Journal of Dependence, 2026; 27(3):199-215

JOURNAL OF DEPENDENCE

Research Article

Maraş powder (smokeless tobacco) use and associated factors in adolescents with attention-deficit/hyperactivity disorder: A cross-sectional comparative study

Asiye Arıcı Gürbüz, Hatice Altun, Feyza Hatice Ekici, Hüseyin Sarıkaya, Semiha Cömertoğlu Arslan

DOI: 10.51982/bagimli.626

Abstract

Objective: Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder associated with an increased susceptibility to nicotine and other substance use. This study aimed to compare Maraş powder (smokeless tobacco) use among adolescents with and without ADHD,identify related factors,examine differences by ADHD treatment status,and assess adolescents' knowledge and beliefs about its use.

Method: This cross-sectional comparative study,included 50 adolescents aged 11–17 with ADHD and 50 age- and sex-matched healthy controls. Participants completed a sociodemographic form,a study-specific Maraş powder knowledge,belief and use questionnaire,the DSM-IV Disruptive Behavior Disorders Rating Scale (DBDRS),the Kovacs Children's Depression Inventory and the State-Trait Anxiety Inventory.

Results: Current regular Maraş powder use was reported by 28.0% of the ADHD group and 10.0% of the control group (OR=3.50,95% CI 1.15–10.63;Fisher p=0.040);while ever use was 32.0% versus 10.0% (OR=4.24,95% CI 1.41–12.70;p=0.007).After adjusted for age and sex,ADHD remained associated with regular use (aOR=3.44,95% CI 1.12–11.99,p=0.031).Within the ADHD group,regular use was reported by 4.2% of adolescents with medical treatment versus 50.0% of untreated adolescents (Fisher p<0.001;aOR=0.04,95% CI 0.003–0.31).Regular users had higher DBDRS,depressive,and state-anxiety scores,but not trait-anxiety scores (all Benjamini–Hochberg-corrected p<0.05).Overall,57.0% of participants either agreed with,or were unsure about,the statement that Maraş powder helps smoking cessation,and substantial misconceptions regarding its harms and regulation were observed in both groups.

Conclusion: In this study,ADHD, lower symptom control and the absence of regular ADHD treatment were associated with a higher prevalence of Maraş powder use. Misconceptions about the harms and the regulation of Maraş powder were common among adolescents in both groups.

Keywords: Attention deficit hyperactivity disorder; Smokeless tobacco; Maraş powder; Nicotine; adolescent; Cross-sectional studies

Asiye Arıcı Gürbüz

Department of Child and Adolescent Psychiatry, Dr. Ekrem Tok Mental Health and Diseases Hospital, Adana, Türkiye

Email: asiyearici@hotmail.com

ORCID iD: 0000-0003-2508-7125

Hatice Altun

Department of Child and Adolescent Psychiatry, Faculty of Medicine, Kahramanmaraş Sutcu Imam University, Kahramanmaraş, Türkiye

Email: drhaticealtun@gmail.com

ORCID iD: 0000-0002-6802-8216

Feyza Hatice Ekici

Department of Child and Adolescent Psychiatry, Mersin City Training and Research Hospital, Mersin, Türkiye

Email: feyzasevgen@gmail.com

ORCID iD: 0000-0002-9784-0107

Hüseyin Sarıkaya

Department of Child and Adolescent Psychiatry, Gaziantep Cengiz Gökçek Women and Children's Hospital, Gaziantep, Türkiye

Email: dr42hsyn@gmail.com

ORCID iD: 0009-0004-7137-0997

Semiha Cömertoğlu Arslan

Department of Child and Adolescent Psychiatry, Faculty of Medicine, Kahramanmaraş Sutcu Imam University, Kahramanmaraş, Türkiye

Email: drsemihacrs@gmail.com

ORCID iD: 0000-0002-2296-5853

Received: 2026-07-14
Accepted: 2026-09-08

e-ISSN: 3108-7973

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is a childhood-onset common neurodevelopmental disorder characterized by inattention, hyperactivity and impulsivity. While it is stated that approximately 1 in 9 children in the United States is diagnosed with ADHD (Danielson et al., 2024), it has been reported that 1 in every 8 primary school students in our country is affected (Ercan et al., 2022). ADHD is associated with an increased risk of a wide range of adverse outcomes, including impaired quality of life, emotional and social difficulties, academic underachievement, psychiatric comorbidities, accidental injuries, crime and delinquency, substance use disorders, suicide, and premature death (Ercan et al., 2022; Faraone et al., 2021). Beyond these functional impairments, growing evidence indicates that individuals with ADHD have a particular vulnerability to addictive behaviors and substance use disorders, making addiction a major clinical concern in this population (Grassi et al., 2024; Rohner et al., 2023; Schellekens et al., 2020).

Adolescents with ADHD are also more likely to initiate and maintain nicotine use than their peers. Meta-analyses have shown that childhood ADHD predicts nicotine use in mid-adolescence and substance use disorders in young adulthood (Charach et al., 2011; Groenman et al., 2017; Lee et al., 2011), and population-based studies have shown that ADHD symptoms predict earlier smoking onset, faster progression to regular smoking and higher rates of nicotine dependence, even after adjustment for other externalising problems (Kollins et al., 2005; Milberger et al., 1997; Mitchell et al., 2019). This increased vulnerability is thought to result from the interaction of neurobiological and behavioral mechanisms. Behavioural disinhibition and impulsivity, difficulties in emotion regulation and — as proposed by the self-medication hypothesis — the attention-enhancing and affect-regulating effects of nicotine are the mechanisms most often invoked to explain this association (Katzman et al., 2017; Wilens & Morrison, 2011). Nicotine-containing products therefore deserve specific attention in this population, yet almost all available evidence concerns cigarettes rather than smokeless products.

Smokeless tobacco (ST) is used by more than 300 million people worldwide and comprises a heterogeneous group of products — snus and moist snuff in Scandinavia and North America, chewing tobacco and gutkha in South Asia, naswar in Central and South Asia, and toombak in Sudan — that differ substantially in nicotine content, pH and levels of tobacco-specific N-nitrosamines (International Agency for Research on Cancer [IARC], 2007; Siddiqi et al., 2020). Restricting the estimate to smokeless products alone, 348,798 deaths and approximately 8.7 million disability-adjusted life-years were attributable to ST use worldwide in 2017 (Siddiqi et al., 2020); an alternative meta-analytic approach including additional causes of death produced a considerably higher figure of 652,494 deaths (Sinha et al., 2018). Despite this burden, ST is regulated far less strictly than cigarettes in most countries, is frequently perceived as a harmless alternative or as a cessation aid, and its use among adolescents remains substantially less studied than smoking (Cohen et al., 1987; Mehrotra et al., 2019).

Maraş powder is the ST product characteristic of Kahramanmaraş and the neighbouring provinces of southern and south-eastern Türkiye. It is prepared from the powdered leaves of Nicotiana rustica L. mixed with the ash of oak, walnut or grapevine wood in a ratio of about 1:2 to 1:3, moistened, and held in the labial sulcus for periods ranging from a few minutes to several hours, several times a day. The nicotine content of N. rustica is approximately 6–10 times that of N. tabacum, and the alkaline pH created by the wood ash converts nicotine to its un-ionised form and markedly increases buccal absorption (Güven & Tolun, 2012). Consistent with this, urinary cotinine concentrations in Maraş powder users have been reported to be about three times higher than in cigarette smokers (Çok & Öztürk, 2000). Use has been associated with

genotoxic damage in buccal mucosal cells (Özkul et al., 1997), increased oxidative stress (Kılınç et al., 2004) and cardiovascular and nervous-system effects (Güven & Tolun, 2012; Tanrıverdi, 2022). Because it is cheaper than cigarettes and is widely believed to be harmless or even helpful for quitting smoking, it is accessible to adolescents from all income groups (Akbay et al., 2017; Keten et al., 2014).

Although the association between ADHD and cigarette smoking is well documented, no previous study has examined smokeless tobacco use in adolescents with ADHD, and data on Maraş powder in adolescents in general are scarce. Accordingly, the primary aim of this study was to compare the prevalence of ever use and of current regular use of Maraş powder between adolescents with ADHD and age- and sex-matched adolescents without a psychiatric disorder. The secondary aims were: (i) to examine the sociodemographic, familial, peer-related and symptom-related correlates of Maraş powder use in the total sample; (ii) to examine, within the ADHD group, whether Maraş powder use differs according to whether the adolescent is receiving regular pharmacological treatment; and (iii) to describe adolescents' knowledge of and beliefs about Maraş powder. We hypothesised that (H1) both ever use and regular use would be more frequent in the ADHD group, (H2) regular users would show higher disruptive-behaviour symptom scores than non-users, and (H3) misconceptions about the harms of Maraş powder would be common in both groups. The analysis of treatment status was planned as an exploratory, hypothesis-generating analysis.

METHODS

Study design and setting

This was a single-centre, cross-sectional comparative study conducted in the Child and Adolescent Mental Health and Diseases Outpatient Clinic of Kahramanmaraş Sutcu Imam University, Faculty of Medicine Hospital, Kahramanmaraş, Türkiye, comparing adolescents with ADHD and age- and sex-matched healthy controls. The study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies. Data were collected between January 2018 and January 2020.

Participants and sampling

Adolescents aged 11–17 years who consecutively presented to the outpatient clinic during the study period and who received a diagnosis of combined presentation ADHD according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) were invited to participate (n = 50). The diagnosis was established by a child and adolescent psychiatrist on the basis of a clinical interview conducted with the adolescent and at least one parent, supplemented by information on functioning at school.

Exclusion criteria for the ADHD group were: a lifetime diagnosis of a psychotic disorder or bipolar disorder; autism spectrum disorder; intellectual disability or any cognitive impairment that would prevent completion of the self-report instruments; a neurological disorder affecting cognition; known genetic, neurological, metabolic or endocrine disorders; severe head trauma or organic brain damage; and refusal to participate after detailed information about the study. Frequently co-occurring disorders were not used as exclusion criteria: adolescents with oppositional defiant disorder, conduct disorder, anxiety disorders, depressive disorders, tic disorders and specific learning disorder were included, and their comorbidities are reported in Table 2. This decision was made in order to preserve the clinical representativeness of the sample, and it is taken into account in the interpretation of the findings.

The comparison group comprised 50 healthy adolescents matched to the ADHD group by age and sex. Participants were recruited from adolescents attending the Child and Adolescent Psychiatry outpatient clinic for routine consultation and were randomly selected after applying the predefined

exclusion criteria. The absence of any psychiatric disorder was confirmed through a comprehensive psychiatric evaluation conducted by a child and adolescent psychiatrist, together with verification that neither the adolescent nor the accompanying parent reported any current or lifetime psychiatric diagnosis or psychotropic medication use. Adolescents who met the diagnostic criteria for any psychiatric disorder were excluded from the study. Additional exclusion criteria for the comparison group included a history of genetic, neurological, metabolic, endocrine disorders or severe head trauma or organic brain damage as well as any previous psychiatric treatment.

During the study period, 463 children and adolescents with DSM-5 ADHD were screened for eligibility. Of these, 178 declined to participate, 126 were excluded because of incomplete study forms, and 109 were excluded for meeting one or more of the predefined exclusion criteria. The final analytic sample comprised 100 adolescents (50 per group) with complete data on all study variables; there were no missing values for the primary outcome or for any of the scales used.

Ethical considerations

Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Kahramanmaraş Sutcu Imam University, Faculty of Medicine (Decision No. 2; Session No. 2017/18; Approval Date: November 8, 2017). All procedures were performed in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants and their parents. Participants were informed that their answers about tobacco and substance use would not be shared with their parents or their school, and the questionnaires were completed in a separate room in order to reduce social desirability bias.

Diagnostic and symptom assessment

All participants, including both the ADHD and control groups, underwent a comprehensive psychiatric evaluation by a certified child and adolescent psychiatrist using the Kiddie Schedule for Affective Disorders and Schizophrenia, Present and Lifetime Version for DSM-5 (K-SADS-PL-DSM-5) (Kaufman et al., 1997; Ünal et al., 2019). The semi-structured diagnostic interview was administered according to standardized guidelines and included separate interviews with both the child and parent. ADHD diagnoses were established based on the DSM-5 criteria. Intellectual disability was excluded according to the Wechsler Intelligence Scale for Children—Revised (WISC-R).

Parents of the children completed the sociodemographic data form and the DSM-IV Disruptive Behavior Disorders Rating Scale (DBDRS). Both the study group and the control group completed the 'Maraş powder knowledge, belief and use questionnaire' prepared by the researchers, the Kovacs Children's Depression Inventory (CDI), which was employed to assess the children's depression levels, and the State-Trait Anxiety Inventory (STAI-1 and STAI-2), which was used to assess the children's anxiety levels.

Measures

Sociodemographic and clinical form. A form developed by the researchers recorded the adolescent's age, sex, school grade, chronic physical illness, parental age and education, family income, family structure, place of residence, and — for the ADHD group — treatment status, medication type, treatment duration and psychiatric comorbidity. Because tobacco use is strongly socially patterned, the form also recorded cigarette, alcohol and other substance use by the adolescent, Maraş powder use within the family, and Maraş powder use by close friends.

Maraş powder knowledge, belief and use questionnaire. Because no validated instrument assessing Maraş powder use and beliefs in adolescents was available, the questionnaire was developed by the research team based on the existing literature on Maraş powder and smokeless tobacco (Akbay et al., 2017; Keten et al., 2014) and the WHO Framework

Convention on Tobacco Control themes of harm perception, dependence and regulation. Belief items were rated as "agree", "no idea" or "disagree". The questionnaire was designed for descriptive purposes only and no formal psychometric validation (including content validity, factor analysis, internal consistency or test–retest reliability) was performed; the instrument is therefore used descriptively rather than as a scale.

Operational definitions. Maraş powder use was assessed with a single item with four mutually exclusive response options, and the following operational definitions were applied consistently throughout the manuscript:

• Never use: the adolescent has never tried Maraş powder, not even once.

• Experimentation: the adolescent has tried Maraş powder once or a few times but does not use it continuously, and did not report ongoing use at the time of assessment.

• Current regular use: the adolescent reports using Maraş powder continuously ("yes, continuously") at the time of assessment. All adolescents in this category reported ongoing use for at least the previous month, with a defined daily frequency and a defined duration of use (Table 6).

• Ever use: experimentation or current regular use, i.e. any lifetime use.

The Kiddie Schedule for Affective Disorders and Schizophrenia for School-Aged Children, Present and Lifetime Version DSM-5 (K-SADS-PL-DSM-5). The K-SADS-PL is a semi-structured interview to determine psychopathology in children and adolescents aged 6–18, according to the DSM-5 criteria (Kaufman et al., 1997). It is designed to assess the past and present psychopathology of children and adolescents. Validity and reliability studies have been conducted on the Turkish sample of the scale, which is based on DSM-5 diagnostic criteria (Ünal et al., 2019).

DSM-IV Disruptive Behavior Disorders Rating Scale — parent form. The DSM-IV Disruptive Behavior Disorders Rating Scale (Turgay's ADHD Scale — ADHD-RS-IV; DBDRS) is an evaluation tool developed by Atilla Turgay using the DSM-IV symptoms without changing the meanings. The scale consists of 41 items and comprises inattention, hyperactivity/impulsivity, conduct disorder and oppositional defiant disorder subscales. Items are rated on a 4-point Likert-type scale from 0 (none) to 3 (very much); higher scores indicate greater symptom severity. In the present study the scale was completed by the parent accompanying the adolescent, under the supervision of the clinician. The study on the reliability and validity of the Turkish version of the scale was performed by Ercan et al. (2001).

Kovacs Children's Depression Inventory (CDI). A self-report scale developed for children and adolescents aged 6–17 years (Kovacs, 1981), consisting of 27 items scored 0, 1 or 2, with a maximum score of 54; higher scores indicate more severe depressive symptoms. The Turkish validity and reliability study was conducted by Öy (1991).

State-Trait Anxiety Inventory (STAI-1 and STAI-2). Consists of 20-item state and 20-item trait anxiety subscales (Spielberger et al., 1971). Reversed items are included in both scales. Items in the scale are scored between 1 and 4. Scores on both scales range from 20 to 80, with higher scores indicating elevated levels of anxiety. The Turkish validity and reliability study was conducted by Öner and Le Compte (1985).

Sample size and statistical power

No a priori sample size calculation was performed; the sample size of 50 participants per group was determined pragmatically by the number of eligible adolescents who could be recruited consecutively during the study period, which is a limitation of the study. A post hoc evaluation indicates that, for a two-sided α of 0.05, the achieved sample provides 63% power to detect the observed difference in

regular use (28.0% vs. 10.0%; Cohen's h = 0.47), 78% power for the observed difference in ever use (32.0% vs. 10.0%), and 98% power for the observed within-group difference by treatment status (50.0% vs. 4.2%). For continuous outcomes, the design provides 80% power to detect a standardised mean difference of d ≥ 0.56 between two groups of 50. The study is therefore adequately powered for medium-to-large effects but underpowered for small effects, and all subgroup analyses involving the 19 regular users should be regarded as exploratory.

Statistical analysis

All statistical analyses were performed using jamovi version 2.6.44.0 and Python 3.13 (SciPy 1.17, statsmodels) for the exact tests, effect-size confidence intervals and penalised regression models. Normal distribution assumptions were evaluated by examining the Kolmogorov–Smirnov and Shapiro–Wilk tests, skewness/kurtosis values and histograms. Between-group comparisons of continuous variables used the Welch t-test or the Mann–Whitney U test according to distributional assumptions. For categorical variables, Pearson's χ^2 test was used when all expected cell frequencies were ≥ 5; when any expected frequency was < 5, Fisher's exact test was used, and for the two primary comparisons both tests are reported so that the robustness of the result is transparent.

Effect sizes with 95% CI are reported for every comparison: odds ratios (OR) for binary outcomes (with the Haldane–Anscombe 0.5 correction when a zero cell was present), Cramér's V for larger contingency tables, and Cohen's d / Hedges' g for continuous variables, with the rank-biserial correlation reported when the Mann–Whitney U test was used. Because the comparisons of the seven symptom, depression and anxiety measures constitute two families of multiple tests (Table 3 and Table 7), p values within each family were adjusted with the Benjamini–Hochberg false discovery rate procedure and both unadjusted and adjusted values are presented. All other analyses, including all subgroup analyses within the ADHD group, are explicitly exploratory and their p values are not corrected; they are interpreted as hypothesis-generating.

Because the number of events was small (19 regular users in the total sample and 14 within the ADHD group) and because one cell of the treatment analysis contained a single event, adjusted analyses used Firth penalised (bias-reduced) logistic regression with profile penalised-likelihood 95% CI and penalised likelihood-ratio tests, which is the recommended approach in the presence of sparse data and quasi-complete separation. Four pre-specified models were fitted: in the total sample, Model 1 adjusted for age and sex and Model 2 additionally for peer Maraş powder use; within the ADHD group, Model 3 adjusted for age and sex and Model 4 additionally for peer use and psychiatric comorbidity. The number of covariates was deliberately restricted to approximately one variable per 5 events; models with a larger covariate set (including family use and cigarette smoking) were fitted as sensitivity analyses and are described in the text. Continuous variables are presented as mean (M) and standard deviation (SD) and categorical variables as number (n) and percentage (%), with the denominator stated for every percentage. A two-sided p value below 0.05 was considered statistically significant.

RESULTS

Sample characteristics

The two groups did not differ significantly in age, sex, education, parental age and education, family income, family structure, place of residence, or Maraş powder use within the family **(Table 1)**. Two variables differed between the groups: a close friend who used Maraş powder was reported more frequently by adolescents with ADHD (50.0% vs. 30.0%; χ^2 p = 0.041, Fisher p = 0.066; OR = 2.33, 95% CI 1.03–5.30), as was any current substance use (46.0% vs. 22.0%; p = 0.011; OR = 3.02, 95% CI 1.27–7.21). Lifetime cigarette smoking was more frequent in the ADHD group but the difference was not statistically significant (60.0% vs. 46.0%; p =

Table 1: Sociodemographic, Familial and Substance-Related Characteristics of the Participants				
Characteristic	**ADHD group (n = 50)**	**Control group (n = 50)**	**p**	**Effect size (95% CI)**
Age, years, M (SD)	15.08 (1.65)	14.82 (1.85)	0.460	d = 0.15 (−0.24 to 0.54)
Education, years, M (SD)	9.56 (1.53)	9.50 (1.75)	0.856	d = 0.04 (−0.36 to 0.43)
Mother's age, years, M (SD)	39.76 (5.75)	39.90 (5.84)	0.904	d = −0.02 (−0.42 to 0.37)
Father's age, years, M (SD)	45.42 (5.74)	44.36 (5.34)	0.341	d = 0.19 (−0.20 to 0.58)
Number of siblings, M (SD)	2.08 (1.14)	2.08 (1.05)	1.000	d = 0.00 (−0.39 to 0.39)
Male sex, n (%)	35 (70.0)	33 (66.0)	0.668	OR = 1.20 (0.52–2.79)
Chronic physical illness, n (%)	6 (12.0)	8 (16.0)	0.564	OR = 0.72 (0.23–2.24)
Mother high school or above, n (%)	21 (42.0)	22 (44.0)	0.840	OR = 0.92 (0.42–2.03)
Father high school or above, n (%)	28 (56.0)	30 (60.0)	0.685	OR = 0.85 (0.38–1.88)
Monthly household income above the minimum wage, n (%)	15 (30.0)	13 (26.0)	0.656	OR = 1.22 (0.51–2.93)
Non-nuclear family, n (%)	6 (12.0)	4 (8.0)	0.505	OR = 1.57 (0.41–5.94)
District/village residence, n (%)	10 (20.0)	10 (20.0)	1.000	OR = 1.00 (0.38–2.66)
Maraş powder use in the family, n (%)	19 (38.0)	18 (36.0)	0.836	OR = 1.09 (0.48–2.45)
Maraş powder use by a close friend, n (%)	25 (50.0)	15 (30.0)	0.041	OR = 2.33 (1.03–5.30)
Ever smoked cigarettes, n (%)	30 (60.0)	23 (46.0)	0.161	OR = 1.76 (0.80–3.89)
Ever used alcohol, n (%)	14 (28.0)	8 (16.0)	0.148	OR = 2.04 (0.77–5.42)
Ever used illicit drugs, n (%)	4 (8.0)	2 (4.0)	0.678*	OR = 2.09 (0.36–11.95)
Any current substance use, n (%)	23 (46.0)	11 (22.0)	0.011	OR = 3.02 (1.27–7.21)

Note. M = mean; SD = standard deviation; OR = odds ratio; CI = confidence interval; d = Cohen's d. p values are from Welch's t-test for continuous variables and Pearson's χ^2 test for categorical variables. Percentages are calculated within each group (denominator = 50). * Fisher's exact test was used because an expected cell frequency was below 5.

0.161). These variables were considered as potential confounders in the adjusted analyses.

Within the ADHD group, 24 adolescents (48.0%) were receiving regular pharmacological treatment, most frequently long-acting methylphenidate (20/24; 83.3%), and 32 (64.0%) had at least one psychiatric comorbidity, most frequently conduct disorder (11/50; 22.0%) and oppositional defiant disorder (8/50; 16.0%) **(Table 2)**. Treatment duration was 12–24 months in 12 adolescents and 24–36 months in 9. In the previous version of the manuscript, treatment duration was inadvertently reported as a mean of 3.71 (0.91) "years"; this value was the mean of the ordinal category codes rather than a duration in years, and it has been replaced by the categorical distribution shown in Table 2.

Knowledge and beliefs about Maraş powder

Knowledge and beliefs were assessed in all 100 participants **(Figure 1)**. Most adolescents agreed that Maraş powder is harmful to health (90/100; 90.0%) and that it is addictive (83/100; 83.0%). However, uncertainty was widespread: 57.0% either agreed with (17.0%) or reported no idea about (40.0%) the statement that Maraş powder helps smoking cessation, 74.0% had no idea whether its nicotine content exceeds that of cigarettes, and only 38.0% correctly rejected the statement that indoor use is not prohibited. Only 9.0% reported knowing where treatment for Maraş powder dependence is available. Beliefs did not differ significantly between the ADHD and control groups for any item (all $p > 0.05$, uncorrected).

Table 2: Clinical Characteristics of the ADHD Group (n = 50)	
Clinical characteristic	**n (%)**
Receiving regular pharmacological treatment	24 (48.0)
Not receiving treatment	26 (52.0)
Medication among treated adolescents (n = 24)	
Short-acting methylphenidate	1 (4.2)
Long-acting methylphenidate	20 (83.3)
Atomoxetine	1 (4.2)
Long-acting methylphenidate + atypical antipsychotic	1 (4.2)
Short- + long-acting methylphenidate	1 (4.2)
Duration of current treatment (n = 24)	
12–24 months	12 (50.0)
24–36 months	9 (37.5)
36–48 months	1 (4.2)
> 48 months	2 (8.3)
At least one psychiatric comorbidity	32 (64.0)
Conduct disorder	11 (22.0)
Oppositional defiant disorder	8 (16.0)
Anxiety disorder	6 (12.0)
Depressive disorder	2 (4.0)
Tic disorder	1 (2.0)
Adjustment disorder	1 (2.0)
Trichotillomania	1 (2.0)
Oppositional defiant disorder + depressive disorder	1 (2.0)
Conduct disorder + alcohol/substance use disorder	1 (2.0)
Other (specific learning disorder, enuresis, conversion, etc.)	0 (0.0)

Note. Percentages for medication type and treatment duration are calculated within the treated subgroup (denominator = 24); all other percentages use the whole ADHD group (denominator = 50). Comorbid diagnoses were established clinically according to DSM-5 criteria. Comorbid disorders were not exclusion criteria.

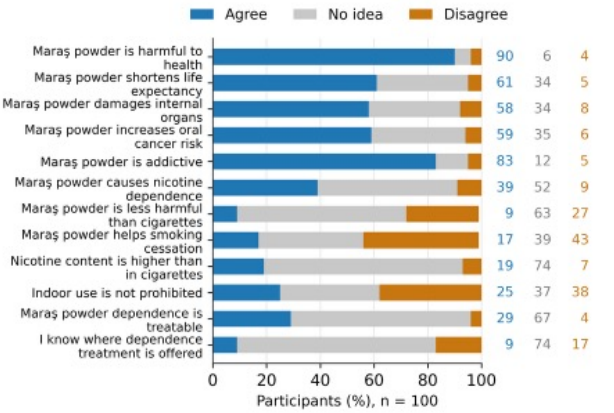

Figure 1: Knowledge of and Beliefs About Maraş Powder Among All Participants (N = 100)

Note. Stacked bars show the percentage of participants who agreed with, had no idea about, or disagreed with each statement. Because n = 100, the values printed to the right of each bar correspond to both counts and percentages; each value is coloured to match its bar segment (blue = agree, grey = no idea, amber = disagree). The item "Indoor use is not prohibited" is negatively worded, so that "disagree" (38.0%) represents the correct answer.

Symptom, depression and anxiety scores in the two groups

The ADHD group had significantly higher scores on all DBDRS subscales than the control group (all Benjamini–Hochberg-corrected $p \leq 0.001$; Hedges' g between 0.77 and 1.37). There was no statistically significant difference between the groups in CDI ($p = 0.826$), state anxiety ($p = 0.652$) or trait anxiety ($p = 0.065$) scores **(Table 3)**.

Maraş powder use in the two groups

Current regular use of Maraş powder was reported by 14 of the 50 adolescents with ADHD (28.0%) and by 5 of the 50 control adolescents (10.0%), while 2 adolescents (4.0%) in the ADHD group and none in the control group reported experimentation without regular use; 34 (68.0%) and 45 (90.0%) respectively had never used the product **(Table 4, Figure 2).**

Table 3: Comparison of Symptom, Depression and Anxiety Scores Between the ADHD Group and the Control Group					
Measure	**ADHD group (n = 50) M (SD)**	**Control group (n = 50) M (SD)**	**p**	**pBH**	**Hedges' g (95% CI)**
DBDRS Inattention	14.92 (5.50)	7.76 (4.90)	<0.001	<0.001	1.37 (0.94 to 1.81)
DBDRS Hyperactivity/ impulsivity	9.82 (5.32)	4.12 (4.13)	<0.001	<0.001	1.19 (0.77 to 1.62)
DBDRS Oppositional defiant	11.66 (6.04)	7.64 (4.18)	<0.001	<0.001	0.77 (0.37 to 1.18)
DBDRS Conduct	4.70 (5.65)	1.32 (2.37)	<0.001	<0.001	0.77 (0.37 to 1.19)
Kovacs Children's Depression Inventory	17.16 (8.98)	16.76 (9.15)	0.826	0.826	0.04 (−0.35 to 0.44)
State Anxiety Inventory	42.64 (11.99)	43.74 (12.30)	0.652	0.760	−0.09 (−0.48 to 0.30)
Trait Anxiety Inventory	45.60 (10.38)	49.94 (12.75)	0.065	0.091	−0.37 (−0.77 to 0.02)

Note. DBDRS = DSM-IV Disruptive Behavior Disorders Rating Scale; CI = confidence interval; pBH = p value after Benjamini–Hochberg false discovery rate correction within this family of seven tests. Welch's t-test was used for all measures except the conduct subscale, for which the Mann–Whitney U test was used (rank-biserial r = 0.36).

Table 4: Maraş Powder Use by Group				
Maraş powder use	**ADHD group (n = 50) n (%)**	**Control group (n = 50) n (%)**	**p**	**OR (95% CI)**
Current regular use	14 (28.0)	5 (10.0)	0.022 (Fisher 0.040)	3.50 (1.15–10.63)
Experimentation without regular use	2 (4.0)	0 (0.0)	—	—
Never used	34 (68.0)	45 (90.0)	—	—
Ever use (regular + experimentation)	16 (32.0)	5 (10.0)	0.007 (Fisher 0.013)	4.24 (1.41–12.70)

Note. OR = odds ratio for the ADHD group relative to the control group; CI = confidence interval. p values are from Pearson's χ^2 test with Fisher's exact p given in parentheses. Percentages use a denominator of 50 in each group. Categories are mutually exclusive; "ever use" combines regular use and experimentation.

The difference was statistically significant both for regular use ($\chi^2 = 5.26$, $p = 0.022$; Fisher $p = 0.040$; OR = 3.50, 95% CI 1.15–10.63; Cramér's $V = 0.23$) and for ever use ($\chi^2 = 7.29$, $p = 0.007$; Fisher $p = 0.013$; OR = 4.24, 95% CI 1.41–12.70; $V = 0.27$).

The frequencies reported in the previous version of the manuscript contained a numerical error: the number of regular users in the ADHD group was given as 11 although the percentage (28.0%) corresponded to 14 adolescents, so that the frequencies summed to 47 rather than 50 and conflicted with the 14 regular users implied by the treatment analysis and with the 19 regular users used in the scale comparisons. The complete dataset has been re-checked; the correct figure is 14 (28.0%), the total number of regular users in the whole sample is 19, and all tables, figures, the abstract and the main text are now mutually consistent.

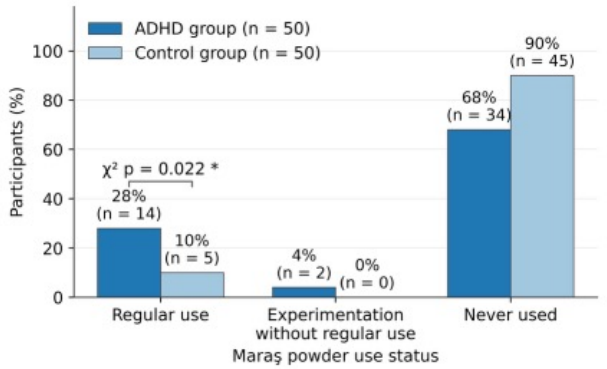

Figure 2: Distribution of Maraş Powder Use Status in the ADHD Group and the Control Group

Note. Bars show the percentage of adolescents in each group; the corresponding counts are given in parentheses above each bar (denominator = 50 per group). Regular use and ever use differed significantly between groups (χ^2 p = 0.022 and p = 0.007, respectively).

Maraş powder use and ADHD treatment status

Within the ADHD group, current regular use was reported by 1 of the 24 adolescents receiving regular pharmacological treatment (4.2%) and by 13 of the 26 untreated adolescents (50.0%) (χ^2 = 13.00, p < 0.001; Fisher p < 0.001; OR = 0.04, 95% CI 0.01–0.37) **(Table 5, Figure 3)**. Treated and untreated adolescents did not differ significantly in age, sex, parental education, income, place of residence, family or peer Maraş powder use, or psychiatric comorbidity, but the small subgroup sizes mean that clinically relevant imbalances cannot be excluded. This analysis was pre-specified as exploratory and treatment was not randomly allocated; the finding is therefore reported as an association only.

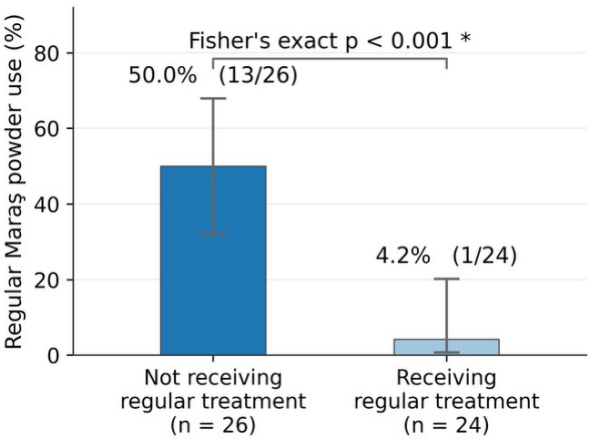

Figure 3: Prevalence of Current Regular Maraş Powder Use in the ADHD Group According to Treatment Status

Note. Bars show percentages with 95% Wilson confidence intervals; counts and denominators are printed above each bar. The difference was statistically significant (Fisher p < 0.001), but treatment was not randomly allocated and the estimate is based on a single event in the treated subgroup.

Characteristics of regular users

The 19 adolescents who reported current regular use had started using Maraş powder at a mean age of 14.89 (SD 0.81) years (range 13–16). Duration of use was 6–12 months in 8 adolescents (42.1%) and longer than 12 months in 8 (42.1%); 9 (47.4%) reported using the product fewer than 5 times per day and 10 (52.6%) 5–10 times per day. The most frequent reason for use was to feel better or to reduce stress (16/19; 84.2%), followed by curiosity (9/19; 47.4%). Twelve adolescents (63.2%) obtained the product from a grocery store. All 19 regular users had also smoked cigarettes, and 8 (42.1%) reported

Table 5: Maraş Powder Use in the ADHD Group by Treatment Status

Maraş powder use	Receiving treatment (n = 24) n (%)	Not receiving treatment (n = 26) n (%)	p	OR (95% CI)
Current regular use	1 (4.2)	13 (50.0)	<0.001 (Fisher <0.001)	0.04 (0.01–0.37)
Ever use	1 (4.2)	15 (57.7)	<0.001 (Fisher <0.001)	0.03 (0.00–0.27)

Note. OR = odds ratio for adolescents receiving regular treatment relative to untreated adolescents; CI = confidence interval. Percentages use denominators of 24 (treated) and 26 (untreated). Treatment was not randomly allocated; see Limitations.

concurrent alcohol or cannabis use; 9 (47.4%) were considering quitting and 9 (47.4%) had previously attempted to quit **(Table 6)**. The 2 adolescents who reported experimentation only had first tried Maraş powder at ages 12 and 13.

Table 6: Characteristics of Current Regular Maraş Powder Users (n = 19)

Characteristic	n (%) or M (SD)
Age at onset of use, years, M (SD) [range]	14.89 (0.81) [13–16]
Duration of use	
0–6 months	3 (15.8)
6–12 months	8 (42.1)
12–18 months	5 (26.3)
18–24 months	2 (10.5)
> 24 months	1 (5.3)
Daily frequency of use	
< 5 times	9 (47.4)
5–10 times	10 (52.6)
Source of supply	
Grocery store	12 (63.2)
Supermarket	1 (5.3)
Friends	2 (10.5)
Grocery store and friends	4 (21.1)
Concurrent tobacco/substance use	
Cigarettes only	9 (47.4)
Cigarettes and alcohol	5 (26.3)
Cigarettes, alcohol and cannabis	3 (15.8)
Not reported	2 (10.5)
Main self-reported reasons for use (multiple answers allowed)	
Feeling better / reducing stress	16 (84.2)
Curiosity	9 (47.4)
Not being excluded by peers	3 (15.8)
Weight control	3 (15.8)
Low cost	2 (10.5)
Feeling grown-up	1 (5.3)
To quit smoking	1 (5.3)
Considering quitting Maraş powder	9 (47.4)
Previous quit attempt	9 (47.4)

Note. Percentages use a denominator of 19 unless otherwise stated. Reasons for use allowed multiple answers, so percentages sum to more than 100. Concurrent substance use was not reported by 2 adolescents. These descriptive data support the operational definition of regular use given in the Methods.

Symptom, depression and anxiety scores by Maraş powder use

Adolescents with current regular use scored significantly higher than non-regular users on all four DBDRS subscales, on the CDI and on state anxiety, with all differences remaining significant after Benjamini–Hochberg correction; effect sizes were moderate to very large (Hedges' g = 0.52–1.97, largest for conduct symptoms). Trait anxiety did not differ between the groups (p = 0.944, g = 0.02) **(Table 7, Figure 4)**. These comparisons combine the ADHD and control groups; the same pattern was observed when the analysis was restricted to the ADHD group, but with wider confidence intervals owing to the smaller sample.

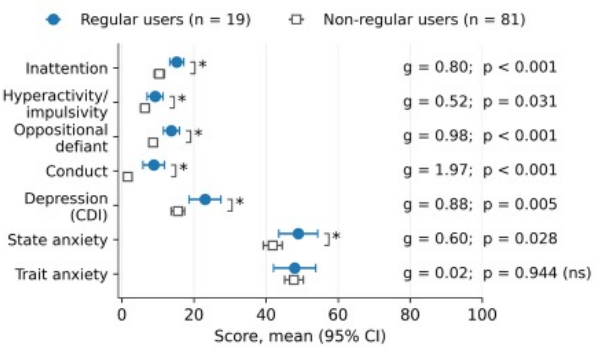

Figure 4: Symptom, Depression and Anxiety Scores of Current Regular Maraş Powder Users (n = 19) and Non-Regular Users (n = 81)

Note. Symbols show group means and horizontal lines the 95% confidence intervals. Hedges' g and the Benjamini–Hochberg-corrected p value are printed to the right of each pair; * indicates a difference that remained significant after Benjamini–Hochberg correction, ns indicates a non-significant difference.

Adjusted analyses

In the total sample, ADHD remained associated with current regular use after adjustment for age and sex (aOR = 3.44, 95% CI 1.12–11.99, p = 0.031; Model 1). When peer Maraş powder use was added, the association was attenuated and no longer statistically significant (aOR = 2.87, 95% CI 0.81–11.59, p = 0.102), whereas having a close

Table 7: Comparison of Symptom, Depression and Anxiety Scores Between Current Regular Maraş Powder Users and Non-Regular Users					
Measure	**Regular users (n = 19) M (SD)**	**Non-regular users (n = 81) M (SD)**	**p**	**pBH**	**Hedges' g (95% CI)**
DBDRS Inattention	15.26 (4.05)	10.42 (6.40)	<0.001	<0.001	0.80 (0.29 to 1.31)
DBDRS Hyperactivity/ impulsivity	9.26 (4.57)	6.43 (5.63)	0.027	0.031	0.52 (0.01 to 1.02)
DBDRS Oppositional defiant	13.79 (4.63)	8.68 (5.31)	<0.001	<0.001	0.98 (0.47 to 1.50)
DBDRS Conduct	8.89 (6.24)	1.63 (2.77)	<0.001	<0.001	1.97 (1.41 to 2.55)
Kovacs Children's Depression Inventory	23.11 (9.16)	15.52 (8.41)	0.003	0.005	0.88 (0.37 to 1.40)
State Anxiety Inventory	48.95 (11.17)	41.84 (11.97)	0.020	0.028	0.60 (0.09 to 1.11)
Trait Anxiety Inventory	47.95 (12.17)	47.73 (11.75)	0.944	0.944	0.02 (−0.48 to 0.52)

Note. DBDRS = DSM-IV Disruptive Behavior Disorders Rating Scale; CI = confidence interval; pBH = Benjamini–Hochberg-corrected p value within this family of seven tests. Welch's t-test was used for all measures except the conduct subscale (Mann–Whitney U test; rank-biserial r = 0.67). Non-regular users include never users and adolescents who reported experimentation only.

friend who used Maraş powder was strongly associated with regular use (aOR = 9.08, 95% CI 2.45–49.45, p < 0.001) and each additional year of age approximately doubled the odds (aOR = 2.04, 95% CI 1.20–4.03, p = 0.007; Model 2). In a sensitivity model additionally including family use and lifetime cigarette smoking, the ADHD estimate was essentially unchanged (aOR = 3.50, 95% CI 0.84–18.10, p = 0.086); it should be noted that all 19 regular users had smoked cigarettes, which produces quasi-complete separation and makes the smoking estimate unstable even under penalisation **(Table 8, Figure 5)**.

Table 8: Firth Penalised Logistic Regression Models for Current Regular Maraş Powder Use			
Model / predictor	**aOR**	**95% CI**	**p**
Model 1 — total sample, outcome: current regular use (n = 100, events = 19)			
ADHD (vs. control)	3.44	1.12–11.99	0.031
Age (per year)	2.23	1.44–3.93	<0.001
Male sex (vs. female)	1.25	0.40–4.12	0.706
Model 2 — total sample, further adjusted for peer use (n = 100, events = 19)			
ADHD (vs. control)	2.87	0.81–11.59	0.102
Age (per year)	2.04	1.20–4.03	0.007
Male sex (vs. female)	1.04	0.28–3.86	0.954
Close friend using Maraş powder	9.08	2.45–49.45	<0.001
Model 3 — ADHD group only, outcome: current regular use (n = 50, events = 14)			
Regular ADHD treatment (vs. none)	0.04	0.003–0.31	<0.001
Age (per year)	3.07	1.42–10.50	0.001
Male sex (vs. female)	2.01	0.33–14.39	0.443
Model 4 — ADHD group only, extended adjustment (n = 50, events = 14)			
Regular ADHD treatment (vs. none)	0.10	0.006–0.89	0.038
Age (per year)	3.09	1.26–11.49	0.010
Close friend using Maraş powder	3.28	0.45–35.31	0.240
Psychiatric comorbidity (vs. none)	2.77	0.26–36.35	0.385

Note. aOR = adjusted odds ratio from Firth penalised (bias-reduced) logistic regression; CI = confidence interval (profile penalised-likelihood); p values are from penalised likelihood-ratio tests. Models 1 and 2 use the total sample (100 participants, 19 events); Models 3 and 4 use the ADHD group only (50 participants, 14 events). Given the small number of events, all adjusted estimates are exploratory.

Within the ADHD group, the absence of regular pharmacological treatment remained associated with regular use after adjustment for age and sex (aOR for treatment = 0.04, 95% CI 0.003–0.31, p < 0.001; Model 3) and after further adjustment for peer use and psychiatric comorbidity (aOR = 0.10, 95% CI 0.006–0.89, p = 0.038; Model 4). Given 14 events, wide confidence intervals and the observational design, these estimates should be regarded as exploratory.

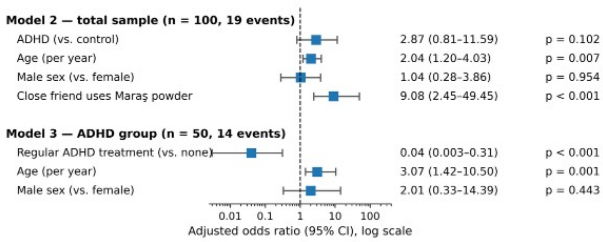

Figure 5: Adjusted Odds Ratios for Current Regular Maraş Powder Use From Firth Penalised Logistic Regression

Note. Squares show adjusted odds ratios and horizontal lines the 95% profile penalised-likelihood confidence intervals on a logarithmic scale; the dashed vertical line marks the null value of 1. The upper block shows Model 2, fitted in the total sample (n = 100, 19 events), and the lower block Model 3, fitted within the ADHD group (n = 50, 14 events); model numbering corresponds to Table 8. Numerical values are given to the right of the plot.

DISCUSSION

This cross-sectional study compared adolescents with ADHD and age- and sex-matched adolescents without a psychiatric disorder with respect to the use of Maraş powder, a high-nicotine smokeless tobacco product. Three findings emerged, corresponding to the three aims of the study.

Primary aim: prevalence of use. Both ever use (32.0% vs. 10.0%) and current regular use (28.0% vs. 10.0%) were about three times more frequent among adolescents with ADHD, and the association with regular use persisted after adjustment for age and sex. To our knowledge, this is the first study to examine a smokeless tobacco product in adolescents with ADHD. The direction and magnitude of the association are consistent with the literature on cigarette smoking: meta-analyses have shown that childhood ADHD is associated with nicotine use in mid-adolescence and with subsequent substance use disorders (Charach et al., 2011; Groenman et al., 2017; Lee et al., 2011), and population-based studies have shown earlier smoking onset and faster progression to regular use in adolescents with ADHD symptoms (Kollins et al., 2005; Milberger et al., 1997; Mitchell et al., 2019). Our data extend this pattern to a smokeless product whose nicotine delivery is at least as high as that of cigarettes (Çok & Öztürk, 2000; Güven & Tolun, 2012). Importantly, the association was attenuated when peer Maraş powder use was taken into account, and all regular users were also cigarette smokers; this suggests that the elevated prevalence in ADHD reflects a broader pattern of poly-tobacco use embedded in a peer context rather than a product-specific vulnerability. Because the design is cross-sectional, it cannot be determined whether ADHD-related characteristics lead to Maraş powder use, whether both share common causes such as externalising problems and peer affiliation, or whether nicotine exposure aggravates symptoms.

Secondary aim: treatment status. Within the ADHD group, regular Maraş powder use was less frequent among adolescents receiving regular pharmacological treatment (4.2%) than among untreated adolescents (50.0%), and this difference persisted in adjusted exploratory models. Superficially, this is consistent with a meta-analytic review reporting that stimulant treatment was associated with a reduced risk of later alcohol and substance use disorders (Wilens et al., 2003) and with the reduction in substance-related emergency visits during medicated periods (Asherson, 2017). However, other meta-analyses have found that stimulant treatment neither increases nor decreases the subsequent risk of alcohol, cigarette, cannabis or other substance use (Humphreys et al., 2013; Molina et al., 2023), and the management of ADHD co-occurring with

substance use is itself recognised as a complex clinical problem (Barbuti et al., 2023). More importantly, in the present study treatment was not randomly allocated. Adolescents who remain in regular treatment may differ from untreated adolescents in adherence, family monitoring, help-seeking, access to health care, symptom severity and unmeasured socioeconomic characteristics, and reverse causality is equally plausible: adolescents who use tobacco regularly may be less likely to attend appointments and to continue medication. Only 1 event occurred in the treated subgroup, so the estimate is imprecise. We therefore describe this finding strictly as an association between regular ADHD treatment and a lower prevalence of Maraş powder use; the present data do not show that ADHD treatment prevents smokeless tobacco dependence, and the term "protective factor" used in the previous version of the manuscript has been removed throughout.

Symptom severity in regular users. Regular users had higher inattention, hyperactivity/impulsivity, oppositional defiant and — most markedly — conduct symptom scores, as well as higher depression and state anxiety scores, than non-users. The largest effect was observed for conduct symptoms ($g = 1.97$), whereas the difference in hyperactivity/impulsivity was moderate ($g = 0.52$) and trait anxiety did not differ at all. This profile suggests that the association is driven more by externalising psychopathology than by ADHD core symptoms alone, and the dissociation between state and trait anxiety is compatible with a state-dependent phenomenon (for example, withdrawal-related distress or situational stress) rather than a stable anxious disposition. Because the study is cross-sectional and did not assess dopamine function, reward processing or emotion regulation directly, no inference can be drawn about the neurobiological mechanisms sometimes invoked in this context; the elevated scores may reflect psychopathology leading to tobacco use, the effects of nicotine on symptoms, or shared underlying externalising liability and unmeasured variables. Our finding that regular users exhibited particularly elevated conduct and other externalising symptoms is consistent with previous studies indicating that externalising psychopathology, rather than ADHD core symptoms alone, is a major correlate of tobacco use in adolescents (Charach et al., 2011; Lee et al., 2011; Molina & Pelham, 2003).

Knowledge and beliefs. Although 90.0% of adolescents recognised that Maraş powder is harmful — consistent with a study of male high-school students in Kahramanmaraş (Keten et al., 2014) — specific knowledge was poor: 57.0% agreed with or were unsure about the claim that it helps smoking cessation, 74.0% did not know that its nicotine content exceeds that of cigarettes, and only 38.0% knew that indoor use is prohibited. Comparable misperceptions of smokeless tobacco have been reported among adolescents in the United States (Cohen et al., 1987) and are a recognised feature of the global smokeless tobacco literature, in which weaker regulation and lower risk perception coexist (Mehrotra et al., 2019; Siddiqi et al., 2020). Given that most regular users in our sample obtained the product from a neighbourhood grocery store and cited stress relief as their main reason for use, prevention efforts targeting adolescents — particularly those in psychiatric care — should address both product-specific misconceptions and access.

Limitations

The following limitations should be considered when interpreting these findings. (1) The design is cross-sectional, so no causal or temporal inference is possible for any of the reported associations. (2) The study was conducted in a single centre with a relatively small sample (50 per group), and no a priori sample size calculation was performed; the study is underpowered for small effects. (3) Subgroup sample sizes are small — 19 regular users in total and only 1 event in the treated subgroup — so several estimates have wide confidence intervals and are unstable. (4) All tobacco and substance use data are self-reported and were not biochemically verified (for example by salivary or urinary cotinine), so recall bias and social desirability bias may have led to underreporting despite the confidentiality procedures used. (5) The

Maraş powder questionnaire was developed by the researchers and has not undergone psychometric validation. (6) Several potentially important confounders were not measured: electronic cigarette use, waterpipe use, parental tobacco use, household tobacco exposure, parental monitoring, and detailed socioeconomic indicators; residual confounding is therefore likely even in the adjusted models. (7) Multiple comparisons were performed; although the two families of scale comparisons were corrected with the Benjamini–Hochberg procedure, the remaining analyses were exploratory and uncorrected, and borderline p values should be interpreted cautiously. (8) The comparison group was recruited from a hospital paediatric clinic rather than from the community, which may limit generalisability. (9) Another limitation is that only adolescents with combined-type ADHD were included; therefore, the findings may not be generalisable to individuals with predominantly inattentive or predominantly hyperactive-impulsive ADHD presentations. (10) Treatment was not randomly allocated and treatment adherence was not verified.

CONCLUSION

In this single-centre cross-sectional study, adolescents with ADHD reported both ever use and current regular use of Maraş powder about three times more frequently than matched adolescents without a psychiatric disorder, and regular use was associated with greater disruptive-behaviour symptom severity, more depressive symptoms and higher state anxiety. Within the ADHD group, regular pharmacological treatment was associated with a markedly lower prevalence of regular use. These results are preliminary and hypothesis-generating: they identify adolescents with ADHD — particularly those with prominent externalising symptoms, those who are not in regular treatment and those whose friends use the product — as a group in which smokeless tobacco should be screened for and addressed, but they do not demonstrate that ADHD treatment prevents smokeless tobacco use. Prospective, multicentre studies with biochemical verification of nicotine exposure and adequate control of family, peer and socioeconomic factors are needed to test the associations reported here.

REFERENCES

Akbay, C., Bilgiç, A., & Dölekoğlu, C. Ö. (2017). Kahramanmaraş il merkezinde tüketicilerin sigara ve Maraş otu kullanımını etkileyen faktörlerin analizi. KSÜ Doğa Bilimleri Dergisi, 20(3), 276–282. https://doi.org/10.18016/ksudobil.289471.

Asherson, P. (2017). Drug treatments for ADHD reduce risk of substance use disorders. American Journal of Psychiatry, 174(9), 827–828. https://doi.org/10.1176/appi.ajp.2017.17070733

Barbuti, M., Maiello, M., Spera, V., Pallucchini, A., Brancati, G. E., Maremmani, A. G. I., Perugi, G., & Maremmani, I. (2023). Challenges of treating ADHD with comorbid substance use disorder. Journal of Clinical Medicine, 12(9), 3096. https://doi.org/10.3390/jcm12093096

Charach, A., Yeung, E., Climans, T., & Lillie, E. (2011). Childhood attention-deficit/hyperactivity disorder and future substance use disorders: Comparative meta-analyses. Journal of the American Academy of Child & Adolescent Psychiatry, 50(1), 9–21. https://doi.org/10.1016/j.jaac.2010.09.019

Cohen, R. Y., Sattler, J., Felix, M. R., & Brownell, K. D. (1987). Experimentation with smokeless tobacco and cigarettes by children and adolescents: Relationship to beliefs, peer use, and parental use. American Journal of Public Health, 77(11), 1454–1456. https://doi.org/10.2105/AJPH.77.11.1454

Çok, İ., & Öztürk, R. (2000). Urinary cotinine levels of smokeless tobacco (Maraş powder) users. Human & Experimental Toxicology, 19(11), 650–655. https://doi.org/10.1191/096032700670928812

Danielson, M. L., Claussen, A. H., Bitsko, R. H., Katz, S. M., Newsome, K., Blumberg, S. J., Kogan, M. D., & Ghandour, R. M. (2024). ADHD prevalence among US children and adolescents in 2022: Diagnosis, severity, co-occurring disorders, and treatment. Journal of Clinical Child & Adolescent Psychology. Advance online publication. https://doi.org/10.1080/15374416.2024.2335625

Ercan, E. S., Amado, S., Somer, O., & Çıkoğlu, S. (2001). Development of a test battery for the assessment of attention deficit hyperactivity disorder. Turkish Journal of Child and Adolescent Mental Health, 8(3), 132–145.

Ercan, E. S., Unsel-Bolat, G., Tufan, A. E., Karakoc Demirkaya, S., Bilac, O., Celik, G., Kılıç, B. G., Akyol Ardic, U., Yalin Sapmaz, S., Aksu, H., Yolga Tahiroglu, A., Karacetin, G., Tural, U., Aktepe, E., Rodopman Arman, A., Başgül, S., Coşkun, M., Dursun, O. B., Durukan, İ., … Ünal, F. (2022). Effect of impairment on the prevalence and comorbidities of attention deficit hyperactivity disorder in a national survey: Nation-wide prevalence and comorbidities of ADHD. Journal of Attention Disorders, 26(5), 674–684. https://doi.org/10.1177/10870547211017985

Faraone, S. V., Banaschewski, T., Coghill, D., Zheng, Y., Biederman, J., Bellgrove, M. A., Newcorn, J. H., Gignac, M., Al Saud, N. M., Manor, I., Rohde, L. A., Yang, L., Cortese, S., Almagor, D., Stein, M. A., Albatti, T. H., Aljoudi, H.

F., Alqahtani, M. M. J., Asherson, P., … Wang, Y. (2021). The World Federation of ADHD International Consensus Statement: 208 evidence-based conclusions about the disorder. Neuroscience & Biobehavioral Reviews, 128, 789–818. https://doi.org/10.1016/j.neubiorev.2021.01.022

Grassi, G., Moradei, C., & Cecchelli, C. (2024). Prevalence and clinical phenotypes of adult patients with attention deficit hyperactivity disorder and comorbid behavioral addictions. Journal of Behavioral Addictions, 13(2), 473–481. https://doi.org/10.1556/2006.2024.00020

Groenman, A. P., Janssen, T. W. P., & Oosterlaan, J. (2017). Childhood psychiatric disorders as risk factor for subsequent substance abuse: A meta-analysis. Journal of the American Academy of Child & Adolescent Psychiatry, 56(7), 556–569. https://doi.org/10.1016/j.jaac.2017.05.004

Güven, A., & Tolun, F. (2012). Effects of smokeless tobacco "Maraş powder" use on nitric oxide and cardiovascular risk parameters. International Journal of Medical Sciences, 9(9), 786–792. https://doi.org/10.7150/ijms.4563

Humphreys, K. L., Eng, T., & Lee, S. S. (2013). Stimulant medication and substance use outcomes: A meta-analysis. JAMA Psychiatry, 70(7), 740–749. https://doi.org/10.1001/jamapsychiatry.2013.1273

International Agency for Research on Cancer. (2007). Smokeless tobacco and some tobacco-specific N-nitrosamines (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 89). IARC.

Katzman, M. A., Bilkey, T. S., Chokka, P. R., Fallu, A., & Klassen, L. J. (2017). Adult ADHD and comorbid disorders: Clinical implications of a dimensional approach. BMC Psychiatry, 17(1), 302. https://doi.org/10.1186/s12888-017-1463-3

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., Williamson, D., & Ryan, N. (1997). Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version (K-SADS-PL): Initial reliability and validity data. Journal of the American Academy of Child & Adolescent Psychiatry, 36(7), 980–988. https://doi.org/10.1097/00004583-199707000-00021

Keten, H. S., Üçer, H., Önay, H., Cerit, M., Gürsoy, H., & Çelik, M. (2014). Kahramanmaraş'ta yurtta kalan erkek lise öğrencilerinin Maraş otu konusunda bilgi, tutum ve davranışları. Turkish Journal of Family Medicine and Primary Care, 8(4), 111–116. https://doi.org/10.5455/tjfmpc.158578

Kılınç, M., Okur, E., Kurutaş, E. B., Güler, F. I., & Yıldırım, İ. (2004). The effects of Maraş powder (smokeless tobacco) on oxidative stress in users. Cell Biochemistry and Function, 22(4), 233–236. https://doi.org/10.1002/cbf.1093

Kollins, S. H., McClernon, F. J., & Fuemmeler, B. F. (2005). Association between smoking and attention-deficit/hyperactivity disorder symptoms in a population-based sample of young adults. Archives of General Psychiatry, 62(10), 1142–1147.https://doi.org/10.1001/archpsyc.62.10.1142

Kovacs, M. (1981). Rating scales to assess depression in school-aged children. Acta Paedopsychiatrica, 46(5–6), 305–315.

Lee, S. S., Humphreys, K. L., Flory, K., Liu, R., & Glass, K. (2011). Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: A meta-analytic review. Clinical Psychology Review, 31(3), 328–341. https://doi.org/10.1016/j.cpr.2011.01.006

Mehrotra, R., Yadav, A., Sinha, D. N., Parascandola, M., John, R. M., Ayo-Yusuf, O., Nargis, N., Hatsukami, D. K., Warnakulasuriya, S., Straif, K., Siddiqi, K., & Gupta, P. C. (2019). Smokeless tobacco control in 180 countries across the globe: Call to action for full implementation of WHO FCTC measures. The Lancet Oncology, 20(4), e208–e217. https://doi.org/10.1016/S1470-2045(19)30084-1

Milberger, S., Biederman, J., Faraone, S. V., Chen, L., & Jones, J. (1997). ADHD is associated with early initiation of cigarette smoking in children and adolescents. Journal of the American Academy of Child & Adolescent Psychiatry, 36(1), 37–44. https://doi.org/10.1097/00004583-199701000-00015

Mitchell, J. T., Howard, A. L., Belendiuk, K. A., Kennedy, T. M., Stehli, A., Swanson, J. M., Hechtman, L., Arnold, L. E., Hoza, B., Vitiello, B., Lu, B., Kollins, S. H., & Molina, B. S. G. (2019). Cigarette smoking progression among young adults diagnosed with ADHD in childhood: A 16-year longitudinal study of children with and without ADHD. Nicotine & Tobacco Research, 21(5), 638–647. https://doi.org/10.1093/ntr/nty045

Molina, B. S. G., Kennedy, T. M., Howard, A. L., Swanson, J. M., Arnold, L. E., Mitchell, J. T., Stehli, A., Kennedy, E. H., Epstein, J. N., Hechtman, L. T., Hinshaw, S. P., & Vitiello, B. (2023). Association between stimulant treatment and substance use through adolescence into early adulthood. JAMA Psychiatry, 80(9), 933–941. https://doi.org/10.1001/jamapsychiatry.2023.2157

Molina, B. S. G., & Pelham, W. E., Jr. (2003). Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. Journal of Abnormal Psychology, 112(3), 497–507. https://doi.org/10.1001/jamapsychiatry.2023.2157

Öner, N., & Le Compte, A. (1985). Durumluk-Sürekli Kaygı Envanteri el kitabı (2nd ed.). Boğaziçi Üniversitesi Yayınları.

Öy, B. (1991). Çocuklar için Depresyon Ölçeği: Geçerlik ve güvenirlik çalışması. Türk Psikiyatri Dergisi, 2(2), 132–136.

Özkul, Y., Dönmez, H., Erenmemişoğlu, A., Demirtaş, H., & İmamoğlu, N. (1997). Induction of micronuclei by smokeless tobacco on buccal mucosa cells of habitual users. Mutagenesis, 12(4), 285–287. https://doi.org/10.1093/mutage/12.4.285

Rohner, H., Gaspar, N., Philipsen, A., & Schulze, M. (2023). Prevalence of attention deficit hyperactivity disorder (ADHD) among substance use disorder (SUD) populations: Meta-analysis. International Journal of Environmental Research and Public Health, 20(2), 1275. https://doi.org/10.3390/ijerph20021275

Schellekens, A. F. A., van den Brink, W., Kiefer, F., & Goudriaan, A. E. (2020). Often overlooked and ignored, but do not underestimate its relevance: ADHD in addiction – addiction in ADHD. European Addiction Research, 26(4–5), 169–172. https://doi.org/10.1159/000509267

Siddiqi, K., Husain, S., Vidyasagaran, A., Readshaw, A., Mishu, M. P., & Sheikh, A. (2020). Global burden of disease due to smokeless tobacco consumption in adults: An updated analysis of data from 127 countries. BMC Medicine, 18, 222. https://doi.org/10.1186/s12916-020-01677-9

Sinha, D. N., Suliankatchi, R. A., Gupta, P. C., Thamarangsi, T., Agarwal, N., Parascandola, M., & Mehrotra, R. (2018). Global burden of all-cause and cause-specific mortality due to smokeless tobacco use: Systematic review and meta-analysis. Tobacco Control, 27(1), 35–42. https://doi.org/10.1136/tobaccocontrol-2016-053302

Spielberger, C. D., Gonzalez-Reigosa, F., Martinez-Urrutia, A., Natalicio, L. F. S., & Natalicio, D. S. (1971). The State-Trait Anxiety Inventory. Revista Interamericana de Psicología, 5(3–4), 145–158.

Tanrıverdi, G. (2022). Dumansız tütün Maraş otunun sağlığa zararları: Geleneksel derleme. Halk Sağlığı Hemşireliği Dergisi, 4(3), 284–292. https://doi.org/10.54061/jphn.1160825

Ünal, F., Öktem, F., Çetin Çuhadaroğlu, F., Çengel Kültür, S. E., Akdemir, D., Foto Özdemir, D., Çak, H. T., Ünal, D., Tıraş, K., Aslan, C., Kalaycı, B. M., Aydos, B. S., Kütük, F., Taşyürek, E., Karaokur, R., Karabucak, B., Karakök, B., Karaer, Y., & Artık, A. (2019). Reliability and validity of the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version, DSM-5 November 2016—Turkish adaptation (K-SADS-PL-DSM-5-T). Türk Psikiyatri Dergisi, 30(1), 42–50. https://doi.org/10.5080/u23408

Wilens, T. E., Faraone, S. V., Biederman, J., & Gunawardene, S. (2003). Does stimulant therapy of attention-deficit/hyperactivity disorder beget later substance abuse? A meta-analytic review of the literature. Pediatrics, 111(1), 179–185. https://doi.org/10.1542/peds.111.1.179

Wilens, T. E., & Morrison, N. R. (2011). The intersection of attention-deficit/hyperactivity disorder and substance abuse. Current Opinion in Psychiatry, 24(4), 280–285. https://doi.org/10.1097/YCO.0b013e328345c956

Peer-Review

Double blind peer reviewed

Conflict of Interest

The authors declare that they have no conflict of interests regarding content of this article.

Financial Support

The Authors report no financial support regarding content of this article.

Ethics Approval

The study protocol was approved by the Clinical Research Ethics Committee of Kahramanmaraş Sutcu Imam University, Faculty of Medicine, Kahramanmaraş, Türkiye (decision no. 02, date: 08.11.2017). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participating adolescents and from their parents or legal guardians.

Author Contributions

Concept: AAG, HA, FHE. Design: AAG, HA, FHE. Supervising: AAG, HA, ASC. Financing and equipment: AAG, HA, FHE, HS, SCA. Data collection and entry: AAG, HA, HS. Analysis and interpretation: AAG, HA, SCA. Literature search: AAG, HA, HS. Writing: AAG, HA, HS. Critical review: AAG, HA, HS. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Corresponding Author

Asiye Arıcı Gürbüz

Department of Child and Adolescent Psychiatry, Dr. Ekrem Tok Mental Health and Diseases Hospital, Adana, Türkiye

Email: asiyearici@hotmail.com

ORCID iD: 0000-0003-2508-7125