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# INFLUENCE OF BIO-SOCIAL DETERMINANTS ON NUTRITIONAL STATUS AMONG SCHEDULED CASTE WOMEN IN DISTRICT BANDA, UTTAR PRADESH

**Arun Kumar and Rajesh K. Gautam**

**ABSTRACT**

Women and children are vulnerable group of Indian population. Further, the scheduled caste women have more degraded condition, therefore a cross-sectional study was conducted among them to understand the nutritional profile and its determinants. For the present cross- sectional study, a total of 1017 scheduled caste women (including 970 mothers) belonging to Chamar, Kori, Dhobi and Domar communities were interviewed and measured for anthropometric and physiological measurements to estimate their current nutritional status based on Body Mass Index (BMI) from 1051 households of district Banda, Uttar Pradesh. All the information was recorded in a pretested semi-structured interview schedule by door-to- door survey. The information about age at puberty was collected using the recall method (retrospective method). To minimize the error TEM was calculated for each measurement.

A total of 47.2% of women were found undernourished whereas 7.0% were found overweight/obese (BMI =25.0-40+ kg/m2). The average BMI varies between 20.49± 4.31to 18.97± 3.46 Kg/$m^2$, respectively, among Dhobi and Kori. The prevalence of underweight is higher among the Chamar and the Kori as 43.6% and 41.3% of them, respectively, were found to be underweight. They are followed by the Dhobi (34.3%) and the Domar (31.7%) ($\chi 2 = 17.23$ and df=6, $p<0.05$). The prevalence of undernourished women decline sharply as per increment of level of education ($r^2$ =0.689 BMI). A total of 71.2% of illiterate females were found undernourished (BMI<18.49 *Kg/$m^2$*). Among educated women, the BMI is largely influenced by anthropometric (body weight, arm circumference, hip circumference, waist circumference) and physiological (body fat percentage, BMR, total energy expenditure and adiposity index) determinants; whereas it is least influenced by socio-demographic variables.

In the present study, the prevalence of malnutrition (under-nutrition as well as obesity) was found higher among illiterate participants. Among educated participants, fetal loss and infant mortality was found to have significant association with BMI whereas reproductive

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determinants like number of pregnancies experienced by mother, number of children ever born, etc., have insignificant influences. It can be concluded that BMI is largely determined and influenced by anthropometric and physiological characteristics and it is least influenced by socio-demographic variables.

***Keyword:*** Malnutrition, Obesity, BMI, Regression, Reproductive profile, Education level.

## INTRODUCTION

Prevalence of underweight and malnutrition among early child-bearing mothers is very high and it is directly associated with common practices of teenage marriage, their education level, wealth index, nature of occupation, residence type and location, parity, etc. (Islam *et al.*, 2016). The prevalence of chronic energy deficiency (BMI<18.5 kg/m$^2$) was reported very high among women of poor families in both rural and urban areas (NFHS-3, 2005-06; Shafique *et al.*, 2007).

For nutritional assessment most commonly used measures of adiposity are body mass index (BMI), waist circumference (WC), and waist-hip ratio (WHR). BMI is the most commonly used measure of nutritional status and it plays an important role in the assessment of nutritional status of adults. In a developing country such as India, anthropometry, despite its inherent limitations, still remains the most practical tools for assessing nutritional status in community (Ghosh *et al.*, 2001).

The BMI also may have an important role in nutrition of women because it has an important relationship with birth weight of infants, lactation and infertility (WHO, 1995). It is apparent from the literature that the level of nutrition also has a relation with fertility. The value of somatometric measurements like weight, height, and upper-arm and thigh circumferences is higher among post-menopausal women as compared to pre-menopausal women (Kaur *et al.*, 2014). Malnutrition among women is exacerbated or compounded by heavy work demands, and nutritional needs, eventually culminating into increased susceptibility to illness and consequent higher mortality (Khan, 2011).

Nonnemaker *et al.* (2009) have observed that some anthropometric and socio-demographic characteristics and its related factors had been significantly associated with adverse health and nutritional consequence among adolescent mothers. These previous studies reveal that the underweight women were associated with higher risk of adverse health outcomes like hip fractures (Gnudi *et al.*, 2009; Morin *et al.*, 2009).

Hossain *et al.* (2012) studied the association between body mass index and bio-socio-demographic characters among ever married non pregnant women in Bangladesh. They reported a zig-zag trend of body mass index among ever married women aged 15-49 years during 1957-1972. Several previous studies have already shown that nutritional status of married and unmarried women was influenced by various factors such as age, education level, wealth index, age at first marriage, age at menarche, menopause, number of ever-born children, type of residence,

religion, occupation, place of delivery, family monthly income, etc. (Khan and Kraemer, 2009; Shafique *et al.*, 2007; Hossian *et al.*, 2012; Subramanian *et al.*, 2009 ; Bharati *et al.*, 2007; Gautam *et al.*, 2006, Gautam, 2007).

## METHODOLOGY

For the present cross-sectional study, data was collocated from 1051 households of district Banda, Uttar Pradesh. A total of 1017 Scheduled Caste women (including 970 mothers) belonging to Chamar, Kori, Dhobi and Domar communities were interviewed and measured for anthropometric and physiological measurements to estimate their current nutritional status based on body mass index and others nutritional indicators. Before taking anthropometric and physiological measurements all the instruments were standardized in our laboratory. To reduce error for each measurement TEM was calculated following Ulijaszek & Kerr (1999).

All the information was recorded in a pretested semi-structured interview schedule by door to door survey. For this survey, scheduled caste women were selected randomly from 35 villages of District Banda of Uttar Pradesh. The villages were selected on the basis of proportion to population size (PPS), for that the villages were listed in descending order as per density of the target group. The information about age at puberty was collected using the recall method (retrospective method). The collected data was analyzed by using SPSS and MS-excel. Descriptive statistic, ANOVA and regression analysis were done to examine the effect of bio-social determinants on nutritional status. In the present study, nutritional status was assessed by BMI and categorized as per WHO classification. The body mass index (BMI) was calculated as the ratio of weight in kg to height in meter squared. BMI was classified as underweight (>18.5 $kg/m^2$), normal (18.5- 24.9 $kg/m^2$) and overweight/obese (25.0-40+ $kg/m^2$).

## RESULTS AND DISCUSSION

In the present study, it was found that average body weight of women was 44.3±8.16 kg and they are categorized as short in their body stature (<160 cm). It is apparent that females were also varying in their body dimensions as per their ethnic origin. It is evident from mean stature that Dhobi women are taller than the remaining three. They were also leading in arm circumference, waist circumference and hip circumference. Similar is the case with wait-hip ratio and adiposity index. Among studied population, average number of scheduled caste women were found nutritionally normal (BMI>18.5 kg/m2).

The one-way ANOVA test proves that the variation among the women of different ethnic origin exists as most of the F-values were significant. It is apparent from Figure-1 that none of Kori, Dhobi and Domar females was tall in stature. The chi-square value indicates that there is significant difference among females of different caste groups as per their stature type ($\chi 2=19.24$, $p<0.05$).

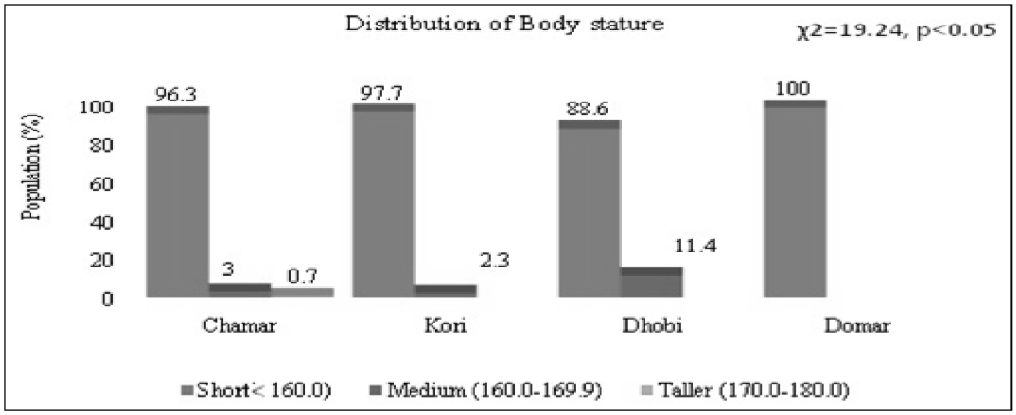


**Figure 1: Caste-wise bar chart of body stature among female participants**

Caste-wise distribution of participants, according to the level of nutrition, is given in Table 2. Nearly half of studied scheduled caste women (47.2%) were found to be undernourished and they were categorized as underweight (BMI (>18.5 kg/m2), whereas only 7.0% of total studied woman were overweight/obese (BMI =25.0-40+ kg/$m^2$). The prevalence of underweight is higher among Chamars and Koris (43.6% and 41.3%), followed by Dhobis (34.3%) and Domars (31.7%). Similarly, the prevalence of nutritionally normal individuals was higher among the Domar (60.0%), followed by Koris (54.9%), Dhobis (54.0%) and Chamars (51.0%). Prevalence of overweight and obese women was found to be higher among the Domars and Dhobis (11.7%) followed by Chamars (5.4%) and Koris (3.8%). To understand the variation of frequency distribution of level of nutrition among the four caste groups, chi-square test was computed ($\chi 2 = 17.23$; df =6; $p<0.05$), which was found significant.

Negri and Milano (1994) has focused on the impact and role of bio-social determinants like socio-economic condition, behavior, dietary profile and reproductive factors on the level of nutrition through their body mass index (BMI). They found inverse impact of education and social classes on their body mass index and also found that among females reproductive activities like marriage, motherhood and number of child ever born, etc., affect their level of nutrition. Many previous studies have found a positive as well as negative association between individual levels of education with their nutritional status and proved that education level of persons has definite impact on their health and nutrition.

Present findings reveal that the proportion of chronic energy deficient and obese women was exceptionally higher among the illiterate. A total of 71.2% of illiterate females were found undernourished (BMI<18.49 $Kg/m^2$).

For further elucidation, line diagrams were drawn to understand the association between level of education and nutritional status (Figure 2). It is apparent from the figure that the prevalence of undernourished women decline sharply as per

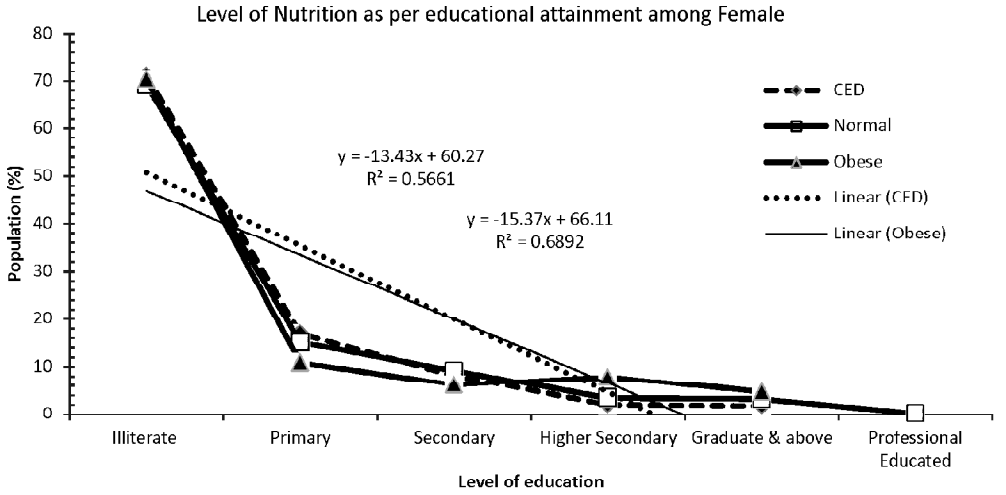


**Figure 2: Line graph showing association between nutrition and educational attainment among females**

increment of level of education among females $R^2 = 0.689$. Similar trend was not found in case of obese individuals. Out of total obese females, 70.3% were illiterate, 10.9 were primary educated, 6.2% were secondary educated, 7.8 higher secondary educated and 4.7% were graduate and above.

To find out the differential nutritional status as per different demographical, biological and socio-economic characteristics independent samples t-test was computed (Table 3). It is evident from independent samples t-test for BMI that the level of nutrition is not influenced by the different biosocial determinants like education, occupation, use of family planning methods, age at marriage (before and after 18 years), nature of menstruation (menstrual and menopausal) and reproductive age (pre and post). All the values of t-test were found insignificant ($p>0.05$). Although, the value of F-ratio was found significant among user and non-users of family planning as well as the women of reproductive and post-reproductive age group ($F= 4.081$ and $6.054$, $p<0.05$).

Table 4 reveals that there is no variation in reproductive performance as well as child mortality among undernourished and overweight/obese women as all the values of t-test and F-ratios were found insignificant.

It is evident from Table 5 that among women in the present sample, the BMI is largely influenced by anthropometric (bodyweight, arm circumference, hip circumference, waist circumference) and physiological (body fat percentage, BMR, total energy expenditure and adiposity index) determinants, whereas it is least influenced by socio-demographic variables such as current age, age at marriage and education. Similarly among females the biological characteristics, like age at menarche and menopause, also do not have significant regression with BMI. It is clear from bivariate regression analyses that health and level of nutritional status among females was significantly associated and influenced by several bio-social factors.

To estimate the influences of reproductive performance on the nutritional status of the women bivariate regression analysis was computed keeping BMI as dependent, and variables of reproductive performance as independent. The findings are displayed in Table 6. It is evident from the table that only fetal loss and infant mortality have significant regression with BMI, whereas the main reproductive determinants like number of pregnancies experienced by women, number of children ever born, number of surviving children, age at first birth of mother and number of child loss have insignificant regression.

## CONCLUSIONS

In the present study, it was found that the proportion of chronic energy deficiency and obesity was exceptionally higher among the illiterate females. The level of nutrition is not influenced by biosocial determinants like education, occupation, use of family planning methods, age at marriage (before and after 18 years), nature of menstruation (menstrual and menopausal) and reproductive age (pre and post). All the values of t-test were found insignificant ($p>0.05$). There is no variation in reproductive performance as well as child mortality among undernourished and overweight/obese women. Among the women in the present study, the BMI is largely influenced by anthropometric (body weight, arm circumference, hip circumference, waist circumference) and physiological (body fat percentage, BMR, total energy expenditure and adiposity index) determinants, whereas it is least influenced by socio-demographic variables such as current age, age at marriage and education. The main reproductive determinants like number of pregnancies experienced by women, number of children ever born, number of surviving children, age at first birth of mother and number of child loss also have insignificant regression.

**Table 1: Descriptive statistics of somatometric characteristics of Scheduled Caste women (pooled data)**

| *Measurement* | *Pooled data* | | *Chamar* | | *Kori* | | *Dhobi* | | *Domar* | | *F* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* | *Mean* | *SD* | *value* |
| Body Weight | 44.3 | 8.16 | 43.97 | 7.79 | 43.49 | 8.12 | 48.33 | 9.91 | 44.14 | 8.56 | 7.55* |
| Height | 150.15 | 63.07 | 150.02 | 6.39 | 149.47 | 5.61 | 151.86 | 6.63 | 149.77 | 5.32 | 2.73* |
| Sitting Height | 74.36 | 4.06 | 74.39 | 3.8 | 74 | 4.59 | 74.56 | 4.48 | 74.16 | 5.01 | 0.54 |
| Arm Circumference | 23.8 | 2.92 | 23.78 | 2.83 | 23.55 | 3 | 24.65 | 3.45 | 23.55 | 2.98 | 2.75* |
| Waist Circumference | 70.17 | 9.74 | 70.28 | 9.66 | 68.57 | 9.11 | 72.58 | 10.38 | 69.33 | 12.04 | 3.29* |
| Hip Circumference | 83.36 | 8.26 | 83.23 | 8.11 | 82.36 | 8.07 | 86.22 | 9.2 | 84.15 | 9.2 | 4.18* |
| Cormic Index | 0.5 | 0.0255 | 0.496 | 0.024 | 0.495 | 0.028 | 0.491 | 0.0267 | 0.495 | 0.023 | 0.866 |
| Body Mass Index | 19.66 | 3.5 | 19.06 | 3.43 | 18.97 | 3.46 | 20.49 | 4.31 | 19.15 | 3.38 | 4.18* |
| Waist Hip Ratio | 1.2 | 0.11 | 1.19 | 0.11 | 1.21 | 0.1 | 1.2 | 0.09 | 1.23 | 0.13 | 2.08 |
| Waist Height Ratio | 0.47 | 0.07 | 0.47 | 0.07 | 0.46 | 0.06 | 0.48 | 0.07 | 0.46 | 0.08 | 1.8 |
| Adiposity Index | 27.42 | 5 | 27.41 | 5.01 | 27.13 | 4.6 | 28.21 | 5.59 | 27.96 | 4.97 | 0.965 |

* significance (2-tailed) ($p<0.05$)

**Table 2: Caste wise distribution of participant according to level of nutrition**

| *Nutritionalstatus* | *Pooled data* | | *Chamar* | | *Kori* | | *Dhobi* | | *Domar* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* | *N* | *%* |
| Underweight (>18.5 kg/m$^2$) | 480 | 47.2 | 357 | 48.8 | 79 | 45.4 | 29 | 36.7 | 15 | 36.7 |
| Normal (18.5- 24.9 kg/m$^2$) | 467 | 45.9 | 326 | 44.5 | 87 | 50.0 | 40 | 50.6 | 14 | 50.6 |
| Overweight/Obese (25.0-40+ kg/m$^2$) | 71 | 7.0 | 49 | 6.7 | 8 | 4.6 | 10 | 12.7 | 4 | 12.7 |
| Total | 1018 | 100 | 732 | 100 | 174 | 100 | 79 | 100 | 33 | 100 |

($\chi 2 = 17.23$; df=6; p=0.008)

**Table 3: Results of independent samples t-test for BMI among Females**

| *Variable* | *Number* | *Mean BMI* | *F value* | *t value* |
|---|---|---|---|---|
| | | Family Planning User | | |
| Not User | 459 | 19.11±3.6 | 4.081* | -0.360 |
| User | 559 | 19.19±3.3 | | |
| | | Level of Education | | |
| Illiterate | 751 | 19.09±3.5 | 3.089 | -0.89 |
| Literate | 267 | 19.3±3.4 | | |
| | | Nature of menstruation | | |
| Menstrual | 684 | 19.20±3.4 | 1.297 | 0.615 |
| Menopausal | 334 | 19.05±3.5 | | |
| | | Reproductive period | | |
| Reproductive age (15-44) | 683 | 19.12±3.4 | 6.054* | -0.36 |
| Post-reproductive age (>45) | 335 | 19.21±3.7 | | |
| | | Age at marriage | | |
| Under 18 year | 845 | 19.11±3.4 | 0.034 | -1.01 |
| After 18 year of Marriage | 171 | 19.40±3.6 | | |
| | | Occupation | | |
| Economically Inactive | 747 | 19.2±3.5 | 0.058 | 0.817 |
| Economically Active | 271 | 19.00±3.45 | | |

(*p<0.05); all the t-values were found insignificant.

**Table 4: Result of independent samples t-test for reproductive performance and child/ fetal loss among women**

| *Reproductive Variable* | *Nutritional status* | *Number* | *Mean* | *t value* | *F value* |
|---|---|---|---|---|---|
| Age at First Birth | Under Nutrition | 460 | 19.7±2.6 | 0.524 | 0.050 |
| | Over weight/ obese | 13 | 19.31±2.62 | | |
| Pregnancies Experienced | Under Nutrition | 460 | 5.96±3.0 | 0.668 | 0.030 |
| | Over weight/ obese | 13 | 5.38±2.95 | | |
| Children ever born | Under Nutrition | 460 | 5.08±2.61 | 1.26 | 0.142 |
| | Over weight/ obese | 13 | 4.15±2.5 | | |
| Surviving Children | Under Nutrition | 460 | 4.02±1.95 | 1.00 | 0.235 |
| | Over weight/ obese | 13 | 3.46±1.7 | | |
| Child loss | Under Nutrition | 460 | 1.06±1.4 | 0.904 | 0.605 |
| | Over weight/ obese | 13 | 0.69±1.3 | | |
| Fetal Loss | Under Nutrition | 460 | 0.88±1.17 | -1.062 | 2.63 |
| | Over weight/ obese | 13 | 1.23±1.58 | | |

All the t-test and F-test values were found insignificant.

**Table 5: Regression analysis computed between body mass index (dependent) and biosocial determinants and health and nutritional measurements (independent) among women**

| *Variable* | *R* | $R^2$ | $\beta$ | *SE* | *t* | *F* | *df* | *p* |
|---|---|---|---|---|---|---|---|---|
| Socio-demographic characteristics | | | | | | | | |
| Current Age | 0.001 | 0.001 | 4.7 | 0.008 | 0.001 | 0.001 | 1016 | 1.00 |
| Age at Marriage | 0.007 | 0.001 | 0.007 | 0.031 | 0.236 | 0.056 | 1014 | 0.814 |
| Level of Education | 0.062 | 0.004 | 0.235 | 0.118 | 1.98 | 3.95 | 1016 | 0.047 |
| Occupation | 0.016 | 0.001 | 0.038 | 0.074 | 0.514 | 0.264 | 1016 | 0.607 |
| Anthropometric profile | | | | | | | | |
| Body weight | 0.887 | 0.784 | 0.384 | 0.006 | 61.3 | 3.7 | 1016 | 0.0001 |
| Body Stature | 0.163 | 0.027 | -0.092 | 0.017 | -5.28 | 27.90 | 1016 | 0.0001 |
| Sitting Height | 0.066 | 0.004 | 0.058 | 0.027 | 2.10 | 4.46 | 1016 | 0.035 |
| Arm Circumference | 0.54 | 0.285 | 0.65 | 0.032 | 20.4 | 417.7 | 1016 | 0.0001 |
| Hip circumference | 0.605 | 0.361 | 0.258 | 0.011 | 24.19 | 585.1 | 1016 | 0.0001 |
| Waist Circumference | 0.611 | 0.373 | 0.221 | 0.009 | 24.63 | 606.6 | 1016 | 0.0001 |
| Physiological measurements | | | | | | | | |
| Blood pressure (S) | 0.25 | 0.065 | 0.040 | 0.005 | 8.380 | 70.22 | 1016 | 0.0001 |
| Blood Pressure (D) | 0.20 | 0.040 | 0.026 | 0.004 | 6.51 | 42.41 | 1016 | 0.001 |
| Blood Glucose | 0.048 | 0.002 | 0.005 | 0.003 | 1.50 | 2.27 | 996 | 0.13 |
| Body Fat % | 0.806 | 0.650 | 0.545 | 0.013 | 43.44 | 1.88 | 1016 | 0.0001 |
| BMR | 0.603 | 0.364 | 0.018 | 0.001 | 24.009 | 580.75 | 1016 | 0.0001 |
| Energy Expenditure | 0.508 | 0.251 | 0.008 | 0.001 | 18.79 | 353.18 | 1016 | 0.0001 |
| Adiposity Index | 0.643 | 0.413 | 0.454 | 0.017 | 0643 | 714.8 | 1016 | 0.001 |

**Table 6: Regression analysis computed between body mass index and reproductive determinants of Schedule Caste mothers**

| *Variable* | *R* | $R^2$ | $\beta$ | *SE* | *t* | *F* | *df* | *p* |
|---|---|---|---|---|---|---|---|---|
| Pregnancies experience | 0.007 | 0.001 | 0.060 | 0.298 | 0.202 | 0.04 | 959 | 0.84 |
| Live Birth | 0.005 | 0.001 | -0.006 | 0.043 | -0.144 | 0.021 | 968 | 0.885 |
| Child survival | 0.023 | 0.001 | -0.043 | 0.059 | -0.72 | 0.531 | 968 | 0.466 |
| Age at First Birth | 0.037 | 0.001 | -0.052 | 0.045 | -1.162 | 1.35 | 968 | 0.24 |
| Child loss | 0.022 | 0.0001 | 0.052 | 0.076 | 0.68 | 0.466 | 968 | 0.495 |
| Fetal loss | 0.063 | 0.004 | 0.189 | 0.096 | 1.97 | 3.88 | 968 | 0.04 |
| Infant mortality | 0.549 | 0.302 | 5.0 | 2.29 | 2.17 | 4.7 | 11 | 0.05 |

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