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Experimental Biomedical Research **Original article**

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

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ABSTRACT

Aim: To evaluate atherosclerosis in Maraşpowder (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: Maraşpowder, tobacco, arterial stiffness, pulse wave velocity, photoplethysmography.

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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. *Maraşpowder* (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 Üniversity (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/m^2), 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

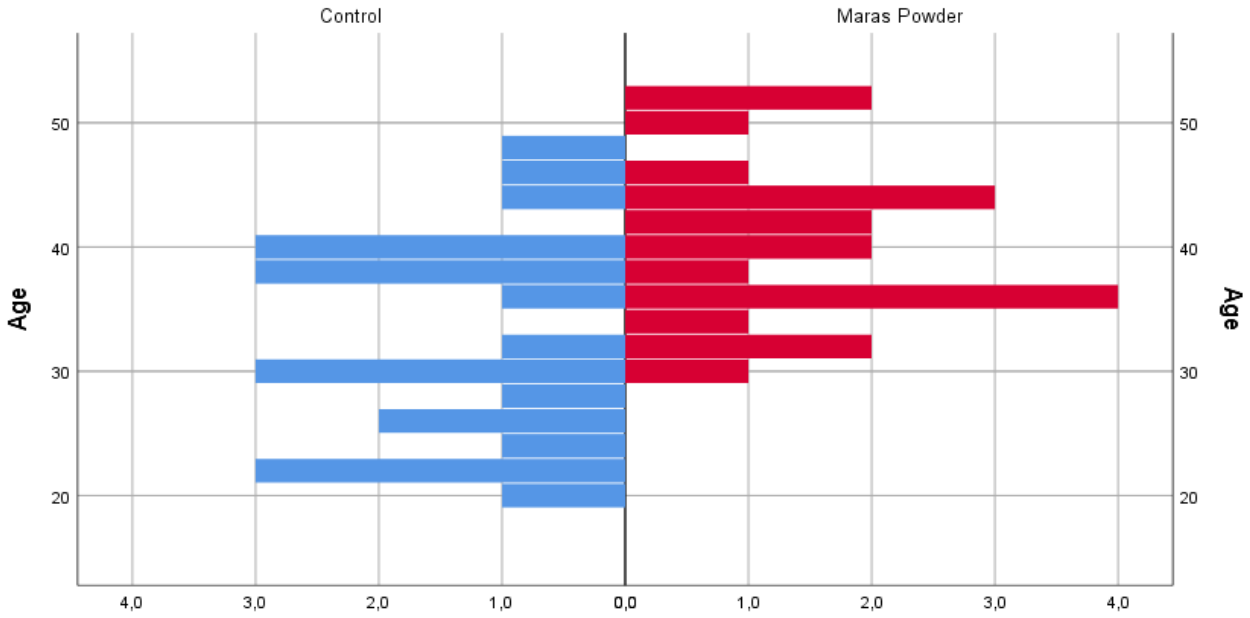

Figure 1. Age distribution of the groups.

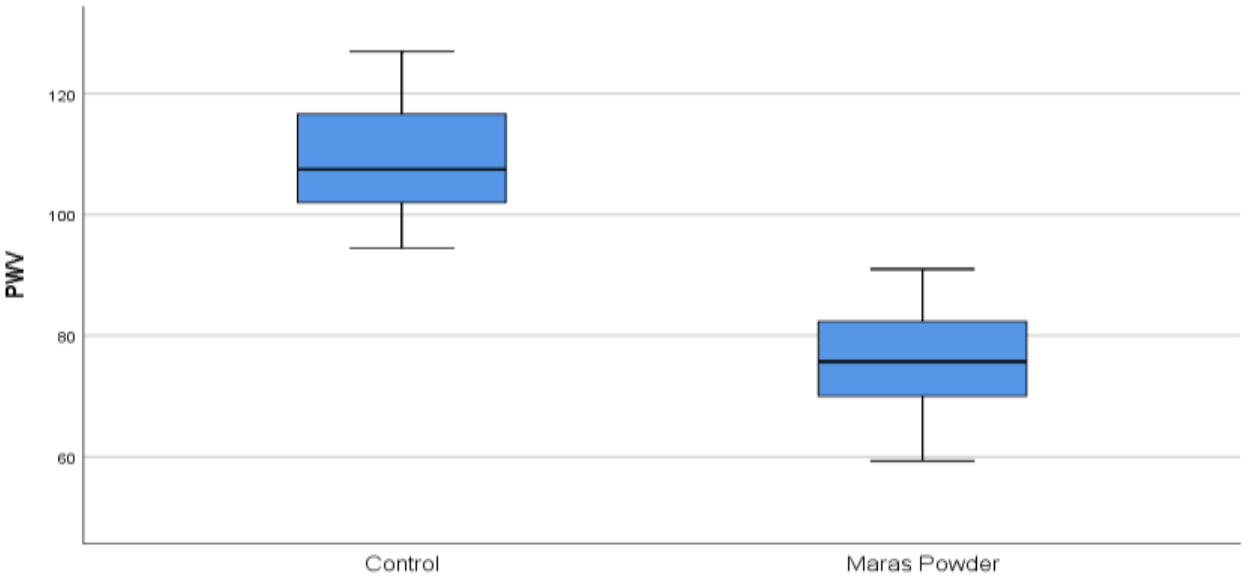

Figure 3. ROC curve of differentiation of groups with PWV.

mean age (p = 0.003). 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).

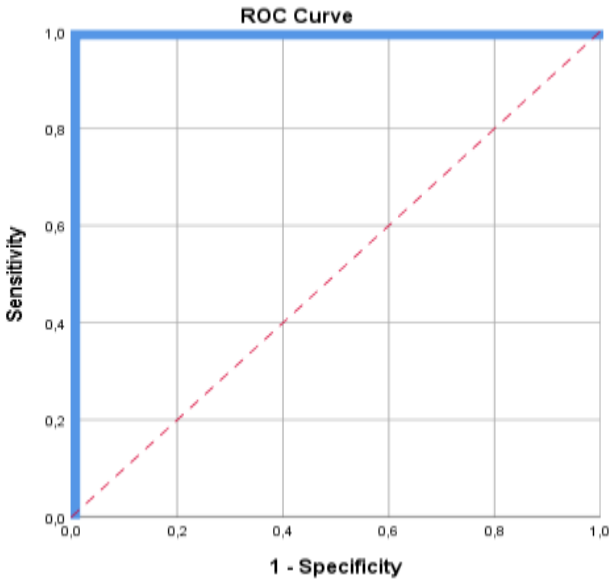

Figure 3. ROC curve of differentiation of groups with PWV.

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, 20, 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.

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

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

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