Tribal Household food insecurity, Mother's food diversity and its association with nutritional status of under-five children in Palghar District, Maharashtra

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Introduction:

Food insecurity affects individuals all around the world. It results in undernutrition among under-five children. It is defined as a lack of consistent access to adequate quality and quantity of food. Food insecurity affects 800 million people globally (Kammi k schemer & Barbara a Piperata, 2017). Despite national and international efforts to enhance food security, in 2013, around 800 million people were food insecure; most live in low- and middle-income nations (FAO 2014).

Food insecurity is widespread across low- and middle-income countries (de Oliveira KHD et al., 2020 & WHO, 2020). Since 2014, the global incidence of moderate or severe food insecurity has steadily increased (FAO, 2020). It results in poor nutritional status among under-five children. As per WHO estimates, in the year 2020, 22.0 per cent (149.2 million) of children under the age of five were stunted, 6.7 per cent (45.4 million) were wasting, and 5.7 per cent (38.9 million) were overweight. (WHO, 2021). Furthermore, by 2030, it is estimated that 119 million children under the age of five will be stunted in 135 low- and middle-income countries (Agraw et al., 2019). According to (UNICEF, 2020), Most of the world's malnourished children live in India. The government of India reports significant variations in the distribution of malnutrition across the country (IIPS & ICF, 2017a).

Children's under-nutrition is closely associated with household food insecurity (K.K. Saha & M.hackett et.a.,2009). Hunger, described as a lack of access to food and actual malnutrition, is a possible result of a root element - food insecurity, which suggests a limited supply of Food (Anderson 1990). Household food insecurity is a broad notion that encompasses not just hunger and malnutrition but also householders' anxiety and uncertainty regarding food. These include perception of food quality and quantity issues, accessibility and acceptability, hunger experiences, and the type of job done to earn money to buy Food (Carlson et al. 1999).

Historically, efforts in India have been made to ensure food security for the population. The Public Distribution System (PDS) was established in British India during World War II to combat starvation and ensure that all households had access to Food (FAO). Numerous nutritional and social assistance programmes are in place in India to ensure food security and reduce undernourishment among all under-

five children, mainly from scheduled tribes. Although NFHS-4 & 5 revealed a noticeable increase in the caloric content of children from the general population, the nutritional status of tribal children is still lower than that of other children (NFHS-4 & 5, 2015-16; 2019-2021).

Mothers are primarily responsible for choosing, preparing, and serving nutritious diets to their children. Few studies have found a link between what mothers eat and what their children eat (Amugsi et al., 2015). The hypothesized relationship between food insecurity and childhood malnutrition has attracted researchers' interest globally (Zalilah & Tham, 2010; Matheson et al.,2002; Nakabo-Ssewanyana, 2003; Bhattacharya et al., 2004; Osei-2010; Gillespei, 2013; Baker-frech et al.,2014). Although numerous research has been carried out to evaluate the correlation between household food insecurity and children's nutritional status, they have revealed contradictory findings. While some research indicated a positive association, others found no relationship (Shen x et al. 2015 & Chandrasekhar S et al. 2017). Multiple studies have found that a mother's diet significantly influences her child's diet and nutritional outcomes (Corsi D et al., 2016 & Kim R et al., 2017). A sufficient and well-balanced diet among women is crucial for children's optimum physical growth and cognitive development (FAO. 2016). Improving the mother's diet can help reduce situations such as stunting, wasting, and being underweight among children.

Food insecurity in the household has been linked to reduced household food supplies, particularly legumes, milk, fruits, and vegetables. In addition, household food insecurity is negatively linked to women's food consumption (Matheson et al., 2002). Inadequate dietary intake and nutritional deficiencies among women result in growth and development-related health issues among children, such as stunting and poor cognitive and behavioural development (Kendall et al., 1996; Olson, 1999; Cook et al., 2004). It results in long-term social and economic implications in the community. Further, a mother's nutrition directly impacts her child's nutritional health. A mother's food intake and nutritional status can affect the outcome of the pregnancy and a child's nutritional status later in life (Nagash C. et al., 2015 & Felisbino et al., 2014). Nutritional deficiencies during pregnancy and lactation can lead to stunting and being underweight in young children (Institute of Medicine, 1991; Abalo, 2009; Coleman-Jensen et al., 2013). Nutritional supplements, particularly during pregnancy and lactation, are essential for a child's physical and mental development (Schwarzenberg S et al., 2018).

Remarkable disparities in health and nutritional status exist among different communities in India. Even after adjusting for other socioeconomic characteristics, children from lower caste communities - such as scheduled castes and tribes- have worse morbidity and mortality indicators due to poor nutritional status. Also, compared to the general population, these communities have less access to health and nutrition programmes (Thorat, S., & Sadana, N.2009). Further, multiple studies have identified the household's socioeconomic status as a primary risk factor for food insecurity. Limited household income and increased living expenses (such as housing, power, children's education, and medical

expenses) can also lead to food insecurity (Zalilah & Tham, 2002; Broughton et al., 2006; Abdul & Perrera, 2011). The factors such as lower status on the social gradient composite of caste class, occupation, and place of living, can determine the health and nutritional status of communities. Compared to the non-tribal general population, the tribal population has less access to amenities and healthcare services due to lower socioeconomic status. A study conducted in Barabanki District in Uttar Pradesh found a high prevalence of children undernutrition among food-insecure tribal households (R Rawat and S Unisa 2021).

The present study area, Palghar, was separated from the Thane district in 2014. Palghar's total population was 3 million in 2011, with STs Accounting for 37.4 per cent of the population (Census, 2011). Because the majority of the people are tribals, the Palghar, Vikramgad, Jawhar, and Dahunu blocks are scheduled regions. Palghar District is home to tribal populations such as the Warli, Katkari, Malhar Koli, Kokana, Dhodiay, and Mahadev Koli. Furthermore, the district has been divided into eight talukas: Mokhada, Talasari, Vasai, Vikramgad, Jawhar, Palghar, Dahanu, and Wada. Due to the high-forested areas, several tribal communities, hamlets, and a few small fishing villages exist. The talukas of Mokhada and Jowhar were frequently mentioned in the press, triggering urgent visits by concerned government officials (Ghosh et al., 2019), because the district of Palghar has had a long-standing problem of under-nutrition(Shah & shah, 1981).

Agriculture is the primary source of livelihood in Maharashtra's Palghar district, most of which is tribal (Teri, 2018). In 2017, the prevalence of undernutrition was reported to be 59 per cent stunting, 53 per cent underweight, and 20 per cent wasting, with 600 children under the age of five dying because of malnutrition (Ghosh & Varerkar, 2019). The study by Ghosh and Varerkar (2019) and Jeyakumar et al. (2021) was an earlier attempt to understand the nutritional status of tribal children younger than five years of age in Palghar, Maharashtra. However, to my knowledge, no study assesses the linkages between household food insecurity, mother food diversity, and their effect on under-five tribal children's nutritional status in Palghar after the pandemic. Hence, the present study was conducted to assess the relationship between selected maternal food diversity, household food insecurity and their effect on under-five tribal children's nutritional status in the Palghar district of Maharashtra. These findings are important for policy makers developing strategies to improve mother food diversity and children's nutrition status and consider household food insecurity as one of the important determinants.

Methods

A cross-sectional was conducted in the four blocks of the Palghar district. The study aimed to assess the association between tribal households' food insecurity, under-five children's nutritional status and mother's food diversity. Using multi-stratified sampling, 575 households (SSUs) from 16 villages (PSUs) were selected. The study covered all households with at least one under-five child. A total of

575 mothers were interviewed using a semi-structured interview schedule. Data were collected between February to August 2021.

Selection of sample-

A multi-stage sampling procedure was used for sample selection. As primary sampling units, villages from four blocks of Palghar were selected. After selecting the villages, with the help of AWW (Anganwadi worker) and the gram panchayat office, listing households with at least one under-five children was done. The list included details such as the name of the head of the household, the total number of family members, the number of living children, the number of children under five years old, the number of under-five years deaths, and the type of ration card.

Out of these households, 575 households were selected using the formula $\boldsymbol{n = \frac{t^2 * P(1-p) * d}{m^2}}$. For the further selection procedure, a unique ID is given to each household.

Further, a proportionate sampling strategy was used to determine the sample size for each village. Once the sample size for each village was determined, the households (SSUs) were selected using a systematic random sampling procedure. A random selection of households was made using the RANDBETWEEN function in MS Excel. For example, assuming any village has 42 study population households (having children under-five years) and 18 of the sample households (based on proportionate sampling procedure). All 42 households were arranged systematically according to the unique ID given to each household, and every (42 ÷ 18 = 2.33 => 2, i.e. "nth") third household was selected to get the 18 sample households for the data collection.

Operational Definitions and Data Collection Tools

Dependent Variable: For children aged one to five, stunting (low height for age), wasting (low weight for height), and underweight (low weight for age). Stunting, wasting, and underweight were classified as 1 = stunted, else = 0; 1 = wasted, else = 0; & 1 = underweight, else = 0 respectively. Furthermore, the Low birth weight of a child was classified into two groups 1= less than 2500 grams weight at birth and 0= more than 2500 grams weight at birth.

Household food diversity: The food security module for this study was developed from the Food and Nutrition Technical Assistance (FANTA) project's Household Food Insecurity Access Scale (HFIAS), which has been tested across cultures and nations (Coates et al. 2007; Coates et al. 2006). The instrument comprised nine questions. Each question assesses a different level of food insecurity intensity. All severity questions were asked if the respondent (on behalf of all household members) felt a certain way or did something in the preceding four weeks. Following each severity question comes a frequency-of-occurrence question. Here each respondent was asked about the frequency of incidence. The responses were scaled using the Likert scale as Rarely (01), Sometimes (02), and Often (03).

These nine indicators also summarise the prevalence of each of the three HFIAS domains–Anxiety (Worry) and uncertainty about food, inadequate quality of food, and poor or insufficient food intake–in households. The questionnaire contained one of nine items to represent the Anxiety domain, two items to represent the domain of Inadequate Food Quality, and six items to assess the domain of Insufficient Quantity or Intake of Food, as compared to three items for Inadequate Quality and five items for Insufficient Quantity in the HFIAS Indicator Guide, respectively (Coates et al. 2007).

The last three items in the list below (7, 8, 9) indicate severe food insecurity and are the same as in the HFIAS.

Domain A) Anxiety and uncertainty about the household food supply:

1- Did you worry that your household would not have enough food?

Domain B) Inadequate Food Quality (including variety and food preferences):

2- Did you eat the same foods daily because you did not have money to buy other foods?

3- Did you or anyone in the household have to eat any food you did not want (undesirable food) because there was no money to buy the foods you preferred?

Domain C) Food Intake insufficient or insufficient in quantity:

4- Did you ever eat less than you felt you should because you did not have enough money to buy food?

5- Have you or any other adult in your household cut the size of your meals because you did not have enough money to buy food?

6- Did you skip some of your daily meals because you did not have enough money for food?

7- The Food you had did not last, and you didn't have enough money to buy more? (Severe condition – ran out of food)

8- Were you ever hungry and did not eat a meal because you did not have enough money to buy food? (Severe condition – hungry)

9- Did you or another adult in your household ever not eat for a whole day because you did not have enough money to buy food? (Severe condition – going an entire day without eating)

Yes, Responses were coded =1, and no responses were coded= 0 for the nine severity questions in the HFIAS. The HFIAS (Household Food Insecurity Access Scale) Score was then calculated as a continuous measure of household food insecurity by adding the codes for each frequency-of-occurrence question following each of the nine severity categories, such as Never =0, Rarely =1, Sometimes =2, and Often =3. (Coates et al., 2007).

The maximum score for households in this survey was 27 (households reporting "yes" to all nine severity items and all nine frequency-of-occurrence questions as "often" coded with a response code of 3). The lowest score was 0 (households responding "no" to all nine severity items, and the interviewer skipped frequency-of-occurrence questions). The higher the score, the more food insecurity the household reported experiencing. The average HFIAS score was computed, and then household food insecurity access prevalence (HFIAP) categories (Food secure, mildly, moderately, and severely food insecure) were generated to determine the status of food insecurity (Coates et al. 2007 & Mulusew, 2015).

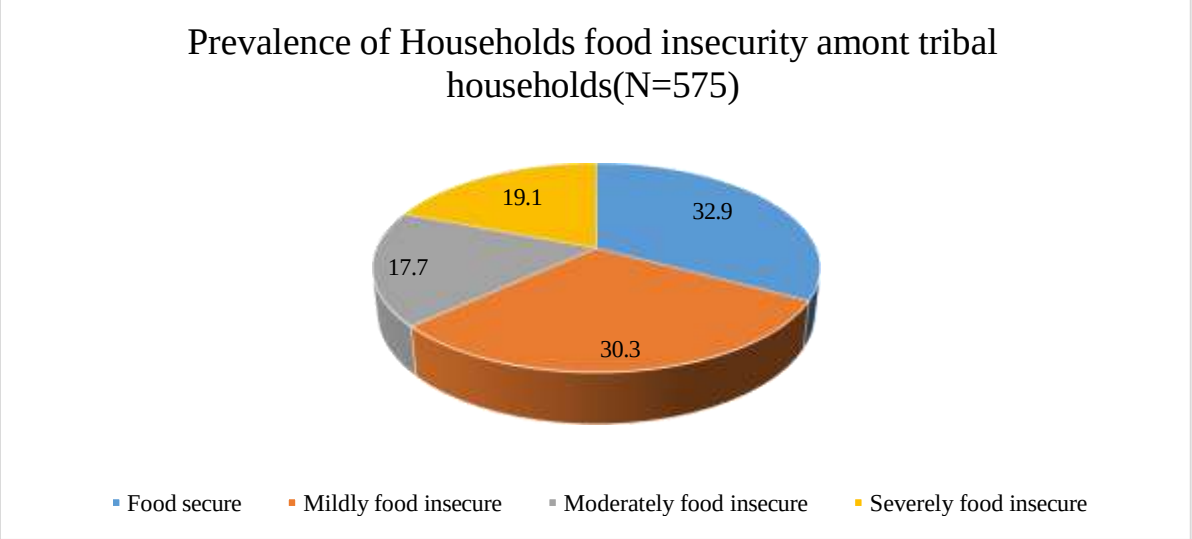
Mother's Food Diversity: Based on a 48-hour recall interval, data on 12 food groups was collected. Like, Grains, white roots, and tubers; pulses; nuts and seeds; dairy; meat, poultry, and fish; eggs; dark green leafy vegetables; other vitamin A-rich fruits and vegetables; other vegetables and fruits. Minimum dietary diversity (MDD) is defined as eating from at least five different food groups and is marked "1" if the women eat a diverse diet and "0" if they do not (FAO, 2016).

Data Analysis:

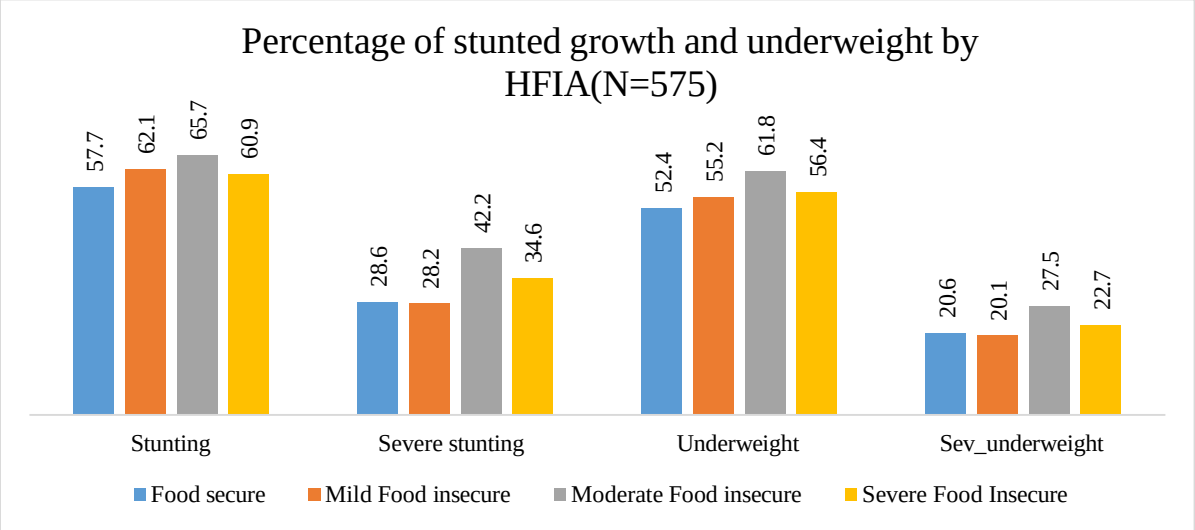
Primary data was entered into Survey CTO software to minimize data cleaning. Further analysis was done using Stata 17. Logistic regression was used to assess the relationship between household food insecurity, the nutritional status of children and mother food diversity.

Results:

Figure 1 presents the prevalence of household food insecurity in the study population. Thirty-three per cent of households reported that they were food secure. Around 30 per cent of households had mild food insecurity, whereas 18 per cent experienced moderate food insecurity. Nineteen per cent of tribal households suffered acute food insecurity, which included going to bed hungry and sleeping without food.



As shown in figure 2, there is a mixed relationship between household food insecurity and child nutrition, i.e., as food insecurity rises, child under-nutrition rises. Stunted insecure households account for 61 per cent of children under five. When 29 per cent of children in food-secure homes suffered from severe stunting, the percentage rose to 42 per cent in moderate food-insecure households and 35 per cent in severe food insecure. Differences in underweight are also quite noticeable depending on one's level of food security. In other words, while 52 per cent of children in food-secure households were underweight, the percentage increased to 62 per cent in moderate and severe food insecurity and 56 per cent in severe food insecurity. In general, Moderate food-insecure households reported more stunted and underweight children under the age of five.



The relationship between household food insecurity and the background characteristics of respondents is presented in Table 1**.** The mean age of children was 27.90 + 16.8 months of experiencing food insecurity**.** Households in the tribal subgroups of Kokana, Dhodiya, and Malhar Koli reported being more secure in their access to food (56 per cent, 36 per cent, and 29 per cent, respectively). In the Katkar and Warli tribes, mothers reported higher levels of food insecurity by about 27 per cent and 22 per cent. Inverse relationships were seen in food-secure and food-insecure households with tribes. Sixteen per cent of male children and 23 per cent of female children living in households suffered severe food insecurity. Mother food diversity and food insecurity in the household were strongly associated ($p<0.005$). Twenty-nine per cent of mothers who ate less than five food groups in the past 48 hours experienced severe food insecurity, compared to mothers who consumed five or more food groups. Mother education is an essential factor in poverty and household food insecurity. Mother education and household food insecurity were strongly related ($p<0.005$). Those mothers who studied 10^{th} and above education (55%) were in more food-secure households than those illiterate mothers (18%). A more significant proportion of mothers from Food insecure households had no formal education than mothers of children from secure food households ($p<.05.$). Significantly, Compared to mothers with BMIs over

25.5, mothers with BMIs under 18.5 and 18.5 to 25.5 lived in households more likely to be severely food insecure (18 per cent, 21 per cent and 7 per cent).

Table 1 Characteristics of children in Palghar District of Maharashtra by household food insecurity

Background characteristics	Household food insecurity index (per cent)					
	Food secure	Mild food insecure	Moderate food insecure	severely Foo insecure access	Total	chi-P-value
Tribes						
M_katakari	25.0(16)	25.0(16)	23.4(15)	26.5(17)	64	32.07
Warli	28.5(94)	31.3(103)	17.6(58)	22.4(74)	329	p<0.000
Malhar koli	36.2(42)	30.1(35)	18.9(22)	14.6(17)	116	
Kokana dhodiya	56.1(37)	30.3(20)	10.6(7)	3.03(2)	66	
Age in Months						
00-12	31.4(44)	30.7(43)	19.3(27)	18.6(26)	140	20.05
13-24	27.6(42)	30.3(46)	25.7(39)	16.5(25)	152	p< 0.066
25-36	42.1(56)	30.8(41)	7.5(10)	19.6(26)	133	
37-48	31.8(28)	30.7(27)	15.9(14)	21.6(19)	88	
49-60	30.7(19)	27.4(17)	19.4(12)	22.6(14)	62	
Gender						
Male child	37.3(110)	30.2(89)	17.0(50)	15.6(46)	295	7.78
Female child	28.2(79)	30.4(85)	18.6(52)	22.9(64)	280	p<0.051
Mother Food Diversity						
Inadequate	19.2(59)	34.9(107)	20.9(64)	25.1(77)	307	57.72
Adequate	48.5(130)	25.0(67)	14.2(38)	12.1(33)	268	p<0.000
Mother Education						
No education	18.0(36)	29.5(59)	22.5(45)	30.0(60)	200	72.32
<5 yrs	24.0(25)	39.4(41)	20.2(21)	16.4(17)	104	p<0.000
6-9 yrs	37.4(46)	30.9(38)	17.1(21)	14.6(18)	123	
10th class and above	55.4(82)	24.3(36)	10.1(15)	10.1(15)	148	
Mother BMI						
<18.5	30.6(79)	31.0(80)	19.8(51)	18.6(48)	258	17.68
18.5-25	31.4(90)	31.0(89)	16.7(48)	20.9(60)	287	p< 0.007
>-25	66.7(20)	16.7(5)	10.0(3)	6.7(2)	30	
Husband Education						
No education	16.5(19)	26.1(30)	19.1(22)	38.3(44)	115	69.02
<5 yrs	27.4(31)	28.3(32)	23.9(27)	20.4(23)	113	p<0.000
6-9 yrs	28.4(44)	38.1(59)	16.8(26)	16.8(26)	155	
10th class and above	49.5(95)	27.6(53)	14.1(27)	8.9(17)	192	
Wealth quintile						
low	17.2(33)	28.7(55)	24.0(46)	30.2(58)	192	78.42
Medium	28.1(54)	32.8(63)	18.8(36)	20.3(39)	192	p<0.000
High	53.4(102)	29.3(56)	10.5(20)	6.8(13)	191	

Table 2 Prevalence of stunting, wasting and underweight by household food insecure and mother food diversity

Background characteristics	Prevalence of under-nutrition and low birth weight						Total
	Stunting	Chi-(P-	wasting	Chi-(P-value)	Underweight	Chi-(P-v	
Household food security							
Food secure	57.7	1.91	24.9	5.84	52.4	2.40	189
Mild food insecure	62.1	p<0.592	24.7	p<0.120	55.2	p<0.493	174
Moderate food insecure	65.7		35.3		61.8		102
Severe Food Insecure	60.9		21.8		56.4		109
Mother Food Diversity							
Inadequate	65.5	5.43	29.9	5.14	60.3	5.66	307
Adequate	55.9	p<0.020	21.6	p<0.023	50.4	p<0.017	268

The food diversity and food insecurity of mothers of underweight, stunted, and wasted children under five are presented in Table 2. Food insecurity in the household was not associated with being underweight, stunting, or wasting. However, there was a direct correlation between stunting, wasting, and being underweight, and the diversity of food available for mothers. For 67 per cent of stunted children, their mothers consumed less than five food groups. In the case of 57 per cent of stunted children, mothers consumed enough food. Children of mothers consuming five or more food groups are less likely to be stunted, wasted and underweight than those not consuming five or more food groups.

Table 3 shows the markedly elevated rates of undernourishment and low birth weight and how these factors are related to maternal food diversity and household food insecurity (p<0.000). Compared to 40 per cent of children from food-secure households who were less malnourished, children from moderately and severely food-insecure households comprised 59 per cent and 48 per cent of the malnourished children, respectively (p<0.007). Children whose mothers consumed at least five food groups had a lower risk of malnutrition (59 per cent) than those children whose mothers did not consume at least five groups. Low birth weight and household food insecurity are strongly associated. Children from moderate (77%) and severe (76%) food-insecure households had low birth weights.

In comparison, food-secure food households had 53 per cent of the LBW children (p<0.000). Similar results were seen in mother food diversity and low birth weight. Mothers with inadequate food diversity had more LBW (75%) and undernourished children (58%) than mothers with adequate food diversity.

Table 3 Prevalence of MUAC, low birth weight by household food insecure and mother food diversity

Particulars	Prevalence of undernutrition and low birth weight			
	MUAC	Chi-(P-value)	low birth weight	Chi-(P-value)
Household food security				
Food secure	39.7	12.09	53.44	24.48
Mild food insecure	52.3	p<0.007	66.09	p<0.000
Moderate food insecure	59.8		77.45	
Severe Food Insecure	48.2		76.36	
Mother Food Diversity				
Inadequate	54.72	9.57	72.31	12.01
Adequate	41.79	p<0.002	58.58	p<0.001

Note: MUAC refer to Mid-Upper Arm Circumference

Table 4 shows a multivariate logistic regression of stunting and food insecurity among under-five tribal households in the Palghar district. According to statistics, food insecurity in the household has not been correlated to low nutritional status in children under the age of five. Children from moderately food-insecure households are 1.28 times more likely than those from food-secure families to be stunted (OR, 1.28, 95% CI, 0.77-2.13, p<0.341). However, there was a relationship between mother food diversity and the nutritional status of children under five. When the mother's food diversity was adequate, their children were 67 per cent less likely to be stunted (OR, 0.67, 95 per cent CI, 0.46-0.97, p<0.034) than those children where the mother's food diversity was inadequate. Similar results were found with wasting and underweight.

Table 4 Multivariate logistic analysis of stunting, wasting and underweight by household food insecurity and mother diversity

Background characteristic	Odds (95 percent CI)		
	Stunting	Wasting	Underweight
Household food insecurity			
Food secure®			
Mild food insecure	1.12 (0.73 , 1.71)	0.89 (0.55 , 1.46)	1.06 (0.69 , 1.61)
Moderated food insecure	1.28 (0.77 , 2.13)	1.46 (0.85 , 2.49)	1.37 (0.83 , 2.25)
Sever Food Insecure	1 (0.61 , 1.64)	0.7 (0.39 , 1.25)	1.06 (0.65 , 1.72)
Mother food diversity			
Inadequate®			
Adequate	0.67** (0.46 , 0.97)	0.6** (0.4 , 0.89)	0.73* (0.51 , 1.05)

Note: Reference categories. ***: 0.01, **: 0. 05, *0.10

Table 5 Multivariate logistic analysis of low birth weight and MUAC by household food insecurity and mother diversity

Background characteristic	Odds(95 percent CI)	
	Low birth weight	MUAC(malnutrition)
Household food insecurity		
Food secure®		
Mild food insecure	1.55** (1.01, 2.39)	1.51* (0.99, 2.31)
Moderated food insecure	2.68*** (1.54, 4.67)	2.01*** (1.22, 3.31)
Sever Food Insecure	2.39*** (1.39, 4.1)	1.15 (0.7, 1.89)
Mother food diversity		
Inadequate®		
Adequate	0.6** (0.4, 0.89)	0.58*** (0.41, 0.83)

Note: Reference categories. ***: 0.01, **: 0. 05, *0.10

Table 5: Low birth weight and malnourishment were highly linked with household food insecurity. Compared to children from food-secure households, those from moderate and severe food-insecurity households had a higher risk of malnutrition and low birth weight. Children whose mothers consumed five or more food groups were less likely to have children with malnourished and low birth weight (OR, 0.68, 95 % CI, 0.4-0.89, $p<0.005$).

Discussion:

This study examines the link between household food insecurity and the nutritional status of children under five among the tribal population in the Palghar district. One of three tribal households in the Palghar district is food insecure. This means more than half of the tribal households in the region are not accessible to nutritionally adequate and safe foods or are unable to acquire food in socially accepted ways. In general, one in nine people globally suffers from food insecurity at some level, which is considered a significant contributor to the high prevalence of undernourishment in developing countries (WFP 2020). The further deterioration of food security can prevail among the most vulnerable populations compared to others (Diansari and Nanseki 2015).

Recent evidence suggests that individual diet diversity is associated with household food security (Ruel 2003). Nearly half of the mothers with adequate diet diversity are from the food secure households in the study area. At the same time, obesity was also higher among women from food-secure households. Studies argued that the changes in the long-held dietary pattern of Indian women (majorly whole grain cereals) are a possible reason for the increase in the rate of obesity, overweight and non-communicable diseases (Sims et al. 2021; Girdhar et al. 2016).

Based on this study, more than half of the educated mothers belong to food-secure households. Overall mother's education is considered the best predictor of nutritional inequalities among households, infants and young children in rural settings (Wamani et al. 2004). In vulnerable settlements, household income has been identified as an essential factor in determining household food security (accessibility and affordability) (Dharmaraju et al. 2018; Joshi et al. 2019). The primary analysis in this study found that only seven percent of household in the highest wealth quintile in Palghar is severely food insecure.

Nationally representative sample-based studies concluded that the prevalence of stunting, wasting and being underweight among tribal children is much higher than the national prevalence (Adhikari et al. 2021; Kumar et al. 2021). The current results show that 61 per cent of children were stunted, 56 per cent of tribal children were underweight, and 26 per cent of children were wasted in the study area. A study conducted in the same region before Covid-19 was also yielded a similar result (Ghosh and Varerkar 2019). Even though this study is not exploring the factors that determine the nutrition status of tribal children, the primary possible reasons can be drawn from earlier studies. Research on malnutrition among tribal children indicated that community wealth and education are the significant determinants (Singh, Alagarajan, and Ladusingh 2015; Arunkumar and Hidhayathulla 2015). Poor diet and disease are considered the immediate determinants of under-nutrition, and household food security plays an underlying factor (Tomaszewska and Kwiatkowska 2019).

The primary focus of this study was to assess the relationship between selected maternal food diversity, household food insecurity and their effect on under-five tribal children's nutritional status. This study finds household food insecurity a risk factor for low birth weight among children. This finding may be explained by mothers' low total energy intake and poor nutrient intake caused by inadequate access to Food (Tarasuk and Beaton, 1999). Additionally, in the face of household food insecurity, mothers often resort to coping strategies by which they compromise their energy intake to meet their current children's or household members' needs (Isanaka et al., 2006). Low-income mothers may allocate resources or sacrifice food consumption to protect their children from hunger (Devine et al., 2015). A malnourished mother gives birth to undernourished children and "severe early malnutrition, particularly during the period of rapid brain function, leading to irreversible intellectual impairment (Levitsky and Strupp, 1995, cited in Fishman et al., 2004, p.101).

Further, the multivariate analysis shows that household food insecurity doesn't affect the children's nutritional status. A study conducted in Kerala found household food insecurity was insignificant in both bivariate and multivariate analysis with children's stunting and wasting (Jayalakshmi, R., & Kannan, S. 2022). The Maharashtra Comprehensive Nutritional Survey (2012) and Nepal research (Osei, A. et.al.,2010) also found a negative association between household food insecurity with children's nutrition status. These results underline the role of food security in nutrition, as access to food is inadequate, and utilization is critical (Burchi and Muro,2016). However, a mother's dietary variety was closely connected with whether a child was stunted, wasted, or underweight (Chandrasekhar S et al., 2017). It can be argued that in the developing world, the food security of a household doesn't capture the nutritional intake of its members, where gender roles and customs play a crucial role in household decision-making and diet diversity (Larson, Castellanos, and Jensen 2019; Chandrasekhar et al. 2017). To our knowledge, no study has examined mothers' minimum dietary diversity and child nutrition among Palghar tribes.

The result shows that children with mothers with adequate diet diversity are less likely to be stunted, wasted or underweight compared to children with mothers with inadequate diet diversity. This high correlation was found in earlier studies (Mahamudul Hasan et al. 2010). In micronutrient deficiency among mothers and children, poor diet quality and diversity are significant predictors (Khatun et al. 2019; Arsenault et al. 2013). Among children under five in lower-middle-income countries, poor diet diversity causes growth to falter, further pushing them to malnourishment (Prentice, Moore, and Fulford 2013; Panter-Brick et al. 2008; Arsenault et al. 2013). In a nutshell, even though household food security doesn't directly involve child nutritional status in the study area, we can still argue that it has invisible involvement in child nutrition through the impact of the mother's diet diversity.

This study is the first of a kind in which we are aware of having analyzed the link between child nutritional status and household food security, and maternal diet diversity among the tribal population through a unique survey after Covid-19. Our findings suggest that in households with enough food for mothers to maintain optimal nutritional status, there is equally enough for adequate child nutrition. Like other studies, this cross-sectional observational study has several limitations that preclude causal inferences. The independent variables used in the study are limited as the primary focus is on food security and diet diversity. There are maybe other factors not captured in this study. Once food insecurity is a necessary but insufficient condition for nutrition security because malnutrition may be caused by other interrelated

factors inadequate maternal and child care, poor health services and an unsanitary environment. Finally, this study is limited to child anthropometric outcomes rather than definite nutrient deficiencies or other health consequences. Nevertheless, the findings in this study will help future nutritional interventions among the tribal population in the study area, and further calls attention to a longitudinal approach to understanding food security and diet diversity and its impact on child nutrition.

Conclusion: Only a few studies on the prevalence of household food security and its relationship to the nutritional status of under-five tribal children have been conducted in India. This study suggests that multi-sectoral strategies need to scale up the dietary knowledge and diversity to reduce child malnutrition among the tribal population. Strengthening the social and health benefits programs and improving the purchasing power of the household will be a primary step towards attaining better results.

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