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Evaluation of biological age and its correlation with cardiac markers in medical students from western Maharashtra

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ABSTRACT

Introduction: There is a strong association between cardiovascular risk factors with that of body age or biological age than the actual age. As the atherosclerotic process start from very early age, young adulthood is considered as favorable period to develop interventional strategies to fight against cardiovascular diseases. Hence this study was an attempt to evaluate the biological age and to find its association with cardiovascular risk factors among Medical students from Western Maharashtra.

Methods: This cross-sectional study was conducted among 2nd year Medical Students. The information was collected from 184 students about their physical activity and anthropometric measurements. Body Mass Index, Waist circumference and Waist-Hip ratio was calculated. Body fat and Biological age was measured by bioelectrical impedance analyzer. Statistical analysis was carried out by using SPSS version20.

Results: The mean body fat% of males (20.38%) and females (31.95) were above the normal limits ie. 5-19.9% and 20-29.9% respectively. the waist circumference and waist hip ratio for both males and females were found proportionately higher in those study subjects with >11 years of age gap between biological age and actual age. Similarly study participants with higher body mass index and body fat% in both boys and girls were found proportionately higher in those with age gap of >11years and their association was found statistically significant.

Conclusion: Cardiac indices like waist circumference, waist hip ratio, BMI and body fat% were significantly associated with the biological age.

Keywords: *Cardiac indices, Biological age and anthropometric measurements*

INTRODUCTION

It has been evident that a strong association between a number of cardiovascular risk factors, such as diabetes, hypertension, dyslipidemia, atherosclerosis with that of body age or biological age than the actual age[1]. The biological age refers to an indicator of development, changes or wear and loss of the structures and functions of some systems. It is determined by a set of metabolic, structural, functional, regulatory and adoptive properties of the organism[2].

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One of the most important etiology which supports to these determinants is stress factor. In medical field doctors are always under stress as they are dealing with the life of patients. The stress level among medical students is always high due to continuous engagement in studies and clinical activities that can increase their biological age which is an important risk factor for the Non communicable diseases. Similarly due to irregular and poorly balanced diet these students are at risk of having high prevalence of cardiovascular disease risk factors which are directly associated with increased biological age[3]. Hence this study was an attempt to evaluate the biological age and to find its association with cardiovascular risk factors among Medical students from Western Maharashtra.

MATERIALS AND METHODS

Study design

A cross-sectional study was carried out to assess the risk factors associated with cardiac morbidities.

Study subjects

All 196 students of IInd year MBBS were enrolled for the study. Subjects with chronic systemic illness were excluded from the study. Those who signed the informed written consent form were included in the study. On applying Inclusion and exclusion criteria total 183 students both boys and girls were included in the study from second MBBS batch. Before commencement of this study, Ethical clearance was obtained from institutional Ethical Committee.

Data collection

The data collection process was started by obtaining their informed written consent from the participants, information about the socio demographic characteristics, their dietary habits and physical activity was recorded in the predesigned and pretested questionnaire. A study conducted in western Maharashtra reported that the significant gap between the chronological and biological age as 1.9 years[4]. Thus in the present study subjects who had the gap up to 2 years between actual age and biological age were considered as normal.

Anthropometric measurements like height in meters, weight in Kg, hip circumference and waist circumference in Cms of each study subjects were recorded to compute Body Mass Index and Waist Hip ratio. Body mass index was calculated by a person's weight in kg divided by square of height in meters. Body fat and biological age was measured by using equipment bioelectrical impedance analyzer[5].

The basic principle behind the functioning of Bioelectrical impedance analyzer is the estimation of body composition by sending a weak electric current through the body and the voltage is measured in order to calculate the impedance or resistance of the body[5]. It calculates biological age on the basis of weight, skeletal muscle mass and body fat percent. The most feasible and easy way for assessing the biological age in a community is by Bioelectrical impedance analyzer due to its simple handling techniques. It calculates biological age on the basis of weight, skeletal muscle mass and body fat%.

Statistical analysis

Data was entered in Microsoft Excel 2010 for windows. Summarization and analysis of data was carried out by using Software Statistical Package for Social Sciences (SPSS version 20). Mean, standard deviation, and percentile values were computed, Chi square test was used to find out the association between socio-economic status, physical activity and cardiac risk factors. P value < 0.05 was considered as significant value.

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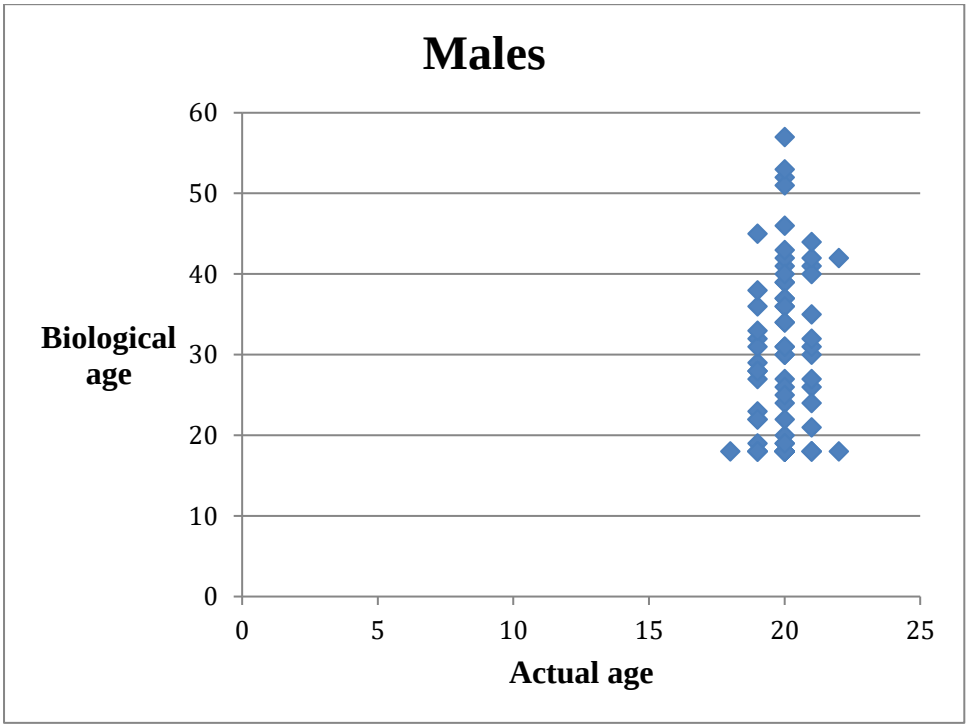

FIGURE 1A: Distribution of males according to Biological age and actual age

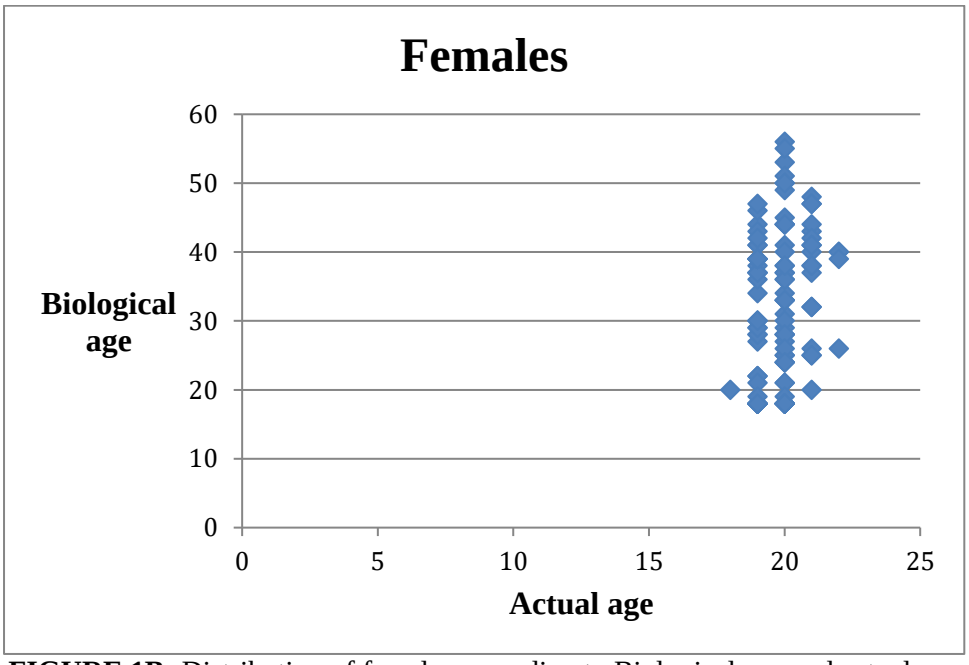

FIGURE 1B: Distribution of females according to Biological age and actual age

According to figure 1a&b, majority of male and female participants were in the age group of 20 years and the maximum biological age of 56-57 years was observed in this age group. The girls of age <20 years were found to have higher biological age.

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TABLE 1: Distribution of study subjects according to socio demographic parameters and age gap between actual age and biological age

Particulars	Age gap								χ^2 value	P value
	≤2		3-10		≥11		Total			
	N	%	N	%	N	%	N	%		
	49	26.8	41	22.4	93	50.8	183	100		
Age										
18	2	100	0	0	0	0	2	1.1		
	4.1		0		0					
19	15	27.3	14	25.5	26	47.3	55	30.1		
	30.6		34.1		28.0					
20	26	29.9	18	20.7	43	49.4	87	47.5	9.251	0.447
	53.1		43.9		46.2					
21	5	15.2	8	24.2	20	60.6	33	18.0		
	10.2		19.5		21.5					
22	1	16.7	1	16.7	4	66.7	6	3.3		
	2.0		2.4		4.3					
Sex										
Male	26	34.2	18	23.7	32	42.1	76	41.5		
	53.1		43.9		34.4				4.721	0.102
Female	23	21.5	23	21.5	61	57.0	107	58.5		
	46.9		56.1		65.6					
Religion										
Hindu	47	28.8	37	22.7	79	48.5	163	89.1		
	95.9		90.2		84.9					
Muslim	2	16.7	2	16.7	8	66.7	12	6.6		
	4.1		4.9		8.6					
Christian	0	0	1	25.0	3	75.0	4	2.2	5.292	0.825
	0		2.4		3.2					
Jain	0	0	1	3.3	2	66.7	3	1.6		
	0		2.4		2.2					
Buddhist	0	0	0	0	1	100	1	0.5		
	0		0		1.1					
Birth order										
1										
	27	26.5	16	15.7	59	57.8	102	55.7		
2	55.1		39.0		63.4					
	18	27.3	21	31.8	27	40.9	66	36.1	7.113	0.119
3	36.7		51.2		29.0					
	4	26.7	4	26.7	7	46.7	15	8.2		
	8.2		9.8		7.5					

According to Table 1, majority of the participants were in the age group of 20 years 87(47.5%) followed by 19 years(30%). It was observed that, almost half of study subjects had biological age more than 11 years than that of actual age and 22% had biological age 3 to 10 years more than actual age. Majority of study subjects of actual age 19 and 20 were reported to have higher biological age(28% and 46%). Similarly age gap was seen higher > 11 years(65.5%) in females.

TABLE 2: Distribution of study subjects according to diet pattern, physical activity and age gap between actual age and biological age

Particulars	Biological Age								χ^2 value	P value
	≤2		3-10		≥11		Total			
	N	%	N	%	N	%	N	%		
	49	26.8	41	22.4	93	50.8	183	100		

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Diet									
Vegetarian	14	27.5	11	21.6	26	51.0	51	27.9	
	28.6		26.8		28.0				
Non-Veg	12	30.8	7	17.9	20	51.3	39	21.3	0.976	0.921
	24.5		17.1		21.5				
Mixed	23	24.7	23	24.7	47	50.5	93	50.8	
	46.9		56.1		50.5				
Physical Activity/Wk									
<150min	36	27.5	28	21.4	67	51.1	131	71.6	
	73.5		68.3		72.0				0.314	0.865
≥150min	13	25.0	13	25.0	26	50.0	52	28.4	
	26.5		31.7		28.0				

According to Table 2, majority of the study participants consumed mixed diet 93(50.8%).Though there was variable diet pattern, almost more than 50% of subjects from each group had age gap of >11years. However age gap 3-10 years was observed among the subjects following mixed diet. In case of physical activity, majority of the study participants were having inadequate physical activity for <150 minutes/week (71.6%). The age gap of >11 years was observed in high proportion among subjects with physical activity <150 min (72%).

TABLE 3: Mean and standard deviation of cardiac markers and biological age among boys and girls

Particulars	Boys	Girls
WC(cms)		
Mean	87.67	80.93
SD	12.31	10.77
Range	121 - 68	106 - 60
WHR		
Mean	0.85	0.78
SD	0.06	0.06
Range	1.07 – 0.74	0.94 – 0.60
BMI		
Mean	23.52	24.75
SD	4.30	4.93
Range	36.80 – 16.80	37.90 – 13.30
BF%		
Mean	20.38	31.95
SD	5.71	5.99
Range	35.49 – 4.79	41.60 – 8.90
BA		
Mean	29.33	32.71
SD	10.46	10.43
Range	57 - 18	56 - 18

Note: S.D – Standard deviation, WC – Waist Circumference, WHR – Waist hip ratio, BF – Body fat, BMI – Body mass index, BA – Biological age

In table-3, the mean waist circumference, waist hip ratio and body mass index of both the sex were within the normal range. But the maximum values noted for waist circumference, waist hip ratio and body mass index in both males and females were 121&106, 1.07&0.94 and 36.80&37.90 respectively which was above the normal limit. However the mean body fat% of males (20.38%) and females (31.95) were above the normal limits ie. 5-19.9% and 20-29.9% respectively and hence the biological age of both boys and girls were higher than their actual age.

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TABLE 4: Association of cardiac marker and age gap among boys

Particulars	Biological Age								χ^2 value	P value
	≤2		3-10		≥11		Total			
	N	%	N	% 18	N	%	N	%		
	26	34.2	23.7		32	42.1	76	100		
WC (cm)										
< 91	26	57.8	14	13.1	5	11.1	45	59.2		
	100		77.8		15.6				45.651	< 0.001
≥ 91	0	0	4	12.9	27	87.1	31	40.8		
	0		22.2		84.4					
WHR										
< 0.91	25	40.3	17	27.4	20	32.3	62	81.6		
	96.2		94.4		62.5				13.409	0.001
≥ 0.91	1	7.1	1	7.1	12	85.7	14	18.4		
	3.8		5.6		37.5					
BMI										
18.5-24.99	26	52.0	18	36.0	6	12.0	50	65.8		
	100		100		18.8				54.340	< 0.001
≥25	0	0	0	0	26	100	26	34.2		
	0		0		81.2					
BF%										
10-19.99	26	76.5	7	20.6	1	2.9	34	44.7		
	100		38.9		3.1				54.779	< 0.001
≥ 20	0	0	11	26.2	31	73.8	42	55.3		
	0		61.1		96.9					

Note: BMI – Body mass index, WHR – waist hip ratio, BF% - body fat percentage, WC – waist circumference

TABLE 5: Association of cardiac marker and age gap among girls

Particulars	Biological Age								χ^2 value	P value
	≤2		3-10		≥11		Total			
	N	%	N	%	N	%	N	%		
	23	21.5	23	21.5	61	57.0	107	100		
WC(cm)										
< 81	23	42.6	20	37.0	11	20.4	54	50.5		
	100		87.0		18.0				60.496	< 0.001
≥81	0	0	3	5.7	50	94.3	53	49.5		
	0		13.0		82.0					
WHR										
< 0.81	19	29.7	15	23.4	30	46.9	64	59.8		
	82.6		65.2		49.2				8.121	0.015
≥0.81	4	9.3	8	18.6	31	72.1	43	40.2		
	17.4		34.8		50.8					
BMI										
18.5-24.99	23	40.4	23	40.4	11	19.3	57	53.3		
	100		100		18.0				70.779	< 0.001
≥25	0	0	0	0	50	100	50	46.7		
	0		0		82.0					
BF%										
20-29.99	22	59.5	15	40.5	0	0	37	34.6		
	95.7		65.2		0				79.708	< 0.001
≥30	1	1.4	8	11.4	61	87.1	70	65.4		
	4.3		34.8		100					

Note: BMI – Body mass index, WHR – waist hip ratio, BF% - body fat percentage, WC – waist circumference

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According to table 4&5, the waist circumference and waist hip ratio for both males and females were found proportionately higher in those study subjects with >11 years of age gap between biological age and actual age. Even though the association between these two cardiac indices and age gap was found to be statistically significant, the waist hip circumference is comparatively less significant than the other indices because the hip circumference which was proportionately higher along with waist circumference in both the gender . Similarly study participants with higher body mass index and body fat% in both boys and girls were found proportionately higher in those with age gap of >11years and their association was found statistically significant.

DISCUSSION

Diabetes mellitus, hypertension and obesity are very strongly associated with cardiovascular diseases all over the world[4,6]. The medical profession is highly burdened with physical and mental stress that make them highly vulnerable to cardiovascular diseases.

In the present study among the total 183 medical students of IInd MBBS, 73.2% students had their age gap more than 2 years between chronological and biological age whereas only 26.8% students had acceptable age gap of 1-2 years according to a study conducted by K S Raje et al[4] who reported the gap of 1.9 years was significant gap between chronological and biological age.

In the present study among the students who had age gap more than 2 years females were more and the age group commonly found to have more age gap was 20 years because their biological age was reported higher than their chronological age. Similar findings were observed in the study conducted in general population of villages of Karad Taluka by K S Raje et al[4]. However this similar findings may be due to the same geographic region. In a study conducted by Prysiazhniuk S et al[7] from Ukraine reported 49 +/- 0.88 years biological age for males which found to be higher than the biological age of boys in present study, similarly they reported the higher biological age 39.5+/- 0.79 years among female subjects than the present study. This difference might be due to the reference study population belonged to the university for Higher education while present study was conducted amongst 2nd year MBBS student who's actual age is less than the reference study.

In the present study 75.3% of participants taken mixed diet had a higher age gap. Similar finding was observed in the study conducted by KS Raje et al[4] at Karad Thaluka where the vegetarians had lower age gap than those taking mixed diet. Since the students were residing in different hostels in depth analysis of their diet could not be done.

The present study revealed that the subjects who were practicing the physical activity for more than 150 minutes/week had lesser age gap between the chronological age and biological age than those who are not practicing any physical activity. Similarly KS Raje et al[4] reported that the subjects practicing yoga had lesser age gap between their chronological age and biological age than those not practicing it.

In our current study the mean waist circumference, waist hip ratio and body mass index of both the sex were within the normal range. However the mean body fat% of males(20.38%) and females(31.95) were above the normal limits. Similar finding was observed by a study conducted by **C.Y.Bae et al**[8] where mean waist circumference, waist hip ratio and body mass index were within the normal range in both sex where as body fat% was found high only in males.

In both boys and girls it was found that waist circumference, body mass index and body fat% were associated with higher biological age in early adulthood whereas the waist hip circumference is comparatively less significantly associated than the other indices because the hip circumference which was proportionately higher along with waist circumference in both the gender resulted in it.

CONCLUSION

This study revealed that their cardiac indices like waist circumference, waist hip ratio, BMI and body fat% were significantly associated with the biological age. Even though the medical students are under physical stress due to non scientific and irregular physical activity their anthropometric measures and body fat% were high which in turn resulted in increased biological age.

RECOMMENDATIONS

As the medical students are always under stress due to huge syllabus, clinical postings and exams they may not find adequate time for quality physical activity. Thus it is recommended that minimum 30 minutes of physical activity and 10

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minutes of meditation is supposed to be included in their regular schedule.

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