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Original Research Paper

Effect of Tobacco Chewing on Arterial Stiffness Index

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ABSTRACT:
Tobacco abuse is a leading cause of premature deaths globally, and it is expected to rise in future. In India tobacco is abused in different forms, chewing is one of them. Unlike smoking, the ill effects of tobacco chewing have been less studied. Tobacco is known to affect the structural and mechanical properties of the arterial walls in many ways. This alters the arterial stiffness which is a strong and independent predictor of cardiovascular morbidity and mortality. This study was intended to explore the ill effects of tobacco chewing on cardiovascular system. The study was performed on males belonging to the age group between 20-40 years with different history of tobacco consumption. Artery stiffness index (ASI) was measured via Pulse wave velocity recording which was recorded from the right index finger in sitting position through plethysmographic transducer using the Dicrowin, a PC based PPG analysis system. The signal from plethysmograph was digitalized using 12-bit analogue to digital converter with a sampling frequency of 200 Hz. Artery stiffness index (ASI) of tobacco chewers of less than 10 years duration is found to be almost similar to age matched controls. However ASI of chewers of more than 10 years has been found to be significantly increased. The increase in arterial stiffness has been attributed to the endothelial dysfunction, altering the levels of secretions like prostacyclin, endothelin, vascular endothelial growth factor, interleukins etc. The changes in elastin and collagen proportion, in matrix metalloproteases and advanced glycation end products also play important role. In present study we demonstrated that long term tobacco chewing is associated with adverse effect on Artery stiffness index which is an important predictor of cardiovascular well being.

Keywords: Tobacco, Arterial Stiffness, Pulse wave velocity.

INTRODUCTION:

Tobacco when consumed either via smoking or chewing leads to blood vessel damage, increased blood pressure and lowered exercise tolerance. It also raises the coaguability of blood and ultimately increases the risk of stroke or sudden death. [1] According to the World Health Organization (WHO) estimates, globally, there were 100 million premature deaths due to tobacco in the 20 century, and if the current trends of tobacco use continue, this number is expected to rise to 1 billion in the 21 century. [2] India's tobacco problem is very complex, with a large use of a variety of smoking forms and an array of smokeless tobacco products. In Indian context many studies have estimated that, nearly 23.7% of the deaths among men (527,500) and 5.7% of the deaths among women (83,000) aged 35–69 years are due to tobacco attributable illnesses. [3] Smoking is responsible for one-tenth of CVD worldwide claiming almost 6 million deaths a year. Awareness of association between smoking and cardiovascular disease remains low in many parts of the world: more than 70 per cent of all smokers do not know that smoking increases their risks of having a stroke. Smoking bans have been proved to be one of the most cost-effective ways to prevent heart attacks. Smokeless tobacco has made resurgence due to vigorous efforts toward increasing awareness of the adverse effects of tobacco and smoking has declined consistently over the past 30 years. According to the National Family Health Survey

(NFHS-5) survey, conducted in 2019–21, tobacco use is more prevalent among men, rural population, illiterates, poor and vulnerable section of the society. Smokeless tobacco use is equally addictive, harmful and carcinogenic. Association between smoking and cardiovascular health hazards has been well established but the ill effects of smokeless tobacco on cardiovascular system have not been studied in sufficient details. [4] Arterial stiffness is a strong and independent predictor of cardiovascular morbidity and mortality risk factor. [5] There is substantial evidence that tobacco consumption adversely affects endothelial functions including structural and mechanical properties of arterial walls, which leads to increase in Arterial Stiffness Index. [6] The physiological balance between nitric oxide (NO) which causes vasodilatation and enodthelin-1 (ET-1) a powerful vasoconstrictor play a crucial role in the pathophysiology of many chronic cardiovascular diseases and subsequently affect arterial stiffness. [7] Although it has been proved in many previous studies that tobacco smoking is associated with changes in endothelial function, however it is not yet clear whether similar changed also occur with tobacco chewing. [8] In order to complement our knowledge about the ill effects of smokeless tobacco on cardiovascular system this cross sectional study was conducted. The study was performed on males belonging to the age group between 20-40 years. The sample size was statistically calculated to be about 360 in accordance to the prevalence data.

Study Groups: - The study population was divided into four groups

Group A – Males of age group 20-30 years who never used tobacco in any form. N = 90

Group B – Males of age group 20-30 years with history of tobacco chewing since 2 to 10 years. N = 90

Group C – Males of age group 31 – 40 years who never used tobacco in any form. N = 90

Group D - Males of age group 31 – 40 years with history of tobacco chewing since 11 to twenty years. N = 90

The subjects were asked not to consume any tobacco products since 12 hours prior to the time of examination to obviate the acute effects of tobacco on cardiovascular system. The recordings were made between 9-10 AM (to avoid circadian change in arterial stiffness). Entire procedure and the protocol were explained to the subjects in vernacular language and written informed consent to participate in study was taken from participants before examination. Confidentiality and safety of the data collected was assured. A detailed history was collected and a thorough clinical examination was performed with special attention to the conditions and factors known to affect the Arterial Stiffness Index. Arterial Stiffness Index was measured via Pulse wave velocity recording which was recorded from the right index finger in sitting position through plethysmographic transducer using the Dicrowin, a PC based PPG (Pulse Plethysmography) analysis system made by Genesis medical Systems. The signal from plethysmograph was digitalized using 12-bit analogue to digital converter with a sampling frequency of 200 Hz. Statistical Analysis was done by Microsoft excel 2010. The result was expressed as Mean ± S.D. Group A was compared with group B and group C was compared with Group D. Unpaired Student's t- test was used for comparison between the groups and P value < 0.05 was considered as significant.

Table: 1- Anthropometric parameter comparison between Group A and B.

	Group A Control N = 90		**Group B Tobacco chewers N = 90**				
Parameters	**Mean**	**S.D**	**Mean**	**S.D**	**T value**	**DF**	**P value**
Age (years)	26.8	2.56	27.45	1.70	2.01	178	0.046
Weight (kg)	62.72	10.07	65.91	10.50	2.08	178	0.038
Height (meter)	1.67	0.05	1.65	0.04	3.22	178	0.0015
BMI (kg/m^2)	22.36	3.35	24.23	3.49	3.67	178	0.0003
Duration of tobacco use (year)			9.08	1.41			
Amount of tobacco used (gram/day)			6.12	1.89			

Table: 2- Anthropometric parameter comparison between Group C and D.

	Group C Control N = 90		Group D Tobacco chewers N = 90				
Parameters	**Mean**	**S.D**	**Mean**	**S.D**	**T value**	**DF**	**P value**
Age (years)	35.76	2.52	36.75	2.89	2.45	178	0.015
Weight (kg)	67.59	11.12	61.44	8.13	4.23	178	< 0.0001
Height (meter)	1.67	0.05	1.62	0.05	8.86	178	< 0.0001
BMI (kg/m^2)	24.06	3.75	23.23	2.72	1.66	178	0.098
Duration of tobacco use (year)			16.91	3.23			
Amount of tobacco used (gram/day)			7.49	2.03			

Table: 3- Comparison of Arterial Stiffness between Group A and B.

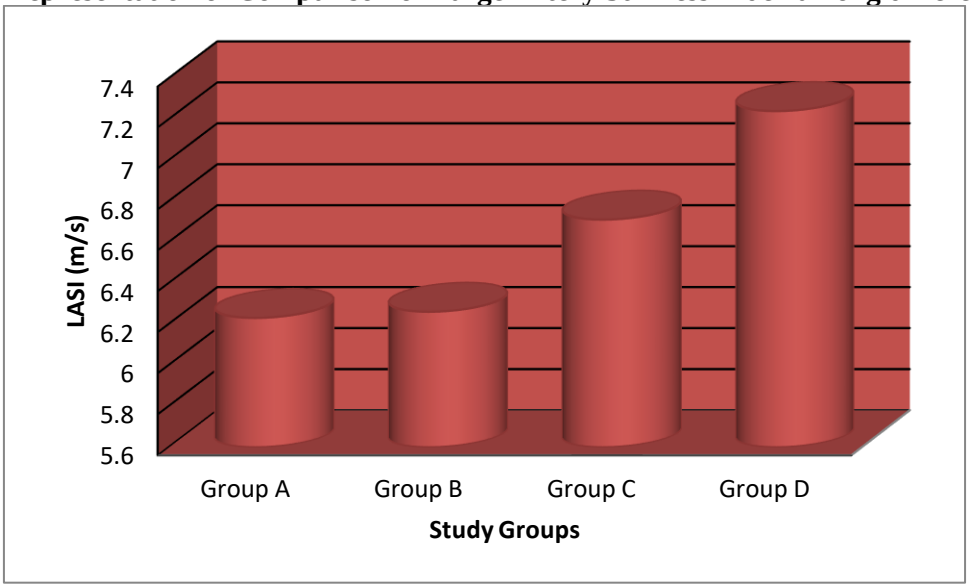
	Group A Control N = 90		Group B Tobacco chewers N= 90				
Parameters	**Mean**	**S.D**	**Mean**	**S.D**	**T value**	**DF**	**P value**
Arterial stiffness index (m/s)	6.23	2.41	6.26	1.04	0.11	178	0.913

Table: 4- Comparison of Arterial Stiffness between Group C and D.

	Group C Control N = 90		Group D Tobacco chewers N = 90				
Parameters	**Mean**	**S.D**	**Mean**	**S.D**	**T value**	**DF**	**P value**
Arterial stiffness index (m/s)	6.71	1.43	7.24	1.69	2.27	178	0.02

The mean value of ASI of group A is 6.23 ± 2.41m/s and of group B is 6.26 ± 1.04m/s with p value 0.913. The mean value of ASI of group C is 6.71 ± 1.43 m/s and of group D is 7.24 ± 2.27 m/s with p value 0.02.

Figure: 1- Graphical Representation of Comparison of Large Artery Stiffness Index among different groups.



DISCUSSION:

Artery stiffness index (ASI) of tobacco chewers of less than 10 years duration is found to be almost similar to age matched controls. However ASI of chewers of more than 10 years has been found to be significantly increased. This shows that habit of tobacco chewing has damaging effect on vessel walls. Long term use of tobacco may lead to decreased elasticity of the vessel wall. As the elasticity decreases vessel wall becomes stiffened and this leads to altered vascular physiology. [9] Endothelial dysfunction resulting in increased degradation or decreased sensitivity to NO has been considered an early phase in the pathogenesis of cardiovascular disease. [10] NO along with many other endothelial secretions like prostacyclin, endothelin, vascular endothelial growth factor, interleukins, tissue plasminogen activator, angiotensin converting enzyme and von Willebrand factor play a key role in regulation of arterial stiffness index. [11] The proportion of elastin and collagen in the arterial wall is in dynamic equilibrium. [9] Physical stress and increase in matrix metalloproteases due to inflammatory mediators makes collagen particularly susceptible to non-enzymatic glycation and cross-linking. [12, 13] Tobacco products lead to activated metalloproteases which generate broken and frayed elastin molecules and cause disruption of the cross-links predisposing to protein mineralization and an increase in arterial stiffness. [14, 15, 16] Advanced glycation end products (AGEs) which are known to be associated with tobacco abuse, also contribute to arterial stiffening by forming irreversible cross-links between proteins such as collagen and elastin. [17, 18, 19, 20] AGEs also impair endothelial function by decreasing nitric oxide and by increasing the generation of oxidants. [21] Furthermore, by binding to specific receptors, AGEs initiate inflammatory responses that lead to increase vascular stiffness via activation of metalloproteinases, which further contributes to endothelial dysfunction and promotes atherosclerosis. [22, 23] Many studies have proved the hazards of smokeless tobacco on human health. However, long term effect of smokeless tobacco use on cardiovascular health has not been thoroughly studied. In present study we demonstrated that long term tobacco chewing is associated with adverse effect on arterial stiffness index which is an important predictor of cardiovascular well being. The results of this study suggest that tobacco chewers are at higher risk of cardiovascular diseases as compared to non-tobacco chewing population. The findings of our study suggest that further longitudinal studies with wider subject base and parameters should be done to establish the degree of correlation between tobacco chewing and cardiovascular health.

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