Impact of Nutritional Status on Body Mass Index of Children

Sohel Rafik Mujawar[1], Pratibha Bajirao Ingawale[2]

[1]Research Student, Département of Economics, Shivaji University Kolhapur Maharashtra, India
Email: *srm.rs.economics[at]unishivaji.ac.in*
Phone No- 8830713493

[2]Research Student, Département of Statistics, Shivaji University Kolhapur Maharashtra, India
Email: *pratibhaingavle[at]gmail.com*
Phone No- 7709100588

Abstract: *The nutritional status of children is a critical determinant of their health, cognitive development, and overall well-being. This study examines the impact of nutritional status on child outcomes in major Indian states, using data from multiple rounds of the National Family Health Survey (NFHS). Key indicators such as stunting, wasting, and underweight prevalence are analyzed to assess their influence on children's physical and cognitive development. By employing econometric techniques to explore the relationship between malnutrition and child development, this research highlights disparities across regions and demographic groups. The findings underscore the need for targeted policy interventions aimed at improving child nutrition, particularly in states with high levels of malnutrition. Addressing these nutritional deficits is crucial for enhancing educational outcomes, long-term economic productivity, and breaking the intergenerational cycle of poverty. The results of this study contribute to the growing body of literature on public health and development economics, offering insights for policymakers and practitioners working to improve child health in India. A community based cross sectional study was conducted in three randomly selected villages of Karveer tehsil of Kolhapur district. Here we apply two stage sampling technique. The population of under 6 years old children of Karveer tehsil is 105972. The total population of under 6 year children in these selected villages is Girgaon, Parite, Shindewadi nutritional Status on Child.*

Keywords: Nutritional, Status, Children, Girgaon, Parite, Shindewadi

1. Introduction

The nutritional status of a child plays a critical role in their overall development, health, and well-being. Below are the key impacts of nutritional status on children. Physical Growth and Development Stunting, Wasting, and Underweight: Poor nutrition leads to stunting (low height for age), wasting (low weight for height), and being underweight. These conditions can severely affect a child's growth. Brain Development: Malnutrition, especially in the first 1,000 days (from conception to age 2), can impair brain development, leading to long-term deficits in cognitive functioning, learning, and memory. Children with poor nutrition, particularly those who experience iron, iodine, and other micronutrient deficiencies, often have lower IQ scores and cognitive abilities. Malnutrition is linked to delayed school enrolment, lower attendance, and poor academic performance, as children may lack the energy to concentrate and participate in learning activities. Poor nutrition compromises the immune system, making children more vulnerable to infections and illnesses such as diarrhea, pneumonia, and other respiratory infections. Repeated infections further contribute to malnutrition, creating a vicious cycle.

Severe malnutrition significantly increases the risk of death from common childhood diseases, particularly in low-income regions. Children who experience malnutrition early in life are at higher risk for developing chronic conditions such as diabetes, heart disease, and obesity later in life. Inadequate nutrition can delay the onset of puberty and result in long-term physical health problems, including decreased muscle mass and bone density. Malnourished children are more likely to grow up with impaired cognitive and physical abilities, reducing their future earning potential and productivity as adults. Families and communities with a high prevalence of malnourished children often experience intergenerational cycles of poverty due to diminished educational attainment and economic productivity. The long-term economic impact of malnutrition is significant, as it reduces a country's human capital potential, leading to lower productivity and higher healthcare costs. Malnutrition in children creates a substantial burden on public health systems due to the need for healthcare services, interventions, and treatment of diseases related to poor nutrition. Given these wide-ranging impacts, improving child nutrition is crucial for individual development and broader economic and social development.

1.1 Objectives

To determine the influence of socio demographic characteristics and immunization status on the nutritional status.

1.2 Method of Data Collection

A community based cross sectional study was conducted in three randomly selected villages of Karveer tehsil of Kolhapur district. Here we apply two stage sampling technique. The population of under 6 years old children of Karveer tehsil is 105972. The total population of under 6 year children in these selected villages is

Villages	Male	Female	Total
Girgaon	233	184	417
Parite	276	221	497
Shindewadi	65	44	109
Total	574	449	1023

Source: Field survey 2024

The study subjects include children between the age group 0-6 years of both genders of the selected clusters in Karveer tehsil. The sample size is determined by using Yamane's formula when population is known.

$$n = \frac{N}{1 + Ne^2}$$

Here, N=population size=105972 and e= margin of error=0.06 (considered)

$$n = \frac{105972}{1 + (105972 \times 0.06 \times 0.06)} \approx 277.05$$

We get the minimum sample size to get desired result is $277.05 \approx 277$. Here we take more than minimum sample size (i.e 288). Here total population of three villages is N_1=1023 and therefore using proportional allocation of sample size for selected clusters (Villages) are as follows

a) Sample size for Girgaon village is:
$$n_1 = \frac{n \; x \; Population \; of \; Girgaon}{N_1}$$

$$n_1 = \frac{288 \; x \; 417}{1023} = 117.39 \approx 117$$

Similarly for other villages, we get the sample size as,

Villages	Girgaon	Parite	Shindewadi
Sample size	117	140	31

Source: Field survey 2024

From the pilot survey, the number of responses was found to be 40.

After getting written informed consent from the project guide, they were interviewed using pretested structured interview schedule. The questionnaire covered the socio demographic characteristics, parent's educational status, complementary feeding practices, dietary habits and morbidity profile, immunization status of the child. Weight was measured by an electronic weighing machine to the nearest of 0.1 kg and height / length was measured using meter stick to the nearest 0.1 cm.

2. Analysis

1) Socio demographic profile of the study subject:

Variables	Number (N=288)	Percentage
Age group (months)		
0-11	45	15.62
12-23	48	16.67
24-35	47	16.31
36-47	43	14.93
48-60	54	18.75
61-72	51	17.70
Gender		
Males	159	55.2
Females	129	44.79
Type of family		
Nuclear	37	12.85
Joint	251	87.15

Source: Field survey 2024

From the above table, the age group wise distribution of children is same. **Also number of male children is larger than female**. We can say that most of people prefer to live in joint family rather than nuclear family.

	Weight of child at birth	Mother age at time of marriage	Weight of mother at time of pregnancy
Mean	2.723	20.461	57.988
Standard deviation	0.539	2.411	10.156
Median	2.75	20	59
Mode	2.5	18	60
Minimum	0.7	15	39
Maximum	4.75	29	96

Source: Field survey 2024

From above table, average weight of mother at time delivery is 57.988 and mostly is 60 kg.

2) Body Mass Index (BMI) of children:

For female:

Age group (months)	Nutritional Status for Female (Percentage)			
	Underweight	Normal	Overweight	Obese
0-11	12	52	8	28
12-23	19.23	42.31	3.85	34.62
24-35	16.67	44.44	5.56	33.33
36-47	11.76	52.94	11.76	23.53
48-60	35.29	29.41	5.88	29.41
61-72	42.31	53.85	3.85	0.00
Percentage	23.25	46.51	6.2	24.03

Source: Field survey 2024

About 46.51% female children have normal BMI. But there are 24.03% are obese and 23.25% are underweight which is not good for health of child.

For male:

Age group (months)	Nutritional Status for Male (Percentage)			
	Underweight	Normal	Overweight	Obese
0-11	15	20	20	45
12-23	22.73	31.82	22.73	22.73
24-35	20.69	34.48	6.90	37.93
36-47	26.92	50.00	3.85	19.23
48-60	54.05	27.03	5.41	13.51
61-72	56	32	4	8
Percentage	34.59	32.7	9.43	23.27

Source: Field survey 2024

About 32.7% children have normal BMI which is less in number but 34.59% are underweight and 23.27% are obese which is not good for their health.

3) Statistical Test:

a) For Chi-square test:
Test statistics is

$$\chi^2 = \sum \frac{(f_0 - f_e)^2}{f_e}$$

Where,

f_0= the observed frequency (the observed counts in the cells)
f_e=the expected frequency if no relationship existed between the variables

If $\chi^2 > \chi^2{}_{(r-1)x(b-1)}$ where r: no. of rows and b: no. of columnsthen reject the null hypothesis.

To test dependency between BMI and Age
Hypothesis:
H_o: BMI is not dependent on age.
V/sH_1: BMI is dependent on age Contingency table:

BMI	Age						Total
	0	1	2	3	4	5	
0	6	10	9	9	26	25	85
1	17	18	18	22	15	22	112
2	6	6	3	3	3	2	23
3	16	14	17	9	10	2	68
Total	45	48	47	43	54	51	288

Source: Field survey 2024Notations:

BMI:
0: underweight child
1: normal child
2: overweight child
3: obese child
age in months: 0:0-11, 1:12-23, 2: 24-35, 3: 36-47, 4: 48-50, 5:61-72
By using pooling method in chi-square test,
Chi-squared = 42.837, DF = 10, p-value = 5.319e-06

To test above hypothesis we use chi-square test of independence and we observed that the value of test statistics is 42.837 and corresponding degrees of freedom are 10. The p-value is less than 0.05 and hence we conclude that the BMIand age are associated to each other.

b) To check dependency between BMI and Gender
Hypothesis:
H_o: BMI is not dependent on gender.
V/sH_1: BMI is dependent on gender.
Contingency table:

BMI\gender	0	1	Total
0	55	30	85
1	52	60	112
2	15	8	23
3	37	31	68
Total	159	129	288

Source: Field survey 2024

Notations:	For BMI:	0: underweight child,
		1: normal child,
		2: overweight child,
		3: obese child
	For gender:	1: female,
		0: male

Chi-squared = 7.541, DF = 3, p-value = 0.05651
Here, p-value = 0.05651 > 0.05

To test the above hypothesis, we use chi-square test of independence and we observed that the value of the test statistics is 7.541 and corresponding degrees of freedom are 3.The p value is large. Hence under 5% level of significance we fail to reject null hypothesis. Hence we conclude that BMI is independent on genderof child.

3. Conclusion

The study concludes that, villages of Karveer tehsil of Kolhapur district. contributed positively in enhancing the Nutritional Status on Chi-square test. From the above table, the age group wise distribution of children is same. Also number of male children is larger than female. We can say thatmost of people prefer to live in joint family rather than nuclear family. About 46.51% female children have normal BMI. But there are 24.03% are obese and 23.25% are underweight which is not good for health of child. About 32.7% children have normal BMI which is less in number but 34.59% are underweight and 23.27% are obese which is not good for theirhealth. To test the above hypothesis, we use chi-square test of independence and we observed that the value of the test statistics is 7.541 and corresponding degrees of freedom are 3.The p value is large. Hence under 5% level of significance we fail to reject null hypothesis. Hence, we conclude that BMI is independent on gender of child. Nutritional Status on Chi-square test of Children in Kolhapur district of Maharashtra

References

[1] Khadse, R. P., & Chaurasia, H. (2020). Nutrition status and inequality among children in different geographical regions of Maharashtra, India. *Clinical Epidemiology and Global Health*, *8*(1), 128-137.
[2] Bhavsar, S., Hemant, M., & Kulkarni, R. (2012). Maternal and environmental factors affecting the nutritional status of children in Mumbai urban slum. *International Journal of Scientific and Research Publications*, *2*(11), 1-9.
[3] Sharma, R. K. (2018). *A Comparative Study to Assess Nutritional Status of Preschool Children in Selected Rural (Kannur) and Urban (Narayanapura) Areas Bangalore, with a View to Develop Pamphlet* (Master's thesis, Rajiv Gandhi University of Health Sciences (India).
[4] Bhavsar, S., Mahajan, H., & Kulkarni, R. (2012). Assessment of the nutritional status and immunization coverage of Anganwadi children in Rafiq Nagar, Mumbai. *Public health research*, *2*(6), 229-34.
[5] Mude, S., Gavade, V. K., Teja, P., Gupta, A., & Patil, U. S. (2021). Enteric Fever: Culture Positive Cases in Tertiary Care Children's Hospital, Kolhapur-2019. *Advance Research Journal of Medical and Clinical Science*, *7*(08), 641-647.
[6] Koppula, J., & Sawant, V. (2020). Sociodemographic Characteristics of PregnancyInduced Hypertension: An Observational Study in the Kolhapur Population. *Indian Journal of Public Health Research & Development*, *11*(7).

[7] *International Journal of Community Medicine and Public Health,* Priyanka R et al. Int J Community Med Public Health. 2016 Dec;3(12):3479-3486

[8] Book of A first course on parametric inference, Narosa Pub. –B.K. Kale

Volume 13 Issue 10, October 2024
Fully Refereed | Open Access | Double Blind Peer Reviewed Journal
www.ijsr.net

Paper ID: SR241022140301   DOI: https://dx.doi.org/10.21275/SR241022140301   1605