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Original Research Article

Rural-urban disparities in prevalence of anemia among adolescent girls in India

Jeetendra Yadav[1], Ashish K. Yadav[2]*, Ranganadham Srinadh[3]

[1]National Institute of Medical Statistics (NIMS), ICMR, New Delhi, India
[2]Department of Community Medicine, ESI-Post Graduate Institute of Medical Sciences and Research, Joka, Kolkata, India; [3]Consultant (Monitoring and Evaluation), United Nations Population Fund (UNFPA)

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***Correspondence:**
Dr. Ashish K. Yadav,
E-mail: ashstatbhu@gmail.com

ABSTRACT

Background: Anaemia continues to be a major public health problem at all ages worldwide. Today, every fifth person in India is an adolescent (Census, 2011). Anaemia effects adolescent girls critically by decreasing their capacity to do physical work, affects their growth as a result they are not well prepared for upcoming pregnancy and motherhood challenge. NFHS-3 reports indicated wide rural-urban disparity in prevalence of anaemia. The present study aims to explore rural-urban disparity in prevalence of anaemia and to study the factor associated with anaemia among adolescent girls in India.
Methods: District levels household survey (DLHS-4, 2012-13) was used for the present study. The outcome variables included in the study was anaemia. Bivariate analyses including chi square tests were applied to determine the prevalence of anaemia and logistic regression models to understand the determinants of anaemia. The whole analysis was performed using STATA version 13.0 to take into account the survey design (i.e. sampling weights with clustering and strata), QGIS, and R CRAN.
Results: The prevalence of anaemia was observed high in urban (65.3%) as compared to rural (57.3%). However, the prevalence of severe anaemia was high in rural area as compared to urban area. The mean hemoglobin level of the study population was 10.4±2.22. Prevalence of anaemia varies across key selected individual, household and community characteristics of adolescent girls. Finding of multivariate logistic regression analysis indicated that anemia has a strong relation with age, education, family size, religion, caste, economic status, sanitation facility and place of residence of adolescents.
Conclusions: This study concludes that the prevalence of anaemia is a significant problem of adolescent girls in India. The study also proved that anemia is significantly associated with age, education, income strata and place of residence.

Keywords: Anaemia, Prevalence, Hemoglobin level, Adolescent girls and DLHS-4

INTRODUCTION

According to WHO adolescence age is between 10 to 19 years and this is the age (10-19) when physical growth and puberty takes place.[1] Almost one fifth (about 1.2 billion) population today in the world are adolescent and their numbers are increasing. India's population has reached the 1 billion mark; among them more than one fifth are adolescents who are undernourished.[2-4] In addition to health problem, anaemia has also impact on social and economic development. Anaemia is the world's second foremost reason of disability and is

accountable for about 1 million deaths a year, of which three-quarters occur in Africa and South-east Asia.[5] In terms of lost years of healthy life, Iron Deficiency anaemia causes 25 million cases of disability adjusted life years (DALYs); this accounts for 2.4 per cent of the total DALYs worldwide.[6] In India, it is common that the girls get married and pregnant before the growth phase is completed; therefore the risk of anaemia increases.[7] NFHS-3 reports state wise differences in prevalence of anaemia.[8] Rajasthan (98%) has the highest (98%) and Andhra Pradesh has the lowest rate (33%).[9-10] Adolescent suffering from anaemia has increased obstetric risk, at the time of pregnancy. According to WHO 2002 anaemia is the one among the top 10 risks for preterm birth, infant mortality and maternal mortality. For the period of adolescence in both sexes prevalence of anaemia is more due to growth especially in girls because they are exposed to risk of beginning of menarche.[11] The present study was carry out with an objective to examine the rural-urban differentials in prevalence of anaemia and its association with other socio-demographic factors.

METHODS

Present study is based on 96204 adolescent girl's dataset extracted from DLHS-4 (District Levels Household Survey, 2012–13) dataset. DLHS-4 being cross-sectional in nature adopts a multi-stage stratified systematic sampling design. Detailed information about sampling employed in this survey can be obtained from the report of DLHS-4.[12] The survey interviews 375601 sampled household (about 55% from rural and 45% from urban areas) spanning 21 states and 528 districts of India. In DLHS-4, all the adolescent girls of the selected household were included in the anaemia testing, where blood drops were collected using dried blood spot (DBS) method and tested in designated laboratories using HemoCue method, a standard method for hemoglobin measurement by the International Committee for Standardization in Hematology and World Health Organization for field studies.[12-14] The hemoglobin levels of >11 mg/dl was considered as any anaemia (normal anaemia), 10–11 mg/dl as mild anaemia, 7–9.9 mg/dl as moderate anaemia, and <7 mg/dl as severe anaemia.[13,15] The outcome variable in the study was anaemia. Based on review of literature[16-18] important predictor variables based on individual, household and community characteristics were shortlisted for the present study. Based on objectives of the study descriptive and inferential statistics was drawn.

RESULTS

Background characteristics of the adolescent girls

Table 1 represents the weighted percent distribution of adolescent girls (age 10-19 years) by type of residence and their background characteristics. Girls from rural background had poor (10.80%) level of higher (secondary and above) education compared to urban (38.16) girls. More than half (57.93%) of the rural adolescent girls were suffering from low BMI as compared to (38.32%) of urban. Compared to rural families urban household have small family size. Almost one third (28.77%) rural adolescent girls belong to poorest wealth quintile as compared to only (8.84%) urban adolescent girls. Two fifth (42.72%) of rural household were using unsafe sanitation as compared to only (12.21%) urban household. Majority (76.27%) rural household were still using the unsafe cooking fuel as compared to only one fourth (20.33%) household in urban area.

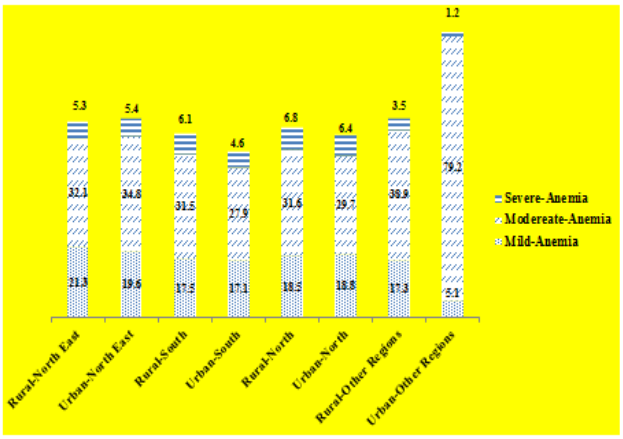

Figure 1: Percentage distribution of adolescent girls by type of anemia in different geographical region of India.

Rural-urban differentials in anaemia among adolescent girls

Figure 1 gives the Percentage distribution of adolescent girls by type of anemia in different geographical region of India except north-east in rest of the region the prevalence of severe anemia in quite high in among rural population compared to urban. However the prevalence of moderate anemia for urban north-east region and other urban regions of the country was high compared to rural counterpart. Table 2 finds that at the legal age of marriage rural females were more anaemic compared to urban females. However the prevalence of moderate anaemia was quite high (74.8%) for urban adolescent girl of age group 16-17 years compared to rural (32.9%) adolescent girls. Among urban population literacy and prevalence of anaemia was found significantly associated. It was shocking to note that the prevalence of severe anemia was almost 4 times higher (6.2%) among illiterate adolescent girls as compared to adolescent girls who have secondary and above education (1.5%). Similar findings were observed for the prevalence of mild and moderate anaemia. There is no differentials found in mild anaemia among adolescent girls whose household having less or more member in the family in rural while the prevalence of anaemia is twofold higher among adolescent girls whose household having more than five member in the

household in urban area and almost same trends were observed in case of moderate anaemia in urban area. A significant association between severe anaemia and education was observed. Drinking water facilities and cooking facilities of the household were also lined with anaemia among adolescent girls.

Table 1: Percent distribution of adolescent girls (age 10-19 years) by selected individual, household and community characteristics, DLHS-4 (2012-13), in India.

Background characteristics	Rural		Urban		Total	
	Sample	Weighted proportion	Sample	Weighted proportion	Sample	Weighted proportion
Individuals characteristics						
Age						
10-12	15295	28.36	8638	20.69	23933	25.10
13-15	16258	30.24	9095	21.75	25353	26.63
16-17	10388	19.39	17817	41.06	28205	28.61
18-19	11715	22.01	6998	16.51	18713	19.67
Education						
Illiterate	2300	4.34	764	1.75	3064	3.24
Literate but below primary	6430	11.79	2677	6.52	9107	9.55
Primary but below middle	16975	31.59	9060	21.62	26035	27.35
Middle but below secondary	22199	41.48	13393	31.95	35592	37.43
Secondary and above	5752	10.80	16654	38.16	22406	22.44
BMI						
Low	30145	57.93	15932	38.32	46077	49.55
Normal	20018	38.17	23788	56.73	43806	46.10
Overweight	2043	3.91	2035	4.95	4078	4.35
Household characteristics						
Family members						
Up to 4 members	15514	29.03	22569	52.28	38083	38.92
5-7 members	23387	43.65	12764	30.47	36151	38.05
More than 7 members	14755	27.32	7214	17.25	21969	23.04
Wealth quintile						
Poorest	15469	28.77	3772	8.84	19241	20.29
Poorer	13033	24.28	6208	14.55	19241	20.14
Middle	11853	22.10	7388	17.71	19241	20.23
Richer	4454	8.23	14787	33.95	19241	19.17
Richest	8847	16.63	10393	24.96	19240	20.17
Sanitation facility						
Unsafe	22665	42.72	5242	12.21	27907	29.75
Safe	30991	57.28	37306	87.79	68297	70.25
Drinking water						
Unsafe	7179	12.65	2724	6.57	9903	10.06
Safe	46477	87.35	39824	93.43	86301	89.94

Determinants of anaemia among adolescent girls

Table 3 demonstrates the results of the binary logistic regression model to examine the effect of individuals household and community characteristics on severe anaemia and place of residence. Females of menstruating age group (13 years or above) were at higher risk of being anaemic compared to adolescent girls of 10-12 years age group. A rural female teen who have acquired even some education (below primary) has 14% lower risk (OR=0.86) of severe anaemia compared to an illiterate female teen. This analysis highlighted that education is one of the potential risk factors for developing anaemia in rural area. However, significant differences were also noted between education of adolescent girl and anemia in urban area but not similar to rural adolescent girls. Adolescent girls with a normal BMI were observed to be marginally significantly less likely to be anaemic (OR=0.857, 95% CI=0.739-0.995) than those with a low BMI. Adolescent girls from the richest wealth quintile were (OR=0.790, 95% CI=0.725-0.860), less likely chances to suffering from anaemia than adolescent girls from the poorest wealth quintile.

Table 2: Percentage distribution of adolescent girls (age 10-19 years) classified by degree of anaemia and by selected individual, household and community characteristics, DLHS-4 (2012-13), in India.

Background characteristics	Anaemia status by hemoglobin level					
	Mild anaemia (10.0-10.9 g/dl)		Moderate anaemia (7.0-9-9 g/dl)		Severe anaemia (< 7 g/dl)	
	Rural	Urban	Rural	Urban	Rural	Urban
Individuals characteristics						
Age	$\chi2$=3.781	$\chi2$=1379.48**	$\chi2$=8.561*	$\chi2$=8413.64***	$\chi2$=16.09***	$\chi2$=295.331*
10-12	19.1	19.2	32.4	28.6	5.3	5.0
13-15	18.4	17.9	32.1	29.8	5.5	4.6
16-17	18.3	6.0	32.9	74.8	6.0	1.9
18-19	18.3	18.0	33.7	30.6	6.4	5.7
Education	χ^2=11.891**	χ^2=1326.186*	χ^2=75.016***	χ^2=8762.91***	χ^2=49.45***	χ^2=368.884**
Illiterate	17.6	18.3	38.0	36.8	8.8	6.2
Literate but below primary	19.4	19.9	35.2	32.7	6.2	5.1
Primary but below middle	19.1	18.9	32.3	29.0	5.5	5.2
Middle but below secondary	18.3	16.9	32.6	30.5	5.5	5.0
Secondary and above	17.6	5.7	29.5	77.0	5.9	1.5
BMI	χ^2=3.454	χ^2=695.432	χ^2=0.798	χ^2=4485.585*	χ^2=2.553	χ^2=172.978
Low	18.8	18.2	32.5	29.8	5.7	5.2
Normal	18.3	9.4	32.8	62.9	5.9	2.7
Overweight	17.4	18.4	33.0	30.1	5.1	4.7
Household characteristics						
Family members	χ^2=6.905*	χ^2=758.742	χ^2=19.725***	χ^2=4505.881*	χ^2=4.872	χ^2=270.665*
Up to 4 members	18.4	9.0	31.5	63.7	5.5	2.3
5-7 members	18.2	18.2	32.8	30.4	5.7	5.2
More than 7 members	19.3	17.7	33.9	32.5	6.1	5.6
Caste/tribes	χ^2= 21.83***	χ^2=781.985	χ^2=14.745**	χ^2=4309.164*	χ^2=17.96***	χ^2=243.629*
Scheduled tribes	19.5	18.9	31.6	30.9	5.6	6.1
Scheduled castes	18.6	18.0	33.6	30.8	6.2	5.3
Other backward classes	17.4	8.9	31.9	63.4	6.1	2.5
Others	18.1	17.9	32.6	30.7	5.0	4.6
Wealth quintile	χ^2=6.559	χ^2=1586.223**	χ^2=186.887***	χ^2=107.320***	χ^2=4.889	χ^2=407.697**
Poorest	19.1	18.4	35.7	33.3	5.5	5.1
Poorer	18.0	17.6	34.7	31.1	6.0	5.1
Middle	18.5	18.4	30.6	30.5	5.9	5.3
Richer	19.0	4.2	28.9	83.1	5.6	1.2
Richest	18.4	17.8	29.4	28.4	5.6	4.9
Sanitation facility	χ^2=0.346	χ^2=127.067	χ^2=9.352***	χ^2=788.841	χ^2=1.182	χ^2=8.130
Unsafe	18.4	18.3	33.4	29.9	5.6	4.5
Safe	18.6	12.6	32.2	50.7	5.8	3.7
Drinking water	χ^2=5.962**	χ^2=66.592	χ^2=31.234***	χ^2=307.396	χ^2=0.521	χ^2=20.146
Unsafe	19.6	18.4	35.7	32.2	5.9	5.3
Safe	18.4	12.9	32.3	49.3	5.7	3.6

Table 3: Estimated effects (odds ratio and confidence intervals) of selected individual, household and community predictors on severe anaemia prevalence among adolescent girls in India, DLHS-4 (2012-13).

Background characteristics	Severe anaemia			
	Rural		Urban	
Individuals characteristics	**Odds ratio**	**95% C.I**	**Odds ratio**	**95% C.I**
Age				
10-12 (ref)	1.00		1.00	
13-15	1.213***	[1.074-1.369]	0.992	[0.785-1.252]
16-17	1.344***	[1.133-1.594]	1.001	[0.724-1.385]
18-19	1.453***	[1.251-1.688]	1.705***	[1.265-2.298]
Education				
Illiterate (ref)	1.00		1.00	
Literate but below primary	0.863	[0.656-1.136]	0.928	[0.604-1.424]
Primary but below middle	0.706***	[0.557-0.894]	1.042	[0.708-1.533]
Middle but below secondary	0.592***	[0.477-0.733]	1.006	[0.716-1.415]
Secondary and above	0.543***	[0.433-0.681]	0.546***	[0.340-0.877]
BMI				
Low (ref)	1.00		1.00	
Normal	1.009	[0.920-1.106]	0.857**	[0.739-0.995]
Overweight	0.913	[0.721-1.157]	0.876	[0.650-1.182]
Household characteristics				
Family members				
Up to 4 members (ref)	1.00		1.00	
5-7 members	1.024	[0.938-1.117]	1.194*	[0.986-1.445]
More than 7 members	1.068	[0.944-1.208]	1.336***	[1.122-1.590]
Caste/tribes				
Scheduled tribes (ref)	1.00		1.00	
Scheduled castes	0.910	[0.756-1.096]	0.819	[0.638-1.051]
Other backward classes	0.895	[0.753-1.063]	0.668***	[0.508-0.880]
Others	0.758***	[0.615-0.935]	0.687***	[0.526-0.897]
Wealth quintile				
Poorest (ref)	1.00		1.00	
Poorer	1.060	[0.911-1.232]	1.014	[0.840-1.224]
Middle	1.029	[0.900-1.176]	0.983	[0.825-1.172]
Richer	0.927	[0.762-1.130]	0.531***	[0.331-0.851]
Richest	0.920	[0.767-1.103]	0.823***	[0.664-1.020]
Sanitation facility				
Unsafe (ref)	1.00		1.00	
Safe	1.139**	[1.005-1.291]	1.049	[0.859-1.282]
Drinking water				
Unsafe (ref)	1.00		1.00	
Safe	0.903	[0.776-1.051]	0.875	[0.656-1.167]
Region				
Northeast (ref)	1.00		1.00	
South	1.079	[0.824-1.412]	1.121	[0.770-1.634]
North	1.466***	[1.134-1.894]	1.809***	[1.183-2.768]
Others	0.594***	[0.424-0.833]	0.539*	[0.266-1.093]

Table 4: Cut off points to determine the iron deficiency anaemia in general population (WHO, 2008).

Prevalence of any anaemia	Public health problem in a general population
<5%	Not a problem
5-14.9%	Low magnitude
15-39.9%	Moderate magnitude
40% and above	High magnitude

DISCUSSION

The present study has comprehensively demonstrated the rural-urban differentials in prevalence of anaemia among adolescent girls in India. While there are different causes that are associated with the prevalence of anaemia, the present study highlighted socioeconomic factors which are responsible for anaemia. Factors like age, education, family size, religion, economic status, sanitation facility and region of residence were the significant determinants of anaemia. Adolescent phase is very critical; this is the time, when physical, psychological and behavioural changes take place. It is evident that the nutritional and the health needs of the adolescents are more due to incenses in physical activity among them, especially in adolescent girls marks the beginning of the menstrual cycle.[22] Earlier studies pointed out that the adolescents gain almost one third of their adult weight and more than one fifth of their adult height between adolescent age (10-19 years), which we can said as expansion burst.[22-24] WHO recommended the following cut off points to determine the iron deficiency anaemia in general population (Table 4).[25] It is evident from the present study, the prevalence of anaemia was near about two third among adolescent girls in India which is a very alarming scenario because WHO/UNICEF recommend that if prevalence of anaemia is more than two fifth, it is became as problematic.[26-27] The prevalence of mild anaemia were higher (18.6%) in rural area as compared to their counterpart urban area (13.3%) while the prevalence of moderate anaemia were higher (48.2%) in urban adolescent girls as compared to rural adolescent girls (32.7%). The present study also revealed that the prevalence of severe anaemia was higher (5.7%) in rural area as compared to their counterpart urban area (3.7%). However, present study did not indicate any association with body mass index and prevalence of anaemia among adolescent girls. The findings of the study are consistent with the several previous studies.[16,28,29] While some earlier studies indicated that the body mass index was associated with anaemia and reported that the prevalence was high in underweight girls.[11,30] This study found that the prevalence of anaemia was slightly high in late adolescents as compared to in the early adolescent's girls which also observed in previous studies that age of the adolescent girls shows a significant relation with the prevalence of anaemia, it may be attributed to started of menarche time.[28,31] However, some studies also indicated that there is no significant association of age of adolescent girls and anaemia.[32-34] On multiple regressions analysis shows that the age of adolescent, education of adolescent, religion, caste, income strata and region of residence is found to be associated with anaemia in adolescent girls which indicated in several earlier studies.[29,35-37] A study highlighted that about 43% of the adolescent deaths are related to pregnancy.[38]

CONCLUSION

This study concludes that the prevalence of anaemia among adolescent girls were very high in India which requires concerted efforts by all the stakeholders, policy maker, planners involved in National Health Policy. Results clearly indicated that the prevalence of anaemia is higher in urban area while the percentage of severe anaemia is higher in rural area than urban area. Iron deficiency, malaria and helminth infections are the main reason behind anemic condition.

Recommendations

Local health providers may play a vital role in creating awareness among women and motivate them so that they can utilize the available healthcare facilities in their community. There is a dire need for regular supply of iron and folic acid tablets at AWCs and also dietary advice pattern among population particularly among adolescent's girls regarding the importance of consuming tablets at regular basis. Simultaneously, it is also important to educate parents and children about regular deworming. It is also impetrative to sensitized parents as well as teachers on health hazards of under nutrition and consequences of anemia. To achieve this, the important role can be played by the research institutions, non-governmental organization and media. Further, political will and health policy makers need to understand that anemia control is cost effective and brings health benefits to the majority.

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