ORIGINAL ARTICLE CODEN: AAJMBG

Dipping tobacco and its health risks among young adults - A short study

M.I. Glad Mohesh* **and R. Arul Bhagyaraj**

Department of Physiology, Shri Sathya Sai Medical College & RI, Ammapettai, Sembakkam Post-603108 Kancheepuram, Tamilnadu, India

Abstract: *Introduction:* Dipping tobacco (DT) also known as "moist snuff" is used by the smokeless tobacco users in the form of small pinches of shredded tobacco pieces kept between the lips and gums. Thirty five percent adults in India use tobacco in any form, wherein 9% smoke tobacco, 21% use smokeless tobacco and the remaining 5% use both. Tobacco accelerates the endothelial dysfunction in large arteries, arterioles and small arteries increasing the sclerotic process and thereby causing arterial stiffness. Nitric oxide (NO), the endothelium produced vasodilator regulates the smooth muscle tone which is damaged by this tobacco. The sclerotic damage in arteries can be ruled out using Pulse wave analysis (PWA), a non-invasive diagnostic tool. *Method:* Dipping tobacco users who scored more than 5 in Fagerstroms nicotine addiction questionnaire were included into the study group (n=30) and they were compared against non tobacco users who served as control subjects. Anthropometric details like age, height and weight were collected. Resting blood pressure using a digital sphygmomanometer (OMRON HEM 501) and finger pulse wave using Digital polyrite (RMS) was recorded. Recorded data was stored in the computer and later analysed for statistical significance using Graphpad prism ver.5.0. *Results:* Results showed a significantly decreased large arterial stiffness in the dipping tobacco users than in the controls (5.16+1.3, 6.82+2.0, $p<0.001$). A slight change on pulse wave velocity was seen which is suspected to be the preliminary change affecting the arteries due to nicotine use. *Conclusion:* Nicotine's action to bring about arterial wall stiffness as reported earlier was contradicted in this study. Limitations in the sample size and inclusion of heavily addicted subjects would probably throw greater light on this issue.

Keywords: moist snuff, pulse wave analysis, nicotine addiction.

Introduction

Dipping tobacco also known as moist snuff is used by the smokeless tobacco users in the form of small pinches of shredded tobacco pieces kept between the lips and gums. The nicotine present in it is absorbed from buccal or sublingual areas through labial arteries. Thus absorbed nicotine remains in the blood even after removing the snuff [1]. This smokeless tobacco contains 28 components that remain as cancer and cardiovascular risk factors [2]. The current study is on cardiovascular health changes due to the dipping tobacco use.

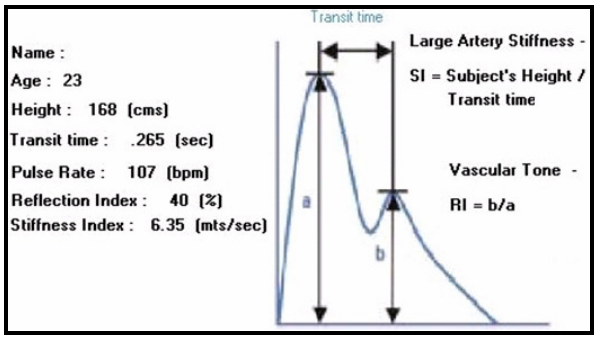
Thirty five percent of adults in India use tobacco in any form wherein, 9% only smoke tobacco, 21% of adults use only smokeless tobacco [3]. Betel quid (pan) and khaini (tobacco with lime) are the most commonly used smokeless tobacco forms in India. Initiation of using smokeless tobacco begins at an age of 12-17 years [4]. It's because of the governments ban on public smoking that has made these smokers to switch on to smokeless tobacco use [5]. Dipping tobacco products are cheaper than cigarettes and is available in easy to carry small pouches. Smoking tobacco increases arterial stiffness by accelerating the sclerotic process. Even a single cigarette smoked would lead to a short term increase in the arterial wall stiffness and an increase in the heart rate [6].Smoking tobacco accelerates endothelial dysfunction, decreasing the Nitric oxide(NO) the endothelium produced vasodilator that regulates the smooth muscle tone [7].

Increased arterial stiffness causes an increase in the transit velocity of both forward and reflected waves. Large artery stiffness is a major determinant of the pulse pressure. When arteries become stiffer reflected waves arrive faster, augments central systolic rather

than diastolic blood pressure, increases left ventricular workload and compromise coronary blood flow [8].Underlying mechanisms by which nicotine causes these are yet to be explained clearly.

In dipping tobacco, nicotine is absorbed through the oral mucosa, which may release catecholamines from sympathetic endings [9] subsequently activates the alpha- adrenoceptors in vascular smooth muscle cells that contracts vascular tissue and elevates blood pressure. Nicotine's role differs, acting directly on vascular smooth muscle brings either vascular relaxation or contraction [10-11]. Nicotine on blood vessels causes vasoconstriction directly via O_2 free radicals and indirectly through impairing the endothelium dependant pathway of vasorelaxation. Stiffness index derived from the pulse wave analysis is comparable to the definitive measure of the arterial stiffness whereas reflection index is a measure of the vascular tone.

Fig-1: Plethysmographic analysis



Pulse wave analysis (PWA) is one of the non-invasive methods used to measure arterial stiffness. Pulse wave contour (fig.1) has two components, 1, caused by the systolic blood pressure wave that reflects from the ejected blood from the left ventricle to aorta, 2.Reflected pressure wave back to the aorta from the lower body. Smokeless tobacco can lead to nicotine addiction and can induce all complications as that of smoking tobacco. As this addiction is in rise among the younger age group, this study aimed at the exposed health risks in young dipping tobacco users.

Aims and objectives: To study the effect of dipping tobacco use on blood pressure, stiffness index, reflection index and pulse wave velocity in young dipping tobacco users by pulse wave analysis technique.

Material and Methods

This study was approved by the Institutional Ethics committee (Human Studies) and was conducted by following the ethical guideline issued by ICMR, New Delhi. Subjects were selected randomly within the medical college campus based on the below said criteria;

Group A (control) → (n=30) males (18-30 years) who never used tobacco in any form.

Group B (study) → (n=30) males (18-30 years) users of dipping tobacco users for minimum 1 year and with a Fagerstroms nicotine addiction score (smokeless tobacco) [12] >5 i.e, significant dependance.

Selected subjects were asked to refrain themselves from tobacco use for more than 12 hours before reporting for the study. Subjects reported to the research lab in the department of physiology between (8am to 10am). Entire procedure and the protocol were explained to them in vernacular language. Confidentiality and safety of the data collected was assured. Written informed consent was obtained. Anthropometric measurements (age, height, weight, sex) were taken. Subjects were enquired for any known cardiovascular illness in the past. After resting for 10 minutes in sitting position, brachial blood pressure was measured in sitting position with a semi-automated digital sphygmomanometer (Omron Hem- 401). Three readings were taken with 1 minute interval and the mean was taken into account. Pulse wave acquisition was made from the right index finger through plethysmographic transducer using the Digital polyrite machine (RMS) in sitting position. After the wave gets stabilized continuous pulse wave recording was done for 5 minutes. Data was stored in the computer for later analysis using Polywrite -D software ver.4.0.

By the above said procedures the following data were recorded:

1. Height, weight, age.
2. Systolic and diastolic blood pressure (SBP/DBP)
3. Pulse rate (PR)

4. Pulse transit time (PTT)
5. Reflection index (RI)
6. Stiffness Index (SI)

From the collected data, mean arterial blood pressure (MABP), body mass index (BMI) and pulse pressure (PP) were calculated. Statistical analysis was done by student "t" test using statistical software Graphpad prism ver.5.0. Significance was set at $p < 0.05$.

Results

Table.1 shows the significant changes in the cardiovascular parameters of the dipping tobacco users in comparison with the age and sex matched normal individuals. There was a significant decrease in the weight of the study subjects with that of the controls (55.43±10.90/ 72.22±15.99kgs) ($p<0.001$). There is rise in the systolic pressure in the study group than in the controls (121.43±10.90/117.54±11.18) mmHg but it appears with no statistical significance. Diastolic pressure was decreased in the study group with no statistical significance. Greater decrease in the pulse rate was noted in the study group which was found to be statistically significant, (80.47±9.30/ 89.06± 17.54 bpm) ($p<0.001$). Stiffness index that represents the large arterial stiffness was found significantly decreased in the study group, (5.16±1.33/6.82±02.08m/sec) ($p<0.0001$). Reflection index that represents the small artery stiffness also had decreased in the study group significantly, (58.73±22.52/ 66.42±17.95%) ($p<0.05$). The pulse transit time which is an indirect measure of the velocity of blood flow in the arteries was found to be increased significantly in the study group than in the controls, (0.320± 0.09/0.268 ± 00.05sec) ($p<0.0005$).

Table-1: Comparison of parameters between the non-tobacco users and dipping tobacco users

		Group A (n=30)	Group B (n=30)	P value
Age	years	18.96 ± 01.70	23.47 ± 03.80	<0.082
Height	cms	171.59 ± 06.90	162.47 ± 06.50	<0.001**
Weight	kgs	72.22 ± 15.99	55.43 ± 10.90	<0.001**
BMI	kg/ m^2	24.53 ± 04.60	20.42 ± 02.50	<0.0001**
SBP	mmHg	117.54 ± 11.18	121.43 ± 10.90	<0.20
DBP	mmHg	70.83 ± 08.67	66.91 ± 10.17	<0.14
MABP	mmHg	85.05 ± 09.83	85.19 ± 09.23	<0.95
PR	bpm	89.06 ± 17.54	80.47 ± 09.30	<0.001**
PP	mmHg	48.03 ± 13.42	54.13 ± 09.56	<0.05*
PTT	sec	0.268 ± 00.05	0.320 ± 00.09	<0.0005**
Ref Index	%	66.42 ± 17.95	58.73 ± 22.52	<0.05*
Stiff Index	m/sec	6.82 ± 02.08	5.16 ± 01.33	<0.0001**

Values in mean ± SD,*significant, **very significant.

Discussion

Decreased body weight of the study subjects may be due to nicotine in tobacco which suppresses the appetite. This effect is overseen by the DT users as an increased work efficiency due to the amount of work that they can do at the jobsite is relatively more. But they donot understand that it is being done at the risk of their health and wellbeing. Cigarette smoking elevates the concentration of circulating plasma Leptin which is a polypeptide hormone secreted by adipocytes that decreases bodyweight mainly by reducing food intake and increasing energy expenditure through central and peripheral mechanisms [13]. Here in this study, we suspect that rise in the metabolism and

decrease in the appetite by Leptin stimulated by nicotine leads to weight loss [14].

Statistically insignificant increased systolic pressure in the study group is not due to any sympathetic activity as there is no increase in the pulse rate. Earlier reports on smoking tobacco explains that there will be an acute increase in the blood pressure along with increase in heart rate. Direct entry and a greater quantity of nicotine in the blood in DT users may be following a different mechanism of action. Further investigation on these lines is needed.

Decreased diastolic pressure in the study group which may be due to excessive vasodilatation. Nicotine's acute effect on cardiovascular system is to influence the mechanisms of endothelial vasodilators thereby bringing vasoconstriction. But this normal phenomenon was not appreciated in our study instead there was a complete vasodilation causing the blood pressure to fall. A fall in the diastolic pressure decreases the total peripheral resistance which is necessary for the blood to flow all over the body to supply each and every organ. With slow flow of blood, organs suffer hypoxia at tissue level. It is advisable to have a hemoglobin test and pulse oximetry tests done in these kinds of subjects. Estimation of the different gases in the blood could show the impact of DT on the oxygen/CO_2 carrying capacity of the blood.

Decreased pulse rate in the study group showed that there is not so marked sympathetic activation due to the intake of nicotine [15]. Pulse pressure remained elevated as both the systolic and diastolic pressure showed some changes. Reflection index and Stiffness index decreased significantly in the study group showing that there is a greater vasodilatation or lesser stiffness in the arteries. This was supported by an increase in the pulse transit time which shows that there is a decreased velocity of blood flow. These results in which there are absence of large arterial and small arterial stiffness becomes contradictory to the earlier reports that said nicotine in smokers cause arterial stiffness. Dipping tobacco's effect may not be seen with the extent of addiction a person has but it depends upon the period of nicotine use to establish a permanent effect on the cardiovascular system. Impact on parameters of cardiovascular system seems to be either less or it's so devastating that all the vascular autonomic responses are failing. Detailed investigation is necessary to conclude.

Nicotine in smoking tobacco causes increased vasoconstriction is due to an increased arterial stiffness but results in smokeless tobacco was opposite. Our study supports few of the earlier studies that says that smokeless tobacco in general do not increase the risk of MI and did not affect the common carotid intima thickness which is associated with CAD[16-18]. We suspect that the nicotine addiction alone is not enough to bring its effects upon the vascular system. Period of addiction and a continuous use is essential.

Further studies are needed to rule out the same effect of nicotine dipping tobacco users. Although some of the previous studies said that, about 3.5mgs of nicotine gets entry in a DT user's vascular system while only 0.5 to 1.5mgs of nicotine makes its ways into a smoker's blood, quantity of nicotine is not all that enough, we believe, it's the period of continuous intake of nicotine that constructs all the adverse effects.

Conclusion

Use of tobacco in any form is going to harm its user. Here in this study we were able to rule out some of the ill-effects of the nicotine in dipping tobacco users. Loss of bodyweight and decrease in the velocity of blood flow are going to cause extensive damage to the health of the DT users. Blood pressure changes although not significant informs us the nicotine's effects on vascular pressure. Its direct entry into the blood from DT was expected to cause a great impact on atherosclerotic changes.

But in this study those vascular changes are not markedly seen. We believe that this is because of the fact that, nicotine addiction of our subjects are high although the period of use is of one year only which is not sufficient enough to get the permanent damage established. It was difficult for us to get isolate DT users as these people once addicted to tobacco will also be using other forms of tobacco like smoke, Gutkha, pan etc and alcohol. Large scale studies that include

smoking/alcoholism could give a clear picture. But this could be also the crucial stage during which the DT users can be alerted on the damage they are getting with the use of this kind of smokeless tobacco.

Also changes in other organs of the body like liver, lung, kidney, CNS and Autonomic nervous system should be studied. Biochemical and biosignal parameters should be taken into account to create more solid evidence against this nicotine from dipping tobacco.

Acknowledgements

The authors are grateful to the Indian Council of Medical Research (ICMR) to have funded this project under ICMR STS 2011 programme.

References

1. Benowitz NL, Porchet H, Sheiner L, and Jacob P. Nicotine absorption and cardiovascular effects with smokeless tobacco use: comparison with cigarettes and nicotine gum. *Clin Pharmacol Ther,* 1988; 44:23-28.
2. Brunnemann KD & Hoffmann D. Chemical composition of smokeless tobacco products. In: Smokeless Tobacco or Health. An International Perspective. Smoking and Tobacco Control Monograph No. 2, NIH Publ. No.93-3461, *Bethesda, MD, National Cancer Institute*.1992.
3. Global adult tobacco Survey; India 2009-2010; 1.
4. Smokeless tobacco use, initiation and relationship to cigarette smoking, 2002 to 2007 the *NSDUH report. March* 2009.
5. Centers for Disease Control and Prevention. Preventing tobacco use among young people: a report of the Surgeon General (Executive Summary). *MMWR* 1994; 43(4):7.
6. Kool MJF, Hoeks APG, Boudier HAJ, Reneman RS, Van Bortel LM. Short- and long-term effects of smoking on arterial wall properties in habitual smokers. *Journal of the American College of Cardiology,* 1993; 22:1881-1886.
7. McVeigh GE, LeMay L, Morgan DJ, Cohn JN. The effect of chronic cigarette smoking on endothelium-dependent responses in humans. *The American Journal of Cardiology,* 1996; 78:668-672.
8. Maddury Jyotsna, Alla Mahesh, Madhavapeddi Aditya, Pathapati Ram Mohan Maddireddy Umameshwar Rao Naidu. Comparison of Invasive vs Noninvasive Pulse Wave Indices in Detection of Significant Coronary Artery Disease: Can We Use Non-invasive Pulse Wave Indices as Screening Test. *Clinical Medicine: Cardiology* 2008; 2:153-160.
9. Salma Toma Hanna. Nicotine Effect on Cardiovascular System and Ion Channels, *J Cardiovasc Pharmacol,* 2006; 47(3): 348-358.
10. Wang R, Wang Z. Three different vasoactive responses of rat tail artery to nicotine. *Can J Physiol Pharmacol.* 2000; 78:20-28.
11. Tang G, Hanna ST, Wang R. Effects of nicotine on K+ channel currents in vascular smooth muscle cells from rat-tail arteries. *Eur J Pharmacol.* 1999; 364: 247-254.
12. Ebbert J, et al. The Fagerstrom Test for Nicotine Dependence-Smokeless Tobacco (FTND-ST). *Addictive Behaviours.* 2006; 31(9):1716-1721.
13. Bayram koc, Fatih bulucu, Nuri karadurmus, Mustafa sahin. Lower Leptin levels in young non-obese male smokers than non-smokers. *Upsala Journal of Medical Sciences,* 2009; 114:165-169.
14. Jean-Claude Orsini, Dependence on tobacco smoking and brain systems controlling glycemia and appetite. *Alcoologie et Addictologie* 2001; 23(2S):28S-36S.
15. Benowitz NL. The role of nicotine in smoking-related cardiovascular disease. *Prev Med.*1997; 26(4): 412-7.
16. Huhtasaari F, Lundberg V, Eliasson M, Janlert U, Asplund K.Smokeless tobacco as a possible risk factor for myocardial infarction: a population-based study in middle -aged men. *J Am Coll Cardiol* 1999; 34:1784-90.
17. Huhtasaari F, Asplund K, Lundberg V, Stegmayr B, Wester PO.Tobacco and myocardial infarction: is snuff less dangerous than cigarettes?. *Br Med J* 1992; 305:1252-6.
18. Bolinder G, Noren A, de Fair U, Wahren J. Smokeless tobacco use and Atherosclerosis: an ultrasonographic investigation of carotid intima media thickness in healthy middle-aged men. *Atherosclerosis*, 1997; 132:95-103.

*All correspondences to: Mr. M.I. Glad Mohesh, BPT, MSc (Medical Physiology), Assistant Professor, Department of Physiology, Shri Sathya Sai Medical College & RI, Ammapettai, Sembakkam Post-603108 Kancheepuram District, Tamilnadu, India.
Email: gladmohesh@gmail.com