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Obesity and chronic deficiency among adult bidi workers of Central India

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Abstract

The present study was conducted among the Bidi workers of a village named Pathaiya Jat of Sagar district of Madhya Pradesh. The data were collected on 254 individuals belonging to a total of 119 households. Anthropometric measurement viz. stature (height), body weight, acromian height and sitting height were measured and body mass index (BMI) and cormic index (CI) were computed for each individual. The average body weight among males was found 56.6 ± 11.0 kg and among females were 50.6 ± 9.86 kg. The average stature among males were 163.4 ± 8.1 cm and among females 161.0 ± 12 cm. The average body mass index among males was 21 ± 4.1 kg m⁻² which is lower than females (22.6 ± 4.4 kg m⁻²). The mean cormic index among males was 0.507 ± 0.052 which is similar to females 0.507 ± 0.044 . A total of 46.3% Bidi workers were found malnourished out of which the proportion of chronic energy deficient was higher as compared to obese. Further the proportions of obese were higher in females as compared to males. According to Asia Pacific BMI cut-off a total of 53.1% and 60.4% female were nutritionally normal and have low to moderated health risk whereas 0.9% male and 0.7% female were found as obese (BMI 35-37.5 kgm⁻²) and having high health risk. The mean BMI of present studied population is higher than previous studies among Indian population. It is apparent from regression analysis that 65% body mass index is determining by body weight and the height have meager (2.3%) role in deciding the BMI followed by other somatometric and physiological characteristics.

Key word: Body mass index (BMI), Cormic index, Nutritional status, t-test ANOVA, Regression analysis

Introduction

Bidi workers are occupational groups, who are engaged in the manufacturing industry of country cigarettes called Bidi. Bidi is Hindi term used for country cigarettes. There are different category of Bidi workers viz. collector of Tendu leave, bidi rollers, sattedar, roasters, steamers and packagers. Among all these the bidi rollers are constantly exposed to tobacco dust. In the present study, the term bidi workers are used for bidi rollers only. There is no exact information about total population of bidi workers, but is estimated to 5 million in the world, out of which approximately 4 lakh bidi workers live in Sagar district of Madhya Pradesh. The socio economic condition and level of education of these bidi workers is not satisfactory and they are lagging behind in health and nutritional status. A large proportion of male bidi worker were found as daily wage labor and engaged in other jobs due to low wages and shifting to other jobs and works. Still large proportion of males and females are engaged in the work of Bidi rolling. The objective of present study was to assess the nutritional stauts of adult Bidi workers and find out its determinants. To fulfill the objectives, the samples were drawn from a village known as Pathariya Jat of the district Sagar of the state of Madhya Pradesh located in Central India.

Body mass index (BMI) is one of the best indicators of nutritional assessment and being widely used by many scholars. It is a ratio of body mass and body height (Ferro-Luzzie 1991 and 1992; James et al. 1988, Shetty and James 1994). BMI may be defined as nutritionally rather than genetically related and despite wide variation in weight and height among human population (Eveleth and Tanner 1990 & Majumder et al. 1990). In developing country such as India, anthropometry, despite its inherent limitation, still remains the most practical tools for assessing nutritional status in community (Ghosh et al. 2001). Many of study have already done in this field for example Khongsdier (1997 and 2001); Adak et al.(2006); Bharti (1989); Naidu et al.(1991 and 1994); Gautam et al. (2006); Gautam (2007); Gautam and Thakur (2009; Tewari , Shekhawat & Chaoudhary (2005); Saheb & Prasad (2009); Gautam et al.(2013) and Mishra & Mohanty (2009) etc. Most of the studies are focused on ethnic groups rather than occupational group; therefore here is an attempt to understand the status of nutrition of a particular type occupational group.

Material and Methods:

For the present investigation data was collected from a total of 254 individuals aged 18+ years consists of 115 male and 139 female belong to 119 households of a village named Pathariay Jat of district Sagar of Madhya Pradesh. The village was selected purposively keeping in mind the prevalence of targeted population

i.e. Bidi workers. Here it should be noted that the Bidi making is one of the home based industry. The trader's engage housewives and unemployed youth and old aged individuals in Bidi making. Around Sagar town there are villages in which large proportion of population are found engaged in this job. They are less paid and unorganized workers. There is no authentic information about their population size. Therefore for the present investigation the village was selected on the basis of information gathered through pilot survey of the area. After selection of the village, a base line survey was conducted and 119 households were identify in which the family members were engaged in Bidi making. From each household two adult one male and one female who were not blood relative were randomly selected for anthropometric measurements. The preference were given to spouses of the family and in this way the study was conducted as a part of doctoral programme in which the information were gathered from a total of 254 individuals. They were measured for 11 anthropometric characteristics which included: body weight, height, sitting height, acromian height, waist circumference, hip circumference, arm circumference and four skin fold measurements in spite of collecting information on somatometric characteristics, the information were also gathered on demographical, physiological, behavioral and socioeconomic characteristics.

The field work was conducted during the winter of year 2013. Before commencement of field work the tools were validated and standardized, simultaneously proper training was given regarding field work and data collection. Ethical consent was obtained from formal and informal leaders as well as from subject.

To minimized the error of imprecision, undependability and inaccuracy; the technical error of measurements (TEM) was calculated by using following formula.

$$TEM = \sqrt{\frac{\sum D^2}{2N}}$$

The TEM were found to be within reference value (Ulijaszek & Kerr1999). Thus TEM was not incorporate in statistically analysis. After collection of data, it was entered in ms-excel worksheet for filtration, analysis and tabulation. After that ms-excel worksheet is converted into SPSS for cross tabulation and other statistical analysis.

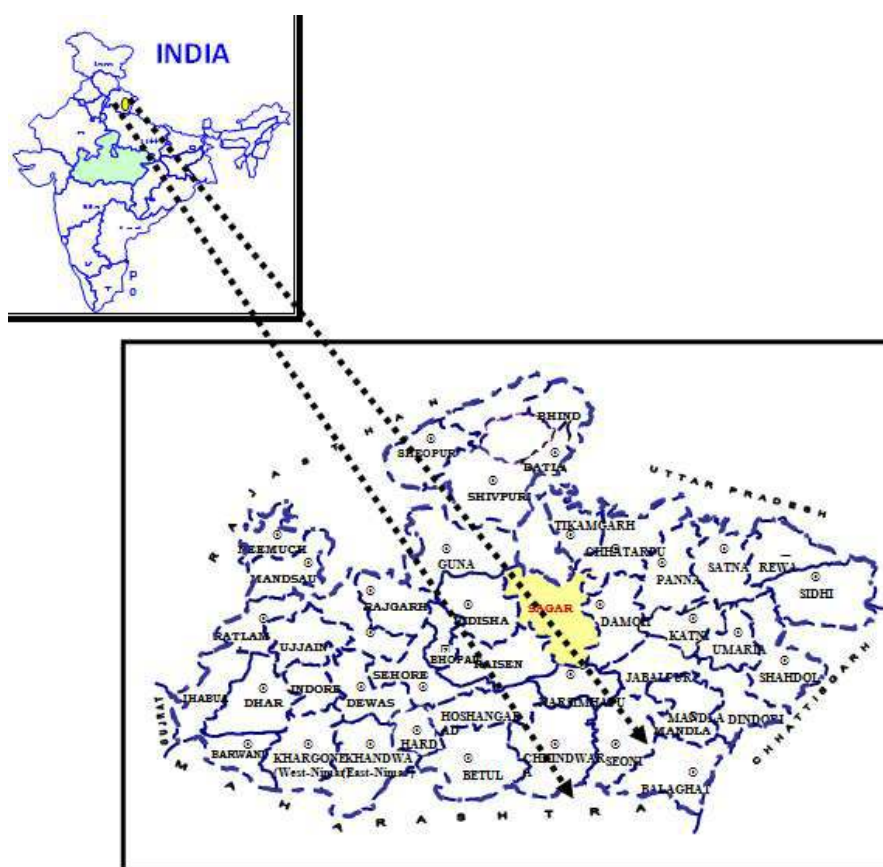


Figure.1. Location map of Study area

Result and discussion

Anthropometric measurements viz. body weight, height, sitting height, acromian height measured and body mass index and cormic index was computed for Bidi workers of Central India is presented in Table 1. It is apparent from Table 1 that the average body weight among male was 56.6 ± 11 kg and among female 50.6 ± 9.86 kg. The average height among male was 163.4 ± 8.1 cm which is higher than average height of female 161.0 ± 12 cm. The mean of sitting height of males were 82.84 ± 8.7 cm and for female it was 76.0 ± 8.7 cm. The mean of acromian height is higher among male as compared to female 137.5 ± 7.7 and 126.3 ± 5.3 cm respectively. To understand the body composition and level of nutrition of the studied population certain ratios and indices were computed, these are comic index and body mass index. The average cormic index among male and female is similar with slight variation in standard deviation, 0.507 ± 0.052 cm and 0.507 ± 0.044 cm respectively. The average body mass index (BMI) among male was 21.3 ± 4.1 kgm^{-2} which is slightly lower than female 22.6 ± 4.4 kgm^{-2} . To understand the gender difference in somatometric characteristics error bar diagramme is drawn (Fig. 2). It is apparent that there is significant difference in stature and body weight of males and females. Males are significantly taller and heavier as compared to female.

According to Ferro Luzzi et al. (1992), BMI is sufficient to define chronic energy deficiency (CED) in adults. The mortality rate is higher in male with a BMI below 16.0kgm^{-2} as compared with those BMI >18.5 kgm^{-2} (Reddy 1991 and Reddy 1998). In fact, it has become standard practice to take 18.5kgm^{-2} as the cutoff point and to screen the nutritionally normal. Shetty and James (1994) are of the opinion that a BMI above 18.5kgm^{-2} is compatible with good health among male soldier and women in the United Kingdom and in the individuals belong to the high socio economic classes in developing countries. Satyanarayana et al. (1991) showed that the difference in mortality rate between adult males with CED grade I and normal CED is only about 1% per year, but it increases rapidly when BMI is less than 17Kg m^{-2} . Deepashree & Prakash (2007) concluded that majority of diabetic patient were found as nutritional normal but symptoms of frequent thirsty and urination was common among them. The prevalence of malnutrition is more sever during pre and early phase of adolescence (Agrawal 2006).

To understand the difference in somatometric characteristics and level of nutrition among male and female, independent sample t-test were carried out and the result is displayed in Table 2. It is apparent from the table that body weight, height and body fat exhibits difference in mean value is statistically significant, whereas, the difference in BMI is statistically insignificant.

The distribution of male and female as per their level of nutrition is given in Table 3. It is apparent from the table that a total of 28.7% of male and 18.8% of female were found chronically energy deficient. Among male a total of 10.4% were found as moderate to severely chronic energy deficient ($\text{BMI} < 17 \text{kg m}^{-2}$) and 18.3 were categorized as CED grade I mild type of chronically energy deficient. Among female out of 18.8% of total chronic energy deficient, majority of 13.7% were categorized under CED grade I whereas remaining 5.1% were found as moderate to severe type of chronically energy deficient. A total of 53.0% of male and 60.4% of female were found as nutritionally normal having BMI 18.5 - 24.9kg m^{-2} . Further 15.7% of male and 18.0% of female were found as obese grade I ($\text{BMI } 25$ - 29.9kg m^{-2}) and only 2% of male and 2.9% of female were found as obese grade II ($\text{BMI } 30$ - 34.9kg m^{-2}). There is insignificant difference of body mass index among male and female bidi workers of central India, as apparent from Error bar diagram. (Fig.2c).

According to Asia Pacific BMI cut-off point for public health and clinical action, the level of nutrition among Bidi workers is presented in Table3. It is apparent from the table that 28.7% male and 18.8% of female were found under weight or chronic energy deficient. Among male a total of 53.1% and 60.4% female were found as nutritionally normal and have low to moderated health risk. Similarly majority of male 17.4% and 20.05% female were found as overweight which are having moderated to high health risk. Whereas remaining 0.9% male and 0.7% female were found as obese ($\text{BMI } 35$ - 37.5kg/m^2) and having high health risk.

To understand the nutritional status of Bidi workers, the mean value of BMI is compared with 13 traditional occupational groups of central India (Fig.4). It is apparent that mean value of BMI among traditional occupational groups varies from 17.8 to 19.5kg m^{-2} among weaver, Priest and Wine merchant (Gautam 2007), whereas among Bidi workers it is slightly higher (21.3kg m^{-2}). The mean of BMI of present studied population is also higher than the estimation of Ferro Luzzi et al.(1991) for Indian males was 17.7kg m^{-2} .

To assess the correlation between Body mass index (BMI) and Cormic index (CI) bivariate scattered plot were drawn (Fig. 5). It is apparent from the bivariate scattered plot diagram that there is a positive correlation between (BMI) and Cormic index (CI). Norgan (1994) was opinion that BMI have lower degree of correlation with sitting height or BMI is lower in those population with higher sitting height. It indicates that there exist an inverse relationship between BMI and CI. But in the present study, it was found that there is positive correlation between body mass index (BMI) and cormic index (CI).

To understand the extent relationship between body mass index (as dependent variable) and demographical variable, regression analysis was done and represented in Table 5. It is apparent from the table that there is insignificant relationship between demographical variables i.e. current age, year of schooling,

occupation, marital status, age at marriage and body mass index. Whereas among male age at marriage have statistically significant relationship with body mass index and it is determine the BMI 9.3%.

Similarly to understand the variation of BMI among the population having different dietary habits, smoking habits and health problem one way ANOVA test were computed and result is present in Table 6. It is apparent that the difference is statistically insignificant.

To find out somatometric and physiological determinants of BMI bivariate linear regression analysis was computed. The findings of regression analysis are displayed in Table 7. It is apparent from the table that except sitting height rest all variable influence BMI at different extent. The first and foremost determinant of BMI is body weight, which can affect upto 65.2% followed by waist circumference, hip circumference, skin fold thickness and body fat these four variable determine the BMI in almost equal extent i.e. 53%. After these four variable arm circumference also determine BMI significantly (44.6%), but the remaining variables determine BMI in a range of 11to1 percent.

Conclusion

Bidi workers are genetically heterogeneous group of people; it is not a caste bound occupation like traditional one. Bidi workers are groups of individuals who belong to different ethnic origin. Large proportion of population are in the category of chronic energy deficient, but still the mean BMI is better than previously reported for the region and different occupational groups which indicates that the nutritional status have improved during last few decades, simultaneously obesity is increasing among rural population and sedentary workers like bidi rollers. Further the females are more prone to obesity than the males. The mean cormic index among male was 0.507 ± 0.052 which is similar to female 0.507 ± 0.044 . Among bidi worker 46.3% were found as malnourished out of which the proportion of chronic energy deficient was higher as compared to nutritionally obese. The proportion of nutritionally obese is higher in female as compared to male. Bidi workers are lagging behind in health and nutritional status. The mean BMI of present studied population in higher than estimated by Ferro-Luzzie et al.(1992) and Gautam (2007). Among Bidi workers the positive correlation was found between BMI and cormic index. Similarly age education levels, occupation, marital status, age at marriage and body mass index have statistically insignificant relationship with BMI. As apparent from regression analysis 65% BMI is determine by body weight and the height have meager (2.5%) role in deciding the BMI, waist circumference, hip circumference as well as skin fold and body fat also have significant stake in BMI; whereas the other somatometric and physiological characteristics have meager role in deciding the BMI.

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Table1. Average and standard deviation of Anthropometric Measurements among Bidi worker of Central India.

Measurement	Male		Female	
	Mean	SD	Mean	SD
Body weight (in Kg)	56.6	11.0	50.6	9.85
Height (in cm)	163.4	8.1	161.0	12
Sitting Height (in cm)	82.84	8.7	76.0	3.8
Acromian Height (in cm)	137.3	7.7	126.3	5.33
Indices				
BMI (in kg m ⁻²)	21.3	4.1	22.6	4.4
Cormic Index	0.507	0.052	0.507	0.044

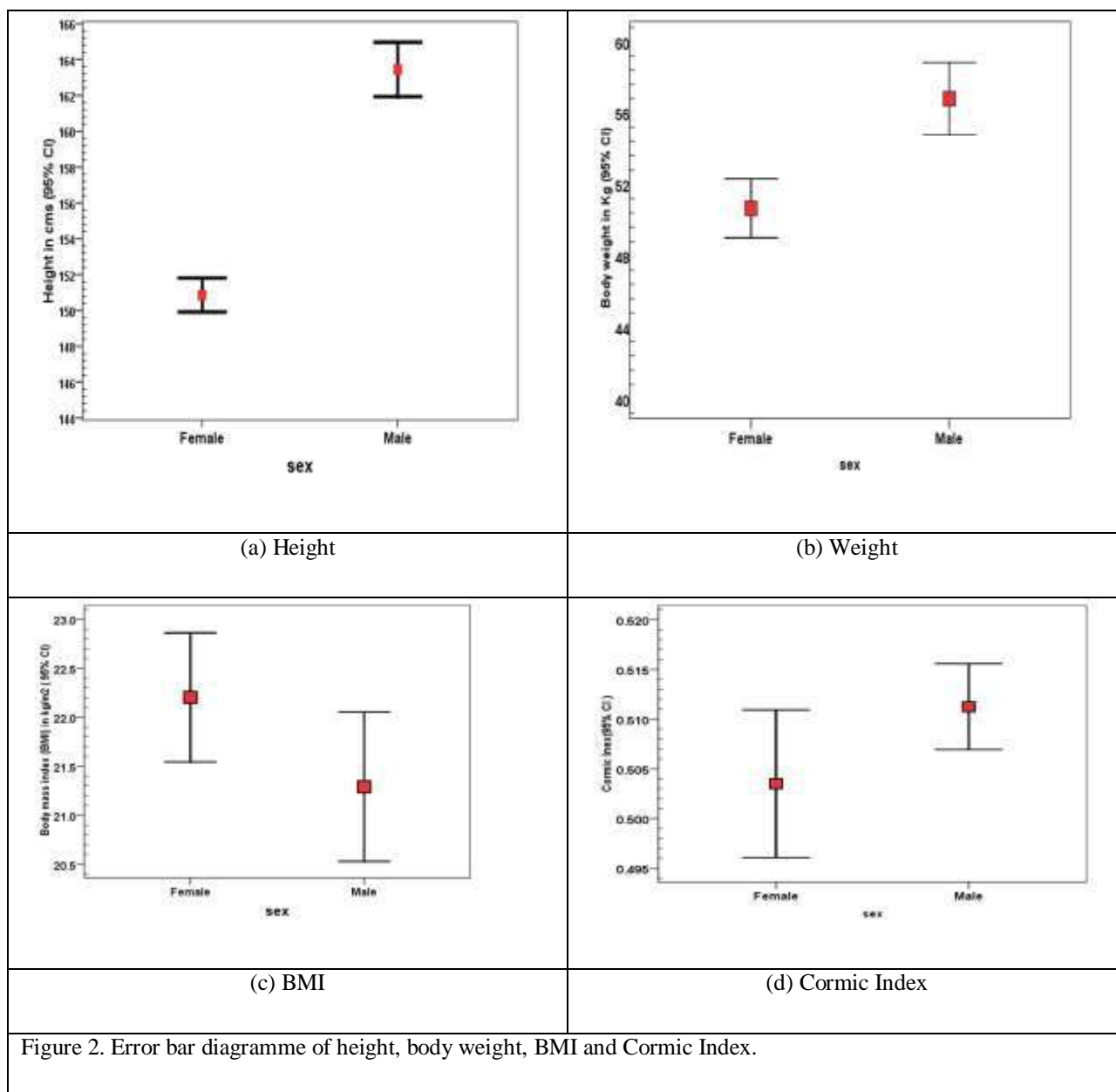


Figure 2. Error bar diagramme of height, body weight, BMI and Cormic Index.

Table2. Independent sample test between male and female.

Measurements	Levine's Test for Equality of Variance		T-test for equality of means				
	Equal variance	F	t	df	Mean difference	Std. Error difference	Sig.
BMI	Assumed	0.729	1.800	252	0.9192	0.506	0.073
	Not Assumed		1.792	238.2	0.91922	0.509	0.074
Body weight	Assumed	3.093	-4.68	252	-6.132	11.310	0.001
	Not Assumed		-4.636	231.2	-6.129	1.324	0.001
Body height	Assumed	5.11	-14.39	251	-12.58	0.874	0.001
	Not Assumed		-13.93	196.7	-12.58	0.903	0.001
Body Fat	Assumed	0.550	3.729	252	2.0942	0.5167	0.001
	Not Assumed		3.721	241.41	2.0942	0.5627	0.001

Table3. Distribution of Population according to level of nutrition (As per BMI cut off).

Nutritional level	Male		Female		Total	
	N	%	N	%	N	%
CED Grade III Severe (BMI<16.0)	6	5.2	3	2.2	9	3.5
CED Grade II Moderate(BMI 16.0-16.99)	6	5.2	4	2.9	10	3.9
CED Grade I Mild (BMI 17.0-18.46)	21	18.3	19	13.7	40	15.7
Low Weight Normal (BMI 18.5-19.9)	20	17.4	18	12.9	38	15.0
Normal (BMI20.0-24.9)	41	35.7	66	47.5	107	42.1
Obese Grade I (BMI 25.0-29.99)	18	15.7	25	18.0	43	16.9
Obese Grade II (BMI 30-39.9)	3	2.6	4	2.9	7	2.8
Total	115	100	139	100	254	100

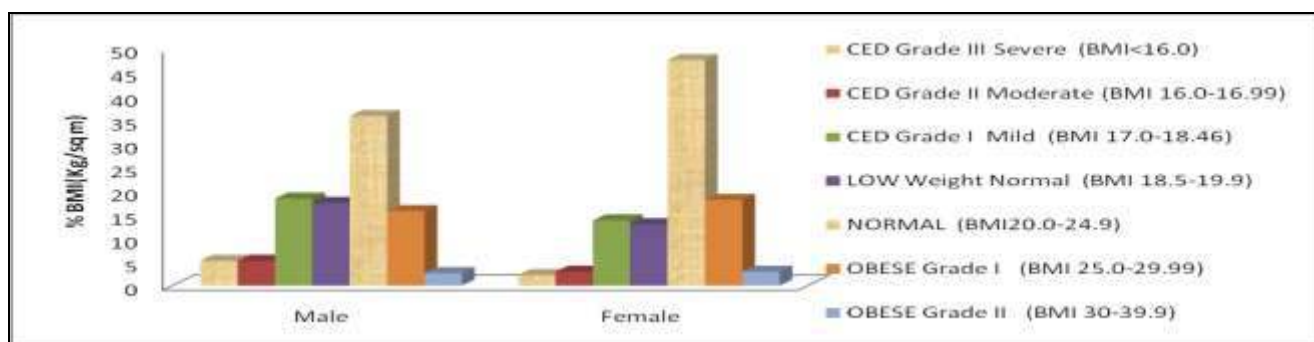


Figure 2: Distribution of Bidi workers as per level of nutrition (following WHO cut off).

Table4: Distribution of Population according to level of nutrition as per Asia Pacific BMI cut-off for Public health and Clinical action based.

Nutritional level Category (Kg/m ²)		Male		Female		Total	
		N	%	N	%	N	%
Under weight	<16.0	6	5.2	3	2.2	9	3.5
	16.0-16.9	6	5.2	4	2.9	10	3.9
	17.0-18.5	21	18.3	19	13.7	40	15.7
(Normal) Low to moderate health risk	18.6-20.0	20	17.4	18	12.9	38	15.0
	20-23.0	27	23.5	39	28.1	66	26.0
	23.0-25.0	14	12.2	27	19.4	41	16.1
(Over weight) Moderate to high health risk factors	25-27.5	10	8.7	12	8.6	22	8.7
	27.5-30	8	7.0	13	9.4	21	8.3
	30.0-32.5	2	1.7	3	2.2	5	2.0
(Obese-II) High to very high health risk	35.0-37.5	1	.9	1	.7	2	.8
Total		115	100	139	100	254	100

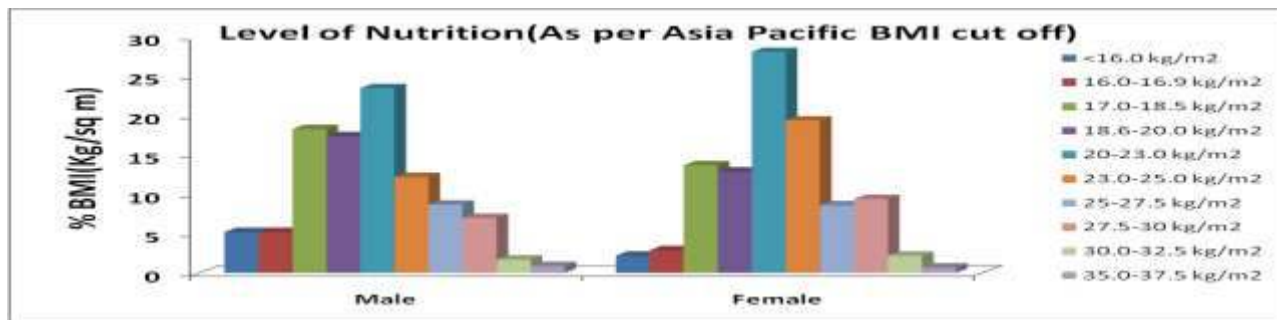


Figure 3: Distribution of Bidi workers as per level of nutrition (Following Asia Pacific BMI cut off).

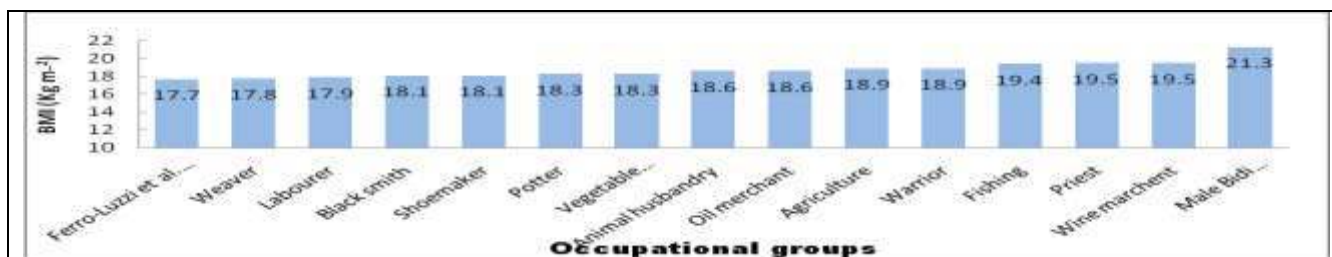


Figure 4. Mean BMI among different occupational groups of Central India

(Source: Gautam 2007).

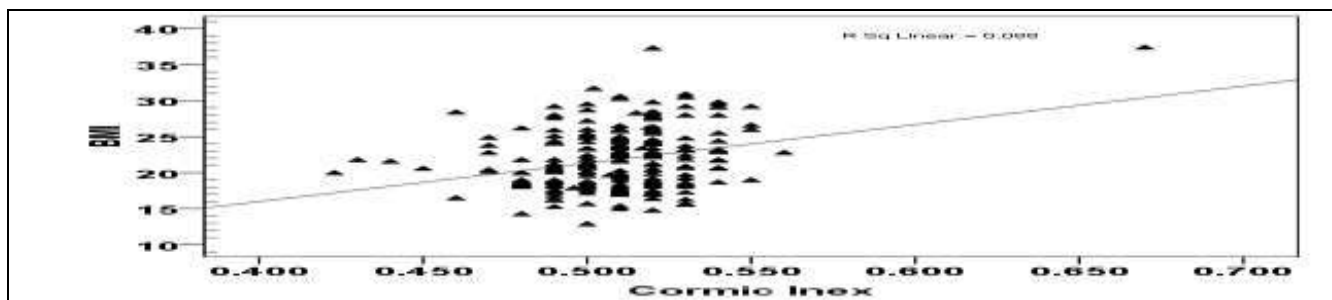


Figure 5. Bivariate scattered plot diagram showing correlation and regression between BMI and Cormic Index among Bidi workers of central India.

Table5. Regression coefficient and F statistics for Body Mass Index with Demographical variable among Male and Female.

S.No	Independent Variable	R	R ²	β	SE	F	T	DF	P
For Male									
1	Current age	0.016	0.001	0.004	0.023	0.30	0.174	114	0.862
2	Year of schooling	0.096	0.009	0.093	0.090	1.056	1.028	114	0.306
3	Monthly income (in Rs.)	0.123	0.015	0.0001	0.0001	1.716	1.310	113	0.193
4	Alternative Occupation	0.056	0.003	0.073	0.122	0.360	0.600	114	0.55
5	Marital Status	0.215	0.046	1.974	0.842	5.49	2.345	114	0.021
6	Age at marriage (in year)	0.305	0.093	0.145	0.043	11.58	3.404	114	0.001
Female									
1	Current age	0.006	0.001	0.001	0.022	0.005	0.0689	138	0.946
2	Year of schooling	0.122	0.015	-0.112	0.078	2.05	-1.435	138	0.154
3	Monthly income (in Rs.)	0.132	0.017	0.001	0.001	2.395	1.548	137	0.124
4	Alternative Occupation	0.61	0.004	-0.086	0.121	0.509	-0.714	138	0.477
5	Marital Status	0.026	0.001	0.246	0.822	0.090	0.300	138	0.765
6	Age at marriage (in year)	0.11	0.013	0.118	0.086	1.883	1.365	138	0.175
Note:									
Alternative Occupation Type :									
1. Bidi Making 2. Labour 3. Student 4. Private Job 5. Government Job 6. Businessman 7. Agriculturist 8. Retired Person 9. House Wife 10. Small Shop Keeper And 11. Non Worker.									
Marital Status:									
1. Unmarried 2. Married 3. Widow/ Widower 4. Divorce /Single									

Table6. One way ANOVA for BMI among male to female.

For male						For Female					
	Sum of Squares	df	Mean Square	F	Sig.		Sum of Squares	df	Mean Square	F	Sig.
Dietary Habits(1= Vegetarian, 2= Non Vegetarian 3=Egetrain)											
Between Groups	28.422	2	14.211	.831	0.438	Between Groups	44.001	2	22.001	1.436	0.242
Within Groups	1915.949	112	17.107			Within Groups	2084.307	136	15.326		
Total	1944.371	114				Total	2128.308	138			
Smoking habits (1=Regular 2= Casual 3= Chewing 4= All habits)											
Between Groups	117.700	3	39.233	2.384	0.073	Between Groups	66.392	3	22.131	1.449	0.231
Within Groups	1826.672	111	16.457			Within Groups	2061.916	135	15.273		
Total	1944.371	114				Total	2128.308	138			
Recently Health problem											

Between Groups	35.232	1	35.232	2.085	0.151	Between Groups	15.278	1	15.278	0.991	0.321
Within Groups	1909.139	113	16.895			Within Groups	2113.03	137	15.424		
Total	1944.371	114				Total	2128.30	138			
Note : Recently health problem:											
1.Healthy 2.Suffering from health problem											

Table7. Regression coefficient and F statistics for Body Mass Index with anthropometric measurements among Male and Female Bidi workers.

Sr. No	Independent Variable	R	R ²	β	SE	F	T	DF	P
Group-A(Body structure)									
1	Weight	0.807	0.652	0.301	0.014	471.881	21.72	253	0.001
2	Height	0.158	0.025	-0.069	0.027	6.459	-2.542	253	0.012
3	Sitting height	0.036	0.001	0.028	0.048	0.330	0.574	251	0.566
4	Acromian height	0.124	0.015	-0.059	0.030	3.913	-1.978	253	0.049
Group B (Body circumference)									
1	Waist circumference	0.729	0.531	0.264	0.016	285.12	16.88	253	0.001
2	Hip Circumference	0.723	0.536	0.332	0.019	290.619	17.048	253	0.001
3	Arm Circumference	0.668	0.446	0.945	0.66	202.875	14.243	253	0.001
Group C (Physiological measurements)									
1	Sum of skin fold	0.730	0.532	0.184	0.011	286.980	16.940	253	0.001
2	Body Fat	0.730	0.534	0.646	0.038	288.22	16.977	253	0.001
3	Pulse rate	0.206	0.042	0.064	0.019	11.157	3.340	253	0.001
4	Blood pressure(P)	0.199	0.040	0.040	0.012	10.399	3.225	253	0.001
5	Blood pressure(D)	0.250	0.063	0.063	0.015	16.790	4.089	252	0.001
6	Basal Metabolic rate	0.342	0.117	0.006	0.001	33.27	5.769	253	0.001
7	Daily energy expenditure	0.253	0.054	0.002	0.001	14.365	3.790	253	0.001