# Dietary Diversity among Indian adolescents and young adults: Evidence from UDAYA study

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# Dietary Diversity among Indian adolescents and young adults: Evidence from UDAYA study


## Abstract

**Objective:** This work studied minimum dietary diversity (MDD) and explored its linkages with background characteristics like household consumption behavior, presence of grandparents in the household, number of siblings, involvement in paid work, etc.

**Design:** For bivariate analysis and sex differentials, chi-square test was done to study the association between MDD and different covariates. Logistic regression analysis was performed to identify determinants of MDD.

**Setting:** Data was collected from two majorly populous and backward states of India, namely Bihar and Uttar Pradesh (UP).

**Participants:** Follow-up survey of the UDAYA study (2018-19) was conducted among adolescents and young adults aged 12-23 years old.

**Results:** We found the prevalence of MDD to be 59% among males and 56% among females. Bihar performed better overall with higher MDD and lesser gender inequality. Wealth Index and caste were observed to be significantly associated with MDD. Food Consumption Score (FCS) of the household and media exposure were significantly impacted the MDD.

**Conclusions:** Improving dietary practices at a younger age eventually results in improved nutritional status and overall development of an individual. It can serve as the key to prevent any nutritional deficiencies and diseases linked with it at later ages. The government should focus more on imparting healthy practices related to diet among both adolescents and their families. Action is required to refine the current schemes present for improvement in household food consumption, more so for the poorer population. Programs are needed that work on reducing gender inequalities, especially in the state of UP.



**Keywords:** Dietary Diversity; India; Adolescents; Nutrition


## List of Abbreviations

FCS- Food consumption score

MDD- Minimum dietary diversity

UDAYA – Understanding the lives of adolescents and young adults

WHO - World Health Organization

SC/ST – Schedule Caste/ Schedule Tribe

OBC- Other Backward Caste

ICDS- Integrated Child Development Services

FAO- Food and Agriculture Organization

## Introduction

India's 253 million adolescent population (highest in the world) presents an unprecedented opportunity as well as a challenge (1). Every fifth person in India is an adolescent (i.e., 10-19 years of age). They can be divided into two categories – the younger (10-14 years) and the older (15-19 years), based on their behavioral attitudes and needs (2). Adolescence is a complex transitional phase from childhood to adulthood, in which they undergo various rapid changes from physical appearances to changes in their food habits (3,4). The adolescence stage is considered the second window of opportunity to improve nutritional status and ensure healthy life expectancy. Ample evidence on dietary diversity shows a significant association with nutritional indicators (5). An adequate diversified diet is vital for optimal health and the development of physical and cognitive health. Adolescence malnutrition (overweight/underweight) is associated with early onset of Non-Communicable Diseases and other morbidities that add on to Years Lived with Disability (YLD) (6). Comprehensive national nutrition survey (CNNS) findings have highlighted the poor nutritional status of adolescents. It measured BMI among adolescents and found 26.3% of adolescent boys, 14.2% of adolescent girls to be moderately or severely thin. The survey has also collected data on micronutrient deficiencies across all ages, from children aged five years to adolescents. It found that one-fourth of adolescents were deficient in vitamin D were deficient in vitamin B12 and folate. In contrast, one-third of adolescents have vitamin A deficiency (7).

Micronutrient deficiency during early childhood can often transverse into adolescence with a long-term effect on health, cognition, education, and productivity (8). Dietary diversity prevents the deficiency of micronutrients, and hence the onset of deficiency diseases and other related health issues. Also, it is strongly associated with various factors such as food insecurity, socio-economic

condition, educational status, knowledge of nutrition, taste preference, and cultural acceptability (9).

Some research shows no difference in the intra-household allocation of food in the case of pre-school and primary school-age children (10–13), but that it begins after a certain age, and the difference persists. Gender-based disparity in intra-household diet consumption exists through all life stages, but the gap widens markedly at 15 years old. Also, some studies have revealed that gender bias influences dietary diversity too. A study found a pro-boy bias in dietary diversity only among the children aged up to 24 months born to illiterate mothers (14). Poor dietary diversity among female adolescents could have intergenerational consequences as well (15). A study found children of teen mothers to be five percentage points more likely to be stunted than children of adult mothers (16). Teen pregnancies persist as age-old traditions such as child marriage are still practiced in some parts of India (1.5 million child marriages every year) (17). The 4th round of NFHS report supports this evidence, as 32% of women who had given birth at that time did it before reaching 18 years of age (16). The dietary diversity of these young mothers if poor, would lead to the next generation being undernourished as well.

The government has launched various policies and intervention programs to create awareness about the importance of dietary diversity but failed to monitor it, especially among adolescent girls. Therefore, our study is an attempt to understand the dietary pattern and diversity and its related factors among adolescents and young adults. The findings of our study could help plan interventions to improve their dietary pattern, nutrition status, and the overall well-being of the adolescents.

In our study, we have used the UDAYA longitudinal study design, which provides a unique opportunity to determine the role of dietary patterns. This rich dataset can help analyze the changing intentions and attitudes in terms of dietary habits. In this study, we tried to examine the role of food consumption behavior of the household to the dietary diversity among adolescents and young adults in UP and Bihar.

## Methods

### *Data Source*

The UDAYA (Understanding the lives of adolescents and young adults) dataset has been used in the study conducted by the Population Council, New Delhi. UDAYA is a longitudinal study done in Uttar Pradesh and Bihar following a cohort of adolescents aged 10-19 years. These two north-Indian states comprise 28% of the adolescent population in the country, given they are large, highly populated, predominantly rural, high poverty states (18).

The study used both cross-sectional and longitudinal designs for sampling at the point of wave 1, and a multi-stage systematic sampling design was employed. UDAYA was designed to provide estimates at two-time points for the state as a whole along with for the urban and rural areas of the state for each of the five categories of respondents, namely younger boys in ages 10–14, older boys in ages 15–19, younger girls in ages 10–14, unmarried older girls in ages 15–19, and married older girls in ages 15–19. A total of 150 primary sampling units (PSUs), 75 for rural and 75 for urban respondents, were sampled in each state using the Probability proportional to size (PPS) technique. PSUs list was stratified using four variables, namely, region, village/ward size, the proportion of the population belonging to scheduled castes and scheduled tribes, and female literacy. The household sample in rural areas was selected in three stages, while in urban areas, in four stages.

Data collection for Wave 1 was done in 2015-16, and after three years, data was collected for wave 2 data in 2018-19. This paper analyses dietary intake in the past 24 hours, and this information was collected only at wave 2. Hence, for the current study, a cross-sectional sample of only wave 2 is used, consisting of information of 12-23 years old adolescents and young adults. For a fair comparison between boys and girls, a sample of married females was dropped as information for its counterpart, i.e., married males are not collected in the survey. The final sample consisted of 4221 male and 5987 unmarried female adolescents. Sampling weights were used as mentioned in the UDAYA guidelines.

The **outcome variable** of the study, i.e., minimum dietary diversity, was defined as the intake of food belonging to at least 5 or more food groups in the past 24 hours, as defined by FAO and FHI 360, 2016 (19). For the computation of the standard measure of Minimum dietary diversity (MDD-W) for women, FAO defines 10 diverse types of food groups as Grains, white roots, and tubers,

and plantains; Pulses (beans, peas, and lentils); Nuts and seeds; Dairy; Meat, poultry and fish; Eggs; Dark green leafy vegetables; Other vitamin A-rich fruits and vegetables; Other vegetables and; Other fruits. Out of these 10, UDAYA asked for information on only the first seven food groups in its survey. For the last three food groups, questions were asked on the overall intake of "fruits" or "vegetables" without emphasizing whether they were vitamin-A rich or not. To adjust for this data limitation, a weightage of 1.5 was given instead of 1 to the two proxy food groups, namely "Fruits" and "Vegetables", as they may or may not be rich in vitamin-A. This way, we got the total dietary diversity score to fall in the range of 0 to 10 as it generally should, where consumption of food from five or more food groups was defined as the proxy measure of minimum dietary diversity for our study population.

**Independent variables** consisted of socio-demographic characteristics like age of the adolescent, sex, completed years of education, mother's completed years of education, whether doing paid work in the past one year and caste. Family arrangement was also studied using information on number of siblings and presence of any grandparent in the household. Other determining factors included media exposure, food consumption behavior and wealth index of the household, place of residence, and state. An additive index of Media Exposure is created comprising eight factors coded in a binary manner (1=Yes/High, 0=No/Low). Eight factors include information on owning mobile; owning of Laptop; usage of social media in the last three years; frequent (high) or infrequent (low) indulgence in activities like watching television; reading of newspaper; listening of radio; watching movies; usage of internet. Here, frequent use refers to the responses "almost every day" and "at least once a week", whereas infrequent usage refers to "at least once a month", "rarely" and "not at all". The final added score ranges from 0 to 8, which is then categorised in to three terciles as Low (0-3), Medium (4-5) and High (6-8).

Food consumption of the household is reflected using a proxy index given some data constraints. The Standard Food Consumption Score (FCS) is an index developed by the World Food Programme (WFP) in 1996 to represent household caloric availability (20). The FCS combines household-level data on the diversity (quality) and frequency (quantity) of food groups consumed over the previous seven days. It is then weighted according to the relative nutritional value of the consumed food groups. For instance, food groups containing nutritionally dense foods, such as animal products, are given greater weight than those containing less nutritionally dense foods, such

as tubers. Broad food groups and associated FCS weights are: main staples—weighted at 2, pulses—weighted at 3, vegetables—weighted at 1, fruit—weighted at 1, meat and fish—weighted at 4, milk—weighted at 4, sugar—weighted at 0.5, and oil—weighted at 0.5. Condiments can also be captured but are weighted at 0. Consumption frequencies are computed by adding the number of days a food item is eaten in a week. Then they are added and rounded off to a maximum limit of 7 per food group. An additive score combining the weighted consumption frequencies of each food group results in a total score ranging from 0 to 112.

But in the UDAYA study, we get a data restriction. Instead of following the standard measure of 7-days recall, a 30-day recall is used, and information is collected on six responses, namely, whether a food item was eaten daily, once in a week, 2-3 times a week, once in two weeks, once in four weeks or never. For finding the number of days per week a food item was consumed, these responses were weighted with 7, 1, 2.5, 0.5, 0.25, and 0 number of days, respectively. To represent the food consumption status of a household as poor, borderline or acceptable, cut-offs defined by WFP are 0-21; 21.5-35, and >35. But these cut-offs are often criticized in literature. They are termed as subjective because assigning cut-off points to a continuous quantitative measure is usually a matter of analytical judgment about the extent to which such categorical cut-offs are universally applicable (Maxwell, 2013). Hence, instead of using these cut-offs, we have simply divided the score into three terciles as Low (0-70), Medium (70-85), High (85-112).

### *Statistical Analysis*

For analysis, cross-tabulation and chi-square test were used to test independence of outcome variable with various factors as mentioned above. Binary logistic regression was used to identify determinants of minimum dietary diversity (Yes=1, No=0) of male and female adolescents. Adjusted odds ratios were computed for Uttar Pradesh and Bihar separately, as well as for the combined sample.

## Findings

Table 1 represents consumption of items from different food groups in the past 24 hours among younger and older adolescents by the sex of the respondents. It was found that almost 100% of the adolescents were consuming grains, white root tubers, and plantains in their diet. Older adolescents

consumed dairy products and pulses slightly more (83% and 63% approx.) compared to younger adolescents (80% and 58% approx.). More than half of the adolescents ate fruits and vegetables the previous day. Females were found to be eating fruits more compared to males, particularly among older adolescents. Mainly, intake of older adolescents was found to be higher than younger adolescents in most food groups. Only one-third of the adolescents ate dark green leafy vegetables. Male adolescents consumed more nuts and seeds, especially in the group of younger adolescents (around 29%) than females (24%). The gender differentials were quite prominent with regards to the consumption of non-vegetarian foods among adolescents. Intake of eggs was almost double in the case of males (18%) compared to females (9%) in older adolescents. A similar pattern was observed in the consumption of meat, poultry, and fish in both younger and older adolescents.

Table 2 shows the prevalence of minimum dietary diversity where Bihar portrays better dietary habits (MDD=61% in both males and females) than UP (MDD=58% in males and 54% in females). Females faced more discrimination in UP compared to Bihar. Advancement in age leads to a significant increase in MDD in the case of female adolescents in both UP and Bihar. Growing level of education of the adolescents and that of mother showed a positive effect on dietary diversity of the adolescents. Huge gender divide was evident among illiterate adolescents of UP, where males' diet was almost twice as diverse (MDD=47%) in comparison to that of females (MDD=26%). Better dietary diversity was observed in female adolescents of Bihar who had studied for 10 years or more and whose mothers had studied for 8 years or more. Respondents who were working in the past year consumed a less diverse diet than those not working. Adolescents belonging to SC/ST caste were less likely to have a diverse diet than OBC, General, and other caste people, especially in the case of UP. Adolescents from urban areas, those belonging to households with better wealth status, received a more diverse diet the previous day than their counterparts. Dietary diversity was found to be highly aligned with the media exposure and food consumption behavior of the household, as those with low media exposure and from low FCS households had MDD as low as 52%. In contrast, those with high media exposure and high consumption households had MDD as high as 75% in the case of adolescents of UP. Media exposure was positively associated with minimum dietary diversity, as those with high media exposure had their minimum dietary diversity as high as 74%. Living arrangement in the household was also found to affect the intake of a varied diet. Less siblings and presence of grandparents in the household was positively associated with intake of a diverse and nutritious diet by the adolescent.

### *Results from Multivariate analysis*

Table 3 shows output of Binary logistic regression analysis. We find out that caste, media exposure, wealth index, and household food consumption status highly influence the minimum dietary diversity of adolescents. Those belonging to the OBC caste were at 1.3 times higher odds of having minimum dietary diversity (A.O.R.=1.3, 95% CI (1.1-1.5)) than adolescents of SC/ST caste. Wealth of the household determined the pattern of diet in the state of Bihar in such a way, where adolescents from the richest category households had 90% higher likelihood of achieving minimum dietary diversity than those from the poorest category households (95% CI (1.2-3.1)). Adolescents belonging to households with high food consumption were three times more likely to have a diverse diet compared to those belonging to households with low food consumption (A.O.R.=3.0, 95% CI (2.3-3.8) for UP; A.O.R.=2.2, 95% CI (1.6-2.9) for Bihar; A.O.R.=2.6, 95% CI (2.1-3.1) overall). Adolescents highly exposed to media were twice as likely to have a minimum dietary diversity compared to those with low media exposure (A.O.R.=2.1, 95% CI (1.7-2.7)). Better education level corresponded to better dietary diversity in the state of U.P. Overall, adolescents from Bihar were 20% more likely to have a minimum dietary diversity than those from Uttar Pradesh.

## Discussion

In the present study, around half of the adolescents and young adults don't have an adequately diverse diet. Higher gender disparities exist in UP compared to Bihar. Bihar also performs better in terms of higher MDD levels. MDD is highly influenced by gender, education, caste, and media exposure of the individual, while wealth index, food consumption, and caste play an essential role at the household level.

It is observed that the most widely consumed food group among all the respondents is "grains, white root tubers, and plantains". Food groups consumed by more than half of the individuals include dairy, fruits, pulses, and vegetables. Similarly, a study conducted in Iran found almost all the female adolescents consuming cereals, and more than half of them consuming fruits and vegetables (21).

Gender-based discrimination is still prevalent in northern, central, and eastern zones of India (22). For instance, females across India consume nutrient-rich food less frequently compared to males

231 (23). Our study shows considerable differences in the non-vegetarian diet practices among male
232 and female adolescents in UP and Bihar. Females have consumed more fruits, whereas males
233 consumed more eggs and meat. This is observed among both age groups, but the gap is even wider
234 in the case of older adolescents. Likewise, a study based in rural India found gender disparity in
235 the dietary pattern of adolescents (24), and it corroborates with another study conducted among
236 adolescents in Bangladesh, where the inadequate dietary deficiency among adolescent girls and
237 boys was 55.5% and 50%, respectively (25). Contrary to that, a study from Australia did not find
238 highly significant differences in the dietary pattern of male and female adolescents (26). Further,
239 a longitudinal study using data from Peru, Vietnam, India, and Ethiopia didn't find marked gender
240 differentials in dietary patterns of the adolescents (27).

241 Many studies from developing countries have found dietary diversity to be significantly associated
242 with the family's economic status (21,28–31). Our study findings concur with the previous study
243 findings that adolescents belonging to the wealthiest quintile have higher odds of reporting MDD
244 than poorer quintiles. A study in Gujarat, India, found that higher income of the family was
245 positively associated with a higher diversity score (32). A study conducted in Bangladesh also
246 stated the positive role of Socio-economic status in MDD among adolescents (33). Lower income
247 can affect the family's purchasing power, and therefore their access and choices to various food
248 items are constrained (34,35).

249 The choices of food in the initial years impact dietary patterns in later part of life also (36). Our
250 study suggests the same where adolescents with medium and high household food consumption
251 are more likely to have MDD than those with low household food consumption. This pattern is
252 observed both in UP and Bihar.

253 Mass media is popular among adolescents. Television and magazines impact adolescents' dietary
254 habits relatively more than other media both in developed and developing countries (37). Our study
255 also finds the role of mass media exposure to be positively associated with the higher dietary score
256 in the two states. Similarly, a study based in India found social media exposure to be significantly
257 associated with the high MDD among adolescent girls (24). At the same time, a study in Austria
258 found that exposure to mass media increases fruit consumption among adolescents (38).

259 The limitation of our study is that it uses a proxy measure of MDD and FCS as there was a lack of
260 complete information required to compute the standard estimate. Few adjustments are made in

261 data so that the represented measure is as close to the standard one. A longitudinal analysis would
262 have helped establish causality of various linkages if the survey team had asked the same questions
263 at both time points. But due to a different set of questions being asked related to the dietary pattern,
264 the analysis is done only on the wave-2 dataset, and hence the inference is from cross-sectional
265 data's point of view.

266 **Conclusion**

267 In developing countries, lack of food diversity due to constraints in access to different food groups
268 and monotonous consumption of certain cereals or food groups impedes achieving optimal
269 nutrition status. Therefore, there is a need to reemphasize the importance of dietary diversity.
270 Vegetables and fruits intake is as important as compared to that of cereals and pulses as it contain
271 a lot of fiber (39). Awareness campaigning is needed on increasing the intake of vegetables as
272 much as that of grains. The industrialization in agriculture and the focus of the government's Public
273 Distribution System (PDS) on mainly wheat and rice has reduced emphasis on many other nutrient-
274 rich kinds of cereal like Bajra, Ragi, Millets, etc. (40) Government can add such variety to its
275 present schemes like PDS, Mid-day meal, Antyodaya Anna Yojana, etc., and intensify awareness
276 on its importance. Our study findings indicate several factors that have a bearing on dietary
277 diversity. Foremost, being the low Socio-economic gradients and food consumption of the
278 household, which has a significant influence on the dietary patterns. Those from wealthier families
279 and higher caste have better dietary diversity. Media can be an essential tool for disseminating
280 messages and raising awareness regarding improving variety in diet among adolescents and young
281 adults. Also, the role of gender-based inequalities being responsible for the inadequate diet among
282 females can't be ruled out.

283 In the past decades, undernutrition among the under-5 has been studied extensively, but that of
284 adolescents and young adults has not received much attention. Even though the young adults (aged
285 20 and above) performed better in their dietary intake, they are also far from the optimum
286 nutritional diet. Adolescence marks an important stage from childhood to adulthood. Especially
287 working on nutrition of female adolescents will result in breaking the malnutrition cycle (41). The
288 government has started taking cognizance of adolescent health issues with the launch of Rashtriya
289 Kishor Swasthya Karyakram. But, the health indicators among adolescents are still poor. Data

shows that the pace of improvement is slow and not enough to attain the SDG targets by 2030. India having the highest adolescent population in the world, should harness its demographic dividend. And to do so, it should invest in the nutritional status and overall health of the adolescents.

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412 **Tables**

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414 **Table 1: Percentage of intake of different food groups in the past 24 hours among younger**
415 **and older adolescents, Udaya study, 2018-19**

| Food Groups | Younger (12-17 years) | | | Older (18-23 years) | | |
|---|---|---|---|---|---|---|
| | Male | Female | Significance | Male | Female | Significance |
| **Grains, White root tubers, Plantains** | 100.0 | 99.5 | | 99.6 | 98.5 | *** |
| **Dairy** | 80.9 | 77.8 | *** | 83.4 | 82.1 | *** |
| **Other and vitamin-A rich Fruits** | 63.7 | 67.2 | *** | 64.2 | 71.2 | *** |
| **Pulses (beans, peas and lentils)** | 58.6 | 58.8 | | 63.0 | 61.6 | *** |
| **Other and vitamin-A rich Vegetables** | 56.9 | 61.7 | | 59.7 | 61.3 | |
| **Dark Green leafy vegetables** | 33.8 | 32.5 | | 32.8 | 32.1 | |
| **Nuts and seeds** | 28.6 | 24.1 | *** | 29.7 | 26.6 | *** |
| **Meat, poultry and fish** | 16.5 | 13.6 | ** | 17.2 | 12.4 | *** |
| **Eggs** | 16.7 | 10.8 | *** | 17.6 | 9.2 | *** |

416 Note: Significance is computed to see differences among males and females using chi-square test, where ***
417 represents p<.01 and ** represents p<.05

418

419 **Table 2: Percentage of Minimum Dietary Diversity w.r.t. demographic and other**
420 **background characteristics, Uttar Pradesh and Bihar, 2018-19**

| | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | UP | Bihar | Overall | UP | Bihar | Overall |
| **Outcome Variable** | | | ** | | | *** |
| **Minimum Dietary Diversity** | 57.9 | 61.0 | 58.8 | 53.5 | 61.1 | 56.3 |
| **Independent Variables** | | | | | | |
| **Age** | **ns** | **ns** | **ns** | ** | *** | *** |
| **12-15 yrs** | 56.6 | 61.2 | 58.2 | 48.4 | 54.8 | 51.8 |
| **16-17 yrs** | 57.0 | 62.2 | 58.8 | 57.6 | 67.4 | 60.1 |
| **18-20 yrs** | 57.9 | 59.5 | 58.1 | 54.8 | 67.2 | 58.1 |
| **19-23 yrs** | 63.0 | 61.4 | 62.6 | 59.1 | 69.0 | 61.5 |
| **Completed years of education** | *** | *** | *** | *** | *** | *** |
| **None** | 46.5 | 59.5 | 50.3 | 25.8 | 50.3 | 33.0 |
| **1-4** | 55.3 | 53.5 | 54.8 | 42.2 | 47.1 | 46.1 |
| **5-7** | 56.4 | 56.4 | 56.4 | 50.2 | 59.3 | 54.3 |
| **8-9** | 55.5 | 66.4 | 58.8 | 51.9 | 55.6 | 53.4 |
| **10-11** | 58.3 | 59.4 | 58.7 | 60.7 | 75.5 | 64.9 |
| **12 and above** | 63.7 | 64.4 | 63.6 | 62.1 | 74.2 | 64.4 |
| **Involved in paid work for the last 12 months** | *** | *** | *** | * | **ns** | *** |
| **Yes** | 53.9 | 55.6 | 54.2 | 52.9 | 59.3 | 54.3 |
| **No** | 60.5 | 63.4 | 61.4 | 53.7 | 61.4 | 57.0 |
| **Mother's Completed years of education** | *** | *** | *** | *** | *** | *** |
| **None** | 55.2 | 59.0 | 56.5 | 52.7 | 58.7 | 54.7 |
| **1-7yrs** | 55.2 | 73.1 | 60.1 | 42.5 | 61.8 | 49.3 |
| **8-9yrs** | 68.3 | 64.1 | 67.1 | 59.8 | 71.6 | 60.2 |
| **10 and above** | 66.8 | 64.3 | 66.0 | 65.2 | 73.7 | 68.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Caste** | *** | *** | *** | *** | *** | *** |
| **SC/ST** | 47.3 | 52.3 | 48.8 | 50.3 | 60.8 | 53.8 |
| **OBC** | 61.8 | 62.8 | 62.1 | 53.0 | 58.8 | 55.8 |
| **General/Others** | 62.0 | 68.3 | 63.3 | 57.7 | 73.7 | 60.2 |
| **Place of residence** | *** | *** | *** | ** | ** | *** |
| **Urban** | 61.8 | 65.3 | 62.7 | 55.1 | 70.0 | 58.9 |
| **Rural** | 56.5 | 59.8 | 57.6 | 52.9 | 59.6 | 54.9 |
| **Wealth index of the household** | *** | *** | *** | *** | *** | *** |
| **Poorest** | 42.0 | 52.6 | 46.8 | 33.1 | 55.6 | 40.9 |
| **Poorer** | 51.5 | 57.8 | 54.1 | 56.8 | 46.4 | 54.3 |
| **Middle** | 58.7 | 57.5 | 58.3 | 57.7 | 58.7 | 58.4 |
| **Richer** | 59.7 | 67.3 | 61.9 | 52.3 | 70.2 | 57.1 |
| **Richest** | 65.4 | 76.1 | 67.0 | 58.7 | 79.7 | 61.9 |
| **Food Consumption Score index** | *** | *** | *** | *** | *** | *** |
| **Low** | 45.1 | 52.6 | 47.3 | 40.2 | 48.9 | 42.8 |
| **Medium** | 67.1 | 61.9 | 65.5 | 57.9 | 63.8 | 58.9 |
| **High** | 71.5 | 71.4 | 71.6 | 66.7 | 72.7 | 70.0 |
| **Media Exposure** | *** | *** | *** | *** | *** | *** |
| **Low** | 49.1 | 57.7 | 52.0 | 49.5 | 55.8 | 51.3 |
| **Medium** | 58.1 | 59.0 | 58.4 | 56.3 | 68.9 | 60.9 |
| **High** | 75.2 | 73.4 | 74.6 | 71.1 | 82.9 | 71.8 |
| **Number of siblings** | **ns** | * | ** | *** | **ns** | *** |
| **<2** | 60.4 | 69.3 | 62.5 | 60.5 | 66.7 | 62.2 |
| **2-4** | 56.5 | 59.4 | 57.3 | 52.8 | 61.3 | 56.3 |
| **4+** | 60.0 | 61.7 | 60.5 | 53.1 | 59.1 | 54.8 |
| **Presence of Grandparent in the household** | *** | ** | *** | * | **ns** | ** |
| **No** | 57.0 | 59.3 | 57.6 | 53.0 | 60.3 | 55.9 |
| **Yes** | 61.0 | 67.4 | 63.0 | 55.2 | 64.2 | 58.1 |

Note: Significance is computed to see differences among males and females using chi-square test, where *** represents p<.01 and ** represents p<.05

**Table 3: Binary logistic regression results presenting Adjusted Odds ratio (AOR) w.r.t. various determinants predicting minimum dietary diversity among adolescents in UP and Bihar, 2018-19**

| | **UP** | **Bihar** | **Overall** |
|---|---|---|---|
| **State** | | | |
| **Uttar Pradesh** | | | |
| **Bihar** | | | 1.2 (1-1.4)** |
| **Sex of respondent** | | | |
| **Male** | | | |
| **Female** | 0.8 (0.7-1) | 1 (0.8-1.3) | 0.9 (0.8-1.1) |
| **Age** | | | |
| **10-12 yrs** | | | |
| **13-14 yrs** | 1.1 (0.8-1.5) | 1.3 (0.9-2) | 1.2 (1-1.5) |
| **15-17 yrs** | 0.9 (0.7-1.3) | 1 (0.7-1.4) | 1.0 (0.8-1.2) |

| | | | |
|---|---|---|---|
| **18-19 yrs** | 1.1 (0.8-1.6) | 1 (0.6-1.5) | 1.1 (0.8-1.5) |
| **Completed years of education** | | | |
| **None** | | | |
| **1-4** | 1.8 (0.9-3.6) | 0.9 (0.4-2.2) | 1.3 (0.8-2.4) |
| **5-7** | 2.1 (1.2-3.7)*** | 1 (0.5-2.1) | 1.5 (1-2.4) |
| **8-9** | 2.0 (1.1-3.5)** | 1.1 (0.5-2.3) | 1.5 (1-2.3) |
| **10-11** | 2.2 (1.2-3.8)*** | 1 (0.5-2.2) | 1.5 (1-2.4) |
| **12 and above** | 2.2 (1.2-3.8)*** | 1.2 (0.6-2.6) | 1.7 (1.1-2.6)** |
| **Whether involved in paid work for the last 12 months** | | | |
| **Yes** | | | |
| **No** | 1.1 (0.9-1.4) | 1.2 (0.9-1.6) | 1.1 (1-1.3) |
| **Mother's Completed years of education** | | | |
| **None** | | | |
| **1-7yrs** | 0.8 (0.6-1) | 1.3 (0.8-1.9) | 0.9 (0.7-1.2) |
| **8-9yrs** | 1.3 (0.9-1.8) | 1 (0.6-1.6) | 1.2 (0.9-1.6) |
| **10and above** | 1.2 (0.9-1.7) | 0.7 (0.5-1.1) | 1.1 (0.8-1.4) |
| **Caste** | | | |
| **SC/ST** | | | |
| **OBC** | 1.4 (1.1-1.7)*** | 1.1 (0.8-1.4) | 1.3 (1.1-1.5)** |
| **General/Others** | 1.3 (1-1.7) | 1.3 (0.8-2) | 1.3 (1-1.6) |
| **Place of residence** | | | |
| **Urban** | | | |
| **Rural** | 1.2 (0.9-1.4) | 1 (0.8-1.3) | 1.1 (0.9-1.3) |
| **Wealth index of the household** | | | |
| **Poorest** | | | |
| **Poorer** | 1.5 (1-2.1) | 0.9 (0.6-1.4) | 1.2 (0.9-1.5) |
| **Middle** | 1.7 (1.2-2.4)*** | 1.0 (0.7-1.5) | 1.3 (1-1.7)** |
| **Richer** | 1.5 (1-2.1)** | 1.4 (0.9-2.2) | 1.4 (1-1.8)** |
| **Richest** | 1.4 (0.9-2) | 1.9 (1.2-3.1)** | 1.3 (1-1.9) |
| **Food Consumption Score index** | | | |
| **Low** | | | |
| **Medium** | 2.0 (1.6-2.5)*** | 1.4 (1-1.9)** | 1.8 (1.5-2.1)*** |
| **High** | 3.0 (2.3-3.8)*** | 2.2 (1.6-2.9)*** | 2.6 (2.1-3.1)*** |
| **Media Exposure** | | | |
| **Low** | | | |
| **Medium** | 1.3 (1-1.6)** | 1.1 (0.8-1.4) | 1.2 (1-1.4)** |
| **High** | 2.3 (1.7-3.1)*** | 1.8 (1.2-2.6)*** | 2.1 (1.6-2.7)*** |
| **Number of siblings** | | | |
| **<2** | | | |
| **2-4** | 1.0 (0.7-1.3) | 0.8 (0.5-1.3) | 0.9 (0.7-1.2) |
| **4+** | 1.2 (0.9-1.7) | 0.8 (0.5-1.3) | 1.1 (0.8-1.4) |
| **Presence of Grandparent in the household** | | | |
| **No** | | | |
| **Yes** | 1.0 (0.8-1.3) | 1.2 (0.9-1.5) | 1.1 (0.9-1.3) |

Note: *** represents p<.01 and ** represents p<.05