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Percentiles Distribution of CVD Risk Factors in Elderly of Asian Indian Origin: The Santiniketan Longitudinal Study on Aging

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Running Title: body composition percentiles in ageing

Abstract: ***Objective: The present community based longitudinal study was undertaken to investigate the percentiles distribution of cardiovascular disease (CVD) risk factors in elderly of Asian Indian origin. Methods: A total of 254 participants aged 55 years and above took part in this longitudinal study. Anthropometric measures were collected using standard techniques. Measures of obesity and body composition were subsequently calculated. Metabolic profiles and blood pressure were also measured. All anthropometric, metabolic and blood pressure measures were twice measured in a gape of exact one year. Results: It was observed that 95th percentile of MWC in two phases was 98.00 and 100.00 respectively (Phase I vs. Phase II). The 95th percentile of TER in two phases was 3.66 and 5.48 respectively. On the other, the 85th and 95th percentiles values for TG in Phase I were 177.00 and 204.75 respectively whereas, the 85th and 95th percentiles values for TG in Phase II were 162.25 and 219.25 respectively. Virtually, no significant sex differences for either of variables were observed in both phases. Conclusion: In absence of reference percentiles data on CVD risk factors in elderly Asian Indians, these data could be used to identify elderly with an elevated risk of developing CVD and provide a baseline for future studies of long term temporal trends***

Keywords: ageing, longitudinal study, percentiles, CVD, Asian Indians

1. Introduction

According to population Census 2011 there are nearly 104 million elderly persons (aged 60 years or above) in India with 53 million females and 51 million males. [1] Both the share and size of elderly population is increasing over time. From 5.6% in 1961 the proportion has increased to 8.6% in 2011. For males it was marginally lower at 8.2%, while for females it was 9.0%. As regard to rural and urban areas, 71% of elderly population resides in rural areas while 29 % is in urban areas. [1-2] The world population is undergoing a dramatic shift in age structure, with rapid population aging among its most notable characteristics. The world population aged 60 and older is currently 760 million people, representing 11% of total population. By 2050, it is expected that 22% of total population, or 2.0 billion people, will be aged 60 and older. With 1.21 billion in habitants counted in its 2011 census, India is the second most populous country in the world. Currently, the 60^{+} population accounts for 8% of India's national populat ion, translating into roughly 93 million people.[3] By 2050 its 60^{+} population share is projected to climb to 19% or approximately 323 millions people. [2-6]

Geriatrics is becoming a more attractive and increasingly important specialty. Research on biological aging once an observational backwater, is now an engaging proactive science, with considerable funding from the US National Institute on Aging but much less support in other countries. [3-6] It was reported in a survey conducted in 45 rural villages in India that about 32% of all deaths were due to Cardiovascular Disease (CVD). [4] Now a day CVD is the leading cause of death for people in the developed and developing countries. [4-7]

According to the World Health Organization (WHO), CVD will be the number one cause of morbidity and mortality in the world by the year 2015 and it is assumed that Indians would be the most affected amongst all ethnic population. [6,7] For men and women, cardiovascular risk is known to increase with age, smoking, hypertension, blood lipids and glucose levels, and central obesity. [5-11] The people of Asian Indian origin maintain a considerable level of central or abdominal obesity along with increased level of metabolic profiles of progressive age. [8-11] These studies had reported that metabolic syndrome (MS) prevalence increases with age, making its diagnosis necessary due to the 2.5- fold increased risk of cardiovascular disease. [9-13]

Virtually no longitudinal studies have been undertaken to investigate the changes in percentiles of CVD risk factors in elderly Asian Indians. [12, 13] Keeping this view in mind the present longitudinal study was aimed to examine the longitudinal changes (yearly change) in percentile distribution of body composition, obesity measures and metabolic profiles and blood pressure in elderly Asian Indians living in and around of Santiniketan, West Bengal, India.

2. Materials and Methods

Study Population

The present community based longitudinal study was conducted between October 2012 and October 2014. All participants were 55 years and above and were inhabitants of Bolpur, Santiniketan area (lies in between 23°40' north latitude and 87°43' east longitude); West Bengal India.
Initially a total of 300 individuals aged 55 years and above (male: female = 1:1) was selected randomly using local voter's registration list. However, a total of 30 individuals

(male = 12, female = 18) were excluded because of their prolong illness (under medication for hypertension, blood sugar or hormone therapy). A further 16 individuals were excluded because of their unwillingness to provide blood sample for the study. Therefore, a total of 254 individual were finally participated in the present longitudinal study. The study was divided into two phase with a gape of exact one year. In both phases, data on socioeconomic characteristic, anthropometry, metabolic profiles and blood pressure were obtained from all 254 participants. All participants were free from any serious disabilities or illness. The subjects were visited in their respective homes and age was ascertained and then crosschecked with horoscope. The written consent from participants was also obtained prior to actual commencement of the study. The departmental board of studies had approved the study.

Anthropometric measures

Anthropometric measure namely height (nearest to 0.1 cm), weight (nearest to 0.5 kg), circumferences of minimum waist (MWC) (nearest to 0.1 cm), maximum hip (MHC) (nearest to 0.1 cm), mid upper arm (MUAC) (nearest to 0.1cm) and skinfolds (nearest to 0.2 mm) at beeps, triceps, subscapular and suprailiac were collected using standard techniques. [14] Percentage of body fat (%BF), sum of four skinfolds (SF_4), fat mass (FM), fat free mass (FFM), arm muscle circumference (AMC), arm muscle area (AMA), arm fat area (AFA), basal metabolic rate (BMR), body mass index (BMI), as well as trunk-extremely ratio (TER), waist-hip ratio (WHR), waist-height ratio (WHtR), conicity index (CI), intrabdominal visceral fat (IVF) were subsequently calculated using standard equations. [15]

Metabolic profiles

A fasting blood sample (7ml) was collected from 254 subjects for the determination of fasting blood glucose (FBG in mg%) and lipids profiles (mg%) namely total cholesterol (TC), Triglyceride (TG), High (HDL), low (LDL) and very low destiny lipoprotein (VLDL), insulin and uric acids. All subjects maintained an overnight fast 0f >12 hours prior to blood collection. The plasma was separated within 2 hours of blood collection using a micro centrifuge at 1000 rpm for about 20 min at room temperature. Estimation of FBG, TC, TG and HDL were carried out using an ERBA microscan ELISA reader (Trans Asia Biomedical Limited, Mumbai, India). [9, 13, 16] Low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) were then calculated by using the standard formula: [9-11] LDL = TC – (HDL + TG/5) and VLDL = TG/5. Homeostasis model assessment – insulin resistance (HOMA – IR) was calculated using standard equation: [9]

$$\text{HOMA – IR} = \frac{\text{fasting insulin [μU/mL] x fasting glucose [mg\%]}}{22.5}$$

Blood pressure

Left arm systolic (SBP) and diastolic (DBP) blood pressure was taken from the participants with the help of an Omron MI digital electronic blood pulse monitor (Omron corporation, Tokyo, Japan). Two blood pressure measurements were taken in 5 minutes interval and averaged for analysis. Mean arterial pressure (MAP) was then calculated accordingly

MAP = DBP +1/3 (SBP- DBP)

Statistical Analyses

The percentiles distribution (25^{th}, 50^{th}, 75^{th}, 85^{th} and 95^{th}) of body composition, obesity measure, metabolic profiles and blood pressure were calculated for both phases and were compared accordingly.

All statistical analysis was performed using the SPSS (PC+ version 17). A p value of <0.05 (two tailed) was considered as significant.

3. Results

The percentiles (25^{th}, 50^{th}, 75^{th}, 85^{th} and 95^{th}) distribution of body composition and obesity measures namely MWC, MHC, MUAC, BMI, WHR, WHtR, CI, TER, %BF, FM, FFM, AMC, AMA, AFA and SF_4 by phase is presented in the **Table 1**. It was observed that 95^{th} percentile of MWC in two phases was 98.00 and 100.00 respectively (Phase I vs. Phase II). The 95^{th} percentile of TER in two phases was 3.66 and 5.48 respectively. However, the 95^{th} percentile of SF_4 was 56.62 and 47.62 respectively in two phases.

The percentiles (25^{th}, 50^{th}, 75^{th}, 85^{th} and 95^{th}) distribution of metabolic profiles namely TC, TG, HDL, LDL, VLDL, FBG, Insulin, HOMA-IR and Uric acids is presented in **Table 2**. The 85^{th} and 95^{th} percentiles values for TG in Phase I were 177.00 and 204.75 respectively whereas, the 85^{th} and 95^{th} percentiles values for TG in Phase II were 162.25 and 219.25 respectively. The 50^{th} percentile of FBG in two phases was 87.00 and 86.00 respectively.

Furthermore, the percentiles distribution of WC, TG, FBG and SBP by sex and phase is presented in **Figure 1a** (phase I) and **1b** (phase II). Virtually, no significant sex differences for either of variables were observed in both phases.

4. Discussion

This study reports the percentiles distribution of body composition, obesity measures, metabolic profiles and blood pressure in one year longitudinal study on elderly individuals (aged 55 years and above) of Asian Indian origin.

The constellation of CVD risk factors is a common phenotype associated with an increased risk for CVD. [17] The elderly are at a risk for the development of obesity because of reduction in physical activity, decreasing levels of mobility and changes in diet. [18-20]

It is noteworthy to mention that no temporal declines in most of CVD risk factors vindicated that increasing age does not warranted decreased CVD incidence in elderly of Asian Indian origin. Moreover, no significant sex differences for most of the CVD risk factors considered further vindicated the fact that elderly women are no less vulnerable to CVD compared to elderly male. [7, 9, 16, 17]

However, lack of reference percentiles data on CVD risk factors in elderly Asian Indians, no comparison of present findings with other findings on elderly Asian Indians was possible and that these data could be used to identify elderly with an elevated risk of developing CVD. Some shortcomings are associated with the present study, including small sample size. Hence, it is not the representative of the entire Asian Indian elderly population. Further long term prospective studies are required on different ethnic groups residing in rural as well as urban areas of India to determine whether similar phenomenon also be present among them. Moreover, study should be undertaken among the *Indian Diaspora* worldwide to elucidate if they also show age trends in CVD risk factors similar to sedentes in India or local population of the respective countries. However, our findings highlighted the importance of percentiles distribution of CVD risk factors in elderly and therefore, might be useful for designing appropriate strategies for cardiovascular health in Indian elderly.

5. Acknowledgements

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6. Conflict of Interest

None

7. Funding

None

Contribution

There is no conflict of interest so far as authorship and funding is concerned. TD was responsible for data collection and preparation of the draft manuscript. AG was responsible for the study design, analyses and final version of the manuscript

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Table 1: Percentiles distribution of body composition and obesity measures by phase

	Phase I					Phase II				
Variables	**25th**	**50th**	**75th**	**85th**	**95th**	**25th**	**50th**	**75th**	**85th**	**95th**
MWC	75.00	84.00	90.00	93.00	98.00	75.00	84.00	91.00	95.00	100.00
MHC	88.00	94.00	100.00	103.00	108.00	85.75	91.25	98.00	101.00	108.00
MUAC	24.00	26.00	28.00	29.00	31.00	23.50	25.25	27.00	28.00	30.00
BMI	20.35	23.05	26.02	27.30	29.72	20.37	23.10	25.70	27.40	30.05
WHR	0.84	0.88	0.91	0.93	0.96	0.85	0.90	0.94	0.96	1.01
WHtR	0.47	0.51	0.56	0.58	0.62	0.46	0.52	0.57	0.59	0.64
CI	1.19	1.25	1.30	1.31	1.35	1.21	1.25	1.31	1.34	1.38
TER	1.23	1.69	2.26	2.80	3.66	1.25	1.81	2.50	3.13	5.48
%BF	24.5	29.45	35.10	37.82	41.37	25.50	29.60	35.17	38.57	42.62
FM	13.83	16.92	21.32	24	28.58	13.72	17.07	21.79	24.07	29.40
FFM	34.67	42.41	47.76	50.64	54.89	34.59	41.40	47.14	50.10	54.46
AMC	22.09	23.80	25.48	26.47	28.50	21.84	23.65	24.99	25.75	27.75
AMA	38.85	45.10	55.79	64.68	37.99	44.56	49.74	52.80	61.34	36.45
AFA	6.15	8.99	12.13	13.96	16.86	4.41	6.91	9.98	11.73	15.33
SF_4	20.87	28.55	37.57	43.87	56.62	15.85	22.30	31.55	37.47	47.62

MWC –minimum waist circumference, MHC-maximum heap circumference, MUAC-mid upper arm circumference, BMI-body mass index, WHR-waist-hip ratio, CI-conicity index, TER-trunk extremity ratio, % BF-percentage of body fat, FM- fat mass, FFM-fat free mass, AMC-arm muscle circumference, AMA-arm muscle area, AFA- arm fat area, SF_4- sum of four (biceps, triceps, subscapular supailiac) skinfolds

Table 2: Percentiles distribution of metabolic profiles by phase

	Phase I					Phase II				
Variables	**25th**	**50th**	**75th**	**85th**	**95th**	**25th**	**50th**	**75th**	**85th**	**95th**
TC	161.00	172.00	191.25	202.75	225.25	154.75	163.50	179.00	193.00	214
TG	102.00	123.00	155.25	177.00	204.75	93.00	112.00	134.25	162.25	219.25
HDL	33.00	36.00	40.00	42.00	48.00	30.00	33.00	36.00	38.00	42.25
LDL	103.00	111.00	124.25	134.00	150.25	103.00	108.50	116.25	125.00	142.00
VLDL	20.00	24.00	31.00	35.00	41.00	19.00	22.00	27.00	32.75	45.00
FBG	79.75	87.00	96.00	103.00	124.50	79.75	86.00	95.00	99.00	126.00
Insulin	2.80	3.90	5.50	7.07	8.40	1.70	2.40	3.50	3.90	6.02
HOMA-IR	10.89	14.93	22.34	28.24	43.19	6.33	9.22	13.47	15.68	25.58
Uric Acid	4.90	5.65	6.30	6.77	7.42	4.70	5.20	6.12	6.90	7.90

TC-total cholesterol, TG-triglyceride, HDL-high density lipoprotein, LDL-low density lipoprotein, VLDL-very low density lipoprotein, FBG-fasting blood glucose, HOMA-IR- Homeostasis model assessment – insulin resistance

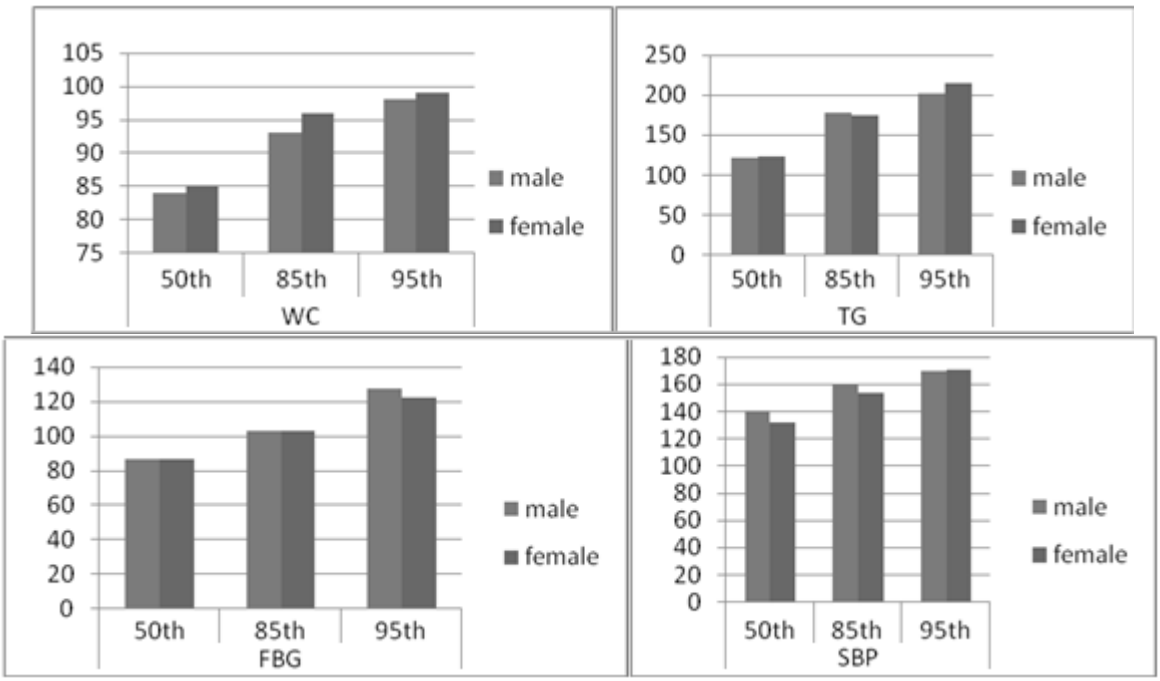

Figure 1(a): percentiles distribution of WC, TG, FBG and SBP by sex in phase-I

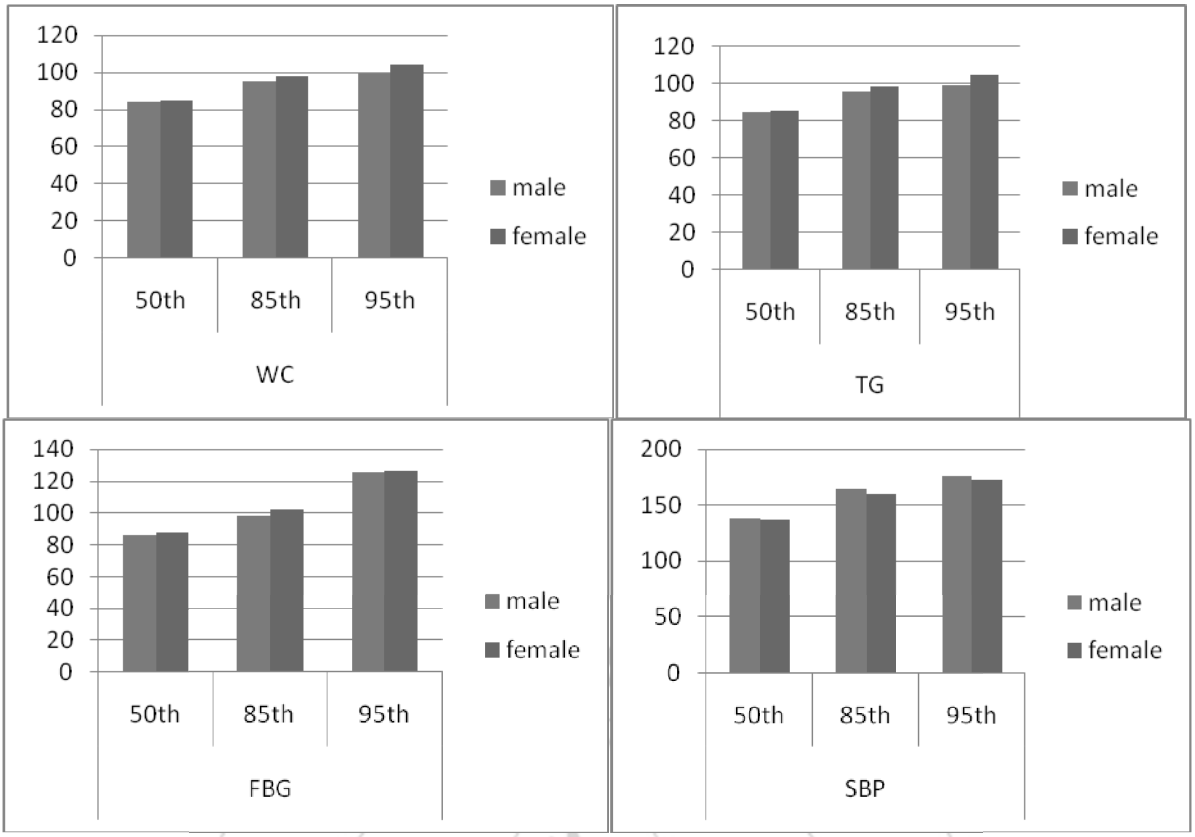

Figure 1 (b): percentiles distribution of WC, TG, FBG and SBP by sex in phase-II