	5645(71.7)	(0.008)	
Missing Data	272(7.6)	466(10.8)		354(11.9)	384(7.8)	738(9.4)		
Gravida								
0	2102(58.8)	2501(58.1)	3.41	1862(62.6)	2741(55.9)	4603(58.5)	125.05	
1	945(26.4)	1159(26.9)	(0.49)	603(20.3)	1501(30.6)	2104(26.7)	(< 0.001)	
2	357(10.0)	463(10.8)		329(11.1)	491(10.0)	820(10.4)		
3	118(3.3)	128(3.0)		119(4.0)	127(2.6)	246(3.1)		
> 3	52(1.5)	50(1.2)		62(2.1)	40(0.8)	102(1.3)		
Parity								
0	1854(51.9)	2030(47.2)	18.63	1534(51.6)	2350(48.0)	3884(49.3)	185.70	
1	1141(31.9)	1541(35.8)	(< 0.001)	799(26.9)	1883(38.4)	2682(34.1)	(< 0.001)	
2	409(11.4)	529(12.3)		417(14.0)	521(10.6)	938(11.9)		
3	122(3.4)	143(3.3)		149(5.0)	116(2.4)	265(3.4)		
> 3	48(1.3)	58(1.3)		76(2.6)	30(0.6)	106(1.3)		
Substance abuse								
Smoking	1(0.03)	3(0.07)	21.24	4(0.1)	0(0.0)	04(0.1)	35.46	
Gutka	3(0.08)	4(0.09)	(0.002)	5(0.2)	2(0.0)	07(0.1)	(< 0.001)	
Snuff	16(0.45)	30(0.7)		46(1.5)	0(0.0)	46(0.6)		
Mishri	118(3.3)	98(2.3)		167(5.6)	49(1.0)	216(2.7)		
Passive Smoking	6(0.17)	21(0.5)		12(0.4)	15(0.3)	27(0.3)		
Consumption of alcohol	18(0.5)	30(0.7)		30(1.0)	18(0.4)	48(0.6)		
Missing data	61(1.71)	63(1.5)		78(2.6)	46(0.9)	124(1.6)		
Total	223(6.2)	249(5.8)		342(11.5)	130(2.7)	472(6.0)		
Meal Consumption practice								
With husband	568(15.9)	816(19.0)	33.29	577(19.4)	807(16.5)	1384(17.6)	49.67	
			(< 0.001)					(< 0.001)
List of figures								

Characteristics	Study	Control	χ^2 (p)	Tribal	Non-tribal	Total (%)	χ^2 (p)
Family members	2628(73.5)	2861(66.5)		1943(65.3)	3546(72.4)	5489(69.7)	
After Men	43(1.2)	87(2.0)		17(0.6)	113(2.3)	130(1.7)	
Last	29(0.8)	20(0.5)		18(0.6)	31(0.6)	49(0.5)	
Missing Data	306(8.6)	517(12.0)		420(14.1)	403(8.2)	823(10.5)	
Perception of women regarding food quantity consumed on an average							
Abundant	2358(66.0)	2724(63.3)	10.42	1883(63.3)	3199(65.3)	5082(64.5)	12.23
Enough	848(23.7)	956(22.2)	(0.015)	597(20.1)	1207(24.6)	1804(22.9)	(0.007)
Less	36(1.0)	56(1.3)		38(1.3)	54(1.1)	92(1.2)	
Remaining	2(0.1)	15(0.3)		9(0.3)	8(0.2)	17(0.2)	
Missing Data	330(9.2)	550(12.8)		448(15.1)	432(8.8)	880(11.2)	
Type of food							
Vegetarian	1598(44.7)	1737(40.4)	46.46	771(25.9)	2564(52.3)	3335(42.3)	487.36
Non-vegetarian	602(16.8)	952(22.1)	(< 0.001)	721(24.2)	833(17.0)	1554(19.7)	(< 0.001)
Sometimes Non-Veg	1119(31.3)	1150(26.7)		1122(37.7)	1147(23.4)	2269(28.8)	
Missing Data	255 (7.1)	462(10.7)		361(12.1)	356(7.3)	717(9.2)	
Calorie intake (Percentage of RDA)							
< 50	58(1.6)	56(1.3)	5.78	35(1.2)	79(1.6)	114(1.4)	94.36
50.00–59.99	605(16.9)	696(16.2)	(0.123)	600(20.2)	701(14.3)	1301(16.6)	(< 0.001)
60.00–69.99	1243(34.8)	1434(33.3)		1101(37.0)	1576(32.2)	2677(34.0)	
≥ 70	1668(46.7)	2115(49.2)		1239(41.6)	2544(51.9)	3783(48.0)	
Protein intake (Percentage of RDA)							
< 50	49(1.4)	59(1.4)	0.38	35(1.2)	73(1.5)	108(1.4)	42.06
50.00–59.99	302(8.4)	347(8.1)	(0.94)	261(8.8)	388(7.9)	649(8.2)	(< 0.001)
60.00–69.99	1038(29.0)	1259(29.3)		984(33.1)	1313(26.8)	2297(29.2)	
≥ 70	2185(61.1)	2636(61.3)		1695(57.0)	3126(63.8)	4821(61.2)	
BMI							
< 18.50	1355(37.9)	1400(32.6)	22.72	1206(40.5)	1549(31.6)	2755(35.0)	142.21
18.50–24.99	1803(50.4)	2160(50.2)	(< 0.001)	1288(43.3)	2675(54.6)	3963(50.4)	(< 0.001)
25.00–29.99	133(3.7)	223(5.2)		66(2.2)	290(5.9)	356(4.4)	
List of figures							

Characteristics	Study	Control	χ^2 (p)	Tribal	Non-tribal	Total (%)	χ^2 (p)
≥ 30.00	38(1.1)	55(1.3)		27(0.9)	66(1.3)	93(1.2)	
Missing data	245(6.9)	463(10.8)		388(13.0)	320(6.5)	708(9.0)	
List of figures							

Height and weight of 7167 women (91.0%) were measured. The Mean BMI of women was 19.73 (SD 3.51). The mean protein intake was 41.69 (8.01) gms and the mean caloric intake of women was 1666.92 (278.37) kcals. None of the women in the category of BMI > 30 perceived that they are eating lesser/leftover food. Majority i.e. 70.0% of undernourished women perceived that they consume abundant food (Table 3).

Table 3
BMI and women's perception of food intake in Nashik District, India, 2018-19

BMI categories	Abundant No. (%)	Enough No. (%)	Lessor/ leftover food No. (%)	Total No. (%)	Chi-square	P-value
< 18.5	1769	645	44	2458	4.69	0.58
18.5-24.99	2622	917	47	3586		
25-29.99	242	87	7	336		
≥ 30	59	21	0	80		
Total	4692	1670	98	6460		

Discussion

In India due to cultural norms most of the married women, especially in rural areas are expected to remain pregnant soon after marriage. The period after marriage and before pregnancy although critical, usually is ignored. Most women become pregnant within one year of marriage. Often women who get married below eighteen years of age and tend to have an unplanned pregnancy and are most likely to be anemic and malnourished at the time of conception. The concept of "continuum of care" for improving pregnancy outcome, and reduction of maternal and neonatal mortality highlights the need for preconception care [9]. The pre-conception period being most critical and to highlight its importance, needs to be included in the continuum of care and rename the program as Reproductive, Preconception, Maternal Neonatal Child Health and Adolescents (RPMNCHA). A wide gap however, exists in the continuum of care because of the misperception that healthy behavior is needed only during pregnancy. As per national-level surveys for the state of Maharashtra 33.7% of women begun childbearing at the age of 18 or 19 years [8]. Despite being pregnant, around 34.5% of women do not undergo any checkup in the first trimester of pregnancy [8]. Thus by the time women visit the health care system, most of the fetal organs have been formed. This highlights the fact that for improvement of the quality outcome of current and subsequent pregnancy, women who plan to conceive should seek preconception care [9].

The current study reported that 15.9% of married women below 19 years of age and a higher proportion of tribal women were desirous to become pregnant more than non-tribal women ($p < 0.001$). This age distribution was similar to population-based studies done in other parts of India and South Asia [9–13]. The educational opportunities and better socioeconomic status in non-tribal areas might be a reason for this difference. Marriage

at a younger age leading to early conception is a health risk that is significantly associated with postnatal complications and other adverse pregnancy outcomes and high chances of unplanned pregnancies [14–15]. Social pressure to marry early, and pressure for early childbearing soon after marriage, often prevents these married women and young girls from accessing contraception [15]. Illiteracy can be seen as a social health risk for the women, it was reported more in tribal than non-tribal women ($p < 0.001$).

This study reports that 4.7% of women despite giving birth to three or more children were still desirous to remain pregnant in the next one year, the difference was statistically significant between tribal and non-tribal ($p < 0.001$). It was almost similar to a multi-centric study in India. This highlights the scope for extension of family planning services and the importance of interventions that may also reduce unintentional births [16–18].

Smoking in preconception period is linked to delayed time to conceive and infertility [1]. Although convincing studies about effect of smoking during preconception period are lacking, indirect evidence of impact at the population level is evident from the introduction of smoke-free legislation in different countries which has been associated with significant reductions in preterm births [2]. The results of a meta-analysis reported that maternal active and passive smoking is associated with a higher risk of congenital heart disease among the offspring [17–18]. In current study however, the prevalence of smoking was low (1.3% in tribal blocks). But the prevalence of consumption of tobacco in any form was 3.8%. Substance abuse was significantly more in tribal women than non-tribal ($p < 0.001$). *Mishri* use is very common in tribal area. Women in reproductive age group have slightly higher tobacco use rates of 11% [19]. Maternal alcohol consumption leads to variety of fetal alcohol spectrum disorders including 30% increase in spontaneous abortion [20]. Since many pregnancies are unplanned the scope for action at individual level is limited; this highlights the importance of cost-effective public health actions to reduce risk behaviors in the whole population and safest approach is to abstain from alcohol when planning a pregnancy as well as during pregnancy [1, 2]. In current study the reported alcohol consumption was very low among the women i.e. 0.7% compared to other studies [5, 21]. The probable reason might be low mean age of participants in the current study.

Physical activity in the preconception period is positively linked to a range of health benefits [1]. In the current study even though information on physical activity was not collected the majority of the women were farmers by occupation which may involve moderate to high-intensity physical activity. Although there is no research about the physical activity in the preconception period, however a study report excessive maternal activity in early pregnancy was associated with adverse fetal outcome [22].

In the current study, almost one-third of women were undernourished ($BMI < 18.5$) similar to other studies [3, 11, 21]. In tribal block the proportion was more than 40%. Overall undernutrition was more and overweight was less in the present study compared to observations in a rural area in Nashik [23]. There could be three reasons; our data is about three years later, secondly the population is exclusively women desiring pregnancy in immediate future and the population consisted of substantial number of women from tribal areas. The reasons for the high prevalence of underweight among pre-pregnant women may not be attributed to discrimination against young women since in the current study majority of women consumed food along with other family members or husband.

Undernutrition can be attributed to other factors like exposure to infectious disease, poor sanitation, and poor diets all contributing to low body mass among women. Interestingly, irrespective of other factors the women in this study are satisfied with their food consumption practices. Surprisingly Although the majority of women perceived that they consumed adequately to abundant food still many were undernourished. The undernutrition needs to be addressed before they become pregnant to improve their pregnancy outcome.

All studies reported an association between pre-pregnancy BMI and the risk of adverse perinatal outcomes i.e. infants whose mothers were underweight had a significantly higher risk of being small for gestational age, low birth weight, or the possibility of preterm birth as reported by studies [3, 23–30]. All women, especially in the adolescent age group or women who delivered require appropriate pre-pregnancy advice as well as interventions on optimizing the BMI [28, 30].

A study in Asia did not find a significant association between low pre-pregnancy BMI and preterm birth, the reason may be the paucity of well-conducted cohort studies [31].

The assessment of dietary intake provided in the present study was done using 24-hour dietary recall because of feasibility and there is almost no loss to recall memory. This method is most commonly used for nutritional surveys [32].

One study reported the proportion of women consuming less than 50% of the RDA was 15.8% for energy, 39.6% for protein [11]. This is in contrast to the current study where only 1.4% of the women were consuming less than 50% of their daily energy and protein requirement. While almost half of the women were consuming 70% or more of their recommended energy intake per day.

Another Indian study reported 26.9% of women having history of consanguineous marriage, while the current study reported it to be 19%. Consanguinity is associated with adverse perinatal outcome, pregnancy loss, stillbirths and low birth weight babies [33].

Limitations

Current study used 24-hour dietary recall method, which lacks weekly variations (usually substantial). Also there is difficulty in precisely estimating the quantity of intake. The missing data was high. The assessment of health status was not supported by laboratory investigations.

Conclusion

Health risks namely younger age, illiteracy, farming with moderate to high-intensity work, high parity, low consumption of protein and calories and undernutrition were found to be prevalent in women desiring to pregnancy within one year and the risks were significantly more in tribal women. The study highlights the need of preconception care in “continuum of care”.

Abbreviations

PCC: Preconception Care; PHCs: Primary Health Centers; ASHAs: Accredited Social Health Activists; WHO: World Health Organization; BMI: Body Mass Index; SPSS: Statistical Package for Social Sciences; RPMNCHA: Reproductive, Preconception, Maternal Neonatal Child Health and Adolescents

Declarations

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Authors' contributions

All authors conceived the study. PPD, SHP, APC, PDP and APSN led data collection. JSG, PPD, SHP and APC conducted the analysis and interpreted the data. JSG drafted the manuscript and substantively revised. All other authors reviewed manuscript drafts critically for intellectual content. All authors have approved the submitted version.

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Availability of data and material

Datasets are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Approval of the Institutional Ethics Committee of Bharati Vidyapeeth Deemed to be University Medical College was obtained before the start of study. Informed consent was sought from all participants before enrolment in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Authors details

¹Department of Community Medicine, Bharati Vidyapeeth Deemed University Medical College, Pune, India 411043.

²Directorate of Health Services, Government of Maharashtra, Pune, India 411001. ³UNICEF Maharashtra, India.

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Figures

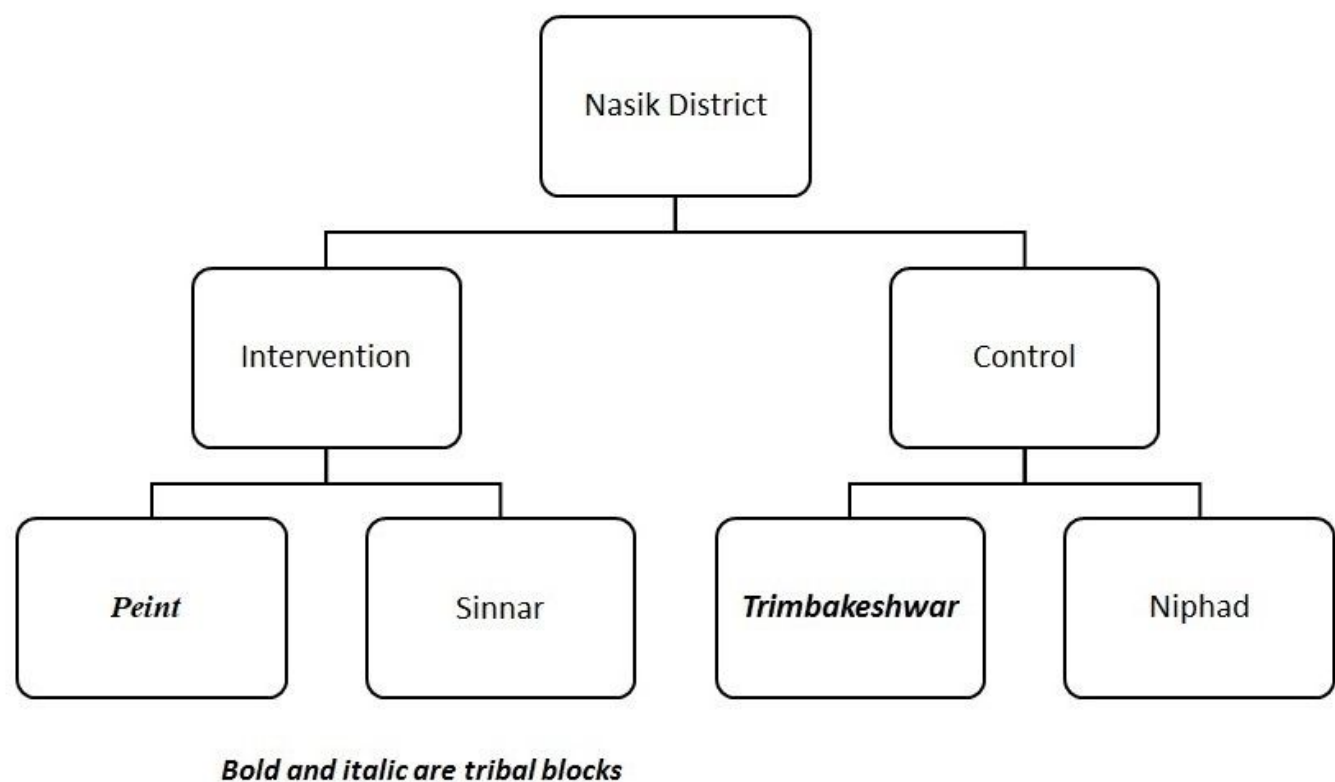


Figure 1

Blocks in intervention and control arm of the study, Nashik district, 2018-19

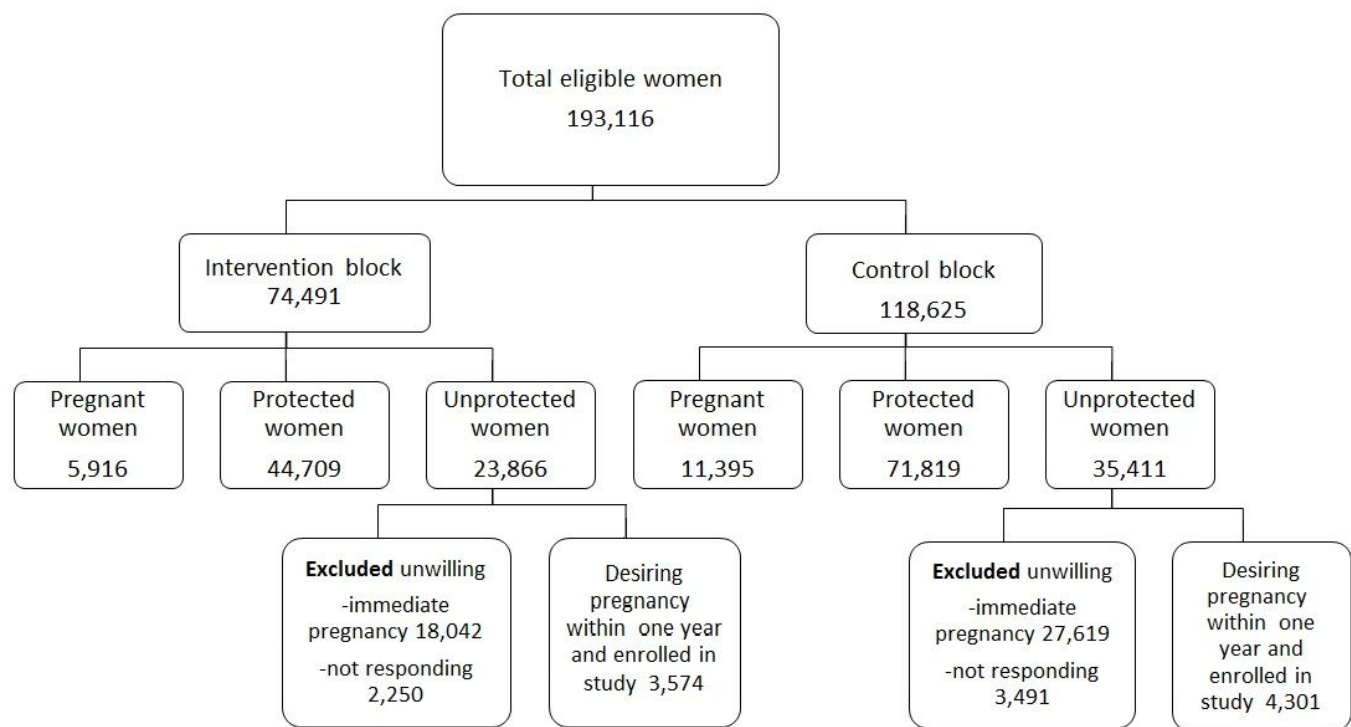


Figure 2

Flow diagram of women in the study , Nasik District, 2018-19

