

Body Mass Index Plays Key Role In The Development Of Premature Canities: A Cross Sectional Study

Padmavathi P¹, Sathiyapriya V^{1*}, Pragna B Dolia¹, Archana¹, Anusha²

¹Department of Biochemistry, ACS Medical College and Hospital, Dr.M.G.R Educational and Research Institute University, Chennai, India

²Department of Biochemistry, Panimalar Medical College Hospital and Research Institute, Chennai, India

ORCID ID: 0000-0002-1587-3272,0000-0002-9067-4994,0000-0002-9294-7394, 0000-0002-3540-8490

Corresponding author

Sathiyapriya Viswanathan, Ph D *,

Associate Professor Department of Biochemistry ACS Medical College and Hospital Velappanchavadi, Chennai-600077 Email: vvspriya@gmail.com

DOI: 10.47750/pnr.2023.14.S02.187

Abstract

Introduction: Hair graying is considered as a sign of ageing. In Asians if hair graying occurs before the age of 25 years it is called as premature canities. It is considered as a risk factor for coronary artery disease. It is well-known fact that obesity and hypertension are associated with coronary artery disease. However, the role of obesity in association with premature canities not well known. Hence the present study aims to identify the role of obesity in premature canities. **Materials and methods:** This cross-sectional study was conducted among the students studying in ACS Medical College and Hospital, Chennai, India. This study was conducted from January 2019 to January 2020. A total of 420 students took part in the present study. Subjects with any known disease were excluded from this study. Subjects with atleast 10 number of gray hairs were considered as cases (n=210) and subjects without gray hair were considered as controls (n=210). Demographic and clinical parameters like age, sex, height, weight, blood pressure, waist circumference and number of gray hairs were collected from the study subjects. P value <0.05 was considered as statistically significant. Statistical analysis was done using SPSS software 20. **Results:** In our study there is no significant difference in the age of the study subjects (19.1 ± 1.4 versus 19.0 ± 0.8 years, $P=0.216$) respectively. Cases were comparatively obese than controls as measured by BMI (23.5 ± 5.2 vs 21.8 ± 3.2 kg/m², $P=0.000$) and WC (75.5 ± 20.8 vs 63.5 ± 21.0 cm, $P=0.000$). The prevalence of obesity is 11% (n=24) in subjects with premature canities. The number of subjects with prehypertension more predominant in cases compared with controls (32.8% vs 25.2%) Similarly, cases were predominantly hypertensive compared with controls (8% vs 2.3%) respectively. correlation analysis also showed a significant association between number of gray hairs SBP mmHg ($r=0.211$) ($P=0.002$) and BMI ($r=0.505$) ($P=0.000$). A significant association between BMI and gray hairs prevailed even after controlling for BP using partial correlation analysis. **Discussion & Conclusion:** Obesity being a proinflammatory condition plays a key role in the development of hypertension and gray hair through oxidative stress in premature canities.

Key words: Premature canities, Body mass index, Obesity, Hypertension

Introduction:

Hair pigmentation is one of the most visible phenotypes of humans ranging from black, brown, blonde to red (1). Hair color depends on the quantity and ratio of black brown melanin and reddish brown pheomelanin (2). Graying of hair is an indicator of natural ageing process which starts occurring at the average age of 40 in case of Asians, 35 in case of Whites and 45 in case of Africans (2). Appearance of gray hair before the expected age of onset that is

occurrence of gray hair before the age of 25 in Asian population, 20 in whites, 30 in Africans is said to be Premature canities (PC) (3). It is well known that gray hair is the most common risk factor for coronary heart disease. Studies have also shown that the risk for coronary artery disease increases proportionately with degree of gray hair (4). According to Kocaman et al even premature canities subjects are associated with coronary artery disease irrespective of their actual age and has concluded that gray hair is an indicator of biological ageing rather than their chronological age (5). Obesity and hypertension are other renowned risk factors for coronary artery disease irrespective of age (6) Obesity and hypertension are the major cause of mortality and morbidity worldwide (7). Obesity along with hypertension are most challenging health issue in developed and developing countries. Studies on the prevalence of obesity and hypertension, the other risk factors for coronary disease are lacking among premature canities subjects. So, the present study aims to evaluate the prevalence of obesity and hypertension among premature canities subjects and their interrelation.

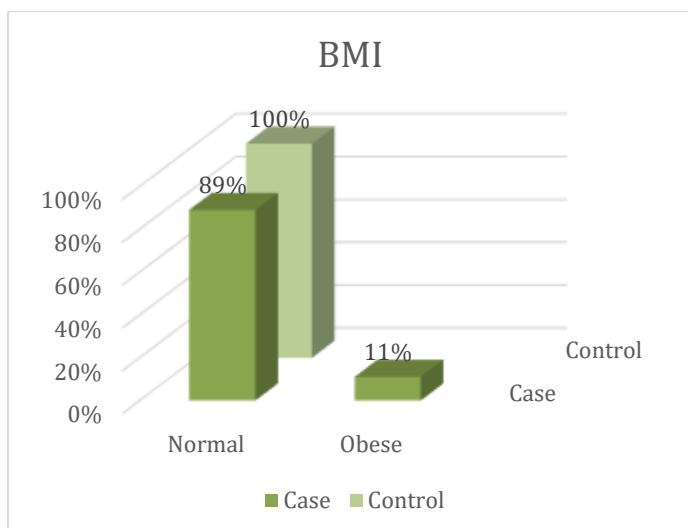
Materials and Methods:

This cross-sectional study was conducted among the college students studying in ACS Medical College and Hospital, Chennai, India. This study was conducted from January 2019 to January 2020. Exclusion criteria: Subjects with autoimmune diseases like skin pigmentation syndrome, premature aging syndromes or under treatment for any clinical conditions were excluded from this study. Inclusion criteria: Healthy volunteers of age < 25 years were included in the present study. Subjects with atleast 10 gray hair were considered as cases, subjects without any gray hair were considered as controls. A total of 420 students took part in the present study among them 210 were control and 210 were cases. Various demographic and clinical parameters like Parameters like age, sex, height, weight, blood pressure (BP), waist circumference (WC), presence of gray hair, number of gray hairs were collected. Blood pressure was recorded using digital sphygmomanometer eurocheck. A fixed wall mount stadiometer was used to measure the heights in the nearest centimetre and a nonelastic tape used to measure the waist circumferences. Body mass index (BMI) was calculated using the expression of: $BMI = \text{Weight (kg)} / \text{Height (m}^2\text{)}$. Obesity ($BMI \geq 30$) and hypertension (SBP 140-159mmHg) (DBP 90-99mmHg) were classified into different stages based on the WHO criteria (8)(9). **Statistical analysis:** Statistical analysis done by using SPSS software 20. Categorical data were expressed with percentages. All the other datas were expressed as mean \pm standard deviation (SD). To find significant difference between the groups student's t-test and one way ANOVA were performed. P value <0.05 was considered as statistically significant. Both partial and pearson correlation analysis were done to analyse the significant association between various parameters.

Results:

In our study there is no significant difference in the age of controls and cases (19.1 ± 1.4 versus 19.0 ± 0.8 years, $P < 0.216$) respectively. Cases are comparatively obese than controls as measured by BMI (23.5 ± 5.2 vs $21.8 \pm 3.2 \text{ kg/m}^2$, $P < 0.000$) and WC (75.5 ± 20.8 vs 63.5 ± 21.0 cm, $P < 0.000$). The prevalence Obesity is 11% ($n=24$) in subjects with premature canities which is shown in figure 1.

Figure1: Prevalence of obesity in subjects with and without Premature canities



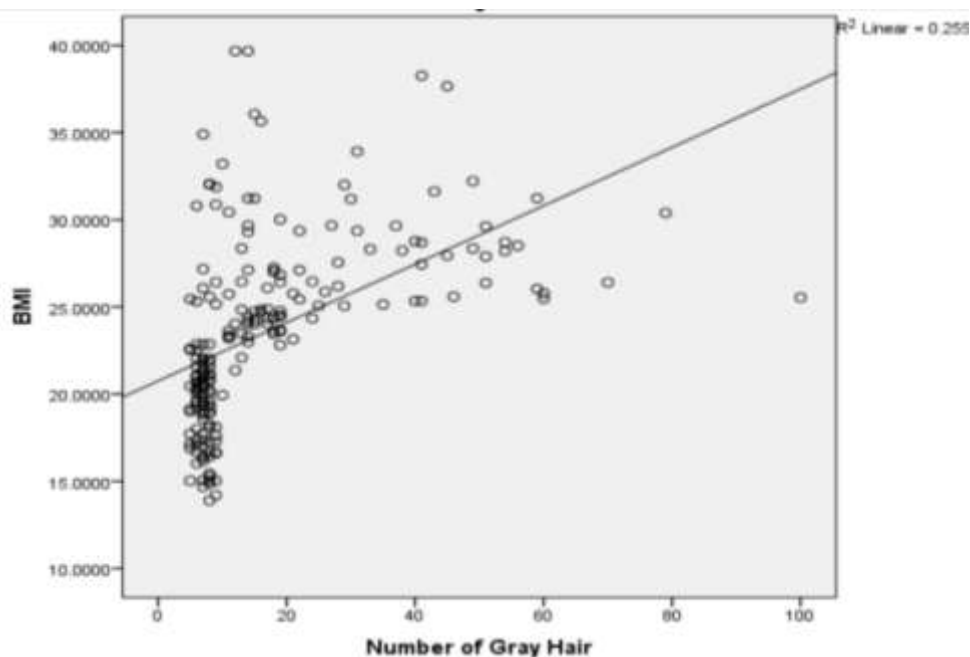
The number of subjects with prehypertension more predominant in cases compared with controls (32.8% vs 25.2%) respectively. Similarly, cases were predominantly hypertensive compared with controls (8% vs 2.3%) respectively. The significant differences are shown in Table 1. correlation analysis also showed a significant association between number of gray hairs, SBP ($r=0.211$) ($p=0.002$) and BMI ($r=0.505$) ($P=0.000$).

Table1: Analysis of different stages of blood pressure in case and controls

Variables	Controls (Mean \pm SD)			Case (Mean \pm SD)			P-value
	Normal (n=152)	Pre hypertension (n=53)	Hyper tension (n=5)	Normal (n=123)	Pre hypertension (n=69)	Hyper tension (n=18)	
SBP mmHg	109.75 \pm 9.4	125.05 \pm 4.0	141.2 \pm 1.7	108.52 \pm 9.91	127.52 \pm 7.06	145.38 \pm 5.05	0.000*
DBP mmHg	70.33 \pm 8.36	80.33 \pm 6.93	90.4 \pm 3.64	71.82 \pm 8.13	82 \pm 7.40	92.6 \pm 4.7	0.000*

($p<0.05$)

Figure 2: Regression analysis of BMI and number of gray hairs



In order to find the cause and effect relationship between number of gray hairs, SBP and BMI, a partial correlation analysis was performed. In this analysis BMI correlated with number of gray hairs even after controlling for SBP ($r=0.470$) ($P=0.000$) but there was no significant correlation between number of gray hair and SBP when controlled for BMI ($r=0.022$) ($P=0.750$) which is shown in Table 2.

Table 2: Correlation and partial correlation analysis of number of gray hairs with blood pressure and BMI

Parameters	r-value	P-value
No. of gray hair vs SBP	0.211	0.002*
vs BMI	0.505	0.000*
Partial correlation analysis		
Controlling for BMI		
SBP vs No. of gray hair	0.022	0.750
Controlling for SBP		
BMI vs No. of gray hair	0.470	0.000*

Discussion:

In our present study premature canities subjects were predominantly obese compared with controls. Similar to our study Acer et al finding demonstrated that the age of onset of premature gray hair decreases with increase in BMI (10). In contrast to our study, Sharma and Dogra did not find any significant difference in BMI between premature gray hair subjects and controls. This could be due to smaller sample size involved in this study (11). The study done by Paik et al blood pressure, BMI, and even blood glucose were elevated in subjects with premature canities and they have concluded that premature canities can be considered as clinical marker of metabolic syndrome (12). In our present study we found that blood pressure was significantly high in premature canities subjects compared to controls. According to ElFaramawy et al hypertension, hair whitening score along with age and dyslipidemia were independent predictors of atherosclerotic Coronary Artery Disease (CAD) (13). In our study both BMI and blood pressure correlated with number of gray hairs. In accordance with our study, Shin et al also demonstrated that obesity correlated with gray hair and its severity (14). In order to find out the

cause and effect relationship between BMI, blood pressure and number of gray hair we did a partial correlation analysis. In our study BMI correlated significantly even after controlling for blood pressure. On the contrary we did not find any significant relationship between blood pressure and number of gray hairs when controlled for BMI. This shows that obesity plays a central role in development of premature gray hair along with blood pressure. In supportive of our observation Paik et al did not find any significant contribution by BMI and blood pressure individually in the development of gray hair but when both the metabolic factors are taken into consideration they were significantly associated with the development and severity of gray hair (13) .

Obesity being a pro-inflammatory condition is known to induce oxidative stress (15). Oxidative stress can increase blood pressure and increased blood pressure can also induce oxidative stress (16) . According to Arck et al premature hair graying occurs as a result of high oxidative stress in melanocyte hair follicle leading to their destruction and inhibition of melanogenesis (17)(18). So obesity plays a key role in the development of not only hypertension but also hair graying through oxidative stress in premature canities

Conclusion:

Obesity being a proinflammatory condition plays a key role in the development of hypertension and gray hair through oxidative stress in premature canities.

Conflict of Interest: Authors declares no conflicts of interest.

Reference:

1. Panhard S, Lozano I, Loussouarn G. Greying of the human hair: a worldwide survey, revisiting the “50” rule of thumb. *Br J Dermatol*. 2012 Oct;167(4):865–73.
2. Daulatabad D, Singal A, Grover C, Chhillar N. Profile of Indian patients with premature canities. *Indian J Dermatol Venereol Leprol*. 2016;82(2):169–72.
3. Pandhi D, Khanna D. Premature graying of hair. *Indian J Dermatol Venereol Leprol*. 2013;79(5):641–53.
4. Schnohr P, Lange P, Nyboe J, Appleyard M, Jensen G. Gray hair, baldness, and wrinkles in relation to myocardial infarction: the Copenhagen City Heart Study. *Am Heart J*. 1995 Nov;130(5):1003–10.
5. Altan Kocaman S, Çetin M, Emre Durakoğlugil M, Çanga A, Çiçek Y, Doğan S, et al. The degree of premature hair graying as an independent risk marker for coronary artery disease: a predictor of biological age rather than chronological age. *Anatol J Cardiol [Internet]*. 2012;12(6):457–63. Available from: <https://dx.doi.org/10.5152/akd.2012.150>
6. Artham SM, Lavie CJ, Milani R V., Ventura HO. Obesity and hypertension, heart failure, and coronary heart disease - Risk factor, paradox, and recommendations for weight loss. *Ochsner J*. 2009;9(3):124–32.
7. Jiang SZ, Lu W, Zong XF, Ruan HY, Liu Y. Obesity and hypertension. *Exp Ther Med*. 2016;12(4):2395–9.
8. World Health Organisation (WHO). WHO | Waist Circumference and Waist–Hip Ratio. Report of a WHO Expert Consultation. Geneva, 8–11 December 2008. 2008;(December):8–11. Available from: <http://www.who.int>
9. Chobanian A V, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Joseph L. J, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood PressureThe JNC 7 Report. *JAMA [Internet]*. 2003 May 21;289(19):2560–71. Available from: <https://doi.org/10.1001/jama.289.19.2560>
10. Acer E, Arslantaş D, Emiral GÖ, Ünsal A, Atalay BI, Göktaş S. Clinical and epidemiological characteristics and associated factors of hair graying: a population-based, cross-sectional study in Turkey. *An Bras Dermatol*. 2020;95(4):439–46.
11. Sharma N, Dogra D. Association of Epidemiological and Biochemical Factors with Premature Graying of Hair: A Case-Control Study. *Int J Trichology*. 2018;10(5):211–7.
12. Paik SH, Jang S, Joh HK, Lim CS, Cho B, Kwon O, et al. Association between premature hair greying and metabolic risk factors: A cross-sectional study. *Acta Derm Venereol*. 2018;98(8):748–52.
13. ElFaramawy AAA, Hanna IS, Darweesh RM, Ismail AS, Kandil HI. The degree of hair graying as an independent risk marker for coronary artery disease, a CT coronary angiography study. *Egypt Hear J [Internet]*. 2018;70(1):15–9. Available from: <https://doi.org/10.1016/j.ehj.2017.07.001>
14. Shin H, Ryu HH, Yoon J, Jo S, Jang S, Choi M, et al. Association of premature hair graying with family history, smoking, and obesity: A cross-sectional study. *J Am Acad Dermatol*. 2015;72(2).
15. Marseglia L, Manti S, D’Angelo G, Nicotera A, Parisi E, Di Rosa G, et al. Oxidative stress in obesity: A critical component in

human diseases. *Int J Mol Sci.* 2015;16(1):378–400.

16. Nambiar S, Viswanathan S, Zachariah B, Hanumanthappa N, Magadi SG. Oxidative stress in prehypertension: rationale for antioxidant clinical trials. *Angiology.* 2009;60(2):221–34.
17. Arck PC, Overall R, Spatz K, Liezman C, Handjiski B, Klapp BF, et al. Towards a “free radical theory of graying”: melanocyte apoptosis in the aging human hair follicle is an indicator of oxidative stress induced tissue damage. *FASEB J.* 2006;20(9):1567–9.
18. Zhang B, Ma S, Rachmin I, He M, Baral P, Choi S, et al. Hyperactivation of sympathetic nerves drives depletion of melanocyte stem cells. *Nature [Internet].* 2020;577(7792):676–81. Available from: <https://doi.org/10.1038/s41586-020-1935-3>