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Nutritional status of children and its association with parental smoking in Uttar Pradesh

Abstract

Background: Exposure to passive smoke due to smoking affects foetus and children. Previous studies have linked this exposure to an increased risk of malnutrition, infant death, respiratory illness and other disorders among infants. The investigation was made to explore the association between stunting of growth and children under 5 years of age who are underweight and are exposed to parental smoking. Exposure to second hand or passive smoke, has adverse impact during pregnancy on the mother as well as the baby. This could include cases of premature birth, birth defects or infant death and respiratory problems among the children. This study discusses the current evidence regarding the effects of parental smoking on their children's health in Uttar Pradesh.

Methods: Parental smoking, and child anthropometry (undernutrition) were examined in a stratified, two-stage cluster sample of 232,920 kids under the age of 5 from National Family Health Survey (2015-16), out of which 35,766 were selected in the study from Uttar Pradesh. Prominent outcomes were that of stunting of growth and a proclivity in children towards remaining underweight.

Results: Prevalence of parental smoking was found in 38.28% of households in Uttar Pradesh. Using the new World Health Organization child growth standards, prevalence of stunted growth, and underweight children was found in 39.34%, 31.15% of the households respectively. After adjusting for potential confounders parental (couple) smoking was associated with increased risk of stunting (AOR 1.17, 95%CI 1.0-1.37, $p<0.05$), and underweight children (AOR 1.09, 95%CI 0.93-1.28).

Conclusion: In Uttar Pradesh, parental smoking is associated with birth factors nutritional status and may divert household funds from food and other necessities towards smoking habits. Parental smoking was also associated with increased risk of stunting of growth and underweight children in the children. The result also suggests that strategies to prevent passive smoke exposure in young children to minimize tobacco smoke exposure are an urgent public and child health priority.

Keywords: nutrition, stunting, underweight, parent, smoke, Uttar Pradesh

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Background

Children's nutritional status is a crucial sign of their health and wellbeing. Children with poor nutritional condition are more likely to develop chronic diseases and obesity as adults. It may also result in learning difficulties and developmental delays. Research suggests that exposure to secondhand smoke from a parent can alter children's eating patterns and nutritional status. Parental smoking has been associated to low nutritional status in children.

On a global scale, Child growth is one of the most imperative public health indicators used for assessing the nutritional status of the populace. A Child's ability to grow often depends on a variety of factors, and one of the most frequently observed factors for inappropriate growth has been Malnutrition. As per WHO, Malnutrition is a major public health concern particularly among children under the age of five.[1] Malnutrition has been seen as a contributing factor in about 45% of fatalities in children under the age of five, and most of these take place in low- and middle-income nations.[2] According to the globally accepted standards, nutritional status among children can be evaluated using anthropometric measures—weight and height. A child can have multiple malnutrition conditions at once. The internationally recognized indicators of Malnutrition are stunting, wasting, and being underweight. Onis and Blössner in their work have defined Stunting among children as low height of a child according to his age, in addition, wasting has been described as low weight of a child concerning his height, and lastly, underweight has been defined as low weight of a child as per his age.[3] Stunting and wasting signify chronic and acute malnutrition, respectively. Nevertheless, Underweight is a composite indicator that incorporates both—acute and chronic malnutrition.

Scholars have also attempted to explore that one of the factors affecting the nutritional growth among children has also been the widespread smoking habit by their parents. Smoking has been seen as the cause of nearly 5 million individuals every year.[4] It's an undeniable fact that smoking is harmful to our respiratory system and increases the chance of bronchitis and lung cancer. The hazardous effects of smoking are not just limited to an individual, but there have been studies conducted showing that sometimes it can create a negative health effect on their offspring as well. Talukder et al.,[4] in his study have explored how parental smoking status is highly associated with an increased risk of malnutrition in children aged 0-5 years and found that if the parents smoke children aged 0-5 years are much more at risk for malnutrition in Albania.[4] However, several of these studies demonstrate a substantial inverse association between tobacco smoking and height at birth.[5,6]

As it is already known that smoking causes various severe health concerns, hence, it is usual to think, also examined in several studies, that smoking might cause negative health effects on a child as well. However, this interrelation between malnutrition and smoking has not been well understood in the states of India. For our study, we are going to assume that malnutrition among children might have

some interrelation with parental smoking. Thus, this study would be an attempt to determine whether or not parental smoking causes malnutrition among children aged 0-5 years. This study would aim to uncover the hypothesized relationship and its determinants in various districts of urban and rural areas in the state of Uttar Pradesh in India. To draw empirical insights into the association between parental smoking and malnutrition among children, we will be using the dataset of National Family Health Survey-5.

Review of literature

Malnutrition has been an unspoken and unseen emergency, as it has been the cause of about 5.2 million deaths of children under the age of five each year in developing.[7] Malnutrition has been defined as a state of poor health brought on by nutritional deficiencies in calories, protein, vitamins, and minerals, which can also interact with infections, other health issues, and other psychological and social issues.[8] There are various interrelated variables that cause malnutrition, which also has negative short- and long-term implications on health. Undernourished children's subpar physical development is a result of poor nutrition, especially in many low- and middle-income nations. It impacts a Child's physical and cognitive growth and considerably raises morbidity and mortality rates among Children.[9] For several years, the WHO Department of Nutrition has depended on anthropometric data to identify patterns and trends of malnutrition in children.[3] Nevertheless, a significant challenge that has been noticed is the non-uniformity of survey analyses and their results. Mercedes Onis, who has extensively worked on Nutritional growth has argued that an important drawback of using anthropometry to evaluate children's nutritional health is that it lacks specificity since changes in body measurements can be influenced by a wide range of variables, such as the consumption of necessary nutrients, infections, altitude, stress, and genetic make-up.[3] Notwithstanding these drawbacks, we can assume that the WHO Global Database on Child Growth and Malnutrition can serve as a model for monitoring nutritional problems that lack reliable data. Malnutrition is closely related to general living standards and underpins all three stunting, wasting, and underweight. Though, it has been often argued that among many factors, one factor for malnutrition is also smoking.

Effects of parental smoking on child's nutritional status

Smoking (tobacco) may have negative impacts on the nutrition and health of a child. It's important to note that there have been multiple studies conducted to examine the relationship between parental smoking and a child's nutritional status. One study conducted in Bangladesh found that parental tobacco use was associated with an increased risk of stunting, underweight, wasting, and severe malnutrition in children between 0 and 5 years of age.[10] Another study conducted in Indonesia found a connection between fathers' smoking habits and their children's risk of malnutrition, particularly in urban poor families. Talukder[4] have also noted in their study that a father's smoking status was found to be strongly associated with the increased risk of child malnutrition in Albania. The research also revealed that about 74% of the populace who smoke was linked to an increased risk of stunning and acute wasting in children.[4] This suggests that smoking may have negative impacts on the nutrition and health of children, and highlights the importance of addressing tobacco use to improve the well-being of children and reduce the risk of malnutrition.[11]

Mothers' smoking during pregnancy has also been seen as a factor contributing to hampering an infant's physical and intellectual development and growth.[6,12] Various researchers have delved into how smoking during pregnancy affects a child's weight and height,[12,13] however, just fewer studies have explored the weight and height follow-up of children born to pregnant women who smoked.[14,15] The study conducted in Indonesia, indicated that parental smoking is an independent risk factor for both underweight and stunting among children from families in rural Indonesia.[16] This further supports the argument that smoking may have negative impacts on the nutrition and health of children, and parents need to be aware of these potential risks when making decisions about tobacco use.

Interrelation of parental smoking with underweight, and stunting

According to the new World Health Organization child growth standards, the prevalence of being underweight, stunting, and wasting was found to be 37.6%, 46.0%, and 12.3%, respectively by Best.[10] While using the new WHO child growth standards and the traditional NCHS reference population, the prevalence of stunting, underweight, and wasting was found to be significantly higher when comparing households with and without tobacco use.[10]

Underweight is a composite indicator that incorporates both chronic stunting and acute wasting.[3] According to the World Health Organization (WHO), in 2016, there were at least 155, 52, and 99 million, respectively, stunted, wasted, and underweight children under the age of five around the world.[17] As per the Millennium Development Goals (MDG), the percentage of underweight children was estimated to have decreased internationally from 25% in 1990 to 15% in 2015.[18] On the contrary, this decrease was not uniformly spread throughout the world, with South East Asia and Sub-Saharan Africa home to roughly 90% of all underweight children.[19] Among various factors, one factor which is often overlooked as the cause of malnutrition is smoking. According to a study conducted in Indonesia, it was hypothesized that in households where the father is a smoker, children are at higher risk of malnutrition, and it was revealed that when the prevalence of paternal smoking was 73.7%, the prevalence of underweight was 29.4%, and severe underweight was 5.2.[10] According to the analysis by Fenercioglu,[20] it was revealed that smoking while being pregnant causes significant deficits in birthweight, and this deficit persistently seen among infants—whose parents smoked, at the age of six months because of their slower development rates for weight and height. In their study, they have also evinced that infants who were exposed to ambient tobacco smoke antenatally were found to have weight deficits (-66.42 g) as compared to infants who were not exposed to smoke.[20]

Around 1 million deaths per year are related to stunting, and, 54.9 million disability-adjusted life years have been lost as a result of stunting.[21] After the year 2000, there has been a significant decrease in stunting globally, but more progress needs to be made to reach the target for 2030.[7] Best et al.,[16] in their analysis has found that when the prevalence of paternal smoking was 73.7% in Indonesia, stunting was found to be 31.4%, and severe stunting was 9.1%. According to an analysis by Bonu and colleagues from the National Family Health Survey-II, children belonging to households where at least one family member used tobacco were more likely to have a child with severe stunting.[22] If stunting, which is brought on by chronic malnutrition, is not treated early on, it could have various short- and long-term implications. Compared to well-nourished children, stunted children may not develop to their full developmental potential over time and may have worse cognitive skills and academic ability.[23] A weakened immune system puts children at an increased risk of diseases including pneumonia and diarrhea in the short term. Often, it has also been empirically proved and argued that parents who smoke may be less able to provide their children with a healthy diet due to the financial resources that smoking requires.[16,22]

Thus, governments, international organizations, and other stakeholders need to continue to work towards improving child

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nutrition and reducing the prevalence of stunting and wasting to improve the health and well-being of children around the world.

Materials & methods

Data source: National Family Health Survey (NFHS-5), 2019-2021 collects information across a wide range of demographic, socioeconomic and health related issues, and it is used in this study for analyzing the child malnutrition and parental smoking. NFHS-5 was a multi -round large-scale survey are conducted as a representative sample of Indian households throughout India by the Ministry of Health and Family Welfare, Government of India (IIPS & ICF 2017). The NFHS-5 collected information from a nationally representative sample of 636,699 households, 57,697 couples aged 15-49 and 232,920 kids under age 5. The survey covered all 37 states/ UTs, and all 707 districts. For this study, response related to Uttar Pradesh has been considered.[23–26]

Variable description

Outcome variable: Children below 5 years of age, were the prime focus of the study. Two indicators of malnutrition have been used in the study as described below.

Stunting of growth: Children whose height-for-age z-score is below minus 2 (-2.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hw70 < -200)**.**

Children below the optimal weight or underweight children: Children whose weight-for-age z-score is below minus 2 (-2.0) standard deviations (SD) below the mean on the WHO Child Growth Standards (hw71 < -200)**.**

Independent variable

If either of the parent (mother or father) habitually smokes at least one of the following from cigarette, pipe, hookah, cigar, tobacco then variable is categorised (parental smoking as yes) and recoded as (=1), else (=0) "No parental smoking".

Covariates

Household cooking fuel (smokeless fuel, smoke fuel), sex of child (male, female), children ever born (2 or less, more than 2 children), birth order (1st, 2nd, 3rd or more). Socio-demographic variables used in the analysis are age of mother (15-19y, 20-24y, 25-29y, 30-34y, 34y and above), place of residence (urban, rural), religion (Hindu, Muslims, and others), caste (SC, ST, OBC, none of them), wealth index (poorest, poorer, middle, richer, richest), education of mothers and fathers (Illiterate, primary, secondary, higher).

Statistical analysis

Descriptive statistics has been used to present percentages of stunted growth and underweight children along with percentage of parental smoking. Following this, logistic regression has been applied for identifying the factors associated with stunting and underweight. Only those variables found significant in bivariate analysis were used for further analysis.

To fit a binary logistic regression model, we use stunted growth as dependent variable. Same is done for wasting. Other predictor variables used in the study are parental smoking, place of residence, type of cooking fuel used, educational level of mother and father, religion, caste, wealth index, sex of child, birth weight, age of mother, children ever born to mother and birth order of mother.

We used binary logistic regression equation to examine the independent association between the child health variable and other explanatory variables. We consider stunting and underweight as dependent variable.

$$\ln\left[\frac{pi}{(1-pi)}\right] = X'\beta \ldots + \text{general effect(constant)}$$

Where,

$$pi = \text{probability that child is } \textit{stunted / under weight}$$

X is set of covariates,

And $X'\beta$ is the linear combination of covariates.

We get the odds Ratio from the fitted equation; also, we get the P-values which determine the significance of β. The test used to check the importance of β is a t-test;

Where $H_0: \beta_i = 0$ against the alternative $H_1: \beta_i$ is not equal to 0.

We reject at 5 % level of significance if P-value is < 0.05 or at 1 % level of significance if P-value is < 0.01 or at 0.1 % level of significance if P-value is < 0.001.

Results

Findings from descriptive statistics are shown in Table 1, which displays that in Uttar Pradesh, the percentage of stunted and underweight children is 39.34 percent and 31.15 percent while it is 38.28 percent of parental smoking. There exists wide variation across background characteristics regarding malnutrition. Results of unadjusted binary logistic regression are shown in Tables 2 and 3 for stunting and underweight respectively. Results of fixed effect (adjusted odds) for stunting and underweight are also shown in the Tables 2 and 3 respectively.

Results (Table 2) show that the parental tobacco smoking is associated with stunted growth [AOR: 1.17; CI: 1.0- 1.37] among children. Results show that children living in household where smoke fuel used are nearly 10 percent [AOR: 1.07; CI: 0.88- 1.29] more likely to be stunted than children living in household with smokeless fuel. Likelihood among children of stunted growth is found to 0.7 times [AOR: 0.72; CI: 0.53- 0.97] less among children with educated mothers than with uneducated mothers. Similar scenario is seen with father's educational status. Odds of stunted growth among children are higher in Schedule tribe as compared to Schedule Caste Results indicate that children belonging to richest quintiles are nearly half as likely [AOR: 0.57; CI: 0.40- 0.080] to witness stunting among children as those belonging to poorest quintiles. Birth weight is found to be associated with stunting, and the children with normal birth weight are 0.25 times [AOR: 0.74; CI: 0.60- 0.90] less stunted than the children with low birth weight. Results also show that women with birth order 3+ are nearly 10 percent more likely to have stunted children than women with birth order 1.

Results (Table 3) show that the parental tobacco smoking is associated with the proclivity of remaining underweight [AOR: 1.09; CI: 0.92- 1.28] in children. Odds of underweight children are highest in Schedule tribe and lowest in general category. Results also indicate that with increase in wealth quintiles odds of underweight of children are decreasing. Birth weight is found to be associated with underweight, and the children with normal birth weight are 0.3 times [AOR: 0.7; CI: 0.57- 0.85] less underweight than the children with low birth weight.

Table 1 Zone wise percentage of stunted and underweight children, and tobacco smoking in Uttar Pradesh

Zone	Stunted	Underweight	Parental tobacco smoking
Agra	40.51	21.21	37.72
Prayagraj	27.19	17.26	39.39
Aligarh	38.07	25.81	36.31
Azamgarh	40.9	38.64	37.95
Bareilly	55.8	42.42	44.76
Basti	37.24	35.67	35.41
Chitrakoot	55.7	46.9	30.84
Devipatan	47.18	35.39	62.07
Ayodhya	28.91	31.14	36.34
Gorakhpur	36.31	35.45	47.36
Jhansi	36.63	36.67	28.83
Kanpur	41.98	31.98	41.4
Lucknow (central)	33.28	29.96	35.12
Meerut	25.1	24.78	24.33
Mirzapur	45.92	33.59	51.55
Moradabad	46.65	30.46	27.4
Saharanpur	28.77	29.39	20.54
Varansi	44.72	30.77	48.09
Total	39.34	31.15	38.28

Table 2 Unadjusted and adjusted odds ratio (with 95 percent confidence interval) for stunting

Stunted	Unadjusted OR (95 percent CI)		Adjusted OR (95 percent CI)	
Tobacco smoke (No®)				
Yes	1.37***	[1.19, 1.59]	1.17*	[1.00, 1.37]
Place of residence (Urban®)				
Rural	1.35**	[1.12, 1.63]	0.99	[0.79, 1.24]
Cooking fuel (Smokeless fuel®)				
Smoke fuel	1.60***	[1.38, 1.85]	1.07	[0.88, 1.29]
Mothers education (Illiterate®)				
Primary	0.75*	[0.59, 0.94]	0.85	[0.66, 1.09]
Secondary	0.65***	[0.55, 0.78]	0.91	[0.74, 1.12]
Higher	0.40***	[0.31, 0.50]	0.72*	[0.53, 0.97]
Fathers education (Illiterate®)				
Primary	0.83	[0.64, 1.08]	0.92	[0.70, 1.21]
Secondary	0.62***	[0.51, 0.75]	0.81	[0.64, 1.01]
Higher	0.40***	[0.31, 0.51]	0.75	[0.55, 1.03]
Religion (Hindu®)				
Muslim	1.04	[0.86, 1.26]	-	-
Others	0.36	[0.04, 3.21]	-	-
Caste (SC®)				
ST	1.50	[0.91, 2.49]	1.34	[0.79, 2.26]
OBC	0.85	[0.72, 1.01]	0.98	[0.82, 1.17]
None of them	0.47***	[0.37, 0.60]	0.63***	[0.49, 0.81]
Wealth index (Poorest®)				
Poorer	0.74**	[0.60, 0.92]	0.85	[0.68, 1.07]
Middle	0.62***	[0.50, 0.77]	0.83	[0.65, 1.06]
Richer	0.46***	[0.37, 0.58]	0.66**	[0.50, 0.87]
Richest	0.34***	[0.27, 0.44]	0.57**	[0.40, 0.80]
Sex of child (Male®)				
Female	0.95	[0.83, 1.10]	-	-
Birth weight (Low®)				
2500+ (Normal)	0.76**	[0.63, 0.92]	0.74**	[0.60, 0.90]
Other	1.30*	[1.01, 1.66]	1.03	[0.79, 1.33]
Age of mother (15-19y®)				
20-24y	1.79	[0.75, 4.29]	1.94	[0.79, 4.75]
25-29y	1.80	[0.76, 4.29]	1.81	[0.74, 4.46]
30-34y	2.84*	[1.18, 6.81]	2.63*	[1.05, 6.57]
34+y	2.04	[0.84, 4.95]	1.55	[0.61, 3.95]
CEB (2 or less®)				
2+ children	1.48***	[1.22, 1.79]	1.07	[0.81, 1.42]
Birth order (1st order®)				
2nd order	1.16	[0.96, 1.40]	1.03	[0.80, 1.33]
3rd order	1.61***	[1.36, 1.92]	1.10	[0.84, 1.44]

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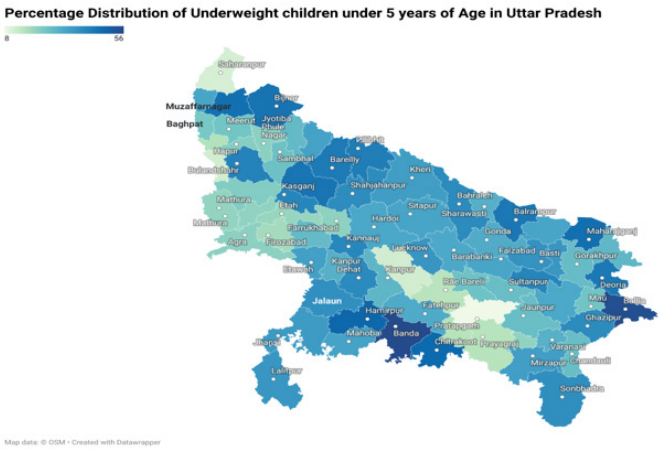
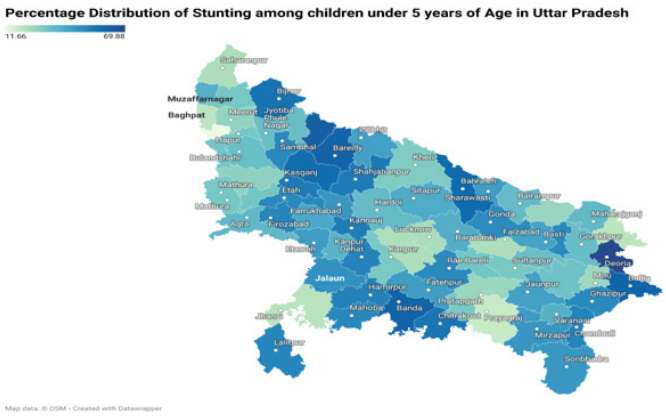
Table 3 Unadjusted and adjusted odds ratio (with 95 percent confidence interval) for underweight

Underweight	Unadjusted OR (95 percent CI)		Adjusted OR (95 percent CI)	
Tobacco smoke (No®)				
Yes	1.27**	[1.09, 1.47]	1.09	[0.93, 1.28]
Place of residence (Urban®)				
Rural	1.18	[0.97, 1.43]	-	-
Cooking fuel (Smokeless fuel®)				
Smoke fuel	1.41***	[1.21, 1.65]	1.01	[0.83, 1.22]
Mothers education (Illiterate®)				
Primary	0.84	[0.66, 1.06]	0.91	[0.71, 1.17]
Secondary	0.71***	[0.59, 0.85]	0.84	[0.68, 1.04]
Higher	0.47***	[0.36, 0.59]	0.66**	[0.48, 0.90]
Fathers education (Illiterate®)				
Primary	0.84	[0.65, 1.10]	0.93	[0.70, 1.23]
Secondary	0.65***	[0.53, 0.79]	0.79*	[0.63, 0.99]
Higher	0.47***	[0.37, 0.61]	0.81	[0.59, 1.11]
Religion (Hindu®)				
Muslim	1.02	[0.84, 1.25]	-	-
Others	0.53	[0.06, 4.79]	-	--
Caste (SC®)				
ST	1.50	[0.91, 2.47]	1.44	[0.86, 2.40]
OBC	0.90	[0.75, 1.07]	1.00	[0.83, 1.20]
None of them	0.55***	[0.42, 0.70]	0.67**	[0.52, 0.88]
Wealth index (Poorest®)				
Poorer	0.80*	[0.65, 1.00]	0.88	[0.70, 1.10]
Middle	0.65***	[0.52, 0.82]	0.78	[0.61, 1.00]
Richer	0.51***	[0.40, 0.64]	0.67**	[0.50, 0.89]
Richest	0.44***	[0.34, 0.56]	0.62**	[0.44, 0.87]
Sex of child (Male®)				
Female	0.90	[0.78, 1.05]	-	-
Birth weight (Low®)				
2500+ (Normal	0.70***	[0.58, 0.85]	0.70***	[0.57, 0.85]
Other	0.78	[0.60, 1.00]	0.64**	[0.49, 0.83]
Age of mother (15-19y®)				
20-24y	0.57	[0.27, 1.22]	-	-
25-29y	0.65	[0.31, 1.38]	-	-
30-34y	0.80	[0.37, 1.70]	-	-
34+y	0.66	[0.31, 1.43]	-	-
CEB (2 or less®)				
2+ children	1.29*	[1.06, 1.58]	0.96	[0.72, 1.29]
Birth order (1st order®)				
2nd order	1.28*	[1.05, 1.55]	1.26	[0.97, 1.64]
3rd order	1.33**	[1.11, 1.60]	1.06	[0.82, 1.38]





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Discussion

Smoking is a major issue affecting the health of people, and it affects health of smokers as well as non-smokers. Passive smoke affects people surrounding them. Parental smoking is also becoming an issue for the children and affects their health, slow down their growth rate, and sometimes leads to malnutrition and even death of the child.

Pregnancy is known to be a critical period of developmental programming, where maternal smoking might influence foetal immune development through activating or silencing foetal genes, affecting lung growth and differentiation, and predisposing offspring to asthma. Exposure to environment tobacco smoke (ETS) during pregnancy is also associated with the same effects and, through genetic variation, a proportion of the population has been shown to be especially vulnerable to such exposure.

In this study, we show the relation between prevalence of stunted growth and underweight children, and parental smoking in Uttar Pradesh. Further we have also found the odds of stunted growth and underweight children can be modified by controlling parental smoking behaviour and household, demographic and socio-economic variables.

Conclusion

The present study concluded that Parental Smoking is associated with significant health-related risks to new-born and young infants. Stunting are underweight are more among those whose parents are smokers than those of non-smokers parents in India. From the study it is also seen that stunting and underweight are more in those families that uses smoke fuel in the kitchen. Parental 'educational level is associated with stunting and underweight and with increasing education chances of their child to be stunted and underweight among them is decreases. It has also been seen that with increasing wealth index, stunting and underweight are decreasing. Stunting and underweight are highest among STs. Parents of under-five children need to be sensitized about the danger of smoking. Strategies to prevent passive smoke exposure in young children to minimize tobacco smoke exposure during pregnancy and lactation are an urgent public and child health priority.

Ethical statement

The analysis of the present study is based on NFHS-5 dataset which is available in public domain. The survey strictly followed all the ethical concerns including inform consent. So, no ethical approval was required for the current study.

Limitation of the study

In study parental smoking character used, in which mothers and fathers smoking behaviour recorded, but mothers smoking character is more like to underreport in the survey. Study based on smoking tobacco only products and didn't include chewing tobacco products which also affects children health.

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None.

Conflicts of interest

No conflicts of interest.

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