Investigation of the effect of using Maraspowder (Nicotiana Rustica) on arterial stiffness by photoplethysmography

Adnan Demirel¹, Ejder Berk²
¹Department of Physical Therapy and Rehabilitation, Bolu Abant İzzet Baysal University Medical School, Bolu, Türkiye
²Department of Physical Therapy and Rehabilitation, Kahramanmaraş Sütcü İmam University Medical School, Kahramanmaraş, Türkiye

ABSTRACT

Aim: To evaluate atherosclerosis in Maraspowder (MP) smokers by measuring pulse wave velocity (PWV) using photoplethysmography.

Method: This study was carried out by forming two groups: MP smokers and a healthy control group. All participants underwent PWV using the photoplethysmography method. Student’s t-test, receiver operating characteristic curve, and regression analysis were performed on age and PWV data to assess arterial stiffness.

Results: There was no statistically significant difference between the groups in terms of age, but the PWV values of the MP group were statistically significantly higher than those of the control group. The sensitivity and predictability of the cut-off value predicting MP smokers was quite high (100%). A logistic regression analysis to determine the correlation of variables did not yield significant results.

Conclusion: As is the case with cigarette use, the use of MP negatively affects cardiovascular health. It is important to develop policies and strategies to warn society about this risk to protect people from irreversible harm to their health.

Key words: Maraspowder, tobacco, arterial stiffness, pulse wave velocity, photoplethysmography.

Introduction

Different forms of tobacco, including smokeless tobacco, are used for nicotine consumption. Regular tobacco (nicotiana tobacum and nicotiana rustica), also known as Aztec tobacco or strong tobacco, comprises just 2 of the 76 nicotiana species consumed on a large scale by humans. Nicotiana rustica contains 5–8 times more nicotine and tobacco-specific nitrosamines than nicotiana tobacum, from which smoking tobacco is derived. Maraspowder (MP), also known as Maraş weed, is a type of smokeless tobacco prepared by pulverizing the leaves of nicotiana rustica. It is widely used in the provinces of this region, especially in Kahramanmaraş in the Eastern Mediterranean region of Türkiye. MP is used instead of cigarettes, with cigarettes, or by chewing it in the mouth. There is a belief that MP is less harmful than cigarettes. However, although it is also used as a smoking cessation aid, many studies have shown that it has analogous effects to smoking. It has also been shown that urinary nicotine
levels, which are an indicator of tobacco consumption and therefore nicotine intake, are three times higher in individuals using MP [1-8]. The relationship between smoking, which can cause cardiovascular damage through endothelial dysfunction and harmful hemodynamic effects, and the stiffness of human arteries has been understood for decades [9-12]. Arterial stiffness is an independent predictor of hypertension, cardiovascular events, stroke, and mortality. Arterial stiffness increases with age, and modifiable risk factors, such as smoking, blood pressure, and salt intake, also affect it. One of the most widely used techniques for gauging arterial stiffness is pulse wave velocity (PWV) measurement, which is a non-invasive method [13-16]. This study aimed to evaluate arterial stiffness using photoplethysmography to measure PWV in MP smokers.

Materials and methods
This study, which was conducted in accordance with the ethical principles included in the 1964 Declaration of Helsinki and its subsequent amendments, was approved by the Clinical Research Ethics Committee of Kahramanmaraş Sütcü İmam University (Date and number: 2016/14).

Study Design
This study included individuals aged 25–60 who had used MP regularly for at least 3 years. Healthy individuals with compatible sociodemographic characteristics who did not use any tobacco products were included as the control group. All participants were given detailed information about the aims of the study, and their verbal and written consent was obtained. Individuals with a history of hypertension, cardiovascular disease, obesity (BMI > 30 kg/m²), alcohol or substance abuse, and regular exercise were excluded from the study.

Measurements
Participants were asked not to drink tea, coffee, or energy drinks for at least 12 hours before the measurement process, and measurements were made between 10 and 12 in the morning in a quiet room with an automatically controlled temperature between 22 and 24°C. First, the ages, heights, and body weights of the patients were recorded. In the PWV calculation, the distance between the suprasternal notch and the middle fingertip was first measured. Second, the pulse transition time (PTT) was calculated from the pulse wave obtained with a photoplethysmography device (Neurosoft Medical Diagnostic Equipment, Ivanovo, Russia) and the electrocardiogram records, which were obtained simultaneously [17]. Finally, the PWV was calculated by dividing the first distance measured by the PTT.

Statistical analysis
The data obtained in this study were statistically analyzed using SPSS Statistics software (Social Package for Social Science version 25.0, IBM Inc., Armonk, USA). The normality of the data was assessed with the Kolmogorov–Smirnov test, and because the variables were normally distributed, continuous variables were defined as mean ± standard deviation and compared with a student’s t-test. Receiver operating characteristic curve and regression analyses were also performed to determine the PWV value that predicted arterial stiffness. A significant p-value was determined to be < 0.05.

Results
The mean age was 32.36 ± 8.44 years in the control group (22 participants) and 39.75 ± 6.51 years in the MP group (20 participants) (Figure 1). There was no statistically significant difference between the two groups in terms of
The PWV values of the MW group were statistically significantly higher than those of the control group (108.16 ± 8.91 cm/s, 75.84 ± 8.27 cm/s, respectively) ($p < 0.001$) (Figure 2). Logistic regression analysis to determine the correlation of variables did not yield significant results. The area under the curve (1.000), sensitivity (100%), and specificity (100%) of the cut-off value (92.72 cm/s) predicting MW users were quite high (Figure 3).
Figure 3. ROC curve of differentiation of groups with PWV.

Discussion
Although many studies have investigated the harmful effects of smoking on arterial stiffness, the effects of MP on arterial stiffness have not been adequately studied. Studies examining the effects of smoking on atherosclerosis have shown that smoking reduces vascular elasticity and increases atherosclerosis. Nicotine is known to be an important risk factor for vascular damage, and its effects include increases in heart rate, cardiac stroke volume, coronary blood flow, and vasoconstriction [18–20]. Various mechanisms have been suggested to cause the increase in arterial stiffness seen in cigarette smokers [1,20]. It has been reported that smoking affects arterial stiffness, and hypertensive smokers are likelier to develop malignant and renovascular hypertension. Smokeless tobacco products are expected to cause comparable systemic effects due to similarities in their components [8, 10, 12, 21–23]. However, it has been stated that there is no significant difference in PWV values between smokers and non-smokers. The measurement of arterial stiffness is currently used for research rather than for clinical applications, but it is believed that it will be used in the calculation of cardiovascular risk in the near future [14–16, 24]. There have been relatively few studies evaluating the effects of smoking on arterial stiffness. However, it has been suggested that the relationship between smoking and arterial stiffness can be evaluated using PWV [13, 20, 23, 25–27]. A recent consensus defined carotid-femoral PWV as the gold standard for measuring arterial stiffness [17, 26, 27].

To the best of our knowledge, the relationship between smokeless tobacco consumption and atherosclerosis was investigated for the first time in this study, and a PWV threshold of 92.72 cm/s appears to successfully distinguish between smokeless tobacco smokers and non-smokers. The results of this study clearly show that MP is at least as effective as regular cigarettes in impacting cardiovascular health.

The most important limitation of this study was that the number of participants was relatively small and included only male participants. Second, groups that use more than one type of cigarette (tobacco products) could be formed. Third, the correlation between MP consumption and many other parameters (e.g., demographic data, alcohol consumption, dyslipidemia, hypertension, renal dysfunction, and COPD) has not been analyzed in detail. Finally, as our study was the first of its kind, we were unable to directly compare our findings with those of other studies.

Conclusion
As with cigarettes, it is important to warn MW users about the potential adverse health effects associated with MP. Therefore, policies and strategies should be developed to prevent irreversible damage to MP users’ health. Given that this is the first study in the literature to use PWV to measure the health effects of using MP, the results can be used to guide future studies.
**Funding:** The author(s) received no financial support for the research, authorship, and/or publication of this article.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Ethical Statement:** Kahramanmaraş Sütçü İmam University ethics committee approved the study protocol (Approval ID: 2016/14).

**Open Access Statement**

Experimental Biomedical Research is an open access journal and all content is freely available without charge to the user or his/her institution. This journal is licensed under a Creative Commons Attribution 4.0 International License. Users are allowed to read, download, copy, distribute, print, search, or link to the full texts of the articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.

**Copyright (c) 2021:** Author(s).

**References**

[1] Bolinder G, Noren A, de Faire U, et al. Smokeless tobacco use and atherosclerosis: an ultrasonographic investigation of carotid intima media thickness in healthy middle-aged men. Atherosclerosis. 1997;132(1):95-103.

[2] Cok I, Ozturk R. Urinary cotinine levels of smokeless tobacco (Maras powder) users. Hum Exp Toxicol. 2000;19(11):650-655.

[3] Sucakli MH, Ozkan F, Inci MF, et al. Effects of smokeless tobacco (Maras powder) use on carotid intima media thickness. Med Sci Monit. 2013;19:859-64.

[4] Akcay A, Aydin MN, Acar G, et al. Evaluation of left atrial mechanical function and atrial conduction abnormalities in Maras powder (smokeless tobacco) users and smokers. Cardiovasc J Afr. 2015;26(3):114-19.

[5] Dogan A, Dogan K, Tasolar S. Magnetic resonance imaging evaluation imaging of the effects of cigarette and maras powder (smokeless tobacco) on lumbar disc degeneration. Clin Neurol Neurosurg. 2019 ;186:105500.

[6] Sagiroglu S, Erdogan A, Doganer A, et al. Otorhinolaryngological symptoms among smokeless tobacco (Maras powder) users. North Clin Istamb. 2019;6(3):284-92.

[7] Shah SS, Shah M, Habib SH, et al. Correlation of plasma kisspeptin with total testosterone levels in smokeless tobacco and smoking tobacco users in a healthy cohort: A cross-sectional study. Andrologia. 2019;51(10):13409.

[8] Kawada T. Effects of maras powder (smokeless tobacco) on lumbar disc degeneration. Clin Neurol Neurosurg. 2020;193:105776.

[9] Noble RC, Penny BB. Comparison of leukocyte count and function in smoking and nonsmoking young men. Infect Immun. 1975;12(3):550-5.

[10] Zhang DY, Huang JF, Kang YY, Dou Y, et al. The prevalence of masked hypertension in relation to cigarette smoking in a Chinese male population. J Hypertens. 2020;38(6):1056-63.

[11] Sangani R, Ghio A, Culp S, et al. Combined Pulmonary Fibrosis Emphysema: Role of Cigarette Smoking and Pulmonary Hypertension in a Rural Cohort. Int J Chron Obstruct Pulmon Dis. 2021;(16):1873-85.

[12] Shu D, Chen F, Zhang C, et al. Environmental tobacco smoke and carotid intima-media thickness in healthy children and adolescents: a systematic review. Open Heart. 2022;9(1). 001790.

[13] Li L, Hu B, Gong S, et al. Age and cigarette smoking modulate the relationship between pulmonary function and arterial stiffness in
heart failure patients. Medicine. 2017;96(10):e6262.

[14] Demirel A, Baykara M, Koca TT, et al. Comparison of vascular arterial stiffness parameters of adolescent wrestlers with healthy subjects: Is heavy training harmful for wrestlers? J Back Musculoskelet Rehabil. 2019;32(1):155-160.

[15] Gencay OA, Baykara M, Demirel A, et al. The Acute Effects of High-Intensity Cycling Exercise on Arterial Stiffness in Adolescent Wrestlers. J Hum Kinet. 2019;(69):99-107.

[16] Baykara S, Gündoğan Bozdağ P, et al. Evaluation of arterial stiffness in patients with schizophrenia. J Clin Neurosci. 2020;79:149-53.

[17] Fındıklı E, Gökçe M, Nacitarhan V, et al. Arterial Stiffness in Patients Taking Second-generation Antipsychotics. Clin Psychopharmacol Neurosci. 2016;14(4):365-70.

[18] Erhardt L. Cigarette smoking: an undertreated risk factor for cardiovascular disease. Atherosclerosis. 2009;205(1):23-32.

[19] Rigotti NA, Clair C. Managing tobacco use: the neglected cardiovascular disease risk factor. Eur Heart J. 2013;34(42):3259-67.

[20] Theresa C, Fastone MG. Effects of Smoking on Arterial Stiffness in Male Adolescents in Lusaka, Zambia. Cardiol Angiol. 2015;4(2):80-89.

[21] Hickler RB. Aortic and large artery stiffness: current methodology and clinical correlations. Clin Cardiol. 1990;13(5):317-22.

[22] Plouin PF, Clement DL, Boccalon H, et al. A clinical approach to the management of a patient with suspected renovascular disease who presents with leg ischemia. Int Angiol. 2003;22(4):333-39.

[23] Virdis A, Giannarelli C, Neves MF, et al. Cigarette smoking and hypertension. Curr Pharm Des. 2010;16(23):2518-25.

[24] Baykara M, Demirel A, Yavuzatmaca İ, et al. Response of Arterial Stiffness Four Weeks After Terminating Short-term Aerobic Exercise Training in a Sedentary Lifestyle. J Ultrasound Med. 2017;36(2):353-59.

[25] Katsiki N, Kolovou G. Smoking and Arterial Stiffness. Angiology. 2015;66(10):969-70.

[26] Yun M, Li S, Sun D, et al. Tobacco smoking strengthens the association of elevated blood pressure with arterial stiffness: the Bogalusa Heart Study. J Hypertens. 2015;33(2):266-74.

[27] Camplain R, Meyer ML, Tanaka H, et al. Smoking Behaviors and Arterial Stiffness Measured by Pulse Wave Velocity in Older Adults: The Atherosclerosis Risk in Communities (ARIC) Study. Am J Hypertens. 2016;29(11):1268-75.