A Study to Minimize the Gap Between Biological Age and Chronological Age Among Medical Students – an Interventional Study in Western Maharashtra

Section A-Research paper

A STUDY TO MINIMIZE THE GAP BETWEEN BIOLOGICAL AGE AND CHRONOLOGICAL AGE AMONG MEDICAL STUDENTS – AN INTERVENTIONAL STUDY IN WESTERN MAHARASHTRA

K.B.Sharavanakumaran[1], Dr.Vaishali V. Raje[2], T.B.Meenalochani[3], M.Mangaleshwari[4*], Danica Da Silva[5]

Abstract

Introduction: Individuals with same chronological age can vary in their biological age and interpersonal health differences create discrepancies between biological and chronological age. Thus by minimizing this gap between biological and chronological age at the early period of life will help the individual to have a healthy and productive future.

Aim: To study the impact of interventional measures in the gap between biological age and chronological age among medical students.

Methods: This interventional follow up study was conducted among 2nd year Medical Students. The information was collected from 183 students about their socio-demography, dietary habits, physical activity and biological age. Biological age was measured using bioelectrical impedance analyzer. Intervention given was Suryanamaskar. Statistical analysis was carried out by using SPSS version20.

Results: After giving intervention for one year with Suryanamaskar for 134 students who were above two years of gap between chronological age and biological age, their biological age was calculated again. It showed reduction in biological age and in addition the total number of students below two years of gap between chronological age and biological age turned to 83(45.4%) which was 49(26.8%) before intervention. Before intervention the mean difference between the chronological age and biological age was 15.94 and the standard deviation is 8.39, after intervention it turned to 8.97 and 8.05 respectively. Repeated measures ANOVA between the means of biological age before and after intervention at 6 months and one year of interval are significant in both males and females.

Conclusion: Biological age significantly reduced with suryanamaskar

Keywords: Biological age, Chronological age and Suryanamaskar

[1] Post graduate student, Department of Community medicine, Krishna institute of medical sciences, Karad-415110, Maharashtra, India.

[2] Professor, Department of Community medicine,Krishna institute of medical sciences, Karad - 415110,Maharashtra, India

[3] Assistant professor, Department of Periodontics, Vinayaka mission's Sankarachariyar dental college, Ariyanur, Tamilnadu-636308, India.

[4*] Senior resident, Department of Ophthalmology, Government medical college-Dindigul, Tamilnadu-624003, India

[5] Post graduate student, Department of Community medicine, Krishna institute of medical sciences, Karad-415110,Maharashtra, India

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1.   Introduction:

Non communicable diseases (NCD) are the important cause of death all over the world and it is one of the major health threats of the 21st century. There has been a strong association between a number of cardiovascular risk factors, such as diabetes, hypertension, dyslipidemia and atherosclerosis with that of body age or biological age than chronological age[2]. Here biological age refers to an indicator of development, changes or wear and loss of the structures and functions of some systems and is determined by a set of metabolic, structural, functional, regulatory and adoptive properties of the organism[3]. Whereas chronological age refers to the actual number of days, months or years a person has been alive regardless of his health status[4]. Hence individuals with same chronological age can vary in their biological age and interpersonal health differences create discrepancies between biological and chronological age. This study is to identify early adulthood like medical students with high biological age in comparison to actual age and to study the impact of interventional measures in the gap between biological age and chronological age. Research in this area of reducing the gap between chronological age and biological age that directly influence in reducing the incidence of NCDs will help policy makers and health administrators for addressing this problem effectively in prevention and management of chronic non-communicable diseases as early as possible in the early adult age.

2.   Materials and Methods

Study design: An Interventional study was carried out to study the impact of interventional measures in the gap between biological age and chronological age

Study subjects: All IInd year MBBS students of Krishna institute of medical science at Karad from western Maharashtra were enrolled for the study. On applying Inclusion and exclusion criteria total 184 students both boys and girls were included in the study. Subjects with Chronic systemic illness were excluded from the study. Before commencement of this study, Ethical clearance was obtained from institutional Ethical Committee.

Study Period: From January 2021 to October 2022

Data collection:

The purpose and process of the study was explained to the study subjects and their verbal consent to participate in the study was obtained. In a pre designed and pre tested questionnaire information about the socio demographic characteristics, their dietary habits and physical activity were recorded. A study conducted in western Maharashtra reported that the significant gap between the chronological and biological age as 1.9 years[5]. Thus in the present study, subjects who had the gap of more than 2 years between chronological age and biological age were considered for intervention.

Bioelectrical impedance analyzer was used to measure the biological age of the study subjects.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[6].

With the guidance of physical trainer, students with the age gap of more than 2 years were taught Suryanamaskar and motivated to do it regularly. In this study Suryanamaskar was used as an interventional measure. Surya Namaskar (SN) literally means salutation to the Sun. It consists of a cycle of twelve postures done rhythmically with controlled breathing[7]. Total energy cost throughout the practice of SN was 13.91 kcal and at an average of 3.79 kcal/min[8]. Normal healthy adults with active metabolic patterns are recommended to perform 12 to 24 rounds of suryanamaskar starting with less counts and gradually increasing it[9]. By doing it regularly extra calories were burnt and as a result body fat reduction and weight reduction were induced. Initially they were made to do 10 cycles and gradually it is increased up to 24 cycles per day[9]. All the students were subjected for 1st follow up after 6 months of enrolment and 2nd follow up at the end of 12 months of enrolment.

Statistical analysis:

Data analysis and summarization of data was carried out by using Software Statistical Package for Social Sciences (SPSS version 20). Mean, standard deviation and chi square values were calculated. In order to test the significance of the difference between the means Repeated measures ANOVA was used.

3.   Results

Table 1: Distribution of subjects in relation to Socio-demographic characteristics, Physical activity and baseline age difference (between biological and chronological age):

Characteristics	Categories	Baseline Age Difference		Chi square value	P value
		≤ 2 N=49(%)	>2 N=134(%)		
Age	18	2 (4.1)	0 (0)		
	19	15 (30.6)	40 (29.9)		

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	20	26 (53.1)	61 (45.5)	8.492	0.0751
	21	5 (10.2)	28 (20.9)		
	22	1 (2.0)	5 (3.7)		
Sex	Male	26 (53.1)	50 (37.3)	3.664	0.0556
	Female	23 (46.9)	84 (62.7)		
Religion	Hindu	47 (95.9)	116 (86.6)	3.903	0.4193
	Muslim	2 (4.1)	10 (7.5)		
	Christian	0 (0)	4 (3.0)		
	Jain	0 (0)	3 (2.2)		
	Buddhist	0 (0)	1 (0.7)		
Education of Father	Upto Higher secondary	9 (18.4)	22 (16.4)	0.09691	0.7556
	Graduate	40 (81.6)	112 (83.6)		
Education of Mother	Upto Higher secondary	14 (28.6)	34 (25.4)	0.1897	0.6632
	Graduate	35 (71.4)	100 (74.6)		
Occupation of father	Professional	19 (38.8)	54 (40.3)	2.308	0.3154
	Skilled	26 (53.1)	76 (56.7)		
	Unskilled	4 (8.2)	4 (3.0)		
Occupation of mother	Professional	12 (24.5)	28 (20.9)	0.5986	0.7413
	Skilled	8 (16.3)	28 (20.9)		
	Home maker	29 (59.2)	78 (58.2)		
Diet	Vegetarian	14 (28.6)	37 (27.6)	0.5274	0.7682
	Non Vegetarian	12 (24.5)	27 (20.1)		
	Mixed	23 (46.9)	70 (52.2)		
Physical activity	Nil	6 (12.2)	6 (4.5)		
	30min-149 min/wk	30 (61.2)	89 (66.4)		
	$\geq$ 150 min/wk	13 (26.5)	39 (29.1)	3.534	0.1709

During the analysis of the socio-demographic factors, diet and physical activity with the age difference between the biological age and chronological age after the base line data collection revealed that the association of sex and age with that of age difference were moderately significant when assuming the level of significance as 10%. But other factors were not significantly associated between the age difference between the biological age and chronological age.

Table 2:Comparison of biological age of males:

Title	Biological age – 1	Biological age – 2	Biological age – 3
Mean	34.86	32.38	28.86
Standard deviation	8.669	9.114	8.089
Sample size	50	50	50
Range	22 – 57	20 – 54	19 – 49

Repeated measure ANOVA F = 113.15,   Multiple comparison test
P value is <0.0001

Comparison	Mean Differeces	95% confidence interval		Q	P value
		From	To		
B.age 1 vs B.age 2	2.480	1.524	3.436	8.750	<0.001

B.age 1 vs B.age 3	6.000	5.044	6.956	21.169	<0.001
B.age 2 vs B.age 3	3.520	2.564	4.476	12.419	<0.001

Note: B.age 1– Biological age in baseline data, B.age 2 – Biological age after 6 months of physical activity, B.age 3 - Biological age after 1 year of physical activity

Comparison of biological age of males at the initial measurement with the biological age taken after 6 months of intervention by physical activity showed a mean difference of 2.480 which was significant. Similarly comparison of biological age of males at the initial measurement with the biological age taken after one year of intervention by physical activity shows a mean difference of 6.000 that was significant. Then the comparison of biological age of males after 6 months of intervention with that of biological age of males after one year of intervention shows a mean difference of 3.520 which was also significant.

Table 3:Comparison of biological age of females:

Title	Biological age – 1	Biological age – 2	Biological age – 3
Mean	36.55	33.58	30.63
Standard deviation	8.302	8.735	8.170
Sample size	84	84	84
Range	22 – 56	19 – 52	18 – 49

Repeated measure ANOVA F = 181.49   Multiple comparison test
P value is <0.0001

Comparison	Mean Differences	95% confidence interval		Q	P value
		From	To		
B.age 1 vs B.age 2	2.976	2.239	3.714	8.750	<0.001
B.age 1 vs B.age 3	5.929	5.191	6.666	21.169	<0.001
B.age 2 vs B.age 3	2.952	2.215	3.690	12.419	<0.001

Note: B.age 1– Biological age in baseline data, B.age 2 – Biological age after 6 months of physical activity, B.age 3 - Biological age after 1 year of physical activity

Comparison of biological age of females at the initial measurement with the biological age taken after 6 months of intervention by physical activity shows a mean difference of 2.976 which was significant. Similarly comparison of biological age of females at the initial measurement with the biological age taken after one year of intervention by physical activity shows a mean difference of 5.92that was significant. Then the comparison of biological age of males after 6 months of intervention with that of biological age of females after one year of intervention shows a mean difference of 2.952 which was also significant.

After giving intervention for one year with Suryanamaskar for 134 students who were above two years of gap between chronological age and biological age, their biological age was calculated again. It showed reduction in biological age and in addition the total number of students below two years of gap between chronological age and biological age turned to 83(45.4%) which was 49(26.8%) before intervention. Before intervention the mean difference between the chronological age and biological age was 15.94 and the standard deviation is 8.39. While after the intervention they had a mean difference of 8.97 and the standard deviation of 8.05.

4. Discussion

Chronological age cannot be an accurate indicator of aging process, whereas biological age estimates the individual's functional status in reference to his or her chronological peers[10]. Concurrently biological age can help the health workers to pick up the changes in the life style, diet and physical activity of an individual at the earliest stage even before occurrence of any acute diseases, from those showing an increased biological age.

According to a similar study conducted by Karan Shivaji Raje et al, the gap of 1.9 years was found to be a significant gap between chronological and biological age among those who do not practice walking exercise[5] and in the same study socio-

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demographic factors like age, sex, marital status, type of work, occupation, BMI, diet and physical activities like yoga and swimming are significantly associated with difference in actual age and biological age where as in our present study physical activity is significantly associated with age gap. Sex and age were moderately significant when associated with age gap.

In the current study the biological age was computed before intervention of Suryanamaskara, after 6 months of initiation of Suryanamaskar and after one year of intervention showed decline in biological age in both males and females. **Liukkonen et al[11]**, showed reduction in the age gap of subjects received physical training by a training computer. **Prysiazhniuk et al[12],** also found among the experimental groups (EG1, EG2 and EG3) the age gap between the chronological age and the biological age decreased maximum in those who practiced the physical activity for 6 hours in a week. In a study conducted by **Sereda IO et al[13]**, the findings revealed the minimal biological age before initiation of yoga was 22 years and the maximal biological age was 55 years. After practicing yoga for 6 months the minimum biological age declined to 20 years and maximum biological age declined to 43 years. The findings of current study are comparable to theses reference studied.

Sinha et al[8] reported Suryanmaskara found to be effective in increasing energy expenditure along with maintaining lower cardiovascular risk, he also commented that in Suryanamaskara it involves static and dynamic muscular exercises involving majority of joints, muscles and different internal organ system of body.

It was estimated that 50% of participants who began physical activity program will drop out in 3 to 6 months[14]. Therefore continuous motivation and monitoring was practiced during the study period among the study population. A whatsapp group was made separately for male and female students, suryanamaskar videos, information for participation in 75 crore suryanamaskar on the occasion of azadi ka amrit mahotsav were shared and doubts regarding their physical activity were discussed in the whatsapp groups.

Very little and sporadic research work is available in context to intervention in biological age. The present study is to identify early adulthood with high biological age in comparison to actual age and working on the modifiable health parameters that help in equalizing chronological age and biological age in early adulthood. Research in this area will help policy makers and health administrators to see if there is any need for addressing this problem effectively in prevention and management of chronic non-communicable diseases as early as possible in the early adult age.

5. Conclusion

This study revealed, along with existing physical activity regular practice of suryanamaskar minimum 24 cycles minimum for 30 min daily for 5 days in a week was proved beneficial in the reversal of biological age with respect to the chronological age. Minimizing the gap between biological and chronological age in the younger adults in turn can help in reducing the higher anthropometric measurements. It primarily helps in the prevention of risks for cardiovascular diseases, stroke and other non communicable diseases. So that productivity and efficiency of the younger generation will not be compromised.

Limitations:
Direct observation of training not done.
During COVID pandemic there was a lag in study due to the absence of study subjects.
Routine physical activity was not ensured.

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