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Magnetic resonance imaging evaluation of the effects of cigarette and maras powder (smokeless tobacco) on lumbar disc degeneration

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ABSTRACT

Objective: The main aim of this study was to investigate and compare the effects of the use of Maras powder and cigarettes on lumbar disc degeneration.
Paients and methods: This study included 87 adult patients who presented at our hospital with a complaint of mechanical low back pain and underwent lumbar magnetic resonance imaging (MRI). Patients meeting the inclusion criteria were divided into three groups. Group 1 included those who smoked Maras powder but not cigarettes, group 2 was comprised of those who smoked cigarettes but did not use Maras powder, and group 3 was comprised of those who did not use tobacco (no cigarettes or Maras powder) (control group). Lumbar disc degeneration was rated according to the Pfirrmann classification. Hematological parameters were obtained from all three groups.
Results: Degeneration levels in group 1 were significant when compared to the other groups at all disc levels. Maras powder contributed to intervertebral disc degeneration and this effect increased gradually towards the distal area. The neutrophil to lymphocyte ratio was significantly higher in group 1 than in the other two groups, and was positively correlated with the duration of use of Maras powder ($r = 0.689$, $p \leq 0.001$).
Conclusion: Although more prevalent in the Maras powder group, lumbar disc degeneration increased significantly with tobacco usage. The results of our study show that Maras powder, commonly used regionally, is likely to cause more spinal disc degeneration than cigarettes.

1. Introduction

One of the leading causes of chronic low back pain is intervertebral disc degeneration, which is thought to be caused by insufficient blood supply to the discs [1]. Atherosclerosis is thought to be primarily responsible for this disc perfusion disorder. Previous studies have shown that smoking is a major risk factor for atherosclerosis, and have demonstrated the relationship between smoking and cervical disc degeneration [2–5].

Cigarettes are one way to smoke tobacco but tobacco can also be used in a smokeless form. Maras powder, also known as crazy tobacco, is a mixture of ash and a powder obtained from the leaves of *Nicotiana rustica* Linn. Ash/tobacco mixtures in ratios of 1:1 to 1:3 and sold in 10–20 g packets, are generally placed between the mandibular and labial groove, either directly or wrapped in cigarette paper and kept in the mouth for 10–15 min. Although Maras powder is commonly used in the eastern Mediterranean region of Turkey, similar usage is seen in other countries, such as Sudan and Saudi Arabia [6–8].

Many studies have been conducted investigating the neutrophil to lymphocyte ratio (NLR), which is a marker of systemic inflammation that can be used to monitor the prognosis, morbidity, and mortality of many diseases [9,10]. Smoking cigarettes increases systemic inflammation according to different biomarkers [11,12]. No study has examined the relationship between the use of Maras powder and lumbar disc degeneration. In the present study, we investigated the effects of using cigarettes and Maras powder on lumbar disc degeneration.

2. Patients and methods

2.1. Study design and participants

Approval for this study was obtained by the Ethics Committee of the Faculty of Medicine of Kahramanmaraş Sütçü İmam University. This retrospective study included 243 consecutive patients who underwent lumbar magnetic resonance imaging (MRI) due to mechanical low back

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pain between July 2016 and June 2018. Patients who received treatment for mechanical back pain in the presence of rheumatic disease, malignancy, trauma, a congenital or acquired spinal deformity, hypertension, diabetes mellitus, coronary heart disease, active infection, or inflammation were excluded from the study. The remaining 87 participants were divided into three groups. Group 1 (n = 29) included patients who used Maras powder but not cigarettes, group 2 (n = 28) smoked cigarettes but did not use Maras powder, and group 3 (control group) (n = 30) did not use any form of tobacco (cigarettes or Maras powder). Because the use of Maras powder is regionally more common among males, the gender distribution in this study was correspondingly male predominant. Therefore, patients were recruited into groups 2 and 3 by propensity score matching and adjusting for age and sex.

2.2. Imaging and assessment

Lumbar MRI was performed using the 1.5 T Philips Ingenia device (Philips Medical Systems, Eindhoven, the Netherlands). Images at each lumbar intervertebral disc level were obtained from sagittal plane T2-weighted images (TR ms/TE ms; 2,948/100, FOV 160 × 295 mm and matrix 384 × 384 mm; 4-mm slice thickness and 1-mm intersection gap, from 15 sagittal images) and evaluated by two radiologists simultaneously with single grading and agreement. Radiologists reviewing the MRI studies were also blinded to the smoking habits of the patients. The intervertebral discs were graded using the Pfirrmann disc degeneration grading system (grades 1–5; higher grades indicate more severe degeneration of the intervertebral disc [13]. (Fig. 1).

2.3. Laboratory analysis

Venous blood samples (0.5–2 ml) were obtained from participants into a purple tube containing EDTA and analyzed using the Sysmex XT-1800i automated hematology device (Sysmex, Kobe, Japan).

2.4. Statistical analysis

Data were analyzed with SPSS for Windows 18 software (SPSS Inc., Chicago, IL, USA). Continuous variables are reported as mean ± standard deviation and categorical variables are presented as numbers and percentages. The Shapiro–Wilk test was used to determine whether the distribution was parametric. Analysis of variance was applied to data with a parametric distribution, and the least significant difference test was used as a post-hoc test. The Kruskal–Wallis test was applied to data with a non-parametric distribution. Pearson's or Spearman's correlation analyses were applied to examine the significance of the direct relationship between the duration of smoking cigarettes or the use of Maras powder. A p-value < 0.05 was considered significant.

Table 1
Comparison of demographic data and laboratory results.

	Group1 (Maras powder) (n = 29)	Group2 (cigarette) (n = 28)	Control Group (n = 30)	P value
Age, years	37.4 ± 11.1	33.7 ± 10.8	35.4 ± 10.5	0.439
Duration Of Use, Year	12.0 ± 8.6	11.3 ± 7.5	–	0.869
Neutrophil ($\times 10^9$ /L)	8.88 ± 2.24	7.74 ± 1.30	6.85 ± 1.75	< 0.001*
Lymphocyte ($\times 10^9$ /L)	4.53 ± 1.46	4.61 ± 1.11	5.06 ± 1.14	0.218
NLR	2.12 ± 0.75	1.72 ± 0.28	1.365 ± 0.22	< 0.001**

* Grup 1 versus grup 2 p = 0.059, group2 versus group 3 p = 0.201, group 1 versus group 3 p < 0.001.

** Grup1 versus grup 2 p = 0.007, grup 2 versus grup 3 p = 0.017, grup 1 versus grup 3 p < 0.001.

3. Results

Demographic data and laboratory test results of the groups are provided in Table 1. No significant differences were observed between the groups in terms of age or gender (p > 0.05 for both). No significant difference was observed between groups 1 and 2 in the duration of tobacco use (12.0 ± 8.6 and 11.3 ± 7.5 years, respectively; p > 0.05).

The NLR was higher in the Maras powder and cigarette user groups than in the control group. A significant positive correlation was detected between the duration of Maras powder usage and the NLR (r = 0.689, p ≤ 0.001) (Fig. 2). A significant positive correlation was also observed between the duration of cigarette use and the NLR (r = 0.467, p = 0.005) (Fig. 3).

The Pfirrmann grades of each lumbar spine segment from the three groups are presented in Table 2. The Pfirrmann score was significantly higher in group 1 than in the other groups at all lumbar levels (p < 0.05). The lumbar disc degeneration scores increased gradually from proximal to distal in all groups.

4. Discussion

The main results of our study are the following: i) the NLR ratio was higher in patients using tobacco than in the control group; ii) the NLR

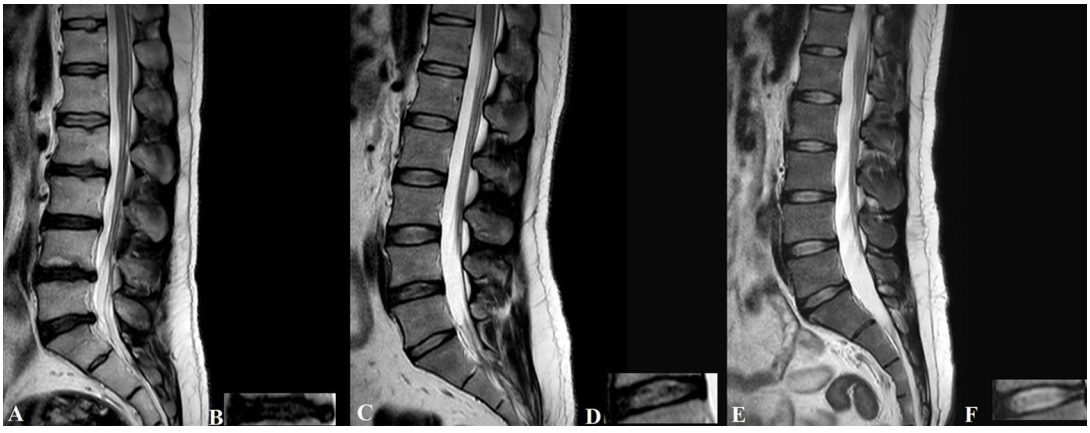

Fig. 1. A- 36-year-old patient with low back pain using Maras powder, sagittal T2-weighted Lumbar Magnetic Resonance, **B**- Grade 4 degeneration of L4-L5 intervertebral disc of the same patient, **C**- 38-year-old patient with low back pain who smoked Sagittal T2-weighted Lumbar Magnetic Resonance, **D-** Grade 3 degeneration of L4-L5 intervertebral disc of the same patient, **E** -A 32-year-old patient with low back pain who did not smoke or use Maras powder Sagittal T2-weighted Lumbar Magnetic Resonance, **F**- Grade 2 degeneration of L4-L5 intervertebral disc of the same patient.

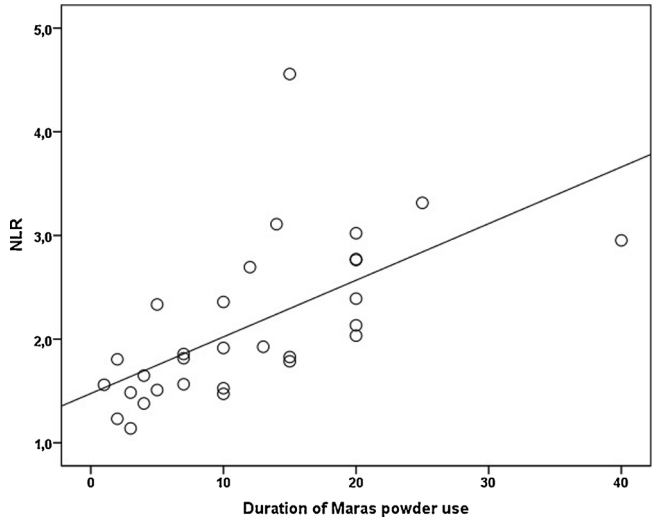

Fig. 2. Comparison of the duration of the use of Maras powder and the ratio of neutrophil to lymphocytes ratio.

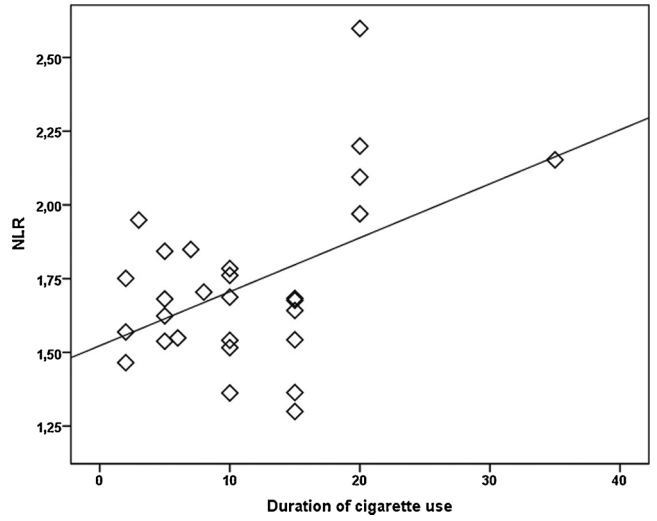

Fig. 3. Comparison of the duration of the use of cigarette and the ratio of neutrophil to lymphocytes ratio.

Table 2
Comparison of 3 gruop disc degeneration scores at all lumbar levels.

Lumbar level	Group 1 (Maras powder) (n = 29)	Group 2 (cigarette) (n = 28)	Control Group (n = 30)	P value
L1-2	2.2 ± 0.8	1.9 ± 0.9	1.5 ± 0.6	0.005^{α}
L2-3	2.4 ± 0.9	2.0 ± 0.8	1.6 ± 0.7	0.001^{α}
L3-4	2.5 ± 0.7	2.4 ± 0.7	1.6 ± 0.7	$< 0.001^{\alpha.\beta}$
L4-5	3.0 ± 0.7	2.8 ± 0.8	2.2 ± 1.1	0.003^{α}
L5-S1	3.5 ± 0.9	3.1 ± 0.8	2.6 ± 1.1	0.010^{α}

The statistical analysis of the Maras powder and non-smoking group with the control group was indicated by α. The statistical analysis of the non-Maras group using the cigarette with the control group is indicated by β.

ratio was higher and positively correlated with tobacco usage, particularly in patients using Maras powder; and iii) the lumbar disc degeneration score was higher in patients using Maras powder than in the other groups.

Cigarette smoking is a form of tobacco use and Maras powder is a smokeless way of using tobacco, which is in the same class as cigarettes as it also contains nicotine. Maras powder is obtained by mixing nicotine with oak, walnut, and vine branch ashes in certain proportions. It is used by placing a small amount in the mandibular-labial groove for approximately 10–15 min. Benowitz et al. reported that oral tobacco use increases blood nicotine levels 15-fold more than cigarette smoking [14]. The nicotine content of Maras powder is derived from the *Nicotiana rustica* plant and the nicotine content in cigarettes is derived from the *Nicotiana tobacum* plant. *N. rustica* has an approximately 10-fold higher level of nicotine than *N. tobacum* [6–8].

In a study of the contribution of cigarette use to intervertebral disc disease (IVDD), Zho et al. showed that cigarette smoking increases degeneration of cervical discs and that this effect is more significant towards the distal area [3]. Schumann et al. found that smoking between 20 and 40 pack/years significantly increases the rate of lumbar disc herniation in men and smoking 8–20 packs/year increases the risk of lumbar disc herniation in women [15]. In a study of monozygotic twins, Battie et al. reported that smokers had higher disc degeneration rates than non-smokers [16]. In the present study, disc degeneration was higher in Maras powder users than in cigarette smokers. It is thought that nicotine increases disc degeneration by disrupting disc perfusion through an effect on atherosclerosis [3,17]. As Maras powder contains more nicotine than cigarettes, the greater effect on disc degeneration may be caused by inflammation.

The levels of pro-inflammatory cytokines and inflammatory mediators are increased during disc degeneration. There is evidence that many pro-inflammatory cytokines are involved in the disc degeneration process [18]. The NLR is calculated from neutrophil and lymphocyte counts in a whole blood test and is now widely used as a proinflammatory indicator [19]. Smoking increases systemic inflammation according to different biomarkers. Gümüs et al. observed an increase in the NLR in smokers [20]. In that study, similar to previous studies, the NLR was higher in tobacco users than in the control group. In the present study, a significant correlation was observed between the duration of tobacco usage and the NLR. This correlation was more significant in patients using Maras powder, suggesting that the release of nicotine-like substances from Maras powder may have a greater effect on increasing the inflammatory markers. In addition to the duration of use of tobacco products, Maras powder may play a role in the increased rate of degeneration by causing a more intense release of nicotine and various mediators, which could explain the higher NLR and greater degree of disc degeneration in Maras powder users compared with the cigarette and control groups.

4.1. Study limitations

1 Although the use of Maras powder is not legally prohibited, it is difficult to determine the true number of users in the general population because it is partially kept secret. The number of patients in this study was 29, which was relatively low, but could be considered sufficient for statistical analysis.
2 Most of the patients were male because the majority of the patients who use Maras powder are male.
3 IVDD was only evaluated at the lumbar level in this study. Further studies should include evaluations at the cervical and thoracic levels.

5. Conclusion

In conclusion, Maras powder, which is used regionally, and cigarette smoking may cause spinal disc degeneration. It may be appropriate to evaluate patients with IVDD in terms of Maras powder use in etiological investigations. There is a need for further randomized studies of larger populations to support the findings of this study.

Declaration of Competing Interest

None declared.

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The English in this document has been checked by at least two professional editors, both native speakers of English. For a certificate, please see: http://www.textcheck.com/certificate/MLYzuN.

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