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RESEARCH ARTICLE

RELATIONSHIP BETWEEN BODY MASS INDEX AND BLOOD PRESSURE PROFILE AMONG ADOLESCENTS

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ABSTRACT

Non communicable diseases (NCDs) and their associated risk factors have emerged as major public health challenges globally. It is well established that the co-existence of two or more risk factors is associated with increased risk of developing NCDs than would be expected on the basis of the sum of the separate effects. The World Health Organization (WHO) has already warned of increasing NCDs among adolescents as a major public health problem. The importance of this age group also lies in the fact that many serious diseases in adulthood have their roots in adolescence. With this context in the background, the present research was conducted to assess the relationship between body mass index and blood pressure profile. The sample of the study comprised 400 adolescents (16-18yrs) across the gender, residing in Urban Jammu district in J&K state of India and studying in the Central Board of Secondary Education (CBSE) schools. The research was undertaken with following objectives:

- Prepare blood pressure profile of selected adolescents
- Asses the body mass index of selected sample
- Study interrelation between blood pressure profile and BMI among the sample adolescent group.

To assess the BMI of sample adolescents anthropometric measurements (including height, weight), standardized anthropometric rod and was used. Electronic blood pressure apparatus (sphygmomanometer) was used to measure blood pressure. Analysis of data revealed that sample girls and boys were having mean height as 160cms and 172cms respectively, which was far less than National Centre for Health Statistics (NCHS, 2010). Mean BMI was 21.74 for girls and 21.08 for boys. More than half of the sample adolescents (52%) were pre- hypertensive. 47.25% of sample adolescents were normotensive and 7.5% of sample adolescents were in hypertensive stage I. Blood pressure readings were found to shift from normotensive to hypertensive with increase in body mass index in sample adolescents. The research has implications for inclusion of indigenous data in the already existing database and for planning health related policies and programmers for adolescents.

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INTRODUCTION

Prevalence of NCDs was experienced in developed countries but now it is increasing in developing countries like India because of the epidemiological transition and adoption of western life-style like low physical activity, high energy food and substance abuse among rural population (Gupta and Gupta, 1996).Lifestyle factors appear to influence the accumulation of fat, which in turn relates to the development of major and conditional NCD risk factors.

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The ICMR (2003-2006) conducted a multi centric study at Ballabgarh (Haryana), Chennai (Tamil- Nadu), Dibrugarh (Assam), Delhi, Nagpur (Maharashtra) and Thiruvanathapuram (Kerala) on risk factors for NCD with WHO support. The ICMR has established formal links with various governments, universities, institutions, agencies across the world to foster biomedical research (Shah & Mathur, 2010).The ICMR-WHO collaborative initiative on NCD risk factor surveillance at six sites provided the requisite experience and mandate to respond to the call of the Ministry of Health and Family Welfare, Govt. of India, to develop the strategy and modules for undertaking NCD risk factor surveillance at a national level. The World Bank supported the Govt. of India to conduct NCD risk factor surveillance under the integrated disease surveillance project (IDSP) in 29 states / UTs in three phases, beginning in 2007.

In Jan, 2008, the Ministry of Health & Family welfare launched the pilot phase of the National programme for prevention and control of Diabetes, CVD and Stroke in 10 districts of the country, and would eventually cover the entire country (Anand et al., 2007). While many studies on relationship between health status and NCD risk factors have been undertaken at the national and international levels, no study on this aspect has been in Jammu district (J&K). None of the earlier studies have been conducted among adolescents of Jammu district. This study is expected to provide data regarding the health risks and associated risk factors among adolescents of Jammu and suggest viable solutions for the problems being faced by them. The research is also envisaged to provide requisite data for ICMR –WHO collaborative initiative on NCD risk factor surveillance, to develop the strategy and modules for undertaking NCD risk factor surveillance at Jammu district level.

MATERIALS AND METHODS

The sample of the study comprised 400 adolescents (divided across gender) between age group 16-18yrs and residing in urban Jammu city. Sample adolescents was selected from various CBSE schools of urban areas of Jammu city through multistage sampling. The following criteria were considered for the sample selection. Only respondents from urban areas of Jammu district were selected for the study. Respondents between the age group of 16-18years were included in the sample. Respondents who fall in the SES group (high and middle income) were selected.

Tools used

- Assessment of body mass index (BMI)
  - Anthropometric measurements including height, weight and BMI (Qutlet index). The calculations were compared with WHO (2010) standard.
- Assessment of blood pressure profile
  - Automated or digital BP sphygmomanometers were easy to use on teens. Once the patient and cuff were positioned properly, the researcher pressed a button on the unit to begin measuring BP with the oscillometric technique. No stethoscope was required and BP and pulse readings were displayed on the unit's screen. Using the correct cuff size is crucial. With proper training on the specific unit and close attention to positioning, fewer operator errors were expected. Since the investigator is a trained physiotherapist, she was able to use the apparatus in the standard manner. Two readings were, however, taken to ensure accuracy in readings. It is recommended that mercury sphygmomanometers remain available as a reference standard for clinical validation of mercury-free blood-pressure measurement devices. The validation of the electronic blood pressure apparatus was constantly undertaken in accordance with this recommendation.

RESULTS AND DISCUSSION

The data collected from sample adolescents (16-18yrs) of Jammu district was analyzed and presented with the help of tables under the following headings:

- Anthropometric measurements of the sample group
- Blood pressure profile of the sample group
- Relationship between BMI and Blood pressure profile among the sample group

Anthropometric measurements of the sample group: Anthropometry term is derived from Greek word 'anthropos' means human and 'metron' means measure (https://en.wikipedia.org/wiki/Anthropometry#cite_note-1, retrieved on 28-3-16). Anthropometry involves the systematic measurement of the physical properties of the human body, primarily dimensional descriptors of body size and shape (Ariful et al., 2001). Modification in lifestyles, nutrition, and ethnic composition of populations lead to changes in the distribution of body dimensions, and require regular anthropometric checkups.

Table 1 reveals anthropometric characteristics of sample adolescents and shows their comparison with National Center for Health Statistics (NCHS, 2010). It was evident from the obtained data that the sample (pooled group) adolescent girls and boys were having mean height as 160cms and 172cms respectively, which was less than their standard height as per age (NCHS norms). Even with regard to standard weight, the sample girls and boys were having less weight as per age. The results were found highly significant when analyzed statistically. The mean BMI was 21.74 and 21.08 for girls and boys respectively, which was under normal BMI category (18-25). Even though BMI was normal, both height and weight among teens was less as per standards resulting in short stature. Figure 1 throws light on BMI percentiles of sample adolescents. It was observed that 15% of girls and 16.5% of sample boys were underweight. Even 18% sample boys and 16% girls were found to be overweight. It was seen that 2.5% sample were girls were obese. No sample boy was found to be obese.

Blood pressure profile of the sample group: The importance of hypertension in childhood and adolescence has not been as well documented as in adults. Children with elevated blood pressure can develop target organ damage (Lande et al., 2006), and they are also at increased risk of cardiovascular disease in adulthood (Must et al., 1991). Consequently, detection and management of elevated BP at an early age may be an important means for limiting the disease burden due to hypertension (Mustaq et al., 2012). Table 2 shows blood pressure profile of sample adolescents and prevalence of hypertension among them. It is depicted from the table that more than half of the adolescents (52%) were in pre-hypertensive category (blood pressure ranging from 120-139mm Hg for systolic and 80-89mmHg for diastolic).47.25% of sample adolescents from the pooled group were normotensive (blood pressure ranging from <120mmHg for systolic and <80mmHg for diastolic, as per National Nutrition Monitoring Bureau, NNMB). It was also seen that a very small number (0.75%) of sample adolescents were in hypertensive stage I (blood pressure ranging from 140-160mmHg for systolic and 90-99mm Hg for diastolic blood pressure). When analyzed statistically, the results were insignificant with regard to gender.

Relationship between BMI and Blood pressure profile among the sample group: The association between measures of body mass and blood pressure has been widely acknowledged, usually with body mass index (kg/m^2) as the measure of relative weight (Stamler, 1991).

Table 1. Anthropometric Characteristics of Sample Adolescents

Anthropometric Measurements	Pooled group (400)	
	Girls(200) With regard to Std values $\bar{x}\pm\sigma$	Boys(200) With regard to Std values $\bar{x}\pm\sigma$
Height (NCHS Average Value , 2010) G:163cms B: 176cms	160±8.73 t:259.11** p: 0.00	172±8.00 t:303.45** p: 0.00
Weight (NCHS Average Value) G:64kgs B: 74kgs	55.54±11.70 t:60.31** p:0.00	62±10.61 t:82.97** p:0.00
BMI (ICMR) 18-24.9	21.74±4.10	21.08±3.03

Table 2. Blood Pressure Profile of Sample Adolescents across gender

Blood Pressure Profile (NNMB, 2006)	Sample group (400)		
	G 200 n	B 200 n	T 400 n
Normotensive	102 (51%)	87 (43.5%)	189 (47.25%)
Pre- hypertensive	95 (47.5%)	113 (56.5%)	208 (52%)
Hypertensive (stage 1)	3 (1.5%)	-	3 (0.75%)
Hypertensive (stage 2)	-	-	-

Inter gender (7&8): t: 0.95,p: 0.33 for systolic BP and t: 0.15, p:0.88 for diastolic BP

Table 3. Association of BMI and Blood pressure profile among Sample adolescents

BMI	Blood Pressure Profile					
	Normotensive		Pre - Hypertensive		Hypertensive stage I	
Underweight	Girls (102) n		Boys (87) n		Girls (95) n	
	16 (15.68%)	19 (21.83%)	13 (13.68%)	Boys (113) n	Girls (3) n	Boys (0) n
Healthy Weight	73 (71.56%)	55 (63.21%)	62 (65.26%)	19 (16.81%)	1 (33.33%)	0
Overweight	11 (10.78%)	13 (14.94%)	17 (17.89%)	71 (62.83%)	2 (66.66%)	0
Obese	2 (1.96%)	0	3 (3.15)	23 (20.35%)	0	0
r/p value	r: 0.06, p:0.49			0	0	0

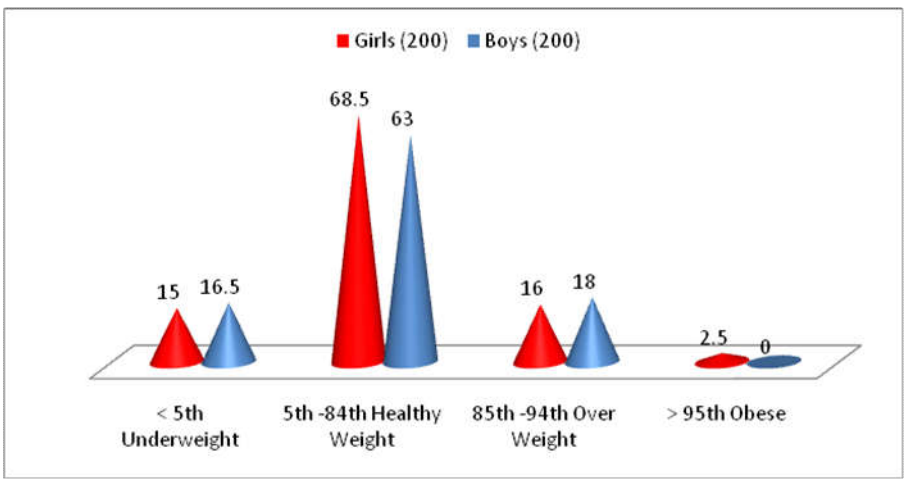

Figure 1. Body Mass Index (percentiles) for Age among Sample Adolescents

The relationship between two, however consistent, is rather modest in magnitude, and large sample sizes are therefore required in order to make estimates with any degree of certainty (Hall, 1994). Due to modernisation, the standard of living continues to rise especially in developing countries. This has led to malnutrition and obesity, which are posing a threat to public. Obesity is perhaps the most established form of malnutrition in developing countries, both among adults and children. Studies have demonstrated that obesity is related to elevated systolic blood pressure (SBP) and diastolic blood pressure (DBP) elevation, dyslipidemia, diabetes, etc (Yusuf et al., 2005). India, in a process of rapid economic development and urbanisation with changing life style factors, has witnessed an increasing trend of hypertension especially among urban population (Srikanth et al., 2011). It is therefore, significant to study the association between BMI. It was seen in Table 3 that sample teens in all the categories of BMI were more prone to hypertension. Most of teens in healthy weight were having normal BP readings but many were pre hypertensive and hypertensive too. Though statistically correlation between BMI and blood pressure profile was found insignificant which may be attributed to small sample size.

Conclusion

The major findings of the research are presented below:

Anthropometric Characteristics of Sample Adolescents: Sample adolescent girls and boys were having mean height as 160cms and 172cms respectively, which was far less than their standard height as per age for NCHS norms. Even with regard to standard weight, the sample girls and boys were having less weight as compared to NCHS (2010) norms. The difference was found significant when analyzed statistically for obtained height and weight with standardized norms. The mean BMI was 21.74 and 21.08 for girls and boys respectively, which was in normal BMI category (18-25).

Many studies have revealed similar findings from different regions of India. A study was conducted by Maiti et al. (2011) to ascertain the growth and nutritional status of adolescent school girls in rural area, West Bengal. The results revealed that the weights and heights of sample girls were below those of standard value and mild malnutrition and stunted growth was present in them. Kalhan et al. (2010) assessed the nutritional status of young school girls of Haryana.Their average weight, height were 22.3% and 14.9% of the reference values. The findings of these studies supported the results of present study. The results of the present study are also in line with the study of Goyle (2009) who reported mean weight were only 75-79% and height were 95-96% to standardized norms in adolescents of Jaipur. One of the research studies reported very high prevalence of stunting and thinness among the boys and girls with significant difference in the prevalence of under nutrition in terms of age and sex amongst them (Sen and Mondal, 2010). A low prevalence of stunting has also been reported by Anand et al. (1999). Many studies reported the normal BMI along with stunting ["height for age" value to be less than two standard deviations of the WHO Child Growth Standards median (WHO, 2006)], as found in present research (Saraf et al., 2012; Kapil et al., 2002 and Gupta et al., 1997).

Body Mass Index (percentiles) for Age percentiles among Sample Adolescents: Among the sample adolescents of the present research 17.25% were underweight, 65.75% healthy weight, 16% overweight and 1.25% obese. Prevalence of underweight was more than obesity in present sample.
There are a number of studies reporting the occurrence of thinness among youth in India (Medhi et al.,2007; Deshmukh et al., 2006; De Onis et al., 2001). In present research, more females were found in overweight and obese category than their boys counterpart. Similar findings were reported in the study carried out amongst adolescents in selected schools in Port Harcourt where prevalence of overweight was more in females than males 1.5% of adolescents were found to be obese (Adesina et al., 2012). The prevalence of obesity was 0.8%-3.7% in boys and 0.0-1.9% in girls (Jakimaviciene & Tutkuviene, 2007) similar to our findings. Contrary to our findings, many studies reported that there is consistent increase in BMI and adolescents are moving toward overweight and obesity (Baratta et al., 2006; Hoelscher et al., 2004).

Blood Pressure Profile of Sample Adolescents: It was evident from the data that more than half of the sample adolescents (52%) were in pre- hypertensive category (blood pressure ranging from 120-139mm Hg for systolic and 80-89mmHg for diastolic).47.25% of sample adolescents were normotensive (blood pressure ranging from <120mmHg for systolic and <80mmHg for diastolic, as per National Nutrition Monitoring Bureau, NNMB). It was also seen that 0.75% of sample adolescents were found in hypertensive stage 1(blood pressure ranging from 140-160mmHg for systolic and 90-99mm Hg for diastolic blood pressure). Similar results have been reported in earlier research studies carried out in different parts of the world. Urrutia-Rojas et al. (2006) reported prevalence of essential hypertension during childhood, ranging from 1.2% to 13%. Even though the pre-hypertensive adolescents cannot be considered hypertensive but these subjects are likely to experience the consequences of these alterations during adulthood (Graeter, 2011). A study done by Mushroor et al., 2015 reported high prevalence of pre hypertension in adolescents of Bangladesh and no significant difference was seen across the gender. Charan et al. (2011) found prevalence of hypertension in males as 6.74% and females 6.13%. A high rate of hypertension was seen in young females (Koura et al., 2012) and males (Sabra, 2007) in Dammam city. Essa and Shemmy (2015) reported that more than half of sample adolescents were pre hypertensive in their study. Hypertension is the powerful universal contributor to cardiovascular mortality. An elevated BP, labile or fixed, systolic or diastolic, at any age, in either sex, is a contributor to all forms of cardiovascular diseases (Wang et al., 2008; Kannel, 1975).

Blood pressure profile and selected lifestyle variables: Most of adolescents were found to be pre-hypertensive irrespective of BMI they had. Statistically correlation between blood pressure profile and BMI was found insignificant. It was further concluded that apart from BMI other risk factors also play important role in determining blood pressure profile of an individual. The present research was undertaken on the premise that BMI of adolescents may be related to their blood pressure readings. Although this correlation was found insignificant among sample adolescents, other results that have been obtained are quite significant especially because no such data is available for this part of the region. A large number of adolescents were found to be showing stunted growth and were also in the pre hypertensive category. These results are alarming and point to a need for undertaking extensive

research and intervention measures at a larger scale so that appropriate timely corrective action is done.

REFERENCES

Gupta, R., and Gupta, V.P. 1996. Meta analysis of coronary heart disease prevalence in India. *Indian Heart Journal*, 48, 241-245.

Shah, B. and Mathur, P. 2010. Surveillance of cardiovascular disease risk factors in India : The need and scope. *Indian Journal of Medical research*, 132, 634 – 642.

Anand, K., Shah, B., Yadav, K., Singh, R., Mathur, P., Paul, E. and Kapoor, S. K. 2007. Are the urban poor vulnerable to non-communicable diseases? A survey of risk factors for non-communicable diseases in urban slums of Faridabad. *National Medical Journal of India*, *20*(3), 115.

Ariful, M.D., Islam, M.D., Asadujjaman, M.D., Hussain, M. 2001. Ergonomics consideration for hospital bed design: A case study in Bangladesh". *Journal of Modern Science and Technology*, 1 (1), 30-44.

Mustaq, M.U., Gull, S., Mustaq, K., Abdullah, H.M., Khursid, U., Shahid, U., Shad, M.A., Akram, J. 2012. Height, weight, and BMI percentiles and nutritional status relative the international growth references among Pakistani school-aged children. *BMC Pediatrics* 2(31), 1-11.

Landa, M.B., Carson, N.L., Roy, J., Meagher, C.C. Effects of childhood primary hypertension on carotid intima media thickness: a matched controlled study. *Hypertension*, 48 (1), 40-44.

Must, A., Dallal, G.E., Dietz, W.H. 1991. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht2) and triceps skinfold thickness. *Am J Clin Nutr*; 53(4), 839-46.

Hall, B. H. 2002. The financing of research and development. *Oxford review of economic policy*, *18*(1), 35-51.

Srikanth, J., Kumar, K. J. and Murthy, M. N. 2011. Factors Influencing Obesity Among Urban High School Children In Bangalore City. *The Indian Journal of Nutrition and Dietetics*, *48*(1), 8-17.

Stamler, J. 1991. Blood pressure and high blood pressure. Aspects of risk. *Hypertension*, *18*(3 Suppl), I95.

Maiti, S., Ali, K. M., De, D., Bera, T. K., Ghosh, D. and Paul, S. 2011. A comparative study on nutritional status of urban and rural early adolescent school girls of West Bengal, India. *Journal of Nepal Paediatric Society*, *31*(3), 169-174.

Kalhan, M., Vashisht, B., Kumar, V. and Sharma, S. (2010). Nutritional status of adolescent girls of rural Haryana. *Internet J Epidemiol*, *8*(1).

Goyle, A. 2009. Nutritional status of girls studying in a government school in Jaipur city as determined by anthropometry. *Anthropologist*, *11*(3), 225-227.

Sen, J., Roy, A. and Mondal, N. (2010). Association of maternal nutritional status, body composition and socio-economic variables with low birth weight in India. *Journal of tropical pediatrics*, *56*(4), 254-259.

Anand, K., Kant, S. and Kapoor, S. K. 1999. Nutritional status of adolescent school children in rural north India. *Indian pediatrics*, *36*, 810-816.

Saraf, D. S., Nongkynrih, B., Pandav, C. S., Gupta, S. K., Shah, B., Kapoor, S. K. and Krishnan, A. 2012. A systematic review of school-based interventions to prevent risk factors associated with noncommunicable diseases. *Asia-Pacific journal of public health*, 10.

Kapil, U. and Bhavna, A. 2002. Adverse effects of poor micronutrient status during childhood and adolescence. *Nutrition reviews*, *60*(s5), S84-S90.

Gupta, S., Pablo, A. M., c Jiang, X., Wang, N., Tall, A. R. and Schindler, C. 1997. IFN-gamma potentiates atherosclerosis in ApoE knock-out mice. *Journal of Clinical Investigation*, *99*(11), 2752.

World Health Organization. 2006. *WHO child growth standards: length/height for age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age, methods and development*. World Health Organization.

Medhi, G. K., Hazarika, N. C. and Mahanta, J. 2007. Nutritional status of adolescents among tea garden workers. *The Indian Journal of Pediatrics*, *74*(4), 343-347.

Deshmukh, P. R., Gupta, S. S., Bharambe, M. S., Dongre, A. R., Maliye, C., Kaur, S. and Garg, B. S. 2006. Nutritional status of adolescents in rural Wardha. *Indian Journal of Pediatrics*, *73*(2), 139-141.

De Onis, M., Dasgupta, P., Saha, S., Sengupta, D. and Blössner, M. 2001. The National Center for Health Statistics reference and the growth of Indian adolescent boys. *The American journal of clinical nutrition*, *74*(2), 248-253.

Adesina, A. F., Peterside, O., Anochie, I. and Akani, N. A. 2012. Weight status of adolescents in secondary schools in port Harcourt using Body Mass Index (BMI). *Italian journal of pediatrics*, *38*(1), 31.

Jakimaviciene, E. M. and Tutkuviene, J. 2007. Trends in body mass index, prevalence of overweight and obesity in preschool Lithuanian children, 1986–2006. *Collegium antropologicum*, *31*(1), 79-88.

Baratta, R., Degano, C., Leonardi, D., Vigneri, R. and Frittitta, L. 2006. High prevalence of overweight and obesity in 11–15-year-old children from Sicily. *Nutrition, metabolism and cardiovascular diseases*, *16*(4), 249-255.

Hoelscher, D. M., Day, R. S., Lee, E. S., Frankowski, R. F., Kelder, S. H., Ward, J. L. and Scheurer, M. E. 2004. Measuring the prevalence of overweight in Texas schoolchildren. *American journal of public health*, *94*(6), 1002-1008.

Urrutia-Rojas, X., Egbuchunam, C. U., Bae, S., Menchaca, J., Bayona, M., Rivers, P. A. and Singh, K. P. 2006. High blood pressure in school children: prevalence and risk factors. *BMC pediatrics*, *6*(1), 32.

Graeter, M. 2011. The relationship between dietary self-monitoring and blood pressure changes in adolescents with pre-hypertension or hypertension participating in a nutrition intervention emphasizing the DASH diet (Doctoral dissertation, University of Cincinnati).

Sabra, A. A., Taha, A. Z., Al-Sebiany, A. M., Al-Kurashi, N. Y. and Al-Zubier, A. G. 2007. Coronary heart disease risk factors: prevalence and behavior among male university students in Dammam City, Saudi Arabia. *J Egypt Public Health Assoc*, *82*(1-2), 21-42.

Koura, M. R., Al-Dabal, B. K., Rasheed, P., Al-Sowielem, L. S. and Makki, S. M. 2012. Prehypertension among young adult females in Dammam, Saudi Arabia/Prehypertension chez des jeunes femmes a Dammam (Arabie saoudite). *Eastern Mediterranean Health Journal*, *18*(7), 728.

Essa, H. A. E. E. and El-Shemy, M. B. A. 2015. Prevalence of lifestyle associated risk factors for non-communicable diseases and its effect on quality of life among nursing students, faculty of nursing, Tanta University. *International Journal*, *3*(5), 429-446.

Wang, Z. V. and Scherer, P. E. 2008. Adiponectin, cardiovascular function, and hypertension. *Hypertension*, *51*(1), 8-14.

Kannel, W. B. and Sorlie, P. 1975. Hypertension in Framingham. *Epidemiology and control of hypertension*, *553*. Websites https://en.wikipedia.org/wiki/Anthropometry#cite_note-1

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