

Original Investigation

Nutritional Disparities in Urban Aging: Ethnicity as culprit for Malnutrition in Ratnanagar Municipality

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ABSTRACT

INTRODUCTION: Nutritional disparities in urban aging have emerged as a critical concern globally. As the aging population grows and urbanization accelerates, understanding the drivers of malnutrition among older adults in urban areas, especially across diverse ethnic groups becomes increasingly urgent. The study addresses the critical concern of malnutrition among older adults in urban areas, focusing on the influence of ethnicity on nutritional disparities. **MATERIALS AND METHODS:** An analytical cross-sectional study was conducted among 341 elderly people aged above 60 years from March 2023 to August 2023 in Ratnanagar municipality of Chitwan. A systematic random sampling technique was employed to select participants from each ward. Face to face interview technique and anthropometric assessment was used in collecting data using semi-structured questionnaire comprising socio-demographic characteristics including ethnicity, life-style factors, dietary factors, functional status and nutritional status. Data analysis was performed using the Statistical Program for Social Sciences version 26. **RESULTS:** The mean age of the participants was 69.86 years (SD = 7.72), with a range from 61 to 99 years. Of 317 participating elderly people, the prevalence of malnutrition and risk of malnutrition was 27.44% and 55.84% respectively. Dalit (50% malnourished, 50% at risk); Janajatis (31.50% malnourished, 57.48% at risk); Madeshi (33.33% malnourished, 50% at risk) and Muslim (20% malnourished, 60% at risk) respondents, categorized as disadvantaged, showed higher proportions of malnutrition or at-risk status; while Brahmin/Chhetri respondents considered advantaged, exhibited comparatively lesser proportion of malnutrition [1.79 (95% CI: 1.06-3.03)]. Likewise, disadvantaged ethnic group exhibited a significant AOR of 1.46 (95% CI: 1.05-2.89) for being at risk, compared to advantaged group. **CONCLUSIONS:** There were significant disparities in nutritional status among older adults in Ratnanagar Municipality, with disadvantaged ethnic groups being particularly vulnerable to malnutrition. The findings of this study have important implications for public health policy and practice in Nepal.

Keywords: Elderly, ethnicity, malnutrition, nutritional disparities.



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INTRODUCTION

Nutritional disparities in urban aging represent a pressing global concern, particularly as urban populations continue to age and urbanization rates accelerate [1]. With this demographic shift, the imperative to comprehend the factors driving malnutrition among older adults in urban settings intensifies, especially considering the diverse ethnic compositions within these populations [2]. Various studies have investigated into this relationship, shedding light on the effect of ethnicity on malnutrition [3-6]. For instance, investigations in Bangladesh have revealed socioeconomic inequalities in chronic non-communicable diseases, with a higher prevalence among affluent urban residents [3]. Similarly, studies in Nepal have highlighted the nutritional challenges faced by marginalized groups

like Dalit women, identifying chronic energy deficiency and vitamin A malnutrition as prevalent issues [4, 5]. Recent studies, such as those by Batis et al. (2020), Ramírez-Luzuriaga et al. (2020) and Mazariegos et al. (2020) have further illuminated the multifaceted nature of malnutrition in urban aging populations, emphasizing the roles of ethnicity in shaping nutritional disparities [6-8].

Despite the growing attention to nutritional disparities, existing programs in Nepal concentrate on the nutritional needs of children and women, overlooking the elderly population, particularly in urban areas like Ratnanagar Municipality [9-11]. Furthermore, research on elderly nutrition has predominantly focused on rural settings and

old-age homes, leaving a dearth of data on the prevalence and determinants of malnutrition among urban elderly residents [12-15]. This gap in knowledge inhibits a nuanced understanding of the distinct challenges confronted by older adults in urban settings, particularly those from diverse ethnic backgrounds. Consequently, there is an urgent need to investigate relationship between ethnicity and nutritional disparities in urban aging to develop effective interventions tailored to the needs of older adults in Ratnanagar Municipality. Therefore, the study aims to assess disparities in nutritional status among older adults in Ratnanagar Municipality, with disadvantaged ethnic groups being particularly vulnerable to malnutrition.

MATERIALS AND METHODS

Study design and setting

This analytical cross-sectional study was conducted from March 2023 to August 2023 in Ratnanagar municipality, located in Chitwan, Nepal. Ratnanagar is situated approximately 109 kilometers from Kathmandu, the capital city of Nepal. The municipality was purposively selected as the study site due to its diverse urban demographics and accessibility.

Participants, sample size and sampling technique:

Individuals aged above 60 years and permanent residents of Ratnanagar municipality were included in the study. Only the eldest adult among multiple eligible elderly in the same household was selected for data collection, while severely ill and bedridden elderly were excluded to ensure a more representative sample. The eligibility of participants and confirmation of their age were determined through the examination of official documents such as senior citizen cards, citizenship cards, voting cards, or any other government-issued identification presenting their verified date of birth. According to the Demographic Report of Ratnanagar Municipality 2021, there were a total of 9165 elderly individuals (>60 years) across sixteen wards [16]. The sample size was determined to approximately 341 participants using a single proportion formula for finite population, considering a design effect of 2, a 95% confidence level, a margin of error of 5%, and an estimated 11.6% prevalence of malnutrition among the elderly population; after adjusting for a non-response rate of 10% [14, 17]. A systematic random sampling technique was employed to select participants from each ward.

Data collection procedure and study variables:

Face to face interview technique and anthropometric assessment was used in collecting data using semi-structured questionnaire (prepared in Nepali Language) comprising socio-demographic characteristics (age, sex, education, ethnicity, self-source of income, current living status and type of family), life-style factors (smoking habit, alcohol drinking habit and disease status), dietary factors, functional status factors and nutritional status (Figure 1). Pilot testing was done on 10 % of sample size of Kalika Municipalities of Chitwan district. The feedback from the pretesting was incorporated and a revised questionnaire was formulated.

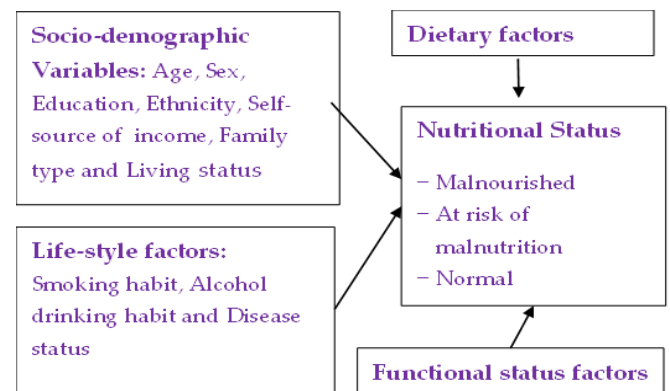


Figure 1| Conceptual framework of the study

For anthropometric measurement, digital SECA scale was used for measuring weight in kilograms; whereas height board (Shorr Boards®) was used to measure height in centimeters [18]. Weight was measured to the nearest 0.1 kg and height to the nearest 0.1 cm. For the elderly with spinal curvatures, arm length was used to estimate height [19]. Moreover, the dependent variable - nutritional status of elderly people was assessed through Mini Nutritional Assessment (MNA) tool [20, 21]. It categorizes elderly participants into three groups: those with normal nutritional status (MNA score ≥ 24), those with malnutrition (MNA score < 17), and those at risk of malnutrition (MNA score between 17 and 23.5). This scoring system demonstrates high sensitivity (96%), specificity (98%), and predictive value (97%) in distinguishing between these categories [22]. On other hand, the ethnicity status of elderly was categorized into the Dalits, Janajatis, Madhesi, Muslim, Brahmin/Chhetri and other castes based on Health Management Information System (HMIS) register [23]. It was further classified into advantaged (Brahmin/Chhetri) and disadvantaged (others) groups [24]. Additionally, Katz Index of Independence in Activities of Daily Living (ADL) tool ranked the functional status as a measurement of the client's ability to perform the six functions of bathing, dressing, toileting, transferring, continence, and feeding by individuals independently [25]. Dietary diversity was assessed through Food and Agriculture Organization (FAO) dietary diversity tool and was expressed as 'less diverse' if individual consumed 1-3 food groups and 'more diverse' in case of 4-9 food groups consumed per day [26]. If the respondents have fasting or attended some ceremony the day before this

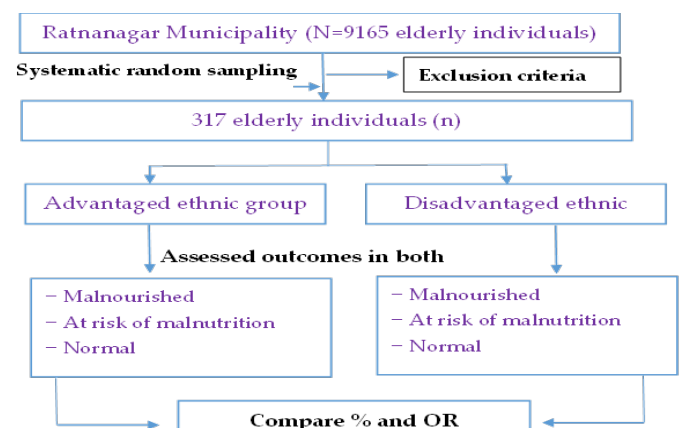


Figure 2| Analytical cross-sectional design

data collection then the information from the earlier day was collected to get actual information on food or dietary diversity.

Statistical analysis and data management:

Collected data were entered in Epi Data Entry version 3.1 applying checks and was imported into Statistical Package for Social Sciences (SPSS) 26 version for statistical analysis. The data was normally distributed when tested through shapiro-wilk test ($p\text{-value} > 0.001$). Descriptive statistics such as frequency, percentage, mean and standard deviation (SD) were reported. Bivariate analysis such as Chi-square, Fisher exact tests and Analysis of the variance (ANOVA) were used to identify factors potentially associated malnutrition at 95% confidence interval (CI) and below 5% level of significance. The Multinomial logistic regression was employed to test the hypothesis after adjusting confounders. Nutritional status was coded 1 for Normal, 2 for at risk of malnutrition and 3 for Malnourished status.

Ethical consideration:

Ethical approval was taken from Institutional Review Committee – Institute of Medicine [reference no. 225(6-11-E)²/074/075] and permissions were obtained from Ratnanagar municipality. Written informed consent was obtained from all participants before enrollment and adhered to the tenets of the Declaration of Helsinki.

RESULTS

Out of 341 older adults, 4 were blinds, 7 had hearing problems, 5 were handicapped, 5 were severely ill and 3 were physically out-of-reach on three successive attempt. It was difficult to take the anthropometric measurement

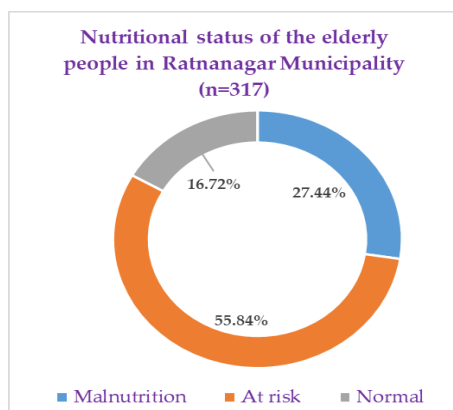


Figure 3| Nutritional status of the elderly people in Ratnanagar Municipality

for these participants and hence excluded from the analysis. However, they were counseled on usefulness of healthy diet to address the ethical issues. Finally, 317 data were analyzed with response rate of 93%.

The descriptive analysis revealed that one-fourth (27.44%) of elderly individuals in Ratnanagar Municipality were classified as malnourished, more than halves (55.84%) were at risk of malnutrition, and only 16.72% was categorized as having a normal nutritional status (Figure 3). The mean age of the participants was 69.86 years (SD =

7.72), with a range from 61 to 99 years. The mean height was 152.45 cm (SD = 9.63), and the mean weight was 52.65 kg (SD = 11.50). However, no significant differences were found in nutritional status across age groups ($p = 0.113$), height ($p = 0.087$), and weight ($p = 0.073$), as determined by ANOVA tests. Further, the data reported varying levels of malnutrition and at risk among different ethnic groups (Figure 4). Dalit (50% malnourished, 50% at risk); Janajatis (31.50% malnourished, 57.48% at risk); Madeshi (33.33% malnourished, 50% at risk) and Muslim (20% malnourished, 60% at risk) respondents, categorized as disadvantaged, showed higher proportions of malnutrition or at-risk status; while Brahmin/Chhetri respondents (31.50% malnourished, 57.48% at risk), considered advantaged, exhibited comparatively lesser proportion of malnutrition. The distribution was significantly associated ($p = 0.038$), emphasizing advantaged ethnic groups exhibiting higher malnutrition rates compared to disadvantaged groups. Similarly, education level demonstrated significance ($p = 0.040$), with illiterate individuals having a higher prevalence of malnutrition compared to literate counterparts. Conversely, no significant associations were found between nutritional status and family type ($p = 0.747$), living status ($p = 0.986$), or source of income ($p = 0.583$).

Regarding lifestyle factors, smoking habit ($n=99$, 31.2%) showed no significant association with nutritional status ($p = 0.442$), with 30.30% of smokers and 26.15% of non-smokers classified as malnourished. Similarly, alcohol drinking habit ($n=66$, 20.8%) exhibited no significant association ($p = 0.559$), with 30.30% of drinkers and 26.69% of non-drinkers classified as malnourished. However, disease status ($n=244$, 77.0%) demonstrated a significant association ($p < 0.001$), with 32.38% of individuals with diseases classified as malnourished compared to 10.95% of those without diseases. In terms of dietary factors, dietary diversity ($n=128$, 40.4%) did not show significant association ($p = 0.132$), with 32.03% of individuals with less diverse diets and 24.34% of those with more diverse diets classified as malnourished. Finally, functional status factors, exhibited no significant association with nutritional status ($p = 0.450$).

A multinomial logistic regression was performed to create a model of the relationship among those variables which had significant distribution of nutritional status in the three groups (malnutrition, at risk and normal) in the bivariate analysis. Table 3 shows the results of the final multinomial logistics regression modelling of the combined effect of ethnic groups, education and disease status for malnutrition and at risk with respect to normal nutritional status. Further, multicollinearity was checked before running multivariate analysis and there was no problem of collinearity among variables as the lowest tolerance was 0.851 (more than 0.1) and as the highest VIF was 2.637 (less than 10). The final model provided a statistically significant improvement over the intercept only-model [$p\text{-value}=0.720$]. The Nagelkerke R^2 for the model was 0.138 which reveals that 13.8% of the variance is explained. The predicted value for - at risk and malnutrition (with respect to normal nutritional status) given by the regression equation are: At risk = $2.508 + 0.378$ (Disadvantaged ethnic group) and Malnutrition = $2.904 +$

Table 1 | Nutritional status across sociodemographic characteristics

Variables	Total n=317 (%)	Nutritional status			
		Malnutrition (n=87)	At risk (n=177)	Normal (n=53)	p-value
Age (in years)					0.113 ^b
Mean± SD	69.86±7.72	65.80±8.24	66.64±8.74	66.85±6.26	
Min-Max	61-99	61-99	61-88	61-92	
Height (in cm)					0.087 ^b
Mean±SD	152.45±9.63	149.57±7.88	150.22±9.41	158.75±11.33	
Min-Max	144-182	144-172	144-175	152-182	
Weight (in Kg)					0.073 ^b
Mean±SD	52.65±11.50	47.33±6.26	52.65±10.44	52.65±11.93	
Min-Max	42-78	42-58	48-75	47-78	
Sex of the respondents					0.218
Male	149 (47.00)	36 (24.16)	91 (60.94)	22 (14.77)	
Female	168 (53.00)	51 (30.36)	86 (51.19)	31 (18.45)	
Ethnicity					0.038 [*]
Disadvantaged	152 (47.95)	50 (32.89)	86 (56.58)	16 (10.53)	
Advantaged	165 (52.05)	37 (22.42)	91 (55.15)	37 (22.42)	
Education					0.040 ^{*a}
Illiterate	202 (63.72)	67 (33.17)	110 (54.46)	25 (12.38)	
Literate	83 (26.18)	17 (20.48)	46 (55.42)	20 (24.10)	
Primary(Grade 1-8)	14 (4.41)	2 (14.29)	10 (71.43)	2 (14.29)	
Secondary(Grade 9-12)	16 (5.04)	1 (6.25)	10 (62.50)	5 (31.25)	
Bachelor and above	2 (0.63)	0 (0.00)	1 (50.00)	1 (50.00)	
Family type					0.747
Single	62(19.6)	16 (25.81)	31 (50.00)	15 (24.19)	
Joint	255(80.4)	71 (27.84)	146 (57.25)	38 (14.90)	
Current living status					0.986 ^a
Single only	29 (9.20)	8 (27.59)	16 (55.17)	5 (17.24)	
Couple only	34 (10.70)	8 (23.53)	17 (50.00)	9 (26.47)	
With son/daughter	251 (79.20)	68 (27.09)	144 (57.37)	39 (15.54)	
With relatives	3 (0.94)	3 (100.00)	0 (0.00)	0 (0.00)	
Self-source of income					0.583
Yes	226 (71.30)	64 (28.32)	125 (55.31)	37 (16.37)	
No	91 (28.70)	23 (25.27)	52 (57.14)	16 (17.58)	

Note: Test applied-Pearson χ^2 /fisher's exact tests^a/ANOVA^b; *p-value<0.05.

0.586 (Disadvantaged ethnic group). This revealed that ethnicity was significantly associated with the both being at risk and malnutrition. After adjusting for other factors, the adjusted odds ratio (AOR) remained significant at 1.79 (95% CI: 1.06-3.03) for malnutrition, suggesting that disadvantaged ethnic groups (Dalit, Janajatis, Madeshi and Muslim) had nearly twice the odds of malnutrition compared to the advantaged group (Brahmin/Chhetri). Likewise, disadvantaged ethnic group exhibited a significant AOR of 1.46 (95% CI: 1.05-2.89) for being at risk, compared to advantaged group; pointing Dalit, Janajatis, Madeshi and Muslim were 1.5 folds more likely to be at risk than Brahmin/Chhetri. However, education and disease

status of the respondents were not significantly associated with both at risk and malnutrition with reference to normal nutritional status on multivariate analysis. Therefore, based on the evidence provided by the study, it can be concluded that there are indeed significant disparities in nutritional status among older adults in Ratnanagar Municipality, with disadvantaged ethnic groups facing a higher risk of malnutrition compared to advantaged ethnic groups.

DISCUSSION

Table 2| Nutritional status across lifestyle, dietary and functional status factors

Variables	Total n=317 (%)	Nutritional status			p-value
		Malnutrition (n=87)	At risk (n=177)	Normal (n=53)	
Lifestyle factors					
Smoking habit					0.442
Yes	99 (31.2)	30 (30.30)	58 (58.59)	11 (11.11)	
No	218 (68.8)	57 (26.15)	119 (54.59)	42 (19.27)	
Alcohol drinking habit					0.559 ^a
Yes	66 (20.8)	20 (30.30)	42 (63.64)	4 (6.06)	
No	251 (79.2)	67 (26.69)	135 (53.78)	49 (19.52)	
Disease status					<0.001**
Yes	244 (77.0)	79 (32.38)	126 (51.64)	39 (15.98)	
No	73 (23.0)	8 (10.95)	51 (69.86)	14 (19.18)	
Dietary factors					
Dietary diversity					0.132
Less diverse (1-3 groups)	128 (40.4)	41 (32.03)	76 (59.38)	11 (8.59)	
More diverse (more than 4)	189 (59.6)	46 (24.34)	101 (53.44)	42 (22.22)	
Functional status factors					
Activities of daily living					0.450 ^a
Severe difficulty	2 (0.63)	1 (1.15)	1 (0.56)	0 (0.00)	
Moderate difficulty	9 (2.83)	8 (9.20)	1 (0.56)	0 (0.00)	
No difficulty	306 (96.52)	78 (89.70)	175 (98.87)	53 (100)	

Note: Test applied-Pearson χ^2 /fisher's exact tests^a; **p-value<0.001.

The study suggested that a considerable portion of the elderly population in Ratnanagar Municipality were either malnourished or at risk of malnutrition, with only a smaller proportion having a normal nutritional status. These findings are in line with previous studies that have also highlighted the high prevalence of malnutrition among elderly populations in Nepal and other developing countries, highlighting the widespread nature of the issue [13, 14, 18, 19]. It is remarkable that the malnutrition rate in Ratnanagar Municipality (27.44%) is comparable to findings from Okharpauwa, Nepal (24%) [18], Brazil (29.1%) [27], Democratic Republic of Congo (28%) [21], Morang, Nepal (24.8%) [4], and Pharping, Nepal (31%) [15]. Interestingly, a study of senior citizen homes in Kathmandu found a much lower prevalence (15%) of malnutrition [28], suggesting potential benefits of interventions specifically designed for this setting. However, this 15% is also unacceptable and the previous study done in Kavrepalanchok, Nepal considered high prevalence for such proportion [14]. Further, it is

noteworthy that malnutrition rate prevalent widely with a substantial number classified as malnourished and a majority at risk of malnutrition including in current study [4, 18, 21, 27]. This highlights potential concerns regarding the nutritional well-being of the elderly population in the municipality, warranting further attention and intervention to prevent malnutrition the further among elders.

Various factors were explored for their association with malnutrition among elders. Unexpectedly, factors such as age, sex, education, family type, self-source of income, smoking, alcohol habits, disease status, functional status and dietary diversity showed no significant association with at risk or malnutrition; but the similar results were seen in several studies [11, 29, 30], suggesting that they may have less influence on malnutrition in the study site. While ethnicity may influence nutritional status, the other sociodemographic, lifestyle related, functional status and dietary diversity might not be primary drivers of malnutrition among elderly individuals in Ratnanagar

Table 3 Final model of Multinomial Logistic Regression (n=317)			
Variables	COR (95% CI)	At risk AOR (95% CI)	Malnutrition AOR (95% CI)
Ethnic group			
Disadvantaged	1.69 (1.03-2.78)	1.46 (1.05-2.89)*	1.79 (1.06-3.03)*
Advantaged	Ref	Ref	Ref
Education			
Illiterate	8.44 (1.10-64.75)	6.55 (0.37-56.83)	6.92 (0.88-54.46)
Literate	4.14 (0.52-33.05)	3.31(0.51-26.91)	3.41(0.42-27.86)
Primary(1-8)	2.59 (0.27-21.75)	1.67 (0.21-20.01)	1.27 (0.11-18.92)
Secondary(9-12) and above	Ref	Ref	Ref
Disease status			
Yes	3.85 (1.79-8.33)	2.17 (0.95-8.04)	2.55 (1.95-9.69)
No	Ref	Ref	Ref

Note: COR- Crude Odds Ratio; AOR- Adjusted Odds Ratio; CI-Confidence Interval; *p-value \leq 0.05; The reference category for the model was normal and this parameter was set to zero because it was redundant.

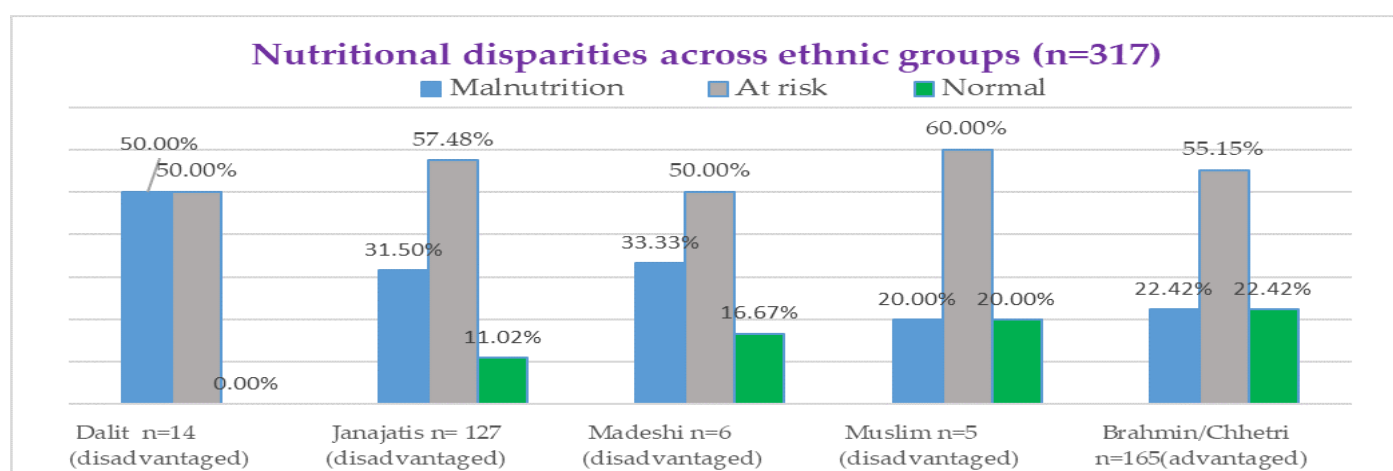


Figure 4: Nutritional disparities across ethnic groups

Municipality. Further research is needed to explore the complex interplay of these factors and their impact on nutritional outcomes. However, these results imply that ethnicity might play a more prominent role in determining nutritional status in our context.

Notably, the study reported significant differences in nutritional status among different ethnic groups only, with disadvantaged groups such as Dalit, Janajatis, Madeshi, and Muslim respondents generally exhibiting higher rates of malnutrition or being at risk compared to advantaged Brahmin/Chhetri groups. Similar categories and proportion was evident in the previous studies conducted in the country [14, 18, 23, 24]. In alignment with ethnicity being culprit for malnutrition, studies conducted in Okharpauwa [18] and Pharping [15] stated the significant association between ethnic groups and nutritional status in Nepal. Specifically, these studies identified factors such

as socioeconomic status, education level, and ethnicity as determinants of malnutrition, consistent with the findings of the current study; emphasizing the role of socioeconomic disparities and social determinants of health in nutritional outcomes [15, 18, 28]. Research from other regions, including Latin America [6, 7], Guatemala [8] and France [20] documented similar disparities in malnutrition, with marginalized populations facing a higher risk. These studies underscored the importance of addressing social determinants of health, such as poverty, education, and ethnicity, in combating malnutrition among elderly populations. This aligns with the concept of intersectionality [2], where ethnicity interacts with other social determinants of health, exacerbating disparities and limiting access to resources and healthcare among elderly populations. This interaction contributes to poorer nutritional outcomes among disadvantaged ethnic groups, highlighting the need for targeted interventions addressing

systemic inequities. Addressing these intersecting factors is essential for promoting health equity and improving nutritional status among vulnerable elderly individuals.

The findings of this study have important implications for public health policy and practice in Nepal. The finding that disadvantaged ethnic groups, including Dalit, Janajatis, Madeshi, and Muslim respondents, are particularly vulnerable to malnutrition underscores the urgent need for targeted interventions on social and structural determinants of health, to address nutritional disparities among elderly individuals in Ratnanagar Municipality. Such interventions could include implementing nutrition education and counselling programs, improving access to nutritious food, health services, social support networks, and addressing socioeconomic factors that contribute to malnutrition [31, 32]. Additionally, these findings emphasize the importance of regular screening and assessment of nutritional status among the elderly population in order to identify individuals at risk of malnutrition early and provide appropriate interventions. These interventions can help improve the overall health and well-being of elderly individuals, reduce healthcare costs, and enhance the quality of life for this vulnerable population.

Despite the valuable insights provided by this study, several limitations should be acknowledged. Firstly, the cross-sectional design precludes establishing causality between ethnicity and malnutrition. Secondly, relying on self-reported data on dietary intake might introduce

bias. Thirdly, the study focuses on a single municipality, limiting generalizability. Most importantly, the sample size (n=317) may be relatively small for conducting multinomial logistic regression, and it can lead to unstable estimates, wider confidence intervals, and potential overfitting of the model.

CONCLUSIONS

The prevalence of malnutrition and risk of malnutrition was unacceptably high in Ratnanagar Municipality. Disadvantaged ethnic groups such as Dalit, Janajatis, Madeshi, and Muslim were more likely to be malnourished compared to Brahmin/Chhetri respondents, considered advantaged group. This suggests a strong link between disparities in social and structural determinants of health; and nutritional well-being; highlighting the need for targeted interventions addressing systemic inequities. Targeted interventions focusing on nutrition education, improving access to nutritious food and healthcare services, and addressing socioeconomic factors are crucial for addressing nutritional disparities among elderly populations. Overall, the findings emphasize the urgent need for proactive measures on social and structural determinants of health to improve the nutritional well-being of elderly individuals in Ratnanagar Municipality and similar contexts.

ADDITIONAL INFORMATION AND DECLARATIONS

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Data Availability: Data will be available upon request to corresponding authors after valid reason.

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