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Passive Exposure to Tobacco Smoke Attitude Scale: A Scale Development Study in High School Students

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ABSTRACT

Objective: Measuring adolescents' attitudes toward passive exposure to tobacco smoke is crucial due to its negative effects on their health. This methodological study aimed to develop a reliable and valid instrument for assessing high school students' attitudes toward passive exposure to tobacco smoke.

Materials and Methods: The research sample consisted of 1,000 students enrolled in seven different high schools. The "Descriptive Information Form" and the "Passive Exposure to Tobacco Smoke Attitude Scale" were used to collect data. Descriptive statistics, content validity index, correlation analysis, Cronbach's alpha, exploratory factor analysis, and confirmatory factor analysis were applied.

Results: The content validity index of the scale was determined to be 0.94. The Kaiser-Meyer-Olkin measure for exploratory factor analysis was calculated as 0.929, and Bartlett's test of sphericity yielded significant results. A three-factor structure was identified, with factor loadings ranging from 0.636 to 0.802, accounting for 58.728% of the total variance. Fit indices were as follows: χ^2/df=2.33, Comparative Fit Index=0.96, Root Mean Square Error of Approximation=0.05, Goodness of Fit Index=0.94, Adjusted Goodness of Fit Index=0.92, and Root Mean Square Residual=0.06. Additional fit indices included Normed Fit Index=0.93, Tucker-Lewis Index=0.95, and Incremental Fit Index=0.96. Cronbach's alpha coefficient values were 0.903 for the Attitude Toward Smoke Exposure sub-dimension, 0.710 for the Attitude Toward Passive Exposure With Friends sub-dimension, 0.693 for the Attitude Toward Passive Exposure in Open Spaces sub-dimension, and 0.906 for the entire scale. The test-retest result was 0.926.

Conclusion: The Passive Exposure to Tobacco Smoke Attitude Scale was determined to be a reliable and valid measurement tool with a 16-item, three-factor structure.

Keywords: Adolescent, attitude, passive exposure, reliability, validity.

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INTRODUCTION

Passive exposure refers to the inhalation by non-smokers of a combination of smoke from the tip of tobacco products and smoke exhaled by smokers into the air.[1] This smoke is toxic and carcinogenic, posing health risks even with short-term exposure.[2,3] Adolescents are particularly

vulnerable to these effects.[4] In 2019, 25% of students in the United States experienced passive exposure at home, while 23% were exposed in vehicles.[5] In Türkiye, 46.1% of adolescents were exposed at home, and 51.8% were exposed in public spaces.[6] This exposure negatively affects physical and cognitive development and increases the risk of mental health issues,[7,8] potentially leading to long-term health problems among adolescents.[7–10]

Adolescents' attitudes toward passive exposure play a crucial role in their ability to avoid it.[11] Attitude, defined as the evaluation of an object, person, or idea, comprises three components: cognition, emotion (positive or negative feelings), and behavior.[12] The cognitive component reflects beliefs, while the behavioral component demonstrates tendencies aligned with these beliefs and emotions.[13,14] Attitudes generally form between the ages of 12 and 30, with minimal change afterward.[14,15] Since attitudes are acquired through learning, those developed during adolescence can influence future health behaviors, health-seeking tendencies, and health priorities.[14,16] Given their ongoing development, adolescents are particularly susceptible to the health risks associated with passive tobacco smoke exposure.[14] Various scales have been developed to assess attitudes toward passive exposure in adults and children.[17–20] However, no specific tools exist to measure high school adolescents' attitudes toward passive tobacco smoke exposure, creating a significant gap in understanding this at-risk group.[14] Additionally, no such measurement tools are available in Türkiye to assess these attitudes. Measuring adolescents' attitudes is essential to identifying and addressing negative tendencies before they become established.[1,15] The aim of this research was to develop a reliable and valid measurement tool called the "Tobacco Smoke Passive Exposure Attitude Scale (PETSAS)" to assess adolescents' attitudes toward passive exposure to tobacco smoke.

KEY MESSAGES

- The factor load values of the developed scale ranged from 0.636 to 0.802, the fit indices were within acceptable and excellent ranges, and the Cronbach's alpha coefficient was 0.906.
- These findings indicate that the developed measurement tool is valid and reliable.
- This measurement tool will serve as a resource for understanding adolescents' attitudes toward passive exposure to tobacco smoke and will support awareness initiatives aimed at reducing and preventing the harms of tobacco products.

MATERIALS AND METHODS

Study Design, Participants, and Settings

This methodological research involved developing the PETSAS and assessing its psychometric characteristics. To ensure comprehensive reporting, the study followed the Guidelines for Reporting Reliability and Agreement Studies (GRRAS).[21]

The study population consisted of 11,355 students enrolled in 21 public high schools governed by the Directorate of National Education, located in a central province in Türkiye' Western Black Sea region. The sample size for the 43-item draft scale was determined to be 860, using a 20:1 ratio.[22,23] Considering potential losses, 1,000 high school students from seven schools across different grade levels were approached. No incentives were provided for participation. The sample was selected using the stratified sampling method.[24] During the scale development process, it was necessary to create a sample with a heterogeneous range to accurately capture the feature being measured.[25] The overall study population included one school each from science, social sciences, sports, and fine arts high schools, along with multiple schools from other categories: nine general Anatolian high schools, five vocational and technical Anatolian high schools, and three religious Anatolian Imam Hatip high schools. In forming the study population, the four schools that represented a single type of high school were directly included in the study population. For high school types with multiple institutions, three schools were randomly selected using the lot method,[24] a simple random sampling technique. At each grade level in each school, classes were selected by drawing lots, and students whose parents provided permission and signed a voluntary consent form were included in the sample.[24] To ensure heterogeneity, the sample was divided into two groups of 500 participants each, designated for exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The division considered students' grade levels and scale scores. The comparability of demographic characteristics between the two groups was verified using independent t-tests and chi-square tests. The suitability of the two independent sample groups for factor analysis was confirmed.

Development Procedure of the PETSAS

Following established steps for scale development,[26,27] the process was conducted in two stages.

Stage 1: Item Pool, Content Validity, and Language Validity

To generate an item pool, resources related to passive exposure were reviewed in accordance with literature recommendations, ensuring that items aligned with the scale's purpose and scope.[6,10,17,25] Additionally, qualitative interviews were conducted with 26 volunteer high school students using semi-structured questions. Items were then created through

content analysis of the students' responses.[15,25] A pool of 55 items related to the subject was prepared.[15,28] For content validity, expert opinions were obtained on key aspects such as whether the items effectively measures the intended variable, the appropriateness of item types, clarity for the target audience, and grammatical accuracy.[25] To achieve this, the draft scale was sent to 18 experts specializing in scale development, public health, and education. Based on expert evaluations, items deemed unsuitable in the draft scale, as well as those with a low content validity index determined using the Davis technique, were excluded. The remaining items were revised for wording and grammar in accordance with expert recommendations, resulting in a 43-item trial version of the draft scale. Validity and reliability analyses were conducted following pilot testing and the main implementation.

The linguistic appropriateness of the scale was confirmed through expert evaluations and a pilot study. Two experts from the Faculty of Education's Turkish Language Education Department and an experienced high school literature teacher with a master's degree were consulted to assess item clarity, grammatical accuracy, and spelling. The pilot study was conducted with 35 students who provided voluntary consent after parental permission was obtained. Following the administration of the questionnaire, the clarity of the items was evaluated through focus group interviews. No negative feedback was received, and students reported that the questions and items were clear and understandable. The students who participated in the pilot study were excluded from the main implementation.

Stage 2: Validity and Reliability Analyses

At this stage, item-total correlation analysis, as recommended in the literature, was conducted to determine whether the draft scale items functioned in alignment with the intended construct validity.[29] If necessary, items with an item-total correlation coefficient between 0.20 and 0.30 may be retained in the scale.[30] Since the correlation coefficients between the items and the total score for the 43 items in the draft scale ranged from 0.278 to 0.695 and were positive, no items were eliminated in the initial stage.

In this study, within the EFA study group, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity were applied.[15,31,32] The principal component analysis method, along with varimax rotation, was utilized.[30,32]

To determine the optimal structure when conducting factor analysis, it is recommended to remove items that measure separate constructs and to consider various criteria, including an eigenvalue greater than 1, total explained variance, high factor loading, item overlap, common factor variance, at least three items in each factor, and scree plot criteria for determining the number of factors.[22,29–34] These criteria were considered in this study. Based on the findings of the initial exploratory factor analysis performed with the 43-item draft scale, eight factors with eigenvalues exceeding 1 were identified. The eigenvalue of the eighth factor was 1.034, and the cumulative total variance explained by these eight factors was 53.420% (Table 1). In the EFA experiments, when the specified criteria were violated, analyses were repeated by removing different items from the scale each time, creating various models. Different factor trials were conducted until the best EFA result was obtained. As a result of these trials, 27 items that did not meet the criteria were discarded from the scale, and CFA analysis was conducted for model fit using the 16 items considered to be the most suitable.

Table 1. Sub-dimensions and total variance explained analysis results of the draft 43-item PETSAS

Item no	Initial eigenvalue		
	Total	Total variance (%)	Cumulative variance (%)
1	12.812	29.795	29.795
2	2.304	5.359	35.154
3	1.928	4.483	39.637
4	1.430	3.325	42.961
5	1.275	2.966	45.927
6	1.102	2.564	48.491
7	1.086	2.524	51.015
8	1.034	2.405	53.420
...			
43	0.238	0.554	100.000

PETSAS: Passive Exposure to Tobacco Smoke Attitude Scale; Extraction Method: Principal Component Analysis (PCA).

CFA is the most effective analysis for evaluating the fit of a predetermined model to the data and determining construct validity, particularly in scale development studies.[29,32] In CFA, model fit is assessed based on fit indices.[29] In this study, to evaluate the fit of the 16-item model defined by EFA to the data and determine its construct validity, first-order multifactor confirmatory factor analysis was conducted in the CFA study group. The χ^2 statistic, χ^2/sd (CMIN/DF), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Residual (RMR), Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Incremental Fit Index (IFI) were used, as recommended in the literature.[29,32,33]

Table 2. Final form of the PETSAS

Original item no	New item no	Item
2	1	I feel uneasy when I am exposed to tobacco smoke.
7	2	When I eat outside the house, I pay attention to sitting in the non-smoking section.
8	3	I don't feel anything when I'm exposed to tobacco smoke.*
9	4	I choose my friends from those who do not smoke tobacco products.
12	5	I feel demoralized when exposed to tobacco smoke.
14	6	I prefer to ventilate the environment when I'm exposed to tobacco smoke.
17	7	To avoid exposure to tobacco smoke in open spaces, I move away from people smoking tobacco products.
22	8	The fact that someone uses tobacco products does not prevent me from making friends with them.*
23	9	Exposure to tobacco smoke makes me nervous.
24	10	Since I am not affected by smoke in open areas, I do not warn people who use tobacco products.*
25	11	I feel overwhelmed when exposed to tobacco smoke.
29	12	I don't think I will be exposed to tobacco smoke in open spaces.*
35	13	Exposure to tobacco smoke worries me.
38	14	In an open space, I do not leave the environment because I am not affected by tobacco smoke.*
39	15	I hate being exposed to tobacco smoke.
40	16	If someone in my group of friends starts smoking tobacco products, I continue to stay with them.*

PETSAS: Passive Exposure to Tobacco Smoke Attitude Scale; *: Reverse-coded item.

Reliability refers to a scale's ability to accurately measure the intended characteristic and eliminate random errors.[35,36] Various reliability coefficients are used to assess reliability.[29] In this study, the most commonly used methods in the literature were applied, including item analysis based on item-total correlation, reliability coefficient if the item is deleted, item analysis based on sub-superior groups, Cronbach's alpha reliability coefficient, test-retest reliability, Tukey's test of additivity, and Hotelling's T^2 test.[29,37]

Following all stages of scale development, validity and reliability analyses confirmed that the final scale had a 16–item, three-factor structure. Within the scale, six items (8, 22, 24, 29, 38, and 40) are reverse coded. The highest possible score on the scale is 80, while the lowest is 16. Higher scores indicate that students have more negative attitudes toward passive exposure to tobacco smoke. When naming the factors, it is essential to first identify the common feature that groups the items together, considering those with the highest loadings.[32] The key objective is to identify a name or label that accurately represents each of the derived factors.[33] In this study, a factor loading threshold of 0.45 was applied, in accordance with literature guidelines. Statements with the highest factor loadings were examined based on their conceptual basis.[26,33] The first sub-dimension was named "Attitude Toward Smoke Exposure," the second was named "Attitude Toward Passive Exposure With Friends," and the third was named "Attitude Toward Passive Exposure in Open Spaces." After the final form of the PETSAS was determined, the items in the scale were renumbered (Table 2).

Data Collection

The trial form was piloted with 35 volunteer students to assess readability and comprehensibility. No negative feedback was received from the students, and these students were excluded from the actual study. The main study was conducted between February 10 and June 2, 2022, with 1,000 students who had signed the consent form along with their parents. For the test-retest analysis, 136 students who participated in the original application and wrote a pseudonym on the questionnaire were contacted three weeks after the first application and asked to complete the questionnaire again.

Statistical Analysis

The data were analyzed using IBM SPSS 22 and AMOS 24 (IBM Corp., Armonk, NY, USA) software. A significance level of p=0.05 was used in data evaluation. The distribution of the data was assessed using skewness and kurtosis values, while outliers were examined using Mahalanobis distance. It was determined that the data were normally distributed

Table 3. Demographic and passive exposure variables across exploratory factor analysis and confirmatory factor analysis split sample (n=1,000)

Variables	Exploratory factor analysis (n=500)	Confirmatory factor analysis (n=500)
Age (Mean±SD)*	16.03±1.30	16.04±1.27
Gender		
Female	202 (40.4)	197 (39.4)
Male	298 (59.6)	303 (60.6)
Type of school		
Anatolian high school	240 (48.0)	240 (48.0)
Vocational and technical anatolian high school	135 (27.0)	135 (27.0)
Anatolian imam hatip high school	60 (12.0)	60 (12.0)
Science high school	25 (5.0)	25 (5.0)
Social science high school	20 (4.0)	20 (4.0)
Sports high school	10 (2.0)	10 (2.0)
Fine arts high school	10 (2.0)	10 (2.0)
Grade level		
9th grade	133 (26.6)	132 (26.4)
10th grade	132 (26.4)	133 (26.6)
11th grade	125 (25.0)	125 (25.0)
12th grade	110 (22.0)	110 (22.0)
Tobacco use among family members		
No	212 (42.4)	234 (46.8)
Yes	288 (57.6)	266 (53.2)
Presence of close friends who use tobacco		
No	218 (43.6)	218 (43.6)
Yes	282 (56.4)	282 (56.4)
Passive exposure to tobacco smoke in the last 7 days		
No	257 (51.4)	262 (52.4)
Yes	243 (48.6)	238 (47.6)

SD: Standard deviation.

with no extreme values. Descriptive analysis included the calculation of mean, standard deviation, percentage, and minimum-maximum values. For scale validity, item analysis was performed with the first group, followed by EFA using principal component analysis with varimax rotation.[30,31] CFA was conducted in the second group.[29,32] Reliability analyses were conducted with the first group to assess the scale's reliability using the following methods: item-total score correlation, Cronbach's alpha coefficient if the item is deleted, item analysis based on sub-superior groups, Cronbach's alpha reliability coefficient, and test-retest reliability. Tukey's test of additivity was applied to evaluate the scale's additivity, while Hotelling's t^2 test was conducted to assess the presence of response bias.[29,30]

Ethical Considerations

Ethical approval was obtained from Bolu Abant İzzet Baysal University Social Sciences Human Research Ethics Committee in November 2021 (date: 11/04/2021; protocol number: 2021/408). Additionally, approval was granted by the Provincial Directorate of National Education (approval number: E-39307281-605.01-38273710). Only students who provided consent forms signed by both themselves and their primary caregivers were included in the study.

Table 4. EFA results for the PETSAS (n=500)

Factor	Item no	Factor loading value			Communalities
		1	2	3	
Smoke exposure	M25	**0.723**	0.217	0.195	0.608
	M7	**0.705**	0.220	0.058	0.548
	M14	**0.703**	-0.075	-0.055	0.503
	M39	**0.693**	0.330	0.226	0.640
	M12	**0.689**	0.197	0.229	0.566
	M2	**0.683**	0.072	0.206	0.515
	M23	**0.653**	0.359	0.172	0.586
	M35	**0.647**	0.237	0.202	0.516
	M8	**0.641**	0.180	0.285	0.525
	M17	**0.636**	0.414	0.126	0.592
Companionship	M22	0.094	**0.802**	0.219	0.699
	M9	0.338	**0.700**	-0.022	0.605
	M40	0.227	**0.683**	0.259	0.585
Open space	M29	0.196	-0.062	**0.794**	0.672
	M38	0.221	0.280	**0.710**	0.631
	M24	0.125	0.351	**0.684**	0.606
Eigenvalue		6.789	1.503	1.104	
Variance (%)		42.433	9.396	6.899	
Cumulative variance (%)		42.433	51.829	58.728	

EFA: Exploratory factor analysis; PETSAS: Passive Exposure to Tobacco Smoke Attitude Scale.

RESULTS

Demographics and Passive Exposure

In the EFA group, 59.6% of the students were male, with a mean age of 16.03±1.30 years. Additionally, 48.0% of the students were enrolled in Anatolian high schools, and 26.6% were in the ninth grade. Notably, 57.6% of students reported that a family member used tobacco products, while 56.4% stated that a close friend used tobacco. Passive exposure to tobacco smoke in the last seven days was reported by 48.6% of students (Table 3).

In the CFA group, 60.6% of participants were male, with a mean age of 16.03±1.27 years. Similar to the EFA group, 48.0% of students were in Anatolian high schools, but 26.6% were in the tenth grade. Within this group, 53.2% reported having a family member who used tobacco products, while 56.4% had a close friend who used tobacco. Passive exposure in the last seven days was reported by 47.6% students (Table 3).

Validity Analysis

Content Validity

The Content Validity Index (CVI) of the 43-item draft scale was calculated as 0.94.

Construct Validity

EFA and CFA were conducted to assess the construct validity of the PETSAS.

Exploratory Factor Analysis (EFA)

The KMO test result (0.929) indicated that the sample size was adequate. Bartlett's Test of Sphericity confirmed that the data met the multivariate normality criteria (χ^2=3403.45; df=120; p<0.001). EFA results indicated that the scale consisted of 16 items, grouped into three factors, reflecting both positive and negative attitudes toward passive exposure (Table 4, Fig. 1). The EFA results revealed that the first factor of the PETSAS

Table 5. Confirmatory factor analysis results for the final model of the PETSAS (n=500)

Examined fit indices	Perfect fit criterion	Acceptable fit criterion	Scale values	Results
χ^2/SD	≤3	≤5	2.33	Perfect
CFI	≥0.97	≥0.95	0.96	Acceptable
RMSEA	≤0.05	≤0.08	0.05	Perfect
GFI	≥0.90	≥0.85	0.94	Perfect
AGFI	≥0.90	≥0.85	0.92	Perfect
RMR	≤0.05	≤0.08	0.06	Acceptable
NFI	≥0.95	≥0.90	0.93	Acceptable
TLI	≥0.95	≥0.90	0.95	Perfect
IFI	≥0.95	≥0.90	0.96	Perfect

PETSAS: Passive Exposure to Tobacco Smoke Attitude Scale; SD: Standard deviation; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index; RMR: Root Mean Square Residual; NFI: Normed Fit Index; TLI: Tucker-Lewis Index; IFI: Incremental Fit Index.

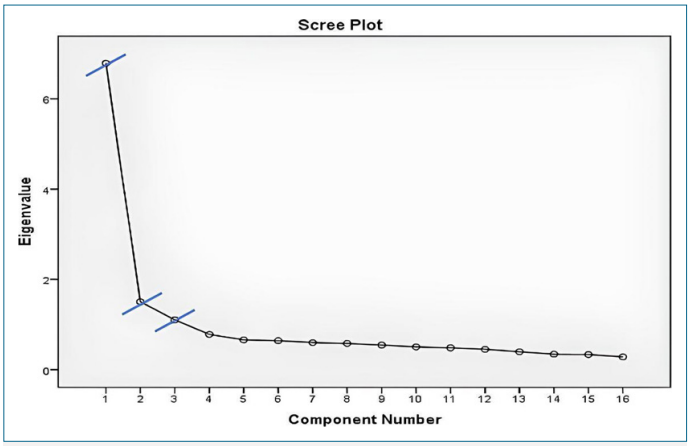

Figure 1. Scree plot for factor solution of items in the Passive Exposure to Tobacco Smoke Attitude Scale (PETSAS).

comprised ten items, with factor loadings ranging between 0.636 and 0.723, explaining 42.433% of the variance. This factor was named "Attitude Toward Smoke Exposure." The second factor consisted of three items, with factor loadings between 0.683 and 0.802, accounting for 9.396% of the variance. This factor was labeled "Attitude Toward Passive Exposure With Friends." The third factor also included three items, with factor loadings ranging from 0.684 to 0.794, explaining 6.899% of the variance. This factor was named "Attitude Toward Passive Exposure in Open Spaces." The cumulative variance explained by all three factors was 58.728%, with common variance values ranging from 0.503 to 0.699 (Table 4).

Confirmatory Factor Analysis

The multifactor first-level CFA results showed that the factor loadings ranged between 0.43 and 0.79, and no modifications were required (Fig. 2). The fit indices for CFA were as follows: χ^2/sd=2.33 (p<0.001), CFI=0.96, RMSEA=0.05, GFI=0.94, AGFI=0.92, RMR=0.06, NFI=0.93, TLI=0.95, and IFI=0.96 (Table 5).

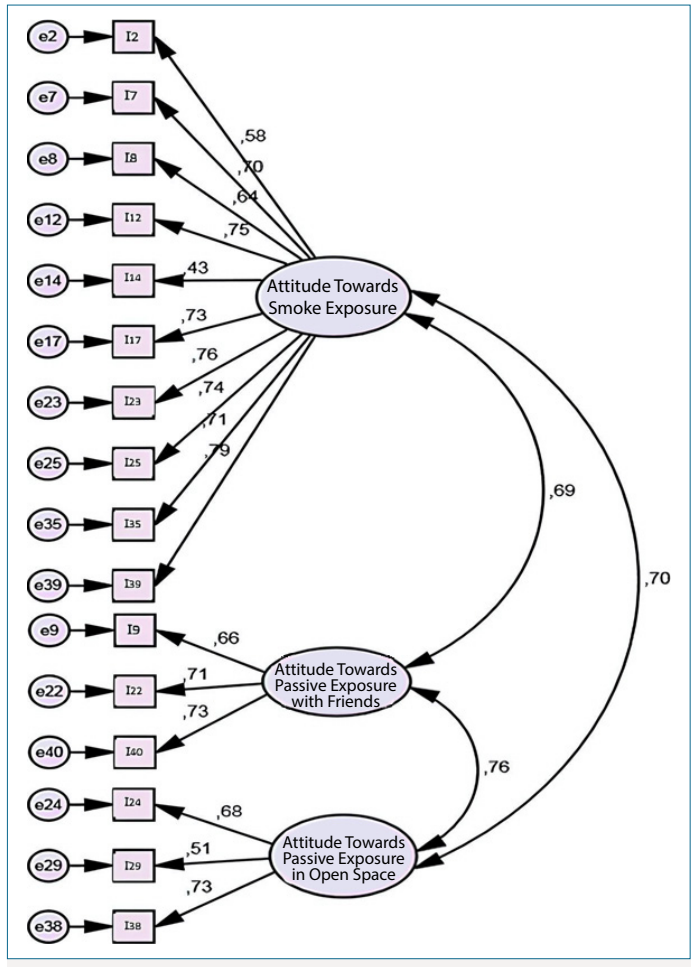

Figure 2. Confirmatory factor analysis model of the Passive Exposure to Tobacco Smoke Attitude Scale (PETSAS).

Table 6. Reliability analysis results for the PETSAS (n=500)

Factor	Item no	Item-total correlation	Cronbach's Alpha if item deleted	t-value (Lower 27% –Upper 27%*)	p value (Lower 27%* –Upper 27%*)	Cronbach's Alpha
Smoke exposure	M2	0.589	0.901	14.531	**0.001****	**0.903**
	M7	0.618	0.900	15.633	**0.001****	
	M8	0.641	0.899	20.280	**0.001****	
	M12	0.664	0.898	20.941	**0.001****	
	M14	0.433	0.905	9.753	**0.001****	
	M17	0.690	0.897	20.938	**0.001****	
	M23	0.691	0.897	22.327	**0.001****	
	M25	0.686	0.897	21.346	**0.001****	
	M35	0.637	0.899	20.654	**0.001****	
	M39	0.735	0.896	23.264	**0.001****	
Companionship	M9	0.525	0.903	15.763	**0.001****	**0.710**
	M22	0.486	0.904	13.720	**0.001****	
	M40	0.546	0.902	14.635	**0.001****	
Open space	M24	0.479	0.904	12.138	**0.001****	**0.693**
	M29	0.382	0.907	11.332	**0.001****	
	M38	0.530	0.903	14.484	**0.001****	
Total PETSAS Cronbach's Alpha						**0.906**
Test-Retest Pearson Correlation Analysis (n=136) (p<0.001)						**0.926**
Tukey's Test for Nonadditivity						p=**0.065**
Hotelling's T-Squared (1623.848)						p=**0.001**

PETSAS: Passive Exposure to Tobacco Smoke Attitude Scale; *n1=n2=135; **p<0.001 indicates statistical significance.

Reliability Assessment

The Cronbach's alpha coefficients of the PETSAS were calculated as follows:

- Attitude Toward Smoke Exposure Subscale: 0.903,
- Attitude Toward Passive Exposure With Friends Subscale: 0.710,
- Attitude Toward Passive Exposure in Open Spaces Subscale: 0.693,
- Overall Scale: 0.906.

The item-total score correlation values ranged between 0.382 and 0.735 for all items. When any item was deleted, no item caused an increase of ≥5% in Cronbach's alpha values. Additionally, the results from the independent group t-test (p<0.001) were significant for all items in the upper and lower 27% groups. The test-retest reliability was calculated as 0.926. Tukey's test of additivity confirmed that the items were significantly different from each other (F (15,1)=184.053; p<0.001), with the probability of non-additivity being non-significant (p=0.065). The result of Hotelling's T^2 test for response bias was 1623.848 (p<0.001) (Table 6).

DISCUSSION

In this study, we developed a reliable and valid attitude scale to assess high school students' attitudes toward passive exposure to tobacco smoke. The CVI of the 43-item draft scale was determined as 0.94. At both the item level and scale level, a CVI of 0.80 or higher is required for content validity.[24,38] The content validity of PETSAS was successfully established. A similar approach was used in a study conducted to develop the "Workplace Second-Hand Smoke: Perception on the Second-Hand Smoke Knowledge, Attitude, and Practice" scale for non-smoking hospital workers in Malaysia. The CVI index was applied in that study; however, the exact index score was not determined.[20]

In this study, the three-factor structure explained 58.728% of the variance. In studies similar to this one, the total variance of the scales was reported to be above 0.70.[17–19] In a study conducted on adults, the total variance of the attitude sub-dimension was 36.6%.[27] The fact that the total variance explained by the PETSAS in this study exceeds the 50% threshold recommended in the literature[29–31,33,35] indicates a satisfactory level in the interpretation of variance.

First-level multifactor CFA was conducted to ensure construct validity. The PETSAS model demonstrated acceptable and good fit index values. In contrast to the present study, scale development studies conducted for adults and children did not include information on CFA analysis[17-20] and instead relied on hair nicotine measurements, which were compared with the scales.[17,19] In this study, CFA was conducted as recommended in the literature,[28,31] confirming that PETSAS is a valid measurement tool.

Internal reliability analyses for the final PETSAS showed that the item-total score correlation values were greater than 0.30.[30] Additional analyses confirmed that no items increased the overall reliability coefficients of Cronbach's alpha by more than 5% when deleted. Another internal reliability measure, the independent group t-test for item analysis based on the 27% lower-upper groups, which evaluates item discrimination, was found to be significant for all items. This confirms that the scale items are discriminative.[29–31] The Cronbach's alpha coefficient for the overall PETSAS was 0.906. The subscale reliability coefficients were 0.903 for the Attitude Toward Smoke Exposure subscale, 0.710 for the Attitude Toward Passive Exposure With Friends subscale, and 0.693 for the Attitude Toward Passive Exposure in Open Spaces subscale. In studies similar to this one, Cronbach's alpha coefficient was found to be above 0.70.[18,20] A Cronbach's Alpha coefficient of 0.80 indicates high reliability, while 0.60 is considered adequate reliability.[30,33] Based on these criteria, the scale demonstrated high reliability (0.906). To assess the stability and consistency of the scale over time, a test-retest analysis was conducted. In previous studies, the test-retest reliability was reported to be 0.85 in one study[18] and 0.76 in another.[20] In the present study, the correlation between the two applications was found to be 0.926, indicating strong reliability. This result confirms that the scale is consistent and invariant over time.[29]

In the literature, various scale development studies on passive exposure have been conducted for adults and children.[17–20] However, existing tools do not specifically assess the attitudes of high school adolescents toward passive exposure, a group that is still undergoing physiological and psychological development and is considered at risk.[14] Additionally, no tools exist in Türkiye to measure high school students' attitudes toward passive exposure. Therefore, developing a reliable and valid measurement tool is essential. This tool will help assess adolescents' attitudes toward passive exposure to tobacco smoke, enabling early intervention to modify these attitudes and reduce negative health effects.[1,15]

The strength of this study lies in the development of the PETSAS, which serves as an important tool for measuring adolescents' attitudes toward general passive exposure, passive exposure with friends, and passive exposure in open spaces simultaneously. A primary limitation of the study is that participants provided subjective reports of their passive tobacco smoke exposure levels. Another limitation is that the research focused only on high school students.

CONCLUSION

As a result of the scale development process for the Passive Exposure to Tobacco Smoke Attitude Scale, designed for high school students, and the reliability and validity analyses, it was determined that the scale possesses robust conceptual foundations and demonstrates strong reliability and validity. Existing scales primarily target other age groups, whereas this newly developed scale serves as a comprehensive tool for measuring adolescents' attitudes toward passive exposure in various contexts, including general passive exposure, exposure with friends, and exposure in open spaces, all within a single instrument. PETSAS has the potential to be a valuable tool for assessing adolescents' attitudes toward passive exposure in community-based studies. However, further research is required. In this regard, we propose the following recommendations:

1. Validating the scale's validity and reliability among diverse student populations and evaluating the practicality and cost-effectiveness of its 16-item format.
2. Adapting the scale to different languages and testing its applicability in various countries.
3. Investigating the scale's validity across different socioeconomic and demographic groups.
4. Using the scale in combination with other health risk-related attitude scales.
5. Incorporating the scale into awareness-raising training programs for high school students to help protect them from the harmful effects of tobacco products.

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