ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 4(D), pp. 25793-25798, April, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

BLOOD PRESSURE PROFILE IN RURAL POPULATION OF WEST BENGAL, INDIA

Sourav Ganguly, Jayeeta Mukherjee, Chandan Mondal, Arup Kumar Sinha, Pradip De and Somnath Bhakat*

Department of Zoology, Rampurhat College, Rampurhat-731224, Dist. Birbhum, West Bengal

DOI: http://dx.doi.org/10.24327/ijrsr.2018.0904.1932

ARTICLE INFO

Article History:

Received 8th January, 2018
Received in revised form 21st February, 2018
Accepted 05th March, 2018
Published online 28th April, 2018

Key Words:

Age group, Systolic blood pressure, Diastolic blood pressure, Height, Weight, Sex, Hypertension

ABSTRACT

Blood pressure changes in relation to sex, height and weight of rural Indian population of the age ranges from 19 years to above 60 years is reported here. No significant relationship is observed in between systolic or diastolic blood pressure (SBP or DBP) and other parameters viz. height and weight in both sexes.

In the early age group (19 to 29 years), both SBP and DBP are same but in older age group (above 60 years) males has higher blood pressure compared to female. Change in SBP is more pronounced compared to DBP in both sexes. These variations are markedly regulated by different hormones as observed by several workers.

In the present study only 16% population is affected by hypertension of which 22% were females. Average SBP and DBP of these individuals are 163.75 and 87.5 mm of Hg respectively.

Vegetarian dietary habit, physical activity, normal salt intake and without obesity or previous history of hypertension are the key controlling factors in the maintenance of normal blood pressure of rural Indian individuals.

INTRODUCTION

Several studies from different countries have reported age associated changes in both systolic and diastolic blood pressure. These changes seem to be different in male and female subjects **(**Boe *et al*, 1957; McDonough *et al*, 1964; Johnson *et al*,1965; Eilertsen and Humerfelt,1968; Miall and Chinn,1973; Kannel and Gordon,1978; Stamler *et al*,1978; Svardsudd and Tibblin, 1980; Amery *et al*,1981; Waldron *et al*,1982). The majority of these studies had been performed on age groups below 60 to 65 years of age **(**Boe J, 1957; Amery *et al*,1981;Landhal and Steen,1981**)** or children **(**Chukwujekwu *et al*,2014**)**.

In modern societies both systolic and diastolic blood pressure tended to increase with age and in addition to it a sex effect on blood pressure has been observed **(**Kotchen *et al*. 1980**).**

Blood pressure is also related to weight, weight change and maturation **(**Kotchen *et al*. 1980**)**. Overweight is an increasingly prevalent condition throughout the world and it is also a risk factor for hypertension **(**Chobanian *et al*.2003**)**. Most of the studies had been done on developed countries among urban people. But practically there is no report on blood pressure study on rural population of India. Hence we urgently need to study the blood pressure scenario among rural population of West Bengal, India.

The aim of this report is to describe blood pressure changes among rural population at the age ranges from 19 to more than 60 years and their relationship with sex, height and weight.

MATERIALS AND METHODS

1. ***Study area and population:*** The study was conducted in the rural areas of Rampurhat subdivision. Total 200 individuals contributing 62% males and 38% females of different age group were studied.
2. ***Instruments for data collection:*** The materials used for the study include – Measuring tape, weighing scale, sphygmomanometer and stethoscope.
3. ***Parameters:*** The following parameters were determined and recorded – age, sex, weight, height, systolic blood pressure and diastolic blood pressure.

Weight of each individual was taken by weighing machine. The height of an individual was measured with the individual standing erect heels together, chin up and a horizontal rule was made to rest on the head and the height was read off from a meter tape placed on a flat surface and against the wall.

Corresponding author:* **Somnath Bhakat
Department of Zoology, Rampurhat College, Rampurhat-731224, Dist. Birbhum, West Bengal

Blood pressure was measured on the left arm by sphygmomanometer in resting condition. Two readings were taken in 10 minutes apart and the average of the two was considered for calculation.

Data analysis: Descriptive statistic of mean and standard deviation were used to examine the data. Least- square method **(**regression analysis**)** was applied to find out correlation of different parameters viz. weight, height and sex with systolic blood pressure and diastolic blood pressure.

RESULT

Weight related systolic blood pressure **(**SBP**)** and diastolic blood pressure **(**DBP**)** of different age group in both sexes are not significant**.** Moreover in the age group 19 to 40 years, negative correlation exists in both systolic blood pressure and diastolic blood pressure in all the males (`Y=-0.4536X + 149.5, r^2= 0.0492 for SBP and Y= -0.1135X + 79.97, r^2= .0078 for DBP).

Systolic blood pressure and diastolic blood pressure when plotted against height all the values indicate no significant relationship.

Table I Mean systolic and diastolic blood pressure in five age groups of male and female individuals.

Age group	Mean ± SD			
	Male		Female	
	SBP	DBP	SBP	DBP
19 to 29	120.44 ± 9.43	74.338 ± 11.10	120±23.09	74.4 ± 12.57
30 to 40	129.52 ± 22.38	73.33 ± 11.68	126.08 ± 16.34	74.78 ± 10.98
41 to 51	132.64 ± 20.91	78.04 ± 9.29	134.11 ± 16.97	75.11 ± 14.08
52 to 62	134.8 ± 19	75.8 ± 12.97	128.4 ± 24.14	72.73 ± 12.88
63 above	137.12 ± 20	78.68 ± 9.78	129.8 ± 14.01	73.5 ± 10.59

Mean systolic blood pressure of five age groups when compared, in the first age group **(**19 to 29 years of age**)** no difference is observed in both male and female and they have normal systolic blood pressure i.e. 120 mm of Hg (Table–I). It is interesting to note that in all age groups the average diastolic blood pressure is less than 80 mm of mercury (Table–I). Moreover both in male and female diastolic blood pressure are almost equal in the first age group. In the next age groups, i.e. 2nd and 3rd the pictures are reverse related to systolic blood pressure. Here diastolic blood pressure in 2nd group is slightly higher in female whereas, in the 3rd group diastolic blood pressure is 3 mm higher in male, but the trend in older age groups i.e. 50 onwards males always have higher diastolic blood pressure than female which is also true in case of systolic blood pressure.

From Table I, a trend in increase of systolic blood pressure is observed among five age group but in case of diastolic blood pressure, the values of diastolic blood pressure in different age groups are fluctuating, though older males have higher diastolic blood pressure and middle aged females **(**40 to 50 years of age**)** have higher diastolic blood pressure.

Regression analysis of all age groups considering systolic blood pressure and diastolic blood pressure of both sexes are presented in Figs. 1, 2, 3 and 4. These show that only systolic blood pressure in male varies significantly with age.

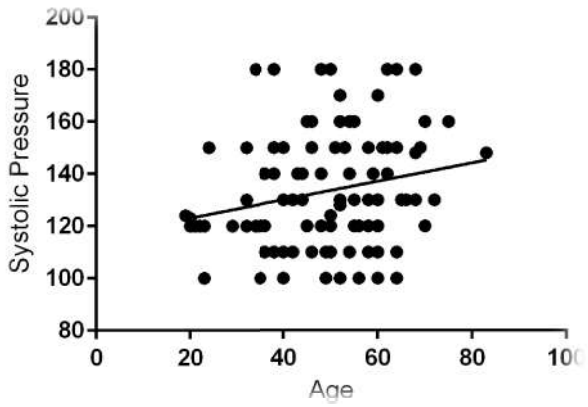

Fig 1 Regression of systolic blood pressure on age of male individuals (Y= 0.3523X + 116.0, r^2= 0.0513).

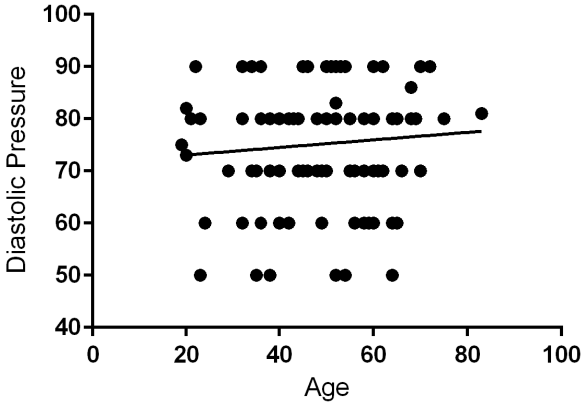

Fig 2 Regression of diastolic blood pressure on age of male individuals (Y= 0.0724X + 71.62, r^2=0 .0082).

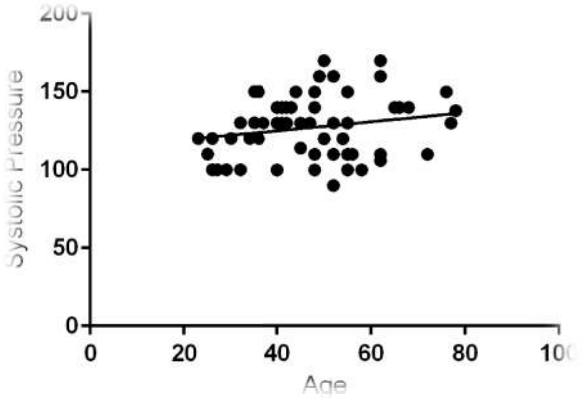

Fig 3 Regression of systolic blood pressure on age of female individuals (Y= 0.2926X = 113.4, r^2= 0.0403).

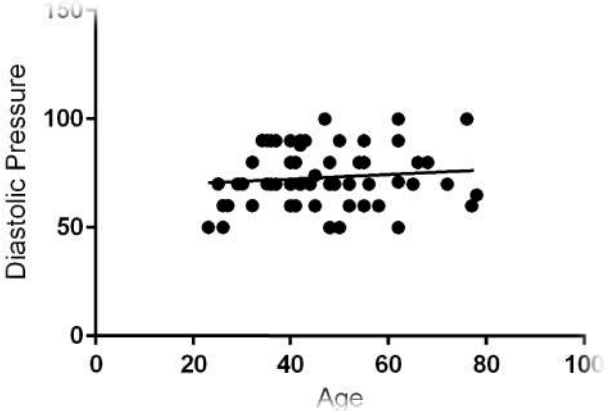

Fig 4 Regression of diastolic blood pressure on age of female individuals (Y= 0.1070X + 68.07, r^2 =0.0122)

Of the total population studied only 32 individuals **(**16%**)** have higher systolic blood pressure and only in three cases diastolic blood pressure is 100 mm of Hg. Mean systolic blood pressure and diastolic blood pressure of these individuals are 163.75 mm of Hg and 87.5 mm of Hg respectively. In this group, percentage of males and females are 78 and 22 respectively and all the individuals are above 45 years of age except four individuals **(**24, 28, 34, and 38 years of age**)**. Weights of these individuals are not so high, ranges from 35 kg **(**age 94 years) to 70 kg(age 50 years) (Table II)

Table II Values of SBP and DBP in 32 hypertension patients belonging to different age and height in both sexes

Age (year)	Sex	Height (cm)	Weight (kg)	SBP	DBP
34	M	147	39	180	90
38	M	152	49	180	80
48	M	165	60	180	80
46	M	168	58	160	90
52	M	152	60	170	90
64	M	168	64	180	80
50	F	163	54	170	90
45	M	160	52	160	90
28	F	160	58	170	90
62	M	163	60	180	90
62	F	157	50	170	90
54	M	157	65	160	90
52	F	165	62	160	70
55	M	160	50	160	80
51	M	165	49	150	90
50	M	147	70	180	80
46	M	145	62	150	90
52	M	157	58	160	90
68	M	163	54	180	80
60	M	165	50	170	90
75	M	165	46	160	80
36	F	160	52	150	90
53	M	168	67	150	90
62	F	152	65	160	100
76	F	163	62	150	100
62	M	165	47	150	90
63	M	168	67	150	90
57	M	170	65	160	100
48	M	117	49	150	90
82	M	175	48	180	90
70	M	163	39	160	80
94	M	132	35	150	80

DISCUSSION

Previous studies on age related changes in blood pressure produced numerous data and inconclusive results (Boe *et al*,1957; McDonough *et al*,1964; Johnson *et al*,1965; Eilertsen and Humerfelt,1968; Miall and Chinn,1973; Kannel and Gordon,1978; Stamler *et al*,1978; Svardsudd and Tibblin, 1980; Amery *et al*,1981; Waldron *et al*,1982). To a great extent, the discrepancies are due to variation in population sampling procedures and the samples investigated, to differences in longevity, food habit as found in the population of developed and developing countries, and to cultural and environmental differences.

The reason for fluctuations of blood pressure in relation to sex is due to two major factors like hormonal changes and difference in salt and water content of the body of both sexes. Maranon and Reckelhoff (2013) hypothesise that blood pressure modulation is multifactorial and sex chromosome and sex steroids probably regulate those many factors that control blood pressure. Our observation also confirms this hypothesis.

To define normal or elevated blood pressure in children it has been suggested that blood pressure be related to height or weight rather than to chronologic age (Voors *et al*,1978; Harlan *et al*,1979; Cornoni- Huntley *et al*, 1979). But in the present study, no significant correlations have been observed in between blood pressure and height or weight. This can be explained that after adolescent, there is no significant variable change either in height or weight within a particular age group. Weight in a particular age group is not widely varied hence systolic blood pressure and diastolic blood pressure yields no significant correlation. This is also true in case of height. There is a positive relationship between overweight or obesity and blood pressure and risk for hypertension. Hubert *et al* (1983) and Stamler *et al* (1978) noted an odd ratio for hypertension of obese relative in younger and older individuals. As in the present study all the subjects are not obese, hence the relationship of hypertension and obesity is not accepted here.

Landhal *et al* (1986) reported that age related increase in systolic blood pressure was less pronounced in men, resulting in a higher (about 10 mm Hg) mean systolic blood pressure in women than in men after 60 years of age. They also reported that mean diastolic blood pressure in women also increased with age up to 70 years, but in men no change in diastolic blood pressure between 50 and 70 years of age in Swedish population. In the present study age related increase in systolic blood pressure is pronounced in men (almost 17 mm of Hg more in older individuals) resulting reverse picture i.e. men have higher systolic blood pressure than women (about 8 mm of Hg).

Recent studies have shown a less pronounced blood pressure increase after age of 50 years in women who are postmenopausal than in woman who still menstruate (Lindquist,1982). Present study also substantiates the hypothesis. Here the increase of mean systolic blood pressure in female is only 1 mm of Hg.

Kotchen *et al* (1982) observed that both systolic and diastolic blood pressure tended to increase with age and also observed sex effect on blood pressure. They observed higher systolic blood pressure in males than that of females between 16 and 40 years of age, in rural Kentucky community. Similar age sex difference have been observed in other population also (Johnson *et al*, 1965). In Indian population also, this tendency is proved to be true.

In men, previous studies in different countries (Boe *et al*, 1957; McDonough *et al*,1964; Johnson *et al*,1965; Eilertsen and Humerfelt,1968; Miall and Chinn,1973; Kannel and Gordon,1978; Stamler *et al*,1978; Svardsudd and Tibblin, 1980; Amery *et al*,1981; Waldron *et al*,1982) have shown an age related increase of blood pressure. The present findings are also in consistent with the observation of other workers. Men typically have higher blood pressure. The sexual dimorphism with blood pressure begins at puberty and persists through adult stages (Himmelmann *et al*.1994; Harshfield *et al*, 1994; Stamler *et al*,1976). In the present study this sex difference in blood pressure is also prominent both in case of systolic pressure and diastolic pressure.

Premenopausal women typically have lower blood pressure than age-matched men (Yanes and Reckelhoff, 2011). The NHANES (National Health and Nutrition Examination Survey)

III and IV studies showed that the prevalence of hypertension was greater in women of 60 years of age and older than men, regardless of ethnicity (Burl *et al*, 1995). In the present study post menopausal blood pressure is also low in women.

Wiinber *et al* (1995) studied blood pressure level in Danish men and women of aged 20 to 79 years and found that blood pressure increased with aging in both men and women but that, men had higher mean blood pressure by approximately 6 to 10 mm of Hg than did women. Khoury *et al* (1992) performed blood pressure monitoring in 131 men and women and found that men had higher blood pressure than did women. Findings were similar in a meta-analysis study performed by Staessen *et al* (1990). Reckelhoff (2001) in his review in gender difference in the regulation of blood pressure reported that blood pressure is higher in men than in women at similar age. All the observations are in concurrence with the present study also.

The findings of high blood pressure in men in the present study can be explained physiologically by the findings of several workers. Venegas-Pont *et al* (2010) reported that when placed on a high salt diet, the males reported with a further increase in blood pressure, whereas, females did not in case of mice. Androgens could promote hypertension by their effects and directly stimulates sodium reabsorption via the proximal tubules of the kidney.

Hypertension defined as a systolic blood pressure in excess of 140 mm of Hg and a diastolic pressure higher than 90 mm of Hg. But here in hypertension patients though average systolic blood pressure is 163.75 mm of Hg, mean diastolic blood pressure is 87.5 mm of Hg which are not in accordance with the definition of hypertension. Anastos *et al* (1991) observed that the incidence of uncontrolled hypertension is also greater in men than in women. This report is also in concurrence with the present observation. Prevalence of hypertension is also higher in men until after menopause in women when the prevalence of hypertension is higher in women than age matched men (Yanes and Reckelhoff, 2011). This finding is also true for the present study as only one fifth of the women population is affected of the total hypertension population.

Numerous dietary components have been identified as potentially impacting blood pressure, most notably sodium intake. But increased fruit and vegetable consumption is clearly pertinent as are numerous other macro and micro nutrients (Appel *et al*, 1997).Vegetarian diets are widely associated with low blood pressure level (Sacks *et al*, 1974). Physical activity, likewise, is associated with decrease in blood pressure level. The result is a situation in which it is not predictable to sort out independent causal effect. The argument then might emerged as to whether dietary or physical activity is a more desirable target for blood pressure control. Adoption of entire package of lifestyle changes, appropriate eating, physical activity and attention to weight management yields the greatest likelihood of success (Elmer *et al*,2006; He *et al*, 2000; Svetkey *et al*, 2008; Dornfield *et al*,1985; Reisen and Forhlich,1982; Davis *et al*,1993; Sjostrom *et al*, 2000; Sjostrom *et al*, 2001; Jeffery *et al*,2000; Kassirer and Angell, 1998; Wing and Phelan, 2005; Hypertension Prevention Trial Research Group, 1990; National Institutes of Health Technology Assessment Conference Panel, 1993; Institute of Medicine, 1995).

CONCLUSION

In the present study blood pressure changes follows the general rule of the aging process and sex. Considering all the observations of previous workers along with the present study, it can be concluded that maintenance of normal blood pressure in the rural population is controlled by the following factors:

1. No previous history of hypertension.
2. No obesity or overweight.
3. Dietary habit: mostly vegetarian.
4. Normal salt intake.
5. Engaged to different types of physical activities.

Acknowledgement

We are thankful to Teacher- in Charge, Rampurhat College for providing research facilities. We are indebted to Prof Alokesh Das, Dept. of Botany of this college for his suggestion and technical help.

References

Amery, A.; Hansson, L.; Andren, L.; Gudbrandsson, T.; Sivertsson, R. and Svensson, A. (1981). Hypertension in the elderly. *Acta Med. Scand*.; 210:221–229.

Anastos, K.; Charney, P.; Cohen, E.; Jones, C. Y.; Marte, C.; Swiderski, D. M.; Wheat, M. E. And Williams, S. (1991). Hypertension in women: what is really known? The Women's Caucus, Working Group on Women's Health of the Society of General Internal Medicine. *Ann. Intern. Med*. 115:287-293.

Appel, L. J.; Moore, T. J.; Obarzanek, E.; Vollmer, W. M.; Svetkey, L. P.; Sacks, F. M.; Bray, G. A.; Vogt, T. M.; Cutler, J. A.; Windhauser, M.M. and Lin, P. H. (1997). The DASH Collaborative Research Group. *N. Engl. J. Med*. 336:1117–1124.

Boe, J.; Humerfelt, S. and Wedervang, F. (1957). The blood pressure in a population: blood pressure readings and height and weight determinations in the adult population of the city of Bergen. *Acta Med. Scand*. [suppl]; 321:77–111.

Burl, V.L.; Whelton, P.; Roccella, E.J.; Brown, C.; Cutler, J.A.; Higgins, M.; Horan, M.J. and Labarthe, D. (1995) Prevalence of hypertension in the US adult population. Results from the third National Health and Nutrition Examination Survey, 1988–1991. *Hypertension* 25:305–313.

Chobanian, A. V.; Bakris, G. L.; Black, H. R.; Cushman, W. C.; Green, L. A.; Izzo, J. L.; Jones, D. W.; Materson, B. J.; Oparil, S.; Wright, J. T.; Roccella, E. J. and the National High blood Pressure Education Program Coordinating Committee (2003). Seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. Hypertension. 42: 1206-1252.

Chukwujekwu, I. E. (2014), Department of Anatomy, College of Health Science Nnamdi Azikwe University, Nnewi Campus, Anambra State, Nigeria.

Cornoni – Huntley, J. C.; Harlan, W. R. and Leaverton, P.E. (1979). Blood Pressure in adolescence: The United States Health examination Survey. Hypertension 1:566.

Davis, B. R.; Blaufox, D.; Oberman, A.; Wasserheil-Smoller, S.; Zimbaldi, N.; Cutler, J. A.; Kirchner, K. and

Langford, H. G. (1993). Reduction in long-term antihypertensive medication requirements: effects of weight reduction by dietary intervention in overweight persons with mid hypertension. *Arch. Intern. Med.*.153:1773–1782.

Dornfield, T. P.; Maxwell, M. H.; Waks, A. U.; Schroth, P. and Tuck, M. I. (1985). Obesity and hypertension : long term effects of weight reduction on blood pressure. *Int. J. Obes*. 9:381–389.

Eilertsen, E. and Humerfelt, S. (1968). The blood pressure in a representative population sample. *Acta Med. Scand.* 183:293–305.

Elmer, P. J.; Obarzanek, E.; Vollmen, W. M.; Morton–Simons, D.; Stevens, V, J.; Young, D. R.; Lin, P. H.; Champagne, C.; Harsha, D.W.; Svetkey, L. P. Ard, J.; Brantley, P. J.; Proschan, M. A. and Erlinger, T. P. (2006), Appel LJ for the PREMIER Collaborative Research Group. Effects of Comprehensive lifestyle modification on diet, weight, physical fitness and blood pressure control: 18 month results of a randomized trial. *Ann. Intern. Med*.144:485–495.

Harlan, W. R.; Cornoni – Huntley, J. C. and Leaverton, P.E. (1979): Blood pressure in childhood: The National Health Examination Survey. *Hypertension* 1:559.

Harshfield, G.A.; Alpert, B.S.; Puliam, D.A.; Somes, G.W. and Wilson, D.K. (1994). Ambulatory blood pressure recordings in children and adolescents. *Pediatrics* 94,180–184.

He, J.; Wheltron, P. K.; Appel, L. J.; Charleston, J. and Klag, M. J. (2000). Long-term effects on weight loss and dietary sodium reduction on incidence of hypertension. *Hypertension*;35:544–549.

Himmelmann, A.; Svensson, A. and Hansson, L. (1994) Influence of sex on blood pressure and left ventricular mass in adolescents: the hypertension in Pregnency offspring Study. *J. Hum. Hypertens*.8,485–490.

Hubert, H. B.; Feinleib, M.; McNamara, P.M. and Castelli, W.P. (1983). Obesity as an independent risk factor for Cardiovascular disease: a 26–year follow-up of participants in the Framingham Heart Study. *Circulation*. 67:968–977.

Hypertension Prevension Trial Research Group (1990). The hypertension prevention trial: three-year effects of dietary changes on blood pressure. *Arch. Intern. Med*.150:153–162.

Institute of Medicine. Weighing the Options: Criteria for evaluating weight management Programs (1995); Washington, DC. Govt. Pr off.

Jeffery, R. W. and Drewnowski, A. (2000). Epstein luteinizing hormone (LH), Stunkard AJ, Wilson GT, Wing RR, Hill DR. Long-term maintenance of weight loss: current status. *Health Psychol*.19:5-16.

Johnson, B. C.; Epstein, F. H. and Kjelsberg, M. D. (1965). Distributions and familial studies of blood pressure and serum cholesterol levels in a total community: Tecumseh, Michigan. *J. Chronic Dis*. 18:147–161.

Kannel, W. B. and Gordon, T. (1978). Evaluation of cardiovascular risk in the elderly: the Framingham study. *Bull. N.Y. Acad. Med*. 54:573–591.

Kassirer, J. and Angell, M. (1998). Losing weight-an ill-fated New Year's resolution. NEJM; 338:52–54.

Khoury, S.; Yarows, S. A.; O'Brien, T. K and Sowers, J.R. (1992). Ambulatory blood pressure monitoring in a non-academic setting: effects of age and sex. *Am. J. Hypertens.*5:616–623.

Kotchen, J. M.; Harlley, M. P. H. And McKean, E. (1982). Blood pressure trends with aging. *Hypertension* 4(5): 128-134.

Kotchen, J.M.; Kotchen, T. A.; Guthrie, G.P.; Cottrill, C.M.; and McKean, H.E. (1980): Correlates of adolescent blood pressure at 5 year follow – up. *Hypertension* 2 (Suppl I): 1 – 124.

Landhal, S. and Steen, B. (1981). Lakemedelskonsumption has 70- och 75- aringar. Lakartidningen 78:2458–2460.

Landhal, S.; Bengtsson, C.; Sigurdsson, J. A.; Svanborg, A. and Svardsudd, K. (1986). Age related changes in blood pressure. *Hypertension* 8(11): 1044-1049.

Lindquist, O. (1982). Influence of the menopause on ischaemic heart disease and its risk factors and on bone mineral content. *Acta obstet. Gynecol. Scand*. [suppl] 110:1–36.

Maranon, R. and Rickelhoff, J. F. (2013). Sex and gender differences in control of blood pressure. *Clinical Science* 125:311-318.

McDonough, J. R.; Garison, G. E. and Hamer, C. G. (1964). Blood pressure and hypertensive disease among negroes and whites: a study in Evans Country, Georgia. *Ann. Intern. Med*. 61:208–228.

Miall, W. E. and Chinn, S. (1973). Blood pressure and ageing: results of a 15-17 year follow-up study in South Wales. *Clin. Sci. Mol. Med*. 45:23–33.

National Institutes of Health Technology Assessment Conference Panel (1993). Methods for voluntary weight loss and control. *Ann. Intern. Med*.119:764–770.

Reisen, E. and Forhlich, E. D. (1982). Effects of weight reduction on arterial pressure. *J. Chron. Dis*. 33:887–891.

Reckelhoff, J. F. (2001). Gender differences in the regulation of blood pressure. Hypertension 37: 1199-1208.

Sacks, F. M.; Rosner, B. and Kass, E. H. (1974). Blood pressure in vegetarians. Am. J. Epidemiol. 100:390-398.

Sjostrom, C. D.; Peltonen, M. and Siosterm, L. (2001). Blood pressure and pulse pressure during long-term weight loss in the obese: the Swedish Obese Subjects (SOS) Intervention Study. Obes. Res; 9:188–195.

Sjostrom, C. D.; Peltonen, M.; Wedel, H. and Sjostorm, L. (2000). Differential long-term effects of intentional weight loss on diabetes and hypertension. Hypertension.36:20–25.

Staessen, J.; Fagard, R.; Lijenen, P.; Thijs, L.; Van Hoff, R. and Amery, A. (1990). Reference values for ambulatory blood pressure: a meta–analysis. J. Hypertens.8 (Suppl 6):S57–S64.

Stamler, R.; Stamler, J.; Riedlinger, W. F.; Algera, G. and Roberts, R. H. (1978). Weight and Blood pressure: findings in hypertension screening of 1 million Americans. *JAMA*; 240:1607–1610.

Stamler, J.; Stamler, R.; Riedlinger, W.F.; Algera, G. And Roberts, R.H (1976) Hypertension screening of 1 million Americans. Community Hypertension Evaluation Clinic (CHEC) Program, 1973 through 1975. JAMA, *J. Am. Med. Asoc.*235:2299–2306.

Svardsudd, K and Tibblin, G. (1980). A longitudinal blood-pressure study: change of blood-pressure during ten years in relation to age and initial level: the study of men born in 1913. *J. Chronic Dis*. 33:627–636.

Svetkey, L.P.; Stevens, V.J.; Brantley, P.J.; Appel, L. J.; Hollis, J. F.; Loria, C. M,; Vollmer, W. M.; Gullion, C. M.; Funk, K.; Smith, P.; Samuel-Hodges, C.; Myers, V. Lien, L. F.; Laferriere, D.; Kennedy, B.; Jerome, G. J.; Heinith, F.; Harsha, D.W.; Evans, P.; Erlinger, T. P.; Dalcin, A. R.; Coughlin, J.; Charleston, J.; Champagne, C. M.; Bauck, A.; Ard, J. D. and Aicher, K. for the Weight Loss Maintenence Collaborative Research Group (2008). Comparison of strategies for sustaining weight loss, the weight loss maintenance randomized controlled trial. *JAMA* 299:1139–1148.

Venegas–Pont, M.; Sartori–Valinotti, J.C.; Glover, P.H,; Reckelhoff, J.F. and Ryan, M.J. (2010). Sexual dimorphism in the blood pressure response to angiotensin II in mice after angiotensin-converting enzyme blockade. *Am. J. Hypertens*. 23:92–96.

Voors, A.W.; Webber, L.S. and Berenson, G.S. (1978): Epidemiology of essental hypertension in youth – implications for clinical practice. *Ped. Clin. North Am*. 25:15

Waldron, I.; Nowotarsky, M. and Freimer, M. (1982). Cross-cultural variation in blood pressure. *Soc. Sci. Med*. 16:419–430.

Wiinber, N.; Hoegholm, A.; Christensen. H.R.; Bang. L.E.; Mikkelsen, K. L.; Nielsen, P.E.; Svendesh. T.L.; Kampmann, J. P.; Madesn. N.H. and Bentzon. M.W. (1995).24 – h Amblatory blood pressure in 352 normal Danish Subjects, related to age and gender. *Am. J. Hypertens*. 8:978–986.

Wing, R.R. and Phelan, S. (2005). Long-term weight loss maintenance. *Am. J. Clin. Nutr*. 82:222S–225S.

Yanes, L.L. and Reckelhoff, J.F.(2011). Postmenopausal hypertension. *Am. J. Hypertens*. 24:740–749.

Yanes, L.L., Romero, D.G., Moulana, M., Lima, R., Davis, D.D., Zhang, H., Lockhart, R., Racusen, L.C. and Reckelhoff, J.F. (2011) Cardiovascular-renal and metabolic charecterization of a rat model of polycystic ovary syndrome. *Gender Med*. 8,103–115.

How to cite this article:

Sourav Ganguly.2018, Blood Pressure Profile in Rural Population of West Bengal, India. *Int J Recent Sci Res.* 9(4), pp. 25793-25798. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0904.1932

****