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COMPARATIVE EVALUATION OF HEALTH STATUS OF BENGALI WOMEN DEPENDING ON SOCIOECONOMIC STATUS

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Abstract

The life style and the related factors influence the health status of the individual. The factors which influence the health status are socioeconomic status, blood pressure, obesity, food habits etc. The socioeconomic condition is one of the major causes of the mental and physical stress, which is indirectly related with blood pressure. The present study was undertaken to find out the variations in body dimensions and blood pressure among Bengali women in relation to socioeconomic status. Three hundred women, excluding pregnant women, were selected from the municipal area of Paschim Medinipur District, West Bengal, India, aged between 20 to 60 years. On the basis of the economic status, the subjects were sub grouped into high income group (HIG), middle income group (MIG) and low income group (LIG). The anthropometric measurement and skin fold thickness were taken, from which the body mass index (BMI) and fat percentage were determined. The blood pressure of all the subjects was taken by mercury sphygmomanometer at resting condition. The results indicate that the mean body weight of women in HIG was significantly higher ($p<0.001$) than that of the MIG and LIG. The mean values of systolic and diastolic blood pressure among women of HIG were also significantly higher ($p<0.001$) than that of MIG as well as LIG. The said values in the subjects of MIG were also significantly higher ($p<0.001$) than that of the LIG. Nearly 34.25% women of HIG suffered from high blood pressure whereas 96.55% women of LIG had low blood pressure. It is therefore concluded that the socio economic status is indirectly related to health status of the Bengalese women.

Key words: Blood pressure, body mass index, fat percentage, socio-economic status.

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Introduction:

Health is a consequence of an individual's life style and a factor for determining it. Socio-economic conditions have long been known to influence human health. For the majority of the people, health status is determined primarily by their level of socioeconomic development, e.g., per-capita GNP, education, nutrition, housing etc. Affluence may be a contributory cause of illness, such as, high rates of coronary heart disease, diabetes and obesity in upper socioeconomic groups.[1] Carroll et al. indicated that blood reactions to mental stress predict future blood pressure status and the increase in resting blood pressure over time due to socioeconomic position and sex.[2] The socioeconomic condition is one of the causes of the mental stress, which is indirectly related with blood pressure. The high job strain was associated with a significantly higher diastolic blood pressure.[3]

The determinant of hypertension has been explored by many investigators. Blood pressure is an important parameter indicating cardiovascular functioning of the body.[4,5] Humayun et al. stated that hypertension, a condition developed as a result of high blood pressure is strongly correlated with BMI.[5] According to Selmer and Tverdal, 1995 and Rocha et al., 2003 there was a relation between hypertension and cardiovascular events. It has also been emphasized that large body size and fatness are associated with high blood pressure.[6,7] Daniels et al. indicated that the effect of obesity may be more important for systolic than for diastolic blood pressure.[8] According to Tesfaye et al. the risk of hypertension was higher among the population group with overweight and obesity.[9] The correlations of lean body mass, skin fold thickness[10,11] and body mass index (BMI) to systolic and diastolic blood pressure were highly significant in adolescents and in adults.[12] Kawada reported that BMI had an influence on blood pressure and lipid profile and was a good predictor of hypertension and hyperlipidemia.[13] Al-Sendi et al. indicated that obesity influenced the BP of Bahraini adolescents and that simple anthropometric measurements such as waist hip ratio (WHR) and waist circumference (WC) were useful in identifying children as well as adolescent at risk of developing high BP.[14]

In the present study variations in body dimensions and blood pressure among Bengali women were investigated in relation to economic status. The degree of association between body dimension and blood pressure has been evaluated. The present study was conducted among women having different economic status and the influence of per-capita income on the body fatness and blood pressure was investigated.

Material and Methods:

The present study was conducted in the department of Human Physiology with Community Health, Vidyasagar University, Midnapore, West Bengal, India, after approval of ethical committee. About 300 apparently healthy non-pregnant women aged between 20 to 60 years were selected from the municipal area of Midnapore District and divided into three subgroups on the basis of their socio-economic status by applying modified Kuppuswami scale[15] viz., high income group (HIG), middle income group (MIG) and low income group (LIG). The smokers and drinkers were not included in this study. For this cross sectional study almost two years (from May 2010 to June 2012) was spend for the data collection. The educational and economic status of the women was studied by asking the questions using the modified Kuppuswami scale[15]. During the time of interview the women had requested to mention the food habit of past three days. Different body dimensions of the subjects were taken by means of anthropometer (Holtain), sliding caliper and steel tape by adopting proper landmark definition[16] and standard measuring techniques.[17] The body weight of the subject was measured by a portable weighing machine (Libra) with an accuracy of 0.5 kg. The data recorded for a subject was the mean of three trials. All subjects were wearing light clothes and were bare footed during measurements. For measuring the Maximum abdominal circumference (MABC) the subjects were asked to stand erect looking straight, heels together and weight distributed equally on both feet. The steel tape was held in a horizontal plane. The measurement was taken laterally at the level of the crest and anterior of umbilicus. Body Mass Index was calculated from the height and weight of the female subjects by the Johnson and Nelson formula.[18] The body composition of the subject was determined by measuring the skin-fold thickness. The triceps, suprailiac and thigh skin folds were taken from female subjects. The skin fold caliper (Holtain) was used for these measurements. The measurements were taken under standardized condition and using proper landmarks.[18,19] From the skin fold data total weight of body fat and lean body weight was determined by the calculating the body density [20,21] and percentage of body fat of female subjects.[22] The following formulae were used:

(a) Body density (gm/cc) for women = 1.0994921 – 0.0009929 (sum of triceps, suprailiac and thigh skin folds) + 0.0000023 (sum of the same three skin folds)^2 – 0.0001392 (age in years).

(b) Percentage of fat = {(4.95 ÷ Body density) – 4.50 }×100

The systolic and diastolic blood pressure was determined by auscultator's method with the help of a sphygmomanometer (mercury type). The measurements were taken in supine position after a rest period of 15 minutes. The subjects did not report any symptoms of hypertension or hypotension during the study. The resting pulse rate was taken as 30 beats time recording method.

Statistical Analysis: All statistical analyses were performed using the STATISTICA software (version 5.0). Relationships between blood pressure and other parameters were analyzed by simple correlation. The mean and standard deviation was calculated for all data. Paired 't'-test and correlation (point biserial r and product moment r) among different groups of parameters had also been made. The values of $p<0.05$ were considered statistically significant.

Results and Discussion:

Different body dimension parameters including weight, height, mean abdominal circumference (MABC), six different skin fold thickness and physiological parameters like systolic blood pressure (SBP), diastolic blood pressure (DBP) and pulse rate (PR) of women of three different income group (HIG, MIG, LIG) were calculated and their mean value and significance difference were represented in the Table 1. From the collected data the BMI, percentage of body fat (fat%) and fat index (FI) were calculated and those are also represented in the same table. From the results it may be noted that the mean body weight of women in HIG was significantly higher ($p<0.001$) than that in MIG and LIG; the MIG also had significantly higher ($p<0.001$) body weight than that of LIG. The similar trend was observed in case of maximal abdominal circumference. The HIG and MIG were significantly taller ($p<0.001$) than that of LIG. In case of height there was no such significance difference found between HIG and MIG but the height of women of the LIG was significantly lower than the prior two groups. The BMI also decreased with the decrease of income in respect to high income group. It appeared from the results that different body dimensions decreased with the decreased economic condition of the subjects. Bharati also observed that the body mass, height, width and girth measurements and body mass index decreased with the decline in economic condition.[23] It was also observed (Table 1 and Fig.1) that the mean values of systolic and diastolic blood pressure in the HIG were significantly higher ($p<0.001$) than that of MIG as well as LIG. The said values in MIG are also significantly higher ($p<0.001$) than LIG. Therefore, a tendency of increase in blood pressure was observed with the increase in economic condition. The same thing also occurred in case of PR of HIG with other two groups. But there was no such significant difference found between the MIG and LIG. Mukherjee et al. indicated socio-economic status as a factor for influencing blood pressure and also found that systolic and diastolic blood pressure had an upward trend with increase in age among rural male and females in West Bengal.[24] The significant relationship between body weight and blood pressure has been observed by different investigators.[25] According to Rooks et al. the socioeconomic status and body composition was an important factor for high blood pressure and aging.[26] Obesity is a significant problem in many developing countries, and it is associated with a high prevalence of hypertension, particularly in women.[27]

In the present study higher values of body weight in higher economic subgroups may be related to the higher values of blood pressure. Body fatness may be another predictor of blood pressure. Maximal abdominal circumference of women may be a parameter for indicating body fatness.[28] In the present study maximum abdominal circumference (MABC) was found to be increased with the increase in economic status. Thus increase in systolic and diastolic blood pressure with economic status may be related to increase in regional obesity of the women. Ghosh et al. demonstrated that in Bengalese Hindu men with average age of 37.5 yrs, obesity measured in the form of waist stature ration (WSR) and BMI explained that the greater risk of developing hypertension was associated with increase in BMI.[29]

The percentage distribution of different status of blood pressure (hypertension, normotension and hypotension) was studied and is presented in table-2. The classification of blood pressure was done on the basis of JNC-VI criteria.[30] Nearly 34.25% women of HIG were hypertensive where as 96.55% women of LIG were hypotensive in our study. Although the dominating blood pressure (Table-2) of the HIG was normotensive but the percentage distribution indicates that there was a tendency to hypertensive of the HIG women. This indicates that income status of the family is one of the major factors for high blood pressure. The educational status of the family should be considered here.

Due to ignorance of several things the LIG does not take the food where as the HIG take huge amount of food.

In Table 3 correlation coefficient matrixes have been shown. From the result it has been observed that the degree of correlation of Fat% between HIG with LIG and MIG is highest ($p<0.001$). A significant correlation was found in BMI ($p<0.001$), FI and MABC ($p<0.05$) between LIG and MIG. Similar correlation was found in FI, SBP and DBP ($p<0.10$ and $p<0.01$ respectively) between MIG and HIG. Among the others parameters between HIG and LIG no such correlation was found. But from Fig. 2 to Fig.4 it has been revealed that with increase of Fat% the SBP and DBP linearly increased according to increase in income status of the family. In the present study all the income groups were sub divided in to two groups according to age (< 40 yrs and > 40 yrs). The table 4 represents the mean ±SD values and significance difference of all parameters according to age difference of all three groups (HIG, MIG and LIG). All parameters show a significant difference ($p<0.001$ or $p<0.01$) except PR and Height. The correlation coefficients according to age groups of all income groups are given in Table 4 and Table 5. Table 6 shows that, there was a significant correlation ($P<0.001$) with all parameters except PR ($p<0.10$) with advance of age (including all income groups). This indicates that all physical and physiological parameters are enhances with the advance of age. The Fig. 2 to Fig. 4**,** represents the relation of age with SBP and DBP. It reveals that SBP and DBP do not increase much with the advance of age in LIG, but in MIG both are increased with increase of age. The DBP increased with increase of age in HIG. This also shows that socio-income status plays an important role on blood pressure.

From the linear regression line we can say that with the increase of FI both the SBP and DBP linearly increased in HIG than among MIG and LIG.

A high linear regression line was also found between FI and BMI and FI and MABC in HIG.

A new formula was also established from this study for calculation of Fat%. This formula is form based on weight (kg) and mean abdominal circumference (MABC in cm). The formula is –

$$\text{Fat\%} = -21.58 + 0.389 \times \text{weight (kg)} + 0.311 \times \text{MABC (cm)}$$

Conclusion: Due to increase of Fat%, FI and other body composition the BP increases. The Fat% and other body composition increase with increase of nutritious food intake, which is indirectly correlated with family income.

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Table 1: Mean ±SD values and significant level of all parameters of different income groups (Low income group (LIG), Middle income group (MIG) and High income group (HIG).

Parameters	High Income Group	Middle Income Group	Low Income Group
Population (n)	108	102	90
Weight (Kg)	54.92 ±6.92	46.21 ±5.41[*]	41.87 ±4.60[*$]
Height (cm)	150.98 ±3.86	151.01 ±4.31	144.23 ±4.13[*$]
BMI	24.16 ±2.74	20.25 ±2.14[*]	20.22 ±2.04[*]
Fat%	24.29 ±4.42	18.65 ±3.37[*]	11.87 ±2.81[*$]
Fat Index	113.87 ±22.92	80.44 ±15.88[*]	46.56 ±11.82[*$]
Mean Abdominal Circumference (cm)	77.16 ±7.80	68.14 ±4.50[*]	61.24 ±5.11[*$$]
Systolic Blood Pressure	127.37 ±13.25	112.73 ±9.62[*]	103.98 ±7.86[*$]
Diastolic Blood Pressure	80.59 ±7.49	68.25 ±8.17[*]	64.02 ±7.41[*$]
Pulse Rate	76.56 ±4.73	71.66 ±3.65[*]	72.83 ±3.89[*$$$]

* w.r.t. HIG   * p<0.001   ** p<0.05
$ w.r.t. MIG $ p<0.001 $$ p<0.0001 $$$ p<0.05

Table 2: Percentage distribution of blood pressure of different income group.

Parameters	High Income Group	Middle Income Group	Low Income Group
Low blood pressure	18.52 %	81.37 %	96.55 %
Normal blood pressure	47.22 %	14.70 %	3.44 %
High blood pressure	34.25 %	3.92 %	-
Dominant blood pressure	Normal BP	Low BP	Low BP

Table 3 : Correlation coefficient (r) of different parameters of LIG with MIG & HIG and MIG& HIG.

Parameters	LIG with MIG	LIG with HIG	MIG with HIG
BMI	0.3279[*]	0.2181[$]	0.00971[^]
Fat%	0.4408[*]	0.3832[*]	0.2933[*]
Fat Index (FI)	0.2220[$]	0.1563[^]	0.1847[@]
Mean Abdominal Circumference	0.2243[$]	0.1485[^]	-0.0489[^]
Systolic blood pressure	-0.0329[^]	0.0889[^]	0.1805[#]
Diastolic blood pressure	0.1675[^]	0.1708[^]	0.3025[@]

* p<0.001   @ p<0.01   # p<0.10 $ p<0.05   ^ p>0.10

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Table 4 : Mean ±SD and significant level of different parameters of different income groups according to age difference (<40yrs and >40yrs).

Groups	Age group	Height (cm)	Weight (Kg)	BMI	Fat%	FI	MABC (cm)	SBP (mmHg)	DBP (mmHg)	PR (b/min)
High Income Group	<40yrs	149.88 ±4.29	51.43 ±6.40	22.96 ±2.66	21.77 ±4.34	103.81 ±23.24	74.45 ±7.50	118.13 ±5.68	74.96 ±5.99	75.04 ±4.56
	>40yrs	151.57 ±3.61	58.37 ±6.51	25.40 ±2.58	26.61 ±3.64	123.12 ±20.99	80.44 ±7.68	133.69 ±12.23	84.87 ±5.80	75.60 ±12.27
	p level	p<0.05	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p>0.10
Middle Income Group	<40yrs	151.25 ±5.01	44.81 ±5.82	19.55 ±2.07	17.37 ±3.64	76.50 ±16.98	67.06 ±4.71	109.71 ±6.42	65.10 ±6.14	71.73 ±3.75
	>40yrs	150.74 ±3.61	47.70 ±4.64	21.01 ±2.03	19.96 ±2.59	85.05 ±13.83	69.38 ±4.07	115.39 ±10.83	71.31 ±8.68	71.69 ±3.68
	p level	p>0.10	p<0.01	p<0.001	p<0.001	p<0.01	p<0.01	p<0.01	p<0.001	p>0.10
Low Income Group	<40yrs	143.89 ±3.88	40.56 ±4.75	19.69 ±2.21	10.05 ±2.09	41.59 ±11.28	59.92 ±4.74	104.42 ±5.48	63.49 ±6.31	73.35 ±3.80
	>40yrs	144.54 ±4.43	43.13 ±4.16	20.74 ±1.76	13.65 ±2.27	51.32 ±10.42	62.54 ±5.25	103.58 ±9.81	64.37 ±8.40	72.27 ±3.99
	p level	p>0.10	p<0.02	p<0.02	p<0.001	p<0.001	p<0.02	p>0.10	p>0.10	p>0.10

Table 5 : Correlation coefficient (r) of different parameters on basis of age difference (<40yrs and >40 yrs) of female subjects according to their income status.

Income group	Height (cm)	Weight (Kg)	BMI	Fat%	FI	MABC (cm)	SBP (mmHg)	DBP (mmHg)	PR (b/min)
High	-0.0896	0.0865	0.7568	0.1935	0.2042	0.1299	0.2846	0.2785	0.1827
Middle	0.2970	0.0992	-0.0768	0.2803	0.1221	0.0737	-0.0708	-0.1058	0.0167
Low	0.2553	0.2551	-0.1664	0.4366	0.4518	0.5065	0.0565	0.3505	-0.1070

Table 6: Correlation coefficient (r) of different parameters on basis of age difference (<40yrs and >40 yrs) of all the female subjects (n=300) excluding income status.

Age	Height (cm)	Weight (Kg)	BMI	Fat%	FI	MABC (cm)	SBP (mmHg)	DBP (mmHg)	PR (b/min)
<40yrs. with >40yrs.	0.4191*	0.4968*	0.2815*	0.7469*	0.7231*	0.5822*	0.5304*	0.5452*	-0.0159#

*** p<0.001 # p<0.10**

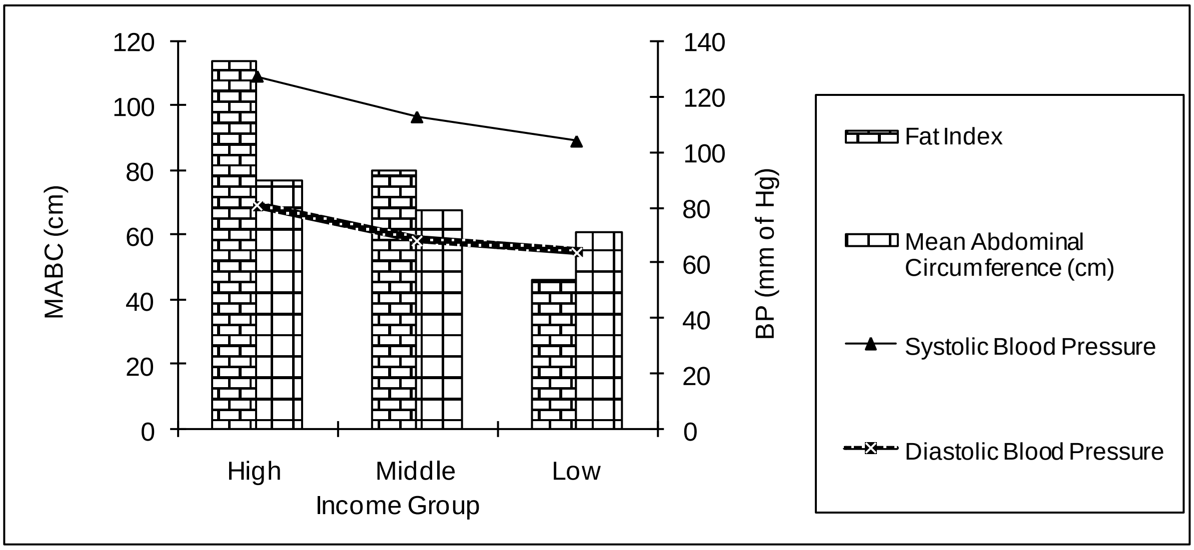

Fig. 1. Bar diagram represent the relation between fat index and MABC with blood pressure in different income group.

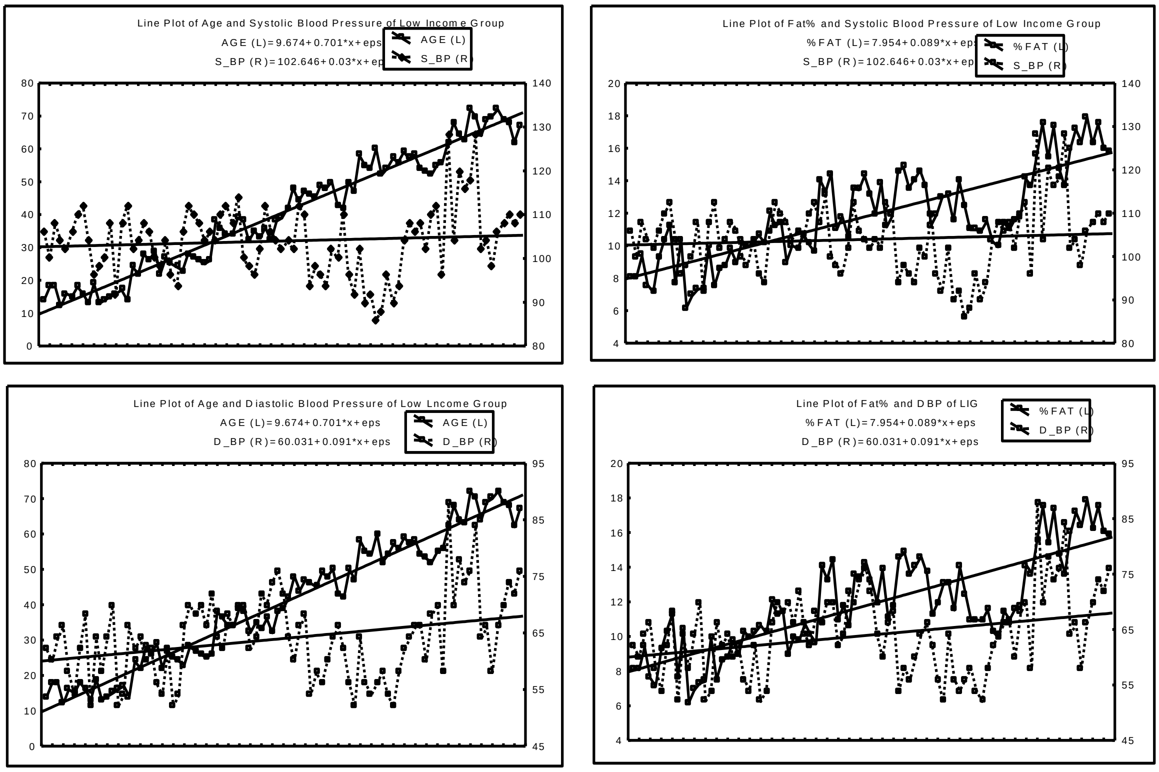

Figure 2: Line plot represent the relationship of age and fat % with blood pressure of low income group.

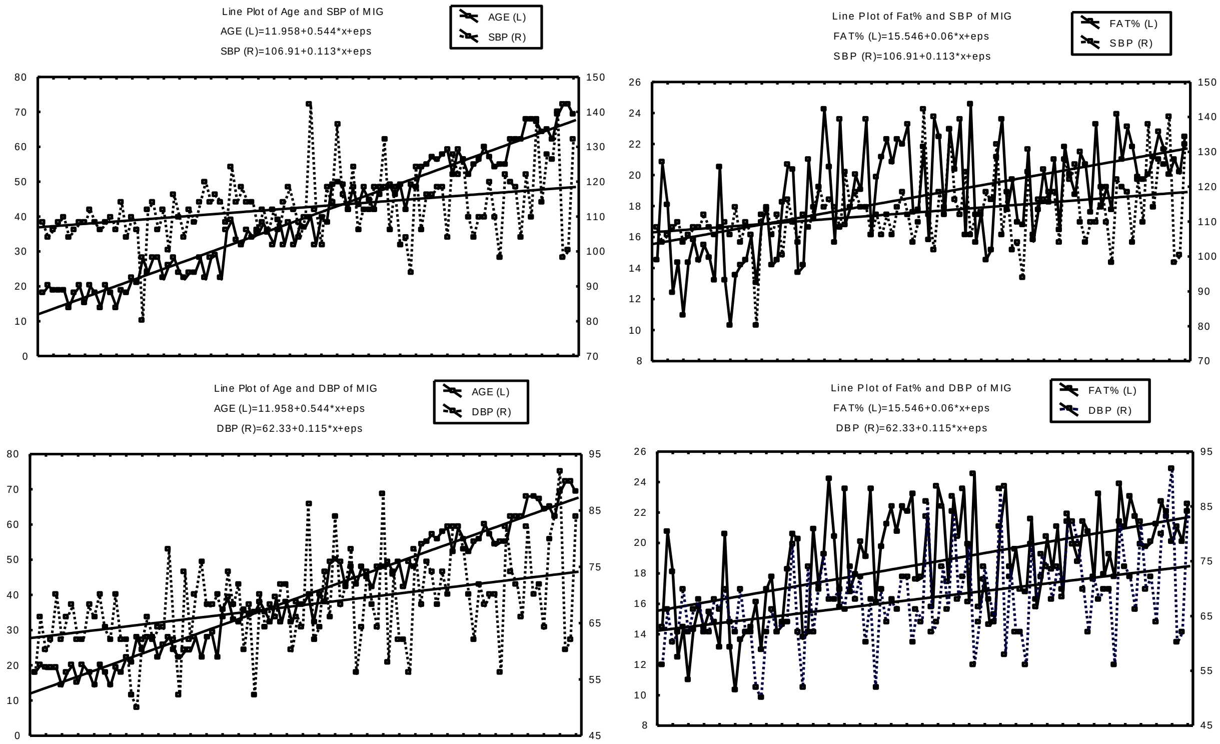

Figure 3: Line plot represent the relationship of age and fat % with blood pressure of middle income group.

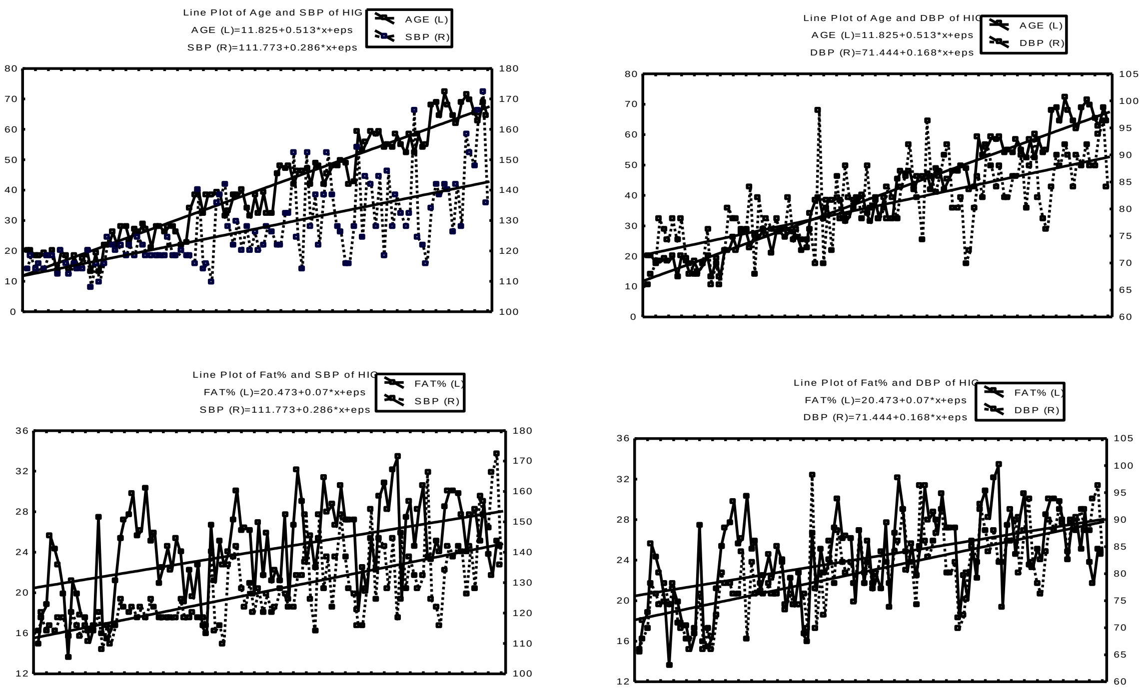

Figure 4: Line plot represent the relationship of age and fat % with blood pressure of high income group.