Asian Pac. J. Health Sci., 2015; 2(3):66-71 e-ISSN: 2349-0659, p-ISSN: 2350-0964

Blood Pressure values of Sri Lankan Tamils in Jaffna District, Sri Lanka

Balasubramaniam M*, Sivapalan K, Tharsha J, Sivatharushan V, Nishanthi V, Kinthusa S, Dilani M

Department of Physiology, Faculty of Medicine, University of Jaffna, Sri Lanka

ABSTRACT

Objective: To measure the blood pressure values of healthy Sri Lankan Tamils in Jaffna district and to correlate with anthropometric characters. **Design and setting:** Descriptive cross sectional study among the healthy Sri Lankan Tamils living in Jaffna district. **Measurements:** An interviewer administered questionnaire was used to select non smoking non alcoholic healthy volunteers. Age, Height, weight, Waist Circumference (WC) and Hip Circumference (HC) were obtained. Waist Hip Ratio (WHR) and Body Mass Index (BMI) were calculated. Blood pressure values were measured with mercury sphygmomanometer. Lowest blood pressure out of three readings obtained in 5 minutes interval after adequate rest was used for analysis. **Results**: Total of 1529 (615 males & 914 females) participants were included in this study. The age range of participants was 15-92 years. Systolic and diastolic blood pressure of females in reproductive age (20-44 years) was lower than that of males ($p<0.05$). Both systolic and diastolic blood pressures showed increase up to the age group of 50-54 years in males. Thereafter there was little reduction in the values which was not statistically significant ($p>0.05$). In females there was a gradual increase in blood pressure values with age. Significant ($p< 0.05$) mild correlation was observed between blood pressure values and anthropometric characters. **Conclusion:** This study will be useful as there are no published data available for healthy Sri Lankans Tamils.

Keywords: Diastolic Blood pressure, Sri Lankan Tamils, Systolic Blood Pressure

Introduction

Ischemic heart disease is a common cause of mortality in Sri Lanka. Hospital admissions due to ischemic heart diseases are higher in Sri Lanka than that in developed countries [1]. Increased blood pressure is an important risk factor for cardiovascular diseases. It is also associated with renal and cerebrovascular diseases. Increasing blood pressure is becoming a common problem in the world due to obesity, changing food habits and sedentary life style. One in four adults is reported to have hypertension in Sri Lanka [2].Defining hypertension depends on normal reference values of blood pressure. Individual variation in blood pressure occurs with sex, age, body weight [3], BMI [4], height [5], lean body mass [6] and total skin fold thickness [7]. In addition lack of physical activity, consumption of alcohol and smoking may also influence blood pressure.

*Correspondence
Balasubramaniam M
Department of Physiology, Faculty of Medicine, University of Jaffna, Sri Lanka.
E Mail: mathu1481@yahoo.com.

Information on normal blood pressure values will be useful in diagnosing hypertension, planning for prevention and in early treatment. Ethnic variations in blood pressure have been reported in the literature. Blood pressures of Indian Children were lower than that of US children. Also the values were lower than Jordanians, Pakistanis and Iranians who had higher values than US children [5]. Genetic, Social, economical, cultural and environmental factors of Sri Lankans differ from other ethnic groups. Published data available for blood pressure values of adults are also limited. In Sri Lanka a large survey was done on blood pressure values to detect the prevalence of hypertension. This was done in 6047 participants aged between 30-65 years from four provinces of Sri Lanka namely Western, North Central, Southern and Uva[8].Sinhalese people populate these districts predominantly. This study used the cut off values of world Health Organization (WHO) to detect hypertension. There are no published data for blood pressure values of healthy Sri Lankans, which would be better to define normal blood pressure. Using foreign data in Sri Lankans may not be appropriate as anthropometric characters differ from population to

population. Therefore, the present study was undertaken with the aim of establishing reference norms of blood pressure values for Sri Lankan Tamils in Jaffna district.

Materials and method

This was a descriptive cross sectional study among the healthy Sri Lankan Tamils living in Jaffna district. Ethical clearance was obtained from Ethical Review Committee, Faculty of Medicine, and University of Jaffna. Volunteers above 15 years of age were recruited in such a way to have 80 males and females in age group of 5 years. Data was collected in schools, at divisional secretariats, by standers of patients attending various clinics in different MOH areas, at the technical college, at temples and among university staff as determined to represent people in Jaffna District. Permission was obtained from each head of the institution prior to the study. Written informed consent was obtained from each participant. An interviewer administered questionnaire was used to get basic information about participants. The participants were recruited for the study if they were non smoking, not consuming alcohol, free from already diagnosed hypertension and diabetes, no signs or symptoms related to cardiac or renal or any other diseases which could elevate blood pressure, mentally healthy and not pregnant.

Age was calculated in years as on last birthday. Height was measured while the participant looks straight ahead while arms were either side of the body and back against the vertical support of the instrument. Weight was measured without foot wears. Both height and weight were measured to nearest 0.5 cm and 0.5 kg respectively using the Seca scale (Germany). Waist Circumference (WC) was measured midway between iliac crest and lower rib margin at the end of normal expiration with a non elastic measuring tape. Hip Circumference (HC) was measured at the maximum circumference of the buttocks with a non elastic measuring tape. Waist Hip Ratio (WHR) and Body Mass Index (BMI) were calculated. Blood pressure was measured in right arm by one qualified medical person while the participant was sitting with supported back and the arm supported at the heart level. It was confirmed that the person was resting for at least 5 minutes before measuring the blood pressure. Mercury sphygmomanometer and standard stethoscope were used to measure the blood pressure. Appropriate adult cuff that covers at least 80 % of the arm was used. Appearance and disappearance of the Korotkoff sound were taken as Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) respectively. Three measurements were taken with 5 minutes interval between each measurement. Lowest reading was taken for analysis. Data were analyzed in SPSS 16. Sex differences and differences between age groups were assessed by independent T test. Pearson correlation was used to get correlation between blood pressure values and anthropometric characters.

Results

Total of 1529 (615 males & 914 females) participants were included in this study. The age range of males was 15- 92 years and 17-85 years for females. Mean height (cm), weight (kg) and BMI (kg/m^2) of males were 169±7, 64.5±12.6 and 22.7±4 respectively. For females the respective values were 156±7, 54.7±4 and 22.6±4.6. HC and WC were 91±9 and 82±12 respectively in males. Females had HC and WC of 90±13, 78±14 respectively. Waist- Hip Ratio (WHR) was 0.9±0.07, 0.84±0.06 in males and females respectively. There was a statistically significant difference ($p< 0.05$) in anthropometric characteristics of males and females except in BMI. Both males and females were separately grouped in to age groups of 5 years. Blood pressure values of males and females in different age groups are summarized in Table 1.

Table 1: Blood Pressure values (mean±SD) of different age groups

Age range (years)	Males			Females			P values for sex differences	
	No of participants	SBP (mmHg)	DBP (mmHg)	No of participants	SBP (mmHg)	DBP (mmHg)	SBP	DBP
15-19	89	112±14	69±12	83	109±10	70±10	0.066	0.748
20-24	96	120±13	78±11	153	113±12	74±10	0.000*	0.017*
25-29	68	122±16	79±11	99	112±12	75±10	0.000*	0.008*
30-34	72	125±14	82±14	120	113±13	76±9	0.000*	0.000*

35-39	66	123±14	83±12	103	115±14	77±9	0.000*	0.000*
40-44	55	128±18	88±14	76	122±15	80±11	0.032*	0.001*
45-49	32	131±21	87±16	72	127±20	83±13	0.342	0.170
50-54	28	132±16	86±11	69	127±18	83±13	0.205	0.157
55-59	36	131±18	85±14	46	126±18	81±11	0.162	0.098
60-64	26	129±19	82±11	37	135±20	85±12	0.181	0.248
>64	47	136±20	82±15	56	137±21	82±12	0.828	0.953

SBP- Systolic Blood Pressure DBP- Diastolic Blood pressure * - $p < 0.05$

Lower systolic and diastolic blood pressure in females compared to males were statistically significant ($p<0.05$) in the age groups of 20-24, 25-29, 30-34, 35-39 and 40-44 (females in reproductive age). Both systolic and diastolic blood pressures increase up to the age of 50-54 years in males. Thereafter there was little reduction in the values which was not statistically significant. In females there was a gradual increase in blood pressure values. The change in SBP and DBP was significant between 14-19 and 20-24 age groups only in both sexes. In other groups the increase was not statistically significant ($p>0.05$) compared to previous age group. Pearson correlation between anthropometric and blood pressure values revealed significant ($p<0.05$) mild correlation of blood pressure values with various anthropometric characters (Table 2).

Table 2: Correlation coefficient blood pressure values with anthropometric characters

Anthropometric characters	**Males**		**Females**	
	SBP	**DBP**	**SBP**	**DBP**
Age	0.348*	0.258*	0.475*	0.335*
Height	0.009	0.116	-0.121	-0.058
Weight	0.293*	0.394*	0.175*	0.239*
Waist circumference	0.393*	0.450*	0.211*	0.216*
Hip circumference	0.332*	0.401*	0.172*	0.186*
Waist-Hip ratio	0.291*	0.308*	0.169*	0.150*
BMI	0.316*	0.383*	0.229*	0.276*

SBP- Systolic Blood Pressure DBP- Diastolic Blood Pressure * $p < 0.001$

Although both systolic and diastolic blood pressures have significant mild positive correlation with age, SBP has higher correlation than DBP in both sexes. Influence of obesity indicators like BMI, WC, and WHR on Blood pressure values was studied. The participants were re-grouped into age of decades starting from 15- 24 years and then, each age group was divided into low, normal and high BMI according to the BMI cut off values for Asian adults [9]. This regrouping was necessary because dividing the original groups did not have adequate numbers for statistical analysis. Blood pressure values of each group are given in Table 3. Also they were divided using Asian cut off values for WC and WHR [9] separately and analyzed (Table 4 &5).

Table 3: Blood pressure in different age groups according to BMI

Age group	**BMI**					
	Low (<18.5)		**Normal (18.5- 24.9)**		**High(>25.0)**	
	SBP	**DBP**	**SBP**	**DBP**	**SBP**	**DBP**
Males						
15-24	112±13(59)	72±18	116±14(89) *	**72**±12**	123±11(37) *	79±11**
25-34	118±18(18)	76±18	117±14(41) *	76±9**	128±14(81) *	84±11**
35-44	112±13(6)	69±15	123±16(35)	84±14	127±16(79)	87±11
45-54	130±9(3)	78±7	131±17(23)	84±9	131±20(33)	90±16
55-64	125±13(6)	75±8	124±19(24) *	81±13	135±17(31) *	87±12
>65	135±22(10)	83±13	138±18(22)	82±13	142±24(19)	88±17

			Females			
15-24	108±13(79)	71±9	111±10* (121)	**73**±4	118±9*(36)	75±7
25-34	108±12(28)	71±8	111±11*(77)	74±9**	115±13*(112)	77±9**
35-44	110±16(20)	72±12	114±14*(39)	76±9**	121±14*(99)	81±10**
45-54	120±15(10)	79±8	124±18(59)	81±11	128±20(90)	84±13
55-64	127±17(17)	79±10	131±21(30)	82±12	130±19(35)	84±11
>65	135±22(20)	83±13	138±18(17)	82±12	137±21(16)	80±10

* - SBP difference in both groups is significant at p <0.05 level
** - DBP difference in both groups is significant at p <0.05 level

Within each age group both SBP and DBP increased with increase in BMI. Statistically significant increase (p<0.05) in both SBP and DBP was noticed between normal and high BMI group until 34 years in males. In females, until the age of 44, higher BMI group had significantly higher (p<0.05) blood pressure values than normal BMI group.

Table 4: Blood pressure based on WC

Age group	**SBP**	**DBP**	**SBP**	**DBP**
Males	**WC≤ 90 cm**		**WC> 90 cm**	
15-24	116±14(177)	73±12	123±11(7)	82±10
25-34	122±15(107) *	79±12**	129±13(32) *	87±11**
35-44	123±15(67)	82±12**	128±17(51)	90±12**
45-54	129±18(36)	84±12	133±18(23)	91±13
55-64	126±17(34)	80±11**	133±19(22)	87±14**
>65	131±19(20)	78±13**	140±25(29)	88±18**
Females	**WC≤ 80 cm**		**WC> 80 cm**	
15-24	111±12(189)	73±10	113±9(43)	72±10
25-34	111±13*(155)	74±10	116±12*(61)	77±9
35-44	115±15*(92)	76±10**	121±13*(83)	80±10**
45-54	121±17*(60)	76±10**	130±18*(78)	81±10**
55-64	128±18(52)	81±10	133±20(30)	84±13
>65	135±19(37)	81±12	137±23(13)	80±11

* - SBP difference in both groups is significant at p <0.05 level
** - DBP difference in both groups is significant at p <0.05 level

SBP and DBP were increased as WC increased in the same age group. DBP was significantly higher (p<0.05) in males who had higher WC than the Asian cutoff values compared to those who had normal.WC in the same age group. In females statistically significant (p<0.05) differences were observed until 54 years between both groups. However in all the age groups of both sexes, SBP& DBP values increased as WC increased.

Table 5: Blood pressure based on WHR

Age group	**SBP**	**DBP**	**SBP**	**DBP**
Males	**WHR ≤0.9**		**WHR> 0.9**	
15-24	116±14(150)	73±13**	119±12(27)	79±11**
25-34	122±16(74)	79±14**	125±14(59)	83±11**
35-44	120±16(29)	82±15	127±16(85)	88±12
45-54	120±14(17) *	80±9**	133±16(39) *	88±13**
55-64	127±14(10)	81±7	128±17(42)	83±12
>65	131±20(9)	79±13	139±22(36)	85±6
Females	**WHR≤0.85**		**WHR> 0.85**	
15-24	111±12(152)	73±10	111±11(79)	72±10

25-34	112±13(140)	74±9	113±13(76)	77±9
35-44	117±15(89)	77±10*	119±14(85)	80±11*
45-54	122±15(52)	81±9	128±19(86)	83±14
55-64	127±18(41)	81±10	133±20(40)	85±12
>65	132±22(23)	81±10	139±17(27)	81±13

* - SBP difference in both groups is significant at p <0.05 level
** - DBP difference in both groups is significant at p <0.05 level

In males, statistically significant differences (p<0.05) in DBP were observed between participant who had normal and higher WHR. In females WHR did not influence statistically (p>0.05) on blood pressure values.

Discussion

Blood pressure values of females in reproductive age group were lower than males which was statistically significant (p<0.05). Thereafter there was no significant difference between both sexes. After age of 45, females who had higher BMI did not differ statistically (p> 0.05) from females of same age with normal BMI. Increased blood pressure values in menopausal women have been reported by Stressen etal [10]. This is explained by reduced estrogen to testosterone ratio after menopause. We did not investigate menopausal age in our participants. However above 45 years most of the females would have achieved menopause. This could have caused the blood pressure of females similar to that of males above this age. Another possible reason could be our sample sizes in groups above 45 years were smaller which may have affected the results of statistical analysis.

Increase in systolic and diastolic blood pressure with age was consistent with other authors [8, 11, 12].This can be explained by increase in stiffness of the arterial wall due to the replacement of elastin fibers with collagen. Statistically significant mild correlation of blood pressure values with BMI, weight, WC, HC and WHR were obtained in our study. Increase in blood pressure values, as the people become obese as indicated by BMI, WC and WHR was noticed in our results. This explains that obesity is a risk factor for high blood pressure.

Our values seems to be higher than the values of Wijewardena *et al* [8] which was a population study in Sri Lanka done to detect the prevalence of hypertension in 4 provinces with Sinhalese as predominant population. Blood pressure values of participants on anti hypertensive treatment were excluded from the analysis of this study. Our participants were non-smoking non-alcoholic and free from diseases causing hypertension. Our data collections were done at work places, clinics and public places which could have increased the blood pressure values due to anxiety and work stress. Even though precautions were taken to rest them for at least 5 minutes, we could not assure that anxiety or stress did not influence completely as we could not bring the participants to laboratory and give complete rest. This was a limitation in our study. The study of Wijewardena *et al* was done a decade ago. Life style changes towards a sedentary life and increasing fast foods would have increased the blood pressure in our participants in addition to ethnic variation.

However our study was done in large number of healthy population. There are no published data available for healthy Sri Lankan Tamils. Therefore this study provides useful information on blood pressure values of Sri Lankan Tamils in Jaffna district. Further studies in a convenient environment are essential for more accurate results.

Acknowledgement

The authors acknowledge Mr. S. B. Rameshkumar, Mr. Pavalarajah and other staff at the Dept. of Physiology for their help in arrangement. Dr Ramalingam Nagaratnam Research fund from Faculty of Medicine, University of Jaffna and Jaffna University Research grant – 2014 are greatly appreciated.

References

1. Ministry of Healthcare and Nutrition Sri Lanka 2009. The national policy for prevention and control of chronic non communicable diseases.
2. Katulanda P, Gunawardena ANP, Constantine JR. Prevalence and correlates of hypertension in Sri Lanka. Ceylon College of Physicians - 42nd Annual Academic Sessions; 2009, 43pp.
3. Gilles Paradis, Mark S Tremblay, Ian Janssen, Arnaud Chiolero, Tracey Bushnik. Blood pressure in Canadianchildren and adolescents. Health Reports 2010; 21(2) .Statistics Canada, Catalogue no. 82-003-XPE.

4. Sudip Datta Banik. Age-Sex and Diurnal Variation of Blood Pressurein Different Nutritional States among the Adult Telegas of Kharagpur in West Bengal, India. *Coll Antropol* 2007; 31: 717–22.
5. Nazeem I Siddiqui, Bose S. Age and height specific normative reference limits of blood pressure inschool going children in Indian population. *Indian Journal of Basic &Applied Medical Research*2012; 1: 268-78.
6. VivekVerma, SK Singh. Influence of lean body mass index versus that of fat mass index onblood pressure of Gujarati school going adolescents. *Indian J Physiol Pharmacol* 2014; 58: 39-44.
7. Renu Lohitashwa ,Parwati Patil. A cross sectional study of relationship of obesity indices with blood pressure and blood glucose level in young adult medical students. *International Journal of Basic Medical Science* 2012; 3: 102-7.
8. Wijewardene K, Mohideen MR, Mendis S, Fernado DS, Kulathilaka T, Weerasekara D, UluwittaP.Prevalence of hypertension, diabetes and obesity: baseline findings of apopulation based survey in four provinces in Sri Lanka. *Ceylon Med J* 2005; 50: 62-70.
9. World Health Organization.Waist Circumference and Waist–Hip Ratio:Report of a WHO Expert Consultation, Geneva, 8–11 December 2008.
10. Jan Staessen, Christopher J Bulpitt, Robert Figard, Paul Lijnen, Antoon Amery. The influence of menopause on blood pressure. *J Hum Hypertens* 1989; 3: 427-33.
11. Violet Kankane Moselakgomo, Abel LaminaToriola, Brandon Stuwart Shaw, Daniel Ter Goon, Oluwadari Akinyemi. Body mass index, overweight and blood pressure among adolescentschoolchildren in Limpopo province, South Africa. *Rev Paul Pediatr* 2012; 30: 562-9.
12. Mungreipy N.K, Kapoor S, Sinha R. Association between BMI, Blood pressure, and age: Study among Tangkhul Naga Tribal Males of Northeast India. *J Anthropol* 2011. doi: 10.1155/2011 /748147.

Source of Support: Nil
Conflict of Interest: None