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Malnutrition and its Associated Factors among Slum Living Adolescents in Uttar Pradesh, India

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Abstract

Malnutrition is one of the major public health problems worldwide. Adolescence is known to be a second opportunity for growth as it facilitates catch-up growth for children experiencing nutritional deficits in their early life. The present paper examines the prevalence and risk factors of nutritional status among adolescents (12-19) living in the slums of Lucknow, Uttar Pradesh, using a cross-sectional study of 590 sample households in 2015. As a part of this investigation, adolescents' underweight and stunting status were examined to determine nutritional status using the WHO growth reference. This study performed bivariate analyses to elucidate differentials in nutritional status and fitted logistic regression models to examine the effect of different socio-economic factors on the likelihood of an adolescent's malnutrition status. About 46 per cent of the adolescents exhibited stunted growth and 10 per cent were severely stunted. About one-fourth of the respondents were underweight and 7 per cent were severely underweight. Reinforcing the existing public health programmes is critical for enhancing the nutritional level among adolescents. Further, school, community and media-based programmes need to become effective platforms to reach adolescents at a stage in their lives when lifelong nutrition patterns are formed.

Keywords: Adolescent, underweight, stunting, Uttar Pradesh.

I. Introduction

Adolescence is a gateway to health promotion since key behavioural patterns that influence health and longevity have their origin in adolescence. Well-developed adolescents who are empowered with appropriate life skills have a better chance of becoming healthy, responsible and productive adults, leading to better potentials for successful careers, and increased productivity. It is a critical period to adopt health behaviours (WHO, 2005). Adolescence refers to the transitional stage between childhood to adulthood and is often regarded as a phase with delicate risk for future development.

Nutritional status is one of the critical indicators of the overall well-being of any population and human resource development. Unbalanced or inadequate diets and chronic illness are responsible for poor nutrition among people. A related concern is that anthropometric indicators of nutrition in India, for both adults and children, are among the worst in the world. The health of adolescents and youth has been neglected largely in the past, perhaps because they are disease-free. Adolescence appears to be a relatively healthy period of life, although not completely hazard-free, given young people's relatively low mortality rates (Lule et al., 2006). Though this situation has been changing over the past two decades, young people still seem to remain a marginalized social group regarding their access to health care and their relative neglect by policymakers (Mann & Tarantola, 1996).

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Adolescents and young adults engage in a range of behaviours that can affect the quality of their health and the probability of their survival in the short term and their lifetime health and survival.

Malnutrition in every form, presents a significant threat to human health. Today the world faces the double burden of malnutrition, including undernutrition and overweight, especially in developing countries. Adolescence is known to be another opportunity for growth as it facilitates catch-up growth for children experiencing nutritional deficits in their early life (Rao, 2001). They have not traditionally been considered at elevated nutritional risk. Only recently, global attention has been given to this vulnerable group. Poor nutritional status during adolescence is an essential determinant of health outcomes.

The health of adolescents is strongly affected by personal, family, community and national levels factors. Since health and health behaviour corresponds strongly from adolescence into adulthood, how these social determinants affect adolescent health is crucial to the whole population's health and the nation's economic development (World Health Organization, 2001). The issues relating to the health of youth are not only age-dependent but also environment specific and are identified with socio-cultural, economic, educational and situational parameters (Reading & Wien, 2009). India is home to more than 253 million adolescents, who account for almost 21 per cent of the country's population (RGI, 2011). In 2001, 23.5 per cent of households in urban areas lived in slums. In 2011, this percentage came down to 17.4 per cent. However, there are still 13.74 million slum households and 68 million people living in the slum areas (*Ibid.*, n.d.) (RGI, 2011). In the context of Uttar Pradesh, though the state is considered one of India's less urbanised states, it has the second-largest urban population in the country. About 22 per cent of the population lives in urban areas in Uttar Pradesh, which constitute more than 44 million. As per the statistics of the committee on Slum Statistics/census, 2011 Government of India, about 10.8 million urban population of Uttar Pradesh live in slums, which constitute about 24 per cent of the urban population.

Adolescents have different needs and diverse problems. Proper nutrition or nutritional status is the outcome of many multifaceted and interrelated determinants such as access to adequate, safe, affordable, nutritious foods, care and healthcare services. However, proper nutrition is universally acknowledged as a fundamental human right. Globally, it has been estimated that more than 800 million people suffer from malnutrition and in developing countries more than 20 per cent of the total population is hungry (Vorster, et al., 1997). In India, there are many fcators that influence adolescent health. The Government of India have launched many helath initatives such as Rashtriya Kishor Swasthya Karyakram (2014) with the aim to provide continuous care for adolescents and meet their developmental needs, and the Mid-day meal scheme has been exgended to cover adolescentg in 2007 to enhance nutriotonal support to adolescents (Maliye, & Garg, 2017). It started a new initiative Rashtriya Bal Swasthya Karyakram (RBSK) in 2013 to address the health issues among children from birth to 18 years encompassing the spectrum of 4Ds- deficiencies, disease, development delays and disability.

Although efforts have been taken through various national programmes to address malnutrition among adolescents in the past two decades, still a number of challenges are faced in addressing the same and malnutrition has continued to be a common health problem among adolescents. The bad consequences of malnutrition among adolescents are tendencies of impaired cognitive development, short stature, poor educational achievement and lower immunity, leading to higher morbidity and mortality. Adolescent obesity, on the other hand, is associated with serious health problems in adolescence and later adulthood including a heightened risk of psychosocial morbidity, cardiovascular complications, type 1 and type 2 diabetes, premature death and impaired social integration and stigmatization (WHO, 2019). However, no single estimation gives complete information on nutritional status. Therefore, a combination of techniques including anthropometric measurements, biochemical analyses, nutrient intakes and clinical signs of ailing health, is typically utilized. Chronic energy deficiency in adolescents results in short stature and lean body mass and is associated with deficiencies in muscular strength and working capacities. While this effort is monumental in scope, it does not focus on the nutritional status of today's adolescents, the next

generation of parents and workers, and the group which, as it ages, will impact nations' healthcare systems. In the above given backdrop, the aim of the present study is to assess the nutritional status of adolescents living in the various slums of Lucknow city and also to assess the socio-demographic and economic factors associated with undernutrition.

II. Data and methods

Data

The present study is based on a cross-sectional survey conducted in the slums of Lucknow in Uttar Pradesh in 2015. Uttar Pradesh has a population of about 190 million which forms 16.5 per cent of India's total population according to the Census 2011. It also has the highest percentage (24.5%) of the adolescent (10-19) population among all the Indian states (RGI, 2011). The multi-stage sampling procedure was used to select the studied participants, resulting in 590 slum households with adolescents aged 12-19. In the case of more than one eligible respondent (age 12-19) in the household, the KISH table was used to select the respondent (Kish, 1949).

Lucknow district was selected for the current study based on the state's similarities in demographics and socioeconomic character. Additionally, the adolescent population in the city is 22.2 per cent, which is close to the state and national average. Another important consideration was the availability of a considerable number of slum communities in the city. Its population is socio-economically and ethnically substantially diverse. About 66.2 per cent of the total population in the district lived in urban areas, and about 33.8 per cent lived in rural areas (Census, 2011). The detailed methodology and sampling procedure have been given elsewhere (Chauhan et al., 2020; Chauhan & Dhar, 2020).

Outcome variables

Adolescent anthropometry

Data on respondents' height and weight were collected to measure the adolescent nutrition level. Anthropometric indices [height-for-age (stunting), and weight-for-age (underweight)] were constructed by comparing indicators based on weight, height, age and sex, date of birth and date of the interview with WHO reference population. Z-scores were then calculated as a proxy measure of nutritional status using the WHO new growth standard (WHO, 2006; Onis et al., 2007). The formula used for calculating the z score as:

$$Z - score\ (or\ SD - score) = \frac{Observed\ value - Median\ value\ of\ the\ reference\ population}{SD\ value\ of\ reference\ populaiton}$$

The study used WHO-recommended cut-off value to understand child malnourishment in each nutrition indices. Adolescents falling below -2 SD of Z-score from the reference median population are classified as malnourished irrespective of the nutritional indices (e.g., low height-for-age and low weight-for-age). A Z-score cut-off below -3 SD was used to define severe malnutrition in the two indices. WHO-Anthro Plus, a computer-based programme, was used to compare the growth of individual adolescents' growth with the new WHO growth reference (WHO, 2006; de Onis et al., 2007).

Predictor variables

The study includes the age of the respondents, gender, religion, caste, working status, average monthly income, household economic status, type of house, and parent's education and occupation as independent variables. The inclusion of these variables was guided by approaches adopted in extant studies. The age of the adolescents was recorded in completed years as 12-15 and 16-19 years. We treated the respondents' gender as a dichotomous variable (male vs. female), as

there was no subject in other categories. Their religion was categorized into Hindu and Muslim. In contrast, their caste was categorized into four groups: scheduled caste (SC), scheduled tribe (ST), other backward classes (OBC) and Others based on the household head's report. The household information was collected based on the household amenities, facilities, consumer durables, and type of house to assess the socioeconomic status.

Statistical analysis

Univariate analysis was performed to see the sample distribution. Bivariate analyses were carried out to elucidate the differentials in adolescent nutritional indices (underweight status and stunting) concerning the adolescent demographic and socio-economic characteristics. To test the significance of association between adolescent nutritional indices and the examined background characteristics, we applied chi-square tests for variables with two categories. One-way analysis of variance (ANOVA) and 't-test' was also employed to test the statistical significance of the difference in mean scores pertaining to the nutritional indices for variables with three or more categories. Multivariate binary logistic regression models were subsequently performed to identify the significant risk predictors of underweight and stunting among the surveyed adolescent. All outcome variables used in this study were coded in a binary form, whereas independent variables were presented in categorical or dichotomous forms.

III. Results

Socioeconomic characteristics of the studied population

Table 1 depicts the distribution of adolescents by their socio-economic and demographic characteristics. The results reveal that a majority of the respondents belonged to 16-19 years of age (54%), followed the Hindu religion (59%), belonged to a scheduled caste (49%) and were illiterate (40%). As many as 45 per cent of the adolescents were working, and among working adolescents, 21 per cent were engaged in labour work. About 18 per cent of the adolescent were married at the time of the survey. Further, 73 per cent of the respondents were living in the *kachha* houses, 72 per cent belonged to a 5-9 members' household size and only 27.5 per cent were exposed to any media.

Table 2 presents the summary of the nutritional indicators of the adolescents. About 46 per cent of the adolescents exhibited stunted growth and 10 per cent were severely stunted. Little less than one-fourth of the respondents were in the underweight category and 7 per cent were severely underweight. The mean Z-score for underweight was -1.3 with an SD of 1.1, and the mean score for stunting was -1.9 with an SD of -1.9.

Socioeconomic Differentials of Malnutrition

The socio-economic and demographic differentials of underweight and stunting among adolescents are given in Table 3. The prevalence of underweight was one-fourth among adolescents of the 16-19-year age group compared with 21.8 per cent in the 12-15 age group. No significant differences were observed among males and females in the underweight category. However, stunting was higher among females with 49 per cent than males (41%) ($p=0.057$). The mean Z score varied from 1.6 for males and 1.5 for females ($p=0.05$). The prevalence of being underweight was higher (25 %) in SCs and the prevalence of stunting was higher (58%) in ST respondents among the caste groups. About 25 per cent of Muslim adolescents were underweight and 60 per cent suffered from stunting ($p<0.001$). The prevalence of stunting was found to be higher among the currently married adolescents (60%) than among those never married (43%), showing a significant association ($p=0.002$).

Table 1: Percent distribution of respondents by socioeconomic characteristics in the slums of Lucknow, 2015

Characteristics	%	Total
Age of respondents		
12-15 years	45.8	270
16-19 years	54.2	320
Sex		
Male	46.3	273
Female	53.7	317
Religion		
Hindu	58.6	346
Muslim	41.4	244
Caste		
SC	49	289
ST	8.5	50
OBC	37.8	223
Others	4.8	28
Completed years of schooling		
Illiterate	40.0	236
1-5 years	22.5	133
6-9 years	31.3	185
10 & above years	6.1	36
Household economic status		
Low	33.4	197
Middle	33.6	198
High	33.1	195
Working status		
Not working	54.8	323
Working	45.3	267
Marital status		
Never married	82.4	486
Currently married	17.6	104
Type of house		
Pucca	17.6	104
Semi pucca	9.3	55
Kachha	73.1	431
Household size		
Less than 5	21.7	128
5-9	72.2	426
10 and above	6.1	36
Media exposure		
No exposure	12.5	74
Partial exposure	60.0	354
Full exposure	27.5	162
Type of slum		
Notified	60.2	355
Non-notified	39.8	235
Total	100	590

Further, stunting was higher among adolescents who never attended school (24%). As adolescents' educational status increases, stunting prevalence decreases ($p<0.001$). Thirty-three per cent of the adolescents from low household economic status were underweight, and 51 per cent were stunted, while in the high household economic category, 18 per cent of adolescents were underweight ($p<0.000$) and 39 per cent were stunted ($p=0.551$). The mean Z score for underweight varies from 1.7 for low economic status to 1.8 for high economic status ($p<0.000$). Stunting varied from 1.5 for

low economic status to 1.6 for higher economic status (p=0.064). The prevalence of stunting was higher among those who were currently working. The prevalence of stunting and underweight was higher among the respondents who were not exposed to media. Among those who were not exposed to media, half of the adolescents were stunted and one-fourth of the adolescents were underweight. Moreover, about 31 per cent adolescents living in the non-notified slum area were underweight, and almost 45 per cent stunted adolescents lived in both notified and non-notified slum areas.

Table 2: Summary of nutritional indices among adolescents aged 12-19 in slums of Lucknow

Nutritional indicators	Per cent		Mean Z score	SD	N
	Malnourished	Severely malnourished			
Underweight	23.7 (140)	6.8 (40)	*-1.3*	1.1	590
Stunted	45.6 (269)	10.0 (59)	*-1.9*	0.9	590

Note: Underweight = Weight-for-age; Stunting = Height-for-age. Value in the brackets represent the numbers of adolescents belongs to a particular malnutrition category.

Determinants of malnutrition (underweight and stunting) among adolescents

Table 4 depicts the logistic regression (odds ratio) result for underweight and adolescent stunting. The result indicates that being underweight is significantly associated with household economic status and types of slums after controlling other variables. Among middle and higher-economic-status households, 54 per cent of adolescents were less likely to be underweight (OR: 0.46; p<0.051) than the low-economic-status households. This risk is significantly higher in non-notified slums as compared with a notified slum (OR: 1.88; p<0.011).

The risk of stunting was slightly high (OR: 1.817; p<0.005) among adolescents of the older age group (16-19) as compared with the adolescents of the younger age group (12-15). Muslim respondents were 2.9 times (OR: 2.938; p<0.001) more likely to have stunted growth than Hindus. Adolescents in the OBCs were 86 per cent more likely to be stunted than those in the scheduled castes.

IV. Discussion and conclusion

Worldwide one billion people live in slums and experts project that this number will double by 2030. Slum populations, which are increasing at an alarming rate in many developing countries, are characterised by poverty, poor housing, overcrowding, poor environment and a high prevalence of communicable diseases. This neglected population has become a significant reservoir for a wide spectrum of adverse health conditions (Riley et al., 2007) such as undernutrition (Huq-Hussain, 1995; Pryer et al., 2003). Despite the magnitude of this problem, very little is known about the potential impact of slum life on the health of adolescents regarding nutritional status. In this study, we analysed adolescent malnutrition regarding underweight status and stunting, aiming to link these indicators with household characteristics. The findings revealed that the prevalence of underweight and stunting among adolescents was 24 per cent and 46 per cent respectively. In line with the results of existing research conducted in India, this study also revealed that stunting is the most common form of malnutrition among children under five, followed by underweight (Prashant & Shaw, 2009; Venkaiah et al., 2002). A higher prevalence of stunting supports the inference that adolescent malnutrition in this population occurs probably due to past or chronic inadequacy of nutrition or long-term growth faltering. In contrast, being underweight indicates disturbances in linear growth and body proportion (Sarkar, 2016).

The results obtained in the present study indicate a significant age differential in the prevalence of underweight and stunting status among adolescents. The prevalence of underweight and stunting was higher among the late adolescents (16-19 years). Similar findings have also been observed in the study conducted in rural Maharashtra (Nair et al., 2017). Moreover, we observed clear gender discrimination in nutritional status among adolescents. Female respondents were found to be more malnourished than their male counterparts in terms of being underweight and stunted.

Table 3: Demographic and socio-economic differentials in underweight and stunting among adolescents in Lucknow slums, 2015

Background characteristics	Underweight		Stunting		Number
	< -2SD	Mean Z score	< -2SD	Mean Z score	
Age of respondents					
12-15 years	21.9	1.8	36.3	1.6	270
16-19 years	25.3	1.8	53.4	1.5	320
p-value	*p= 0.325*	*p = 0.324*	*p <0.001*	*p= <0.001*	
Sex					
Male	23.4	1.8	41.4	1.6	273
Female	24.0	1.8	49.2	1.5	317
p-value	*p= 0.880*	*p = 0.880*	*p =0.057*	*p= 0.057*	
Religion					
Hindu	22.8	1.8	35.6	1.6	346
Muslim	25	1.8	59.8	1.4	244
p-value	*p= 0.542*	*p = 0.543*	*p =<0.001*	*p =<0.001*	
Caste					
SC	25.3	1.8	41.2	1.6	289
ST	18.0	1.8	58.0	1.4	50
OBC	24.7	1.8	49.3	1.5	223
Others	10.7	1.9	39.3	1.6	28
p-value	*p= 0.260*	*p = 0.366*	*p = 0.069*	*p =0.159*	
Years of schooling					
No schooling	24.2	1.8	54.2	1.5	236
1-5 years	30.1	1.7	45.9	1.5	133
6-9 years	20	1.8	38.4	1.6	185
10 & above	16.7	1.8	25	1.8	36
p-value	*p= 0.145*	*p= 0.201*	*p= <0.001*	*p= <0.001*	
Households' economic status					
Low	33.5	1.7	51.3	1.5	197
Middle	19.2	1.8	46	1.5	198
High	18.5	1.8	39.5	1.6	195
p-value	*p= <0.001*	*p=<0.001*	*p= 0.551*	*p= 0.019*	
Work status					
Yes	24.0	1.8	49.4	1.5	267
No	23.5	1.8	42.4	1.6	323
p-value	*p = 0.900*	*p = 0.901*	*p = 0.088*	*p = 0.089*	
Marital status					
Never married	23.9	1.8	42.6	1.6	486
Currently married	23.1	1.8	59.6	1.4	104
p-value	*p= 0.863*	*p= 0.864*	*p= 0.002*	*p= 0.002*	
Type of house					
Pucca	20.2	1.8	51	1.5	104
Semi pucca	12.7	1.9	32.7	1.7	55
Kachha	26	1.7	45.9	1.5	431
p-value	*p = 0.060*	*p = 0.09*	*p = 0.086*	*p = 0.661*	
Members in households					
Less than 5	29.7	1.7	52.3	1.5	128
5-9	22.5	1.8	43.7	1.6	426
10 and above	16.7	1.8	44.4	1.6	36
p-value	*p = 0.147*	*p = 0.05*	*p = 0.222*	*p = 0.142*	
Media exposure					
No exposure	24.3	1.8	50.0	1.5	74
Partial exposure	23.5	1.8	49.7	1.5	354
Full exposure	24.1	1.8	34.6	1.7	162
p-value	*p = 0.98*	*p = 0.99*	*p = 0.004*	*p< 0.001*	
Type of slum					
Notified	18.9	1.8	45.6	1.5	355
Non-notified	31.1	1.7	45.5	1.5	235
p-value	*p<0.001*	*p <0.001*	*p = 0.981*	*p = 0.981*	
Total	23.7		45.6		590

Note: Chi-square test was applied to test the association of outcome variables with different exposure variables. To compare the mean, z score of outcome variable among different categories of exposure variable, t-test/F test was applied.

Table 4: Odds ratio result from the logistic regression showing the determinant of underweight status among adolescents in slums of Lucknow, 2015

Covariates	Underweight	Stunting
Age of respondents		
12-15 years®		
16-19 years	1.457*	1.817**
Sex		
Male®		
Female	0.97	1.007
Religion		
Hindu®		
Muslim	1.34	2.938***
Caste		
SC®		
ST	0.418	1.101
OBCs	1.201*	1.858**
Other/General caste	0.318*	0.715*
Completed years of schooling		
No schooling®		
1-5 years	1.783	1.271
6-9 years	1.076	0.926
10 & above	1.051	0.396
Households' economic status		
Low®		
Middle	0.465**	0.836
High	0.460*	0.692*
Marital status		
Never married®		
Currently married	0.786	1.126
Respondents' work status		
Yes®		
No	1.250	0.736
Type of house		
Pucca®		
Semi-pucca	0.501*	0.475*
Kachha	1.105	0.787
Household size		
Less than 5 ®		
5-9	0.838	1.367
10 and above	0.485	1.074
Media exposure		
No exposure®		
Partial exposure	1.322	1.052
Full exposure	1.751	0.76
Type of slum		
Notified®		
Non-notified	1.876**	0.772

Note: Level of significant: * p<0.05, ** p<0.01, *** p<0.001; ® represents the reference category

Our study is similar to others conducted in northern Karnataka which also found that the prevalence of underweight and stunting was higher among female adolescents than males. This may be because of the social discrimination which the female child faces throughout childhood. Female children experience multifaceted discrimination including lack of adequate nutritious diet, inappropriate healthcare practices and inconsistent treatment seeking, triggering numerous health

consequences, such as malnutrition, illness, morbidity and mortality (Gupta, 1987; Kishor, 1993; Sen, 1988).

Results further reveal that religion and caste are important determinants of being underweight among adolescents. Muslim adolescents were more likely to be underweight and stunted compared with Hindu adolescents. Similarly, adolescents from other caste groups were less likely to be stunted and underweight than scheduled caste adolescents. Religion and caste are important means of social stratification in India. Previous studies have claimed that social groups could broadly be considered a proxy for socioeconomic status and poverty (Deshpande, 2000; Thorat & Neuman, 2012) and highly associated with poor nutritional level (Chauhan & Rai, 2015). Probably higher stunting and underweight among Muslim adolescents may be due to the differentials in childcare practices, poor utilization of healthcare services and inadequate child-feeding behaviour.

Moreover, it was also observed that household economic status is negatively associated with the nutritional status of adolescents. Documented findings in Nepal reported that poor socioeconomic status was found as a risk factor for stunting and being underweight (Gurung & Sapkota, 2010). Interestingly, family size is negatively associated with the nutritional level of adolescents. Lower undernutrition in large families indicates the role of familial support in preventing undernutrition in adolescents. The legal status of the slums is also one of the determinants of the nutritional level of adolescents. The prevalence of underweight among adolescents was higher in non-notified slums than in notified slums. The non-notified slums face multifaceted deprivation and lag behind in access to basic services provided by local bodies and state government (Nolan et al., 2017) which probably leads to poor health of the residents.

In conclusion, the study shows that despite of implementation of various programmes, the nutritional status of the adolescents has not improved considerably. This suggests that urgent action is needed to document the nutritional status of adolescents, which can provide insights for the betterment of the implementation of existing programmes. Strengthening the programme, which comes under the umbrella of NHM and self-help groups (SHGs) could play a significant role in improving the adolescent nutrition level. Moreover, the government and other stakeholders should target vulnerable populations (such as Muslims, females and adolescents belonging to poor families) in order to improve the situation of nutrition among adolescents in the slums of Lucknow. The priority should be reducing the prevalence of stunting rather than the prevalence of underweight among adolescents because stunting is a far bigger problem than underweight.

Limitations

The present study also has some limitations to be acknowledged. Firstly, this is a cross-sectional study which did not track the history of adolescent malnutrition across age. Secondly, there may be recall bias among the respondents answering the questions. Last but not least, the contribution of sanitation and hygiene-related factors has not been included in the study, which is a very critical determinant of health in general and the nutritional level of adolescents in particular.

Ethical issues

This work is based on the Ph.D. work of the first author. The ethical clearance was taken from the Students' Research Ethics Committee of the International Institute for Population Sciences Mumbai, India. The consent to participate has also been obtained from each of the respondents before starting the interview.

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