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Magnitude and Correlates of Nutritional Status of Women Across Rural-Urban Interface of Bengaluru

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Abstract

India is facing a triple burden of malnutrition undernutrition and overnutrition/ obesity. The study attempts to examine the determinants of malnutrition among women across the rural-urban interface in relation to age, education, family size and per capita consumption of diverse food items. The primary data was collected from 348 female respondents in the north of Bengaluru. The multiple linear regression and multinomial logistic regression were employed to identify the factors influencing Body Mass Index (BMI) of women across the gradient. The study shows that urban women are relatively prone to overweight and obesity compared to transition and rural women, this is because of change in lifestyle, increase in age with less physical activity, working status of women in relation to educational attainment, consumption of unhealthy (junk or fast) food items. The results indicated that age and number of years of schooling, the presence of diabetes and hypertensive patients have a tendency to have increased BMI. Increase in consumption of cereals and starchy vegetables have a significant influence on increased BMI. Since undernutrition was found to be high in the rural area, creating awareness and educating women regarding the nutritive value of food items is crucial. Increase in body weight is responsible for both diabetes and blood pressure. Along with the promotion of nutrient-rich food, providing basic facilities of pure drinking water, creating household hygiene will improve utilization and absorption capacity of food.

Keywords: Rural-urban interface, Body mass index (BMI), Nutritional status

Nutrition is essential for growth and development of human being and nutritional status is the state of individual's health determined by what we eat. According to FAO (Anonymous, 2007), Nutritional status is the balance between the intake of nutrients by an organism and the expenditure of these in the processes of growth, reproduction, and health maintenance.

A proficient nutritional status of a country's population is responsible for its socio-economic development. Increased employment opportunities among men and women have a direct influence on the lifestyle changes, diet and consumption pattern which inturn has an influence on health and nutritional status, especially among women. Nutritional status of women can be known through their Body Mass Index (BMI), which enables to classify them as under weight (under nourished) and overweight/obesity (over nourished). In the past two decades, the mean BMI has increased globally, even in India. Obesity is a risk factor for many chronic, non-communicable diseases, including type two diabetes and cardiovascular diseases and the burden of these diseases are most prominent in low and middle-income countries (LMICs) (Neuman *et al*., 2013).

India is presently facing the problem of under nutrition as well as over nutrition. As reported by Karnataka National Family Health Survey (NFHS-4, 2015-16), nutritional status of women, as determined by Body Mass Index (BMI), indicated that 24 per cent of women in rural area and 16 per cent of women in urban area are underweight, this leads to the problem of chronic energy deficiencies (energy intake less than the recommended/required). In contrast, 17 per cent of women in rural area and 32 per cent of women in urban area are obese and this leads to the problem of high cholesterol, high blood pressure, diabetes etc. In India, under nutrition and overweight/obesity both are

high in women (6.6 %) in comparison to men (3.5 %). The burden of over weight and obesity is more of the genetic problem which may be inherited, along with the implications of external factors like socio-economic and cultural aspects which also contribute to the problems of under nutrition and over nutrition. To see the factors associated with nutritional status of women in general and farm women in particular, the present study adopts an anthropometric approach to assess the nutritional status of women across the rural-urban interface of Bengaluru North.

Objectives

1. To determie the magnitude of undernutrition among women in rural-urban interface of Bengaluru
2. To determine the socio-economic and other factors associated with nutritional status of women in relation to irrigation and income across rural-urban interface of Bengaluru

Hypotheses

1. There is no significant difference in the nutritional status of women across gradients in north of Bengaluru
2. Income and irrigation have no impact on nutritional status of women across gradients of north of Bengaluru

METHODOLOGY

For the present study the study area, i.e. Bengaluru was divided into two transects namely North of Bengaluru and South of Bengaluru taking the reference point as Vidhana Soudha, which is located in the heart of the city. Each transect was further divided into three layers namely rural, transition and urban areas. The distinction of the areas into rural, transition and the urban area was made based on the survey stratification index developed by considering the percentage of built-up area and its linear distance from the city center. The building of the state legislature, Vidhana Soudha was used as the reference point to measure the distance. Up to about 20 to 25 km away from the city center, building density was strongly correlated to distance (the closer to the city, the higher the percentage of built-up area). Beyond that, however, the two parameters were negatively correlated (Ellen *et al.*, 2017). Based on the bifurcation, according to the survey stratification index, primary data was collected from 29 households of an urban area, 56 households of transition area and 118 households of rural area, summing up to 203 households. Women respondents were interviewed from these households for the analysis. On validation of data, about 348 women respondents were considered. To assess the nutritional status of women in general and farm women in particular, various anthropometric measurements and indices were used. BMI has been referred to evaluate the nutritional status of the individual women in a household. Hence height, weight and other related details of each women respondent from household were accounted using appropriate measuring devices.

Analytical tools

In the study descriptive statistics, multiple linear regression and multinomial logistic regression analysis were used. Descriptive statistics have been used to explore the patterns of important socio-economic and demographic features of the sample respondents, multivariate regression analysis was carried out to determine the factors influencing BMI of women in the north of Bengaluru. Multinomial logistic regression analysis was used to determine the risk factors associated with nutritional status of women in the north of Bengaluru.

Stepwise multiple linear regression analysis

To determine the factors influencing BMI of women and farm women in north of Bengaluru, multiple linear regression was used as given in equation. 1:

$$Y=a+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9+b_{10}X_{10}+b_{11}D_1+b_{12}D_2+b_{13}D_3+b_{14}D_4+b_{15}D_5+b_{16}D_6+b_{17}D_7+b_{18}D_8+b_{19}D_9+e^u \quad \ldots\ldots(1)$$

Where,

Dependent variable:

$$BMI = \frac{Weight\ (kg)}{Height\ (\mathrm{m2})} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Y = BMI (kg/m^2)

BMI is calculated using the equation (2). Independent variables used in the model are explained in Table 1

Multinomial logistic regression

The multinomial logistic regression model was used to identify the risk factors associated with nutritional status of women or to predict the probability of success or failure. This model was developed by Walker and Duncun (1967) and Cox (1970).

Based on the classification of BMI, women were classified into four categories; underweight (<18.5 kg/m^2), normal weight (18.5 – 22.9 kg/m^2), overweight (23-25 kg/m^2) and obese (>25 kg/m^2). The predictor variables that were used in this model are presented in Table 1 and the four categories of BMI were taken

TABLE 1

Description of the explanatory variables used in the study

Variables	Definition	Apriori expected relationship
Age (Years) (X_1)	Age in years	Positive
Education (Years) (X_2)	Education in years	Positive
Wealth index (X_3)	It was constructed using ownership of household assets such as TV, Radio, phone/mobile, washing machine etc. For developing the wealth index weights were given to the each indictors using factor score of PCA (principle component analysis, after summing up of each weights given to the indicators will get the wealth index.	Positive
Per capita income (Rs./annum) (X_4)	Annual income in rupees	Positive
Cereals consumption (kg/person/month) (X_5)	Per capita consumption of cereal per person per month (Cereals: rice, wheat, ragi, bajra, maize, millets etc)	Positive
Fruits consumption (kg/person/month) (X_6)	Per capita consumption of fruits per person per month (Fruits: apple, banana, jackfruit, orange, papaya, grapes etc)	Positive
Vegetables consumption (kg/person/month) (X_7)	Per capita consumption of vegetables per person per month (Vegetables: potato, pea, onion, beetroot, carrot, radish, sweet potato, leafy vegetables etc)	Positive
Pulses consumption (kg/person/month) (X_8)	Per capita consumption of pulses per person per month (Pulses: redgram, blackgram, green gram etc.,)	Positive
Meat and animal products consumption (kg/person/month) (X_9)	Per capita consumption of meat and animal products per person per month (Meat and animal products: chicken, mutton, egg, fish, milk, curd, ghee, butter, etc)	Positive
Nuts consumption (kg/person/month) (X_{10})	Per capita consumption of nuts per person per month(Nuts: cashew, resins, almond, avocado etc)	Positive
Oil consumption (kg/person/month) (X_{11})	Per capita consumption of oil per person per month(Oil: coconut oil, groundnut oil, mustered oil etc.)	Positive
Family size (X_{12})	Family size in numbers	Negative
Urban (Dummy) (D_1)	'1' if place of residence is urban, otherwise '0'	Positive
Transition (Dummy) (D_2)	'1' if place of residence is transition, otherwise '0'	Positive
Working status (Dummy) (D_3)	'1' if women is working (involved in income earning activity from non-farm or off farm), otherwise '0'	Negative

Variables	Definition	Apriori expected relationship
Diabetes (Dummy) (D_4)	'1' women who is diabetic, otherwise '0'	Negative
Blood pressure (BP) (D_5)	'1' women who is BP patient, otherwise '0'	Negative
Health insurance (Dummy) (D_6)	'1' if women having health insurance, otherwise '0'	Positive
Caste (Dummy) (D_7)	'1' if women belongs to SC/ST category, otherwise '0'	Negative
Irrigation (Dummy) (D_8)	'1' women belongs to irrigated family, otherwise '0'	Positive
Sedentary work (D_9)	'1' if women is sedentary worker, otherwise '0'	Positive
Marital status (D_{10})	'1' if women is married, otherwise '0'	Positive
Decision making (D_{11})	'1' if women is a decision maker, otherwise '0'	Positive

as dependent variable. The reference category is the normal weight category.

The basic form of the logistic function is

$$P = P\left(Y = \frac{1}{X_1, X_2, X_3, X_4, X_5, \ldots\ldots X_k,}\right) = \frac{e^Z}{1 + e^Z} = \frac{\exp(Z)}{1 + \exp(Z)}$$

Where, $Z = \beta_0 + \beta_i X_i$ and X_i are set of predictor variables.

$$\frac{P_i}{1 - P_i} = e^{Z_i} \quad \text{.....(3)}$$

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_0 + \beta_i X_i \text{.....(4)}$$

The quantity $\frac{P_i}{1 - P_i}$ is called the odds and hence, the $\ln\left(\frac{P_i}{1 - P_i}\right)$ log odds is Logit. The coefficients β_i are logit regression coefficients. These coefficients are used to compute odds ratios, which give the ratio of two odds of an event occurring (Y=1). In the case of a dichotomous independent variable, the odds ratio can be interpreted as the increased odds of a positive outcome on the dependent variable for the affirmative category (X=1) over the negative one (X=0) (Ramesh, 2004). Logistic regression commands in the Stata 14.2 version software was used to find the maximum likelihood estimation of the independent variables.

Results and Discussion

General characteristics of women in north of Bengaluru

General characteristics of women in the north of Bengaluru is presented in Table 2. The results showed that the average age of the women respondents in the study area was around 42 years and the age is more or less similar for the women across the gradients. Per capita income per annum was found to be more in urban (₹ 96138) area compared to rural (₹ 45298) and transition areas (₹ 47064). It was observed that the sample women respondents in the urban area were into formal employment. About 66 percent of the urban women were working as salary earner (contract and non-contract), business and other income-generating activities. In contrast, the proportion of women in non-working category formally were more (55 and 82% for the transition and rural region, respectively) compared to working women (45% and 18% for the transition and rural region, respectively). The problem of diabetes and blood pressure was found to be high in the urban and transition area. Health insurance beneficiaries were found to be high in rural (29%) area because of access to the yashaswini health insurance scheme. The mean BMI in urban area, transition area and rural area was 25.80 kg/m^2, 23.60 kg/m^2, and 22.01 kg/m^2, respectively.

TABLE 2

General characteristics of women in north of Bengaluru

Particulars	Urban(n=38)	Transition(n=105)	Rural(n=205)	Overall(n=348)
Age (years)	43	41	41	42
Per capita income (Rs./annum)	96138	47064	45298	50887
Working status of women (No.)				
Working	25 (66)	47(45)	37 (18)	109 (31)
Not working	13 (34)	58 (55)	168 (82)	239 (69)
Number of diabetic patients (No.)				
Diabetes	9 (24)	36 (34)	53 (26)	98 (28)
Non diabetic	29 (76)	69 (66)	152 (74)	250 (72)
Number of BP patients (No.)				
Women with BP	10 (26)	28 (27)	36 (18)	74 (21)
Women without BP	28 (74)	77 (73)	169 (82)	274 (79)
Health insurance (No.)				
With health insurance	11 (29)	38 (36)	73 (36)	122 (35)
Without health insurance	27 (71)	67 (64)	132 (64)	226 (65)
BMI (kg/m^2)	25.80	23.60	22.01	22.62

Note: Figure in parenthesis indicate the percentage

Nutrtional status of women in north of Bengaluru

Nutritional status of women in north of Bengaluru is given in Table 3. It was observed that 42 per cent of the women respondents were obese, followed by women under the category of underweight (24%), normal weight (21%) and overweight (13%) in urban areas of the north of Bengaluru. However, in case of transition area, it was observed that 30 per cent and 31 per cent of women respondents were underweight and obese, respectively. In the rural area, majority of the women respondents were underweight (37%) followed by normal weight (26%), obese (22%) and overweight (15%). The results revealed that, the rural women are more prone to underweight and the urban women to obesity. This is attributed to the location, wherein rural women were more concerned about the timely and qualitative consumption habit, achieving the nutritional status whereas, urban women were characterized by less of drudgery work, leading to obeseness. Similar results have been reported by Gouda and Ranjan (2014), where more than 23 per cent of

TABLE III

Nutritional status of women across rural-urban interface of north of Bengaluru.

(Numbers)

BMI category	Urban	Transition	Rural	Total
Underweight	9.00 (23.68)	31.00 (29.52)	76.00 (37.07)	116.00 (33.33)
Normal weight	8.00 (21.05)	20.00 (19.04)	53.00 (25.85)	81.00 (23.27)
Overweight	5.00 (13.15)	21.00 (20.00)	31.00 (15.12)	57.00 (16.37)
Obese	16.00 (42.10)	33.00 (31.42)	45.00 (21.95)	94.00 (27.01)
Total	38.00	105.00	205.00	348.00

Note: Figure in the parentheses represents the respective percentage

women in the urban area were either overweight or obese compared to 7 per cent of women in rural areas.

Factors influencing BMI of women in the north of Bengaluru

The factors influencing BMI of women in the north of Bengaluru is presented in Table 4. The factors such as urban dummy, wealth index, irrigation dummy, diabetes, blood pressure, cereal consumption, meat and animal product consumption and vegetable consumption were positively and significantly contributing towards the BMI of women.

The results revealed that the threshold BMI of women (contribution of factors other than those included in the model) is 20.87 kg/m^2. The threshold BMI shifts by 1.92 kg/m^2 if women are residing in the urban area. Indicating that the threshold BMI for women in an urban area was 22.79 kg/m^2 (20.87+1.92 kg/m^2). The shift in BMI is due to the modern lifestyle in urban areas (Consumption of snacks, junk food coupled with less physical activity) as against the traditional way of life in rural areas.

The threshold BMI for working women shifts downwards by 0.54 kg/m^2. The threshold BMI thus for working women was 20.33 kg/m^2. The results are contradictory with the study conducted by Raza *et al.,* 2017 where they concluded that working women had a good dietary practice and there was a positive relation between BMI and work status. The marginal effect of Wealth index on BMI of women was positive (2.42 Kg/m^2) and the association between wealth index and BMI is similar to the apriori expectation.

BMI shifts by 1.74 kg/m^2 if the women were suffering from diabetes *i.e.,* the threshold BMI for the women suffering from diabetes was 22.61 kg/m^2. If the women are suffering from, diabetes, the probability of being obese or overweight is more. Since the analysis has considered women from all the gradients, the problem

TABLE 4

Factors influencing BMI of women in north of Bengaluru

Variables	Coefficients	t value	P value
Age	0.010	0.680	0.494
Education	0.020	0.550	0.580
Urban	1.921 *	3.770	0.000
Transition	0.008	0.020	0.983
Work status	-0.539 ***	-1.690	0.092
Wealth index	2.429 *	4.550	0.000
Diabetes	1.741 *	2.800	0.005
BP	1.439 **	2.200	0.028
Per capita income	0.000	-1.550	0.122
Health insurance	-0.355	-1.120	0.262
Caste	-0.381	-1.130	0.259
Cereal consumption	0.122 **	2.200	0.028
Fruits consumption	-0.285 *	-2.680	0.007
Vegetables consumption	0.238 *	2.760	0.006
Pulses consumption	-0.256	-1.370	0.170
Meat and animal products consumption	0.307 *	4.310	0.000
Constant	20.873 *	24.550	0.000
R^2		0.2408	
F value		5.80 *	

of diabetes and blood pressure was found to be more in the urban and transition area as compared to rural areas. Hence, women with the degenerative health problems have higher body mass index. The results are in line with the study conducted by Bay *et al.,* 2007 and the results revealed that BMI is generally associated with a significant increase in prevalence of diabetes mellitus and hypertension. If the women are suffering from high blood pressure, her BMI shifts by 1.44 kg/m^2. Mungreiphy *et al*., (2011), reported that, if the women are suffering from high BP, her BMI is usually more.

The marginal effect of cereal consumption (0.12), vegetable consumption (0.24) and meat and animal product (0.31) consumption had positive significant influence on the BMI of women. Fruit consumption had negative marginal effect (-0.28) on BMI of the farm women. Since fruits contains more than 80 per cent of water and presence of anti-accidents will reduces the BMI but maintains the good health status of human being. Schroder (2009) reported that BMI and consumption of fruits were inversely related.

Factors associated with nutritional status of women in North of Bengaluru

Factors associated with nutritional status of women living in rural, urban and transition areas of north of Bengaluru is presented in Table 5.

It was found that, if the age of women increases by one year, the log of the odds ratio, probability of underweight category to probability of normal weight category ln [P(underweight)/P(normal weight)], decreases by 0.042. *i.e.,* the probability that she remains in underweight category falls by 0.48 and the probability of shifting to normal weight category was 0.52. To measure the expected change in magnitude of dependent variable with respect to a unit change in an independent variable, marginal effect from the multinomial logistic regression was analysed. Results revealed that increasing the age by one unit decreases the probability of women to be in underweight category by 0.4 per cent.

As the education of women increases by one year, then the probability of being in underweight category falls by 0.469 *i.e.,* with the increase in education they shifts from underweight category to the base category *i.e.,* normal weight category. Increase in education among women, will make her to be more conscious about her nutritional status, by this she will move from underweight category to the normal weight category.

If the number of members in a family increases by one, then the log of the odds ratio, probability of underweight category to probability of normal weight category ln [P(underweight)/P(normal weight)], decreases by 0.223. The probability that she remains in underweight group was 0.554 and the probability of shifting to normal weight group was 0.446. Increase in family size in underweight category would leads to lack of availability of sufficient quantity of food stuffs within the family members. Hence, increase in family size in underweight category increases the problem of under nutrition rather than reducing it.

As per capita income increases by one rupee per annum, then the probability of remaining in underweight category was 0.50. Though the log of odds ratio is positive, it has no considerable effect on BMI but they shifts to normal weight category because the log of odds is positive. If the women is suffering from diabetes, log of the odds ratio, probability of overweight category to probability of normal weight category ln [P(underweight)/P(normal weight)], increases by 1.665 or in other words, the probability that they remain in overweight category is more (0.841) and is consistent with many medical research. If the women is suffering from high blood pressure, log of the odds ratio, probability of overweight category to probability of normal weight category ln [P(underweight) / P(normal weight)], increases by 3.543 *i.e.,* the probability that they remain in overweight category is more (0.972).

As the wealth index increases by one per cent then, log of the odds ratio, probability of overweight category to probability of normal weight category ln [P(underweight)/P(normal weight)], increases by 1.435. If the women is sedentary worker, log of the odds ratio, probability of overweight category to probability of normal weight category ln [P(underweight)/P(normal weight)], increases by

TABLE 5

Factors associated with nutritional status of women in north of Bengaluru

Variables	Underweight			Overweight			Obese		
	Coefficients	P value	Marginal effect	Coefficients	P value	Marginal effect	Coefficients	P value	Marginal effect
Age	-0.042 ** (0.489)	0.018	-0.004	0.023 (0.506)	0.218	0.003	0.001 (0.500)	0.943	0.000
Education	-0.123 ** (0.469)	0.014	-0.004	0.063 (0.516)	0.240	0.007	0.043 (0.511)	0.301	0.007
Urban	-1.689 (0.516)	0.168	-0.251	0.869 (0.704)	0.306	0.048	0.977 (0.726)	0.136	0.203
Transition	0.035 (0.509)	0.939	0.015	0.506 (0.624)	0.283	0.030	0.335 (0.583)	0.394	0.033
Family size	0.223 ** (0.554)	0.025	0.013	-0.145 (0.464)	0.105	-0.008	-0.133** (0.467)	0.034	-0.008
Diabetes	0.053 (0.513)	0.933	0.095	1.665 * (0.841)	0.002	0.007	2.793 * (0.942)	0.000	0.371
BP	0.307 (0.576)	0.701	0.052	3.543 * (0.972)	0.000	0.276	1.405 ** (0.803)	0.016	0.010
Wealth index	-0.035 (0.491)	0.962	-0.026	1.435 ** (0.808)	0.029	0.087	0.873 (0.705)	0.118	0.056
Per capita income	0.000 * (0.500)	0.001	0.000	0.000 (0.500)	0.612	0.000	0.000 *** (0.500)	0.088	0.000
Sedentary work	0.914 (0.714)	0.294	0.065	2.164 *** (0.897)	0.065	0.168	0.623 (0.651)	0.343	-0.073
Vegetarian	1.003 (0.732)	0.272	0.010	2.343 * (0.912)	0.006	0.001	1.352 *** (0.794)	0.078	0.001
Intercept	0.913 (0.714)	0.486	-	-5.209 * (0.005)	0.001	-	-2.032 ** (0116)	0.048	-

Note: Log likelihood = -302.92, Chi-square=178.21; *Significant at 1 per cent; **significant at 5 per cent; *** significantat 10 per cent; Figures in parentheses indicate probability value

2.164. In other words, the probability that they remain in overweight category is 0.897. Sedentary means inactive or less work, if the women are inactive they remain over weight.

If the family size increases by one member, the log of the odds ratio, probability of obese category to probability of normal weight category ln [P(underweight)/P(normal weight)], decreases by 0.133. *i.e.,* the probability that she remains in normal weight group is 0.46 and the probability of shifting to normal weight group is 0.54. If the women is suffering from diabetes, log of the odds ratio, probability of overweight category to probability of normal weight category ln [P(underweight)/P(normal weight)], increases by 2.793 and the probability that they remain in overweight category is more (0.942). If the women is suffering from BP, log of the odds ratio, probability of obese category to probability of normal weight category ln [P(underweight)/P(normal weight)], increases by 1.405 or in other words, the probability that they remain in obese category is 0.803

Factors influencing BMI of farm women in north of Bengaluru

To identify the factors influencing BMI of farm women, multiple linear regression was used and the results are presented in Table 6. Education, per capita income, diabetes, blood pressure, irrigation, consumption of meat and animal products were positively contributing towards the increase in BMI among farm women. It is interesting to note that, per capita income and irrigation had a positive and significant influence in increasing the nutritional status of women. If the women belong to irrigated farm family then her BMI shifts by 0.444 kg/m^2 and the threshold BMI for the farm women belonging to irrigated farm family was 16.40 kg/m^2. This is because, most of the irrigated farm families in the study area, were growing vegetables, fruits, and high-value crops, resulting in higher income. Thus they get access to all sorts of nutritious food and hence they have more threshold BMI compared to women belonging to the non-irrigated family. Therefore irrigation has a significant influence on the nutritional status of women and the hypothesis 2 is rejected.

TABLE 6

Factors influencing BMI of farm women in north of Bengaluru

BMI	Coefficients	t value	P value
Age	0.034	1.550	0.122
Education	0.183 *	2.950	0.004
Per capita income	0.001 *	2.710	0.007
Diabetes	2.618 *	4.790	0.000
Fruits consumption	-0.207 **	-2.260	0.025
Irrigation	0.444 *	1.800	0.086
Meat and animal products	0.364 *	2.860	0.005
Nuts consumption	2.829 ***	1.690	0.093
BP	1.624 *	2.630	0.009
Vegetable consumption	0.205 ***	1.680	0.094
Sedentary work	3.033 ***	1.700	0.091
Intercept	15.969 *	7.290	0.000
R^2 value		0.2873	
F value		6.08 *	

Note:*Significant at 1 per cent, **significant at 5 per cent,*** significant at 10 per cent.

Factors associated with nutritional status of farm women in north of Bengaluru

Factors influencing nutritional status of farm women in north of Bengaluru was analysed using multinomial logistic regression and the results are given in Table 7. Age and education had positive influence on overcoming the problem of underweight among the farm women. If the age and education of farm women increases by one year, then the probability of being in underweight category falls by 0.486 and 0.471, respectively and it is also revealed from the marginal effect analysis that, increasing the age and education by 1 unit decreases the probability of women to be in the underweight category by 0.6 per cent and 1.5 per cent, respectively.

It was found that, if the consumption of fruits increases by one gram per day, then the probability of being in obese category will falls by 0.437. Thus, fruit consumption acts as an anti-obesity agent to maintain the balanced nutritional status of women. Who expert

TABLE 7

Factors influencing nutritional status of farm women in north of Bengaluru

Variables	Underweight			Overweight			Obese		
	Coefficients	P value	Marginal effect	Coefficients	P value	Marginal effect	Coefficients	P value	Marginal effect
Age	-0.055 ** (0.486)	0.013	-0.0065	0.018 (0.504)	0.466	0.0026	0.004 (0.501)	0.847	0.0008
Education	-0.117 ** (0.471)	0.046	-0.0151	0.048 (0.512)	0.463	0.0041	0.070 (0.517)	0.210	0.0087
Caste	-0.183 (0.454)	0.361	-0.0255	0.011 (0.503)	0.960	0.0063	0.274 (0.568)	0.141	0.0362
Fruits consumption	-0.026 (0.494)	0.847	-0.001	0.041 (0.510)	0.691	0.0144	-0.253* (0.437)	0.003	-0.0319
Irrigation	0.458 (0.612)	0.523	0.0846	-1.081 *** (0.253)	0.090	-0.0848	-0.734 (0.324)	0.202	-0.055
Meat consumption	0.037 (0.509)	0.802	0.0002	-0.012 (0.497)	0.941	-0.0108	0.225 ** (0.556)	0.044	0.0271
Nuts consumption	-0.024 (0.494)	0.988	-0.0406	0.146 (0.536)	0.943	0.0606	1.905 (0.870)	0.163	0.2263
Oil consumption	-0.858 (0.298)	0.613	-0.0139	-1.990 (0.120)	0.377	-0.0264	3.817 *** (0.970)	0.057	0.3696
Pulses consumption	-2.544 * (0.073)	0.008	-0.2319	-1.769 *** (0.146)	0.063	-0.0919	-0.796 (0.311)	0.341	-0.02
Vegetable consumption	0.188 (0.547)	0.198	0.0108	0.259 *** (0.564)	0.093	0.0109	0.271 *** (0.567)	0.077	0.0192
Wealth index	1.082 (0.747)	0.200	0.0875	1.143 (0.758)	0.110	0.0694	0.533 (0.630)	0.420	0.0004
Decision making	0.037 (0.509)	0.967	0.0296	1.406 (0.803)	0.100	0.1213	0.371 (0.592)	0.684	0.0111
Marital status	-0.342 (0.415)	0.514	-0.0246	-0.471 (0.384)	0.402	-0.0306	-0.217 (0.446)	0.684	-0.0015
Health insurance	-0.484 (0.381)	0.302	-0.0571	-0.193 (0.452)	0.726	-0.0255	0.405 (0.600)	0.408	0.0658
Diabetes	-0.543 (0.368)	0.541	-0.1535	1.571 ** (0.828)	0.017	0.0267	3.454 * (0.969)	0.000	0.3678
BP	-0.232 (0.442)	0.769	-0.1007	3.129 * (0.958)	0.000	0.276	0.828 (0.696)	0.211	0.0186
Sedentary work	-1.040 (0.261)	0.533	-0.4258	15.041 (1.000)	0.987	1.4318	1.000 (0.782)	0.461	0.4192
Intercept	4.570 ** (0.990)	0.045	-	-15.990 (0.000)	0.986	-	-3.063 (0.045)	0.170	-

Note: Log likelihood=212.71, Chi-square=196.29; *Significant at 1 per cent; **significant at 5 per cent; *** significant at 10 per cent; Figures in parentheses indicate probability value.

consultation report (2003), states that consumption of fruits and vegetables according to the per capita per day recommendation will decrease the risk of obesity, diabetes and Cardio Vascular Diseases (CVD). Contrast to the fruit consumption, an increase in per capita consumption of vegetable by one kg, the log of the odds ratio, probability of underweight category to the probability of normal weight category ln [P(underweight)/P(normal weight)], increases by 0.271. This might be due to the consumption of more vegetables by the women in obese category than the recommended limit. Vegetables containing a large amount of carbohydrates like potato, sweet potato, baby corn, peas have a direct influence on obesity. Hence, it is expected that consumption of starch-rich vegetables contributes to increase in the risk of obesity. Increase in the problem of diabetes and blood pressure will make the women to stay in the obese and overweight category, respectively. The study revealed that, despite of women belonging to farm or nonfarm, dwells in rural or urban area, if she is suffering from a diabetes and blood pressure usually have high BMI.

Urbanization has a direct impact on nutritional status of women, as we move across the gradient from rural to urban, the magnitude of obesity increases to the tune of 42 per cent. This happened due to the effect of urbanization and industrialization in and around Bengaluru. The study showed that urban women are relatively more prone to overweight and obesity compared to transition and rural women. This could be because of change in lifestyle, increase in age with less physical activity, working status of women in relation to educational attainment, consumption of unhealthy food items. The analysis has shown that age and number of years of schooling, the presence of diabetes and hypertensive patients have a tendency to increase BMI. Increase in consumption of cereals and starchy vegetables have a significant influence on the increase in BMI. Hence, creating awareness and educating women in this regard is of prime importance. Since undernutrition was found high in the rural area, creating awareness and educating women regarding the nutritive value of food items is crucial. Increase in body weight responsible for both diabetes and blood pressure. Promoting consumption of millets both in the rural and urban area in addition to lifestyle changes may jointly address the issue. In addition, due to gadgets, the exercise opportunity has reduced largely in urban areas. Along with the promotion of nutrient-rich food, providing basic facilities of pure drinking water, creating household hygiene will improve utilization and absorption capacity of food.

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