

## ARAŞTIRMA | RESEARCH

# Adaptation of the Lebanon Waterpipe Dependence Scale to Turkish: A Reliability and Factor Analysis Study

## Lübnan Nargile Bağımlılığı Ölçeği'nin Türkçeye Uyarlanması: Güvenilirlik ve Faktör Analizi Çalışması

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### ABSTRACT

**Objective:** This study aimed to adapt The Lebanon Waterpipe Dependence Scale (LWDS-11) to Turkish in order to facilitate research regarding waterpipe dependence. The LWDS-11 has been constructed and validated as a need for a standardized measure that incorporates not only the assessment of physiological dependence on nicotine but embodies psychosocial factors as well.

**Method:** A sample of N=401 participants responded to the LWDS-11, the Fagerström Test for Nicotine Dependence scale (FTND), and additional socio-demographic related items. Exploratory factor analysis (EFA) has been conducted and outcomes were compared with confirmatory factor analysis (CFA). Assessment of construct and criterion validity was done by the results of the CFA and correlations between the LWDS and the FTND.

**Results:** The sample consisted of N=288 males and N=113 females between the ages 18 and 62.. Computed internal consistency provided a Cronbach's alpha of .80. Two factors explaining 59% of variance were computed.

**Conclusion:** The outcome of this study has suggested a reliable Turkish assessment tool with validity regarding waterpipe dependence in a Turkish sample.

**Keywords:** Waterpipe tobacco smoking, waterpipe, nicotine, dependence, scale

### ÖZ

**Amaç:** Bu araştırma, nargile bağımlılığı konusunu araştırmayı kolaylaştırmak için Lübnan Nargile Bağımlılığı Ölçeğini (LWDS-11) Türkçeye uyarlama amacıyla yapılmıştır. Lübnan Nargile Bağımlılığı Ölçeği sadece nikotine fizyolojik bağımlılığın değerlendirilmesini değil, aynı zamanda psikososyal faktörleri de kapsayan standart ölçüm aracına ihtiyaç kapsamında geliştirilmiş ve geçerli kılınmıştır.

**Yöntem:** Araştırma N=401 kişiye ulaşarak LWDS-11 ölçeği, Fagerström Nikotin Bağımlılık Testi ölçeği (FTND) ve sosyodemografik bilgi formu uygulamıştır. Ölçeklerin güvenilirlik çalışması araştırmacılar tarafından yapılmış olup ek olarak açıklayıcı ve doğrulayıcı faktör analizi uygulanarak ölçeğin yapısal geçerliliği analiz edilmiştir.

**Bulgular:** Örneklem 18-62 yaş arasında N=288 erkek ve N=113 kadından oluşmuştur. Hesaplanan güvenilirlik Cronbach alfa değeri .80 olarak elde edilmiştir. Araştırmanın sonucunda, ölçek maddelerinin, varyansın % 59'unu açıklayan iki faktöre yüklendiği görülmüştür.

**Sonuç:** Çalışma, nargile bağımlılığına ilişkin Türk örneklemde geçerliliği olan güvenilir bir Türkçe değerlendirme aracı önermektedir.

**Anahtar kelimeler:** Nargile tütün tüketimi, nargile, nikotin, bağımlılık, ölçek

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**Author's Note /Yazarın Notu:** This research has been orally presented with the title "Adaptation of the Lebanon Waterpipe Dependence Scale To Turkish: A Reliability and Validity Analysis" at the AYBÜ Psikoloji Kongresi: Deneyim Oluşturma ve Aktarımı-IV, in Ankara, Turkey between 25-27 April, 2018.

Received /Gönderilme tarihi: 25.03.2020 Accepted /Kabul tarihi: 11.05.2020

## INTRODUCTION

The World Health Organization's (WHO) Global report on trends in prevalence of tobacco smoking states that approximately six million people die each year by the hand of tobacco usage and another estimation of 600,000 people die of second-hand smoking (1). In their paper Maziak, Ward, Soweid, and Eissenberg note that the deaths induced by tobacco use make it an international epidemic (2). Even more, Maziak et al. refer to the waterpipe as "a tobacco use method that may be re-emerging as a virulent strain in the tobacco epidemic" (2). This re-emerging method of tobacco use has also been observed in Turkey with the introduction of aromatic tobacco variants for waterpipe usage (3,4). The WHO reports that an estimation of 15 million men and women above the age of 15 are currently smoking tobacco products in Turkey (1). The Ministry of Health of Turkey published in their Global Adult Tobacco Survey report of 2012 that the prevalence of overall smoking tobacco using a waterpipe was found to be 0.8 % through 9,851 completed interviews (5).

The extant literature points out several contributing factors in the rise of waterpipe tobacco smoking (WTS) with some denoting it as a global epidemic. A recent study, which consisted of a meta-analysis of publications between 2004 and 2014, has stated that the introduction of aromatic waterpipe tobacco known as maassel, socializing effects and uprising waterpipe cafés, the social- and mass media coverage as well as the internet, and the lack of specific WTS regulations and governmental policies were found to be contributory factors in the rapid popularity gaining of waterpipe tobacco smoking (6,7). Reasons presented by young individuals regarding WTS consist of relaxation, boredom, entertainment, and socializing (8). Moreover, some see WTS as part of their culture, especially Eastern Mediterranean individuals (9). In addition, in one research among 450 respondents 3.8 % said imitation was a reason for them to engage in WTS (10).

Distorted beliefs, perceptions, and attitudes toward WTS have, as research evidence has provided, contributed to the rise in prevalence among youth as well as globally. In their meta-analysis, Akl et al. reported that most studies found that WTS was perceived less harmful relative to cigarette usage (8,9). However, research has reported that like cigarettes, Waterpipes (also referred as Hookah, Shisha, Narghile, or Hubble-Bubble in the literature) also contain nicotine, tar, carbon monoxide, and various other toxins and metals that are influential in the implication of lung diseases, cardiovascular diseases, and nicotine dependence (8,11-13). A study conducted in Turkey about fallacies regarding WTS had found that among 1,255 respondents 6.3 % believed that waterpipe smoking is not harmful, 25.33 % believed that the carcinogens and other toxins are being filtered while the smoke passes through the water, 12.11 % had replied yes to the item "Waterpipe contains no nicotine", and 18 % believed aromatic waterpipe has no addictive feature (14). When compared to cigarettes, WTS is used more intermittent which adds favorable to false beliefs of less harmfulness (15). In one review the authors reported that adolescent waterpipe smokers perceived experiencing alleviation of anxiety, reduction in stress, lessening of anger and depression, memory enhancement, and extending concentration (9). Another distinction in use between WTS and other forms of tobacco smoking is that the preceding is consumed most of the time in social settings, whether in company of friends or in so called lounges (15). When compared on toxicity, study finding reported that the smoked inhaled during one WTS session, which contains toxic elements and

carcinogens, is equivalent to smoke made by  $\pm 100$  cigarettes (15). Further, Maziak reports study findings which express that the highly dependence eliciting nicotine deliverance of WTS equals that of 10 cigarettes (15). Thus, the literature regarding WTS indicates that the psychological aspects are related to attitudes, beliefs, perceptions and psychosocial factors which in turn increases risk-taking behavior by engaging in WTS despite empiric evidence of negative health effects.

Review of publications regarding WTS dependence has shown that the frequency of engaging in WTS can be considered as a primary characteristic of WTS dependence (2,16). Accordingly, Aboaziza and Eissenberg concluded in their review that WTS fosters dependence considering the evidence indicating WTS individuals engage in nicotine delivery and self-administration on a frequent basis, experience withdrawal symptoms, adjust their behavior for the sake of acquiring a waterpipe, and encounter difficulties in cessation even when motivated (16).

Various research report different methods in assessment of waterpipe dependence. In a review paper the authors report that one research had modified two scales generally used in assessing nicotine dependence in cigarette smokers to measure WTS dependence (16). A recent consensus paper authored by renowned researchers in the waterpipe dependence field recommended assessment items, however, these recommendations were made regarding epidemiological studies (17). In Turkey, several studies have been conducted in order to assess WTS and related dependence, however, these mostly incorporated self-report surveys regarding perceptions and factors associated with waterpipe smoking (4,10,18). Taken together, results from studies mentioned above instigated the development of a measure assessing WTS-specific dependence.

The Lebanon Waterpipe Dependence Scale-11 (LWDS-11) was constructed and validated by Salameh et al. (19). The creation of the scale is advocated as a need for a standardized measure which incorporates not only the assessment of physiological dependence on nicotine, but embodies psychosocial factors as well (19). Moreover, in their publication Salameh and colleagues advocate that the development of a multidimensional construct which assesses the various aspect of dependence may be important, at least for research purposes, taken in consideration that WTS is differentiated from cigarette smoking by WTS's own unique characteristics (i.e. intermitted and social use) (19).

Salameh et al. adapted scale items from a widely used assessment scale of nicotine dependence in cigarette smokers, namely the Fagerström Test for Nicotine Dependence scale (FTND). In addition, several DSM-IV items regarding substance addiction and additional ones covering psychological and social aspects were included (19). Validation of the scale resulted in the final form of the LWDS-11 counting 11 items with a 4-point (0 – 3) Likert response setup tapping on four domains of dependence (19). The dimensions represent physiological dependence, negative reinforcement, positive reinforcement, and psychological craving. Research has reported on variants of the LWDS-11 which are also discussed in this study (16).

To the best of our knowledge, no research up to now has been conducted in Turkey regarding waterpipe dependence detecting tools. This study aimed to adapt the Lebanon Waterpipe LWDS-11 to the Turkish language in order to facilitate research regarding waterpipe dependence among Turkish individuals. It is anticipated that the adaptation of the

scale will contribute to cessation and intervention research. Furthermore, the intention is to provide a take-off point in research and generation of domestic dependence scales regarding tobacco and waterpipe smoking.

## MATERIAL AND METHODS

### Sample

The criteria for participation was determined to be having smoked waterpipe at least once in the last two weeks. There were no exclusion criteria for smoking behavior, because, cigarette smokers and waterpipe smokers often use both together from time to time (20). Participants were recruited from various establishments providing WTS services located in Ankara, Turkey. In addition, we reached out to potential participants via the social media to take part in an online survey. The underlying reason for two different administration settings was to reach as many participants as possible. A total of 966 individuals were reached. Of these participants, 518 were eliminated due either not filling in the LWDS-11 scale or failure to respond to the FTND. Furthermore, 11 participants were excluded because they were under the age of 18. Following the screening and elimination of outliers, N=401 (41.51% of 966) participant data remained eligible to analyze.

### Procedure

This study was reviewed and approved by the Humanities and Social Sciences Ethical Review Committee of Ankara Yıldırım Beyazıt University under reference number: 31.07.2017/25. The corresponding author of the original construction and validation study was informed about this study and permission to adapt the scale was asked (19). A formal approval was granted. An informed consent form was provided and all eligible participants were asked to give consent for the use of their data in this study.

The initial take-off point in this study was translating the LWDS-11 to Turkish. In origin the scale is Arabic, however, the items in English were reported and these were used to form the basis of the translation. Further, the original scale was derived partly from the Fagerström dependence scale items (19). Likewise, the Turkish FTND was taken as an example for building the structure of the translated LWDS-11. Following the recommendations of Sousa and Rojjanasrirat, translations of the scale to Turkish were provided by three Psychology BA students of whose English language proficiencies were considered satisfactory by us (26). In addition, one English language instructor of the department of preparatory school has provided a translation. The provided translations, along with the original version, were clustered and administered as a pilot study to ten students of the psychology department who had sound knowledge of both languages. In the pilot study, reviewers were asked to rate each item's comprehensibility on a 5-point Likert scale (1="very easy to understand" to 5="very difficult to understand"). For each translated item and results of the pilot study, discussion and feedback rounds were conducted among the translators. Consequently, we synthesized, after deliberation, the final form of the scale and piloted the revisions again on comprehension. The English instructor along with the psychology students who partook in the translation process, and the pilot study participants were all affiliated with the Ankara Yıldırım Beyazıt University.

Having reached a satisfying translation of the LWDS-11 to Turkish, we administered the translated scale and the Turkish FTND to WTS individuals in establishments providing waterpipe smoking service in the city of Ankara, Turkey. Along with face-to-face administration, the scales were also distributed via the internet using social media. This was accomplished by using the Google Forms application. Additional socio-demographic information was collected from the participants. The data collection bundle included a consent form which briefed the participants about the research. Administering the scale took 5 minutes on average per participant.

### Measures

In this research, the English version of the LWDS-11 has been translated to Turkish for administration (Appendix A). Secondly, a Turkish version of the FTND has been administered. Additional socio-demographic information was collected from the participants.

#### Lebanon Waterpipe Dependence Scale

The LWDS-11 consists of 11 items with a 4-point (0 – 3) Likert response setup in Arabic (19). There are no reversed items. This research has used the English version found in Aboaziza and Eissenberg (16). The items of the scale load on four dimensions which are described as (1) physiological nicotine dependence (items 1– 4), (2) termination of dysphoric states or negative reinforcement (items 5 and 6), (3) psychological craving (items 7 – 9), and (4) positive reinforcement (encompassing pleasure and social interaction, items 10 – 11) (19). For instance, the item “Number of water pipes you usually smoke per week?” is part of the physiological dependence factor. The psychological craving dimension contains items such as “Are you ready not to eat in exchange for a waterpipe?”. Scores obtained on the scale indicate the level of dependence and a total score is reached by adding up the corresponding points. According to Kassime et al, a cut-off point of 10 can be approved to categorize the respondents as less ( $\leq 9$  scores) and more likely ( $\geq 10$  scores) to be dependent (21). Salameh and colleagues have reported an internal consistency reliability coefficient of .83 (19).

#### Fagerström Test for Nicotine Dependence

The FTND, “Fagerström Nikotin Bağımlılık Testi” in Turkish, includes 6-items to evaluate the level of dependence on nicotine. Heatherton, Kozlowski, Frecker, and Fagerström derived this test from the original 8-item FTQ developed by Fagerström (22,23). Uysal et al. have adapted the FTND to Turkish (24). Each answer is equivalent to a given scoring point. The total acquired score depending on the response option indicates the degree of physical dependence on nicotine. Bozkurt and Bozkurt give a three-category model of dependency degree, that is low (0 to 3 points), medium (4 to 6 points), and high (7 points or higher) (25). Uysal et al. computed a Cronbach alpha coefficient of .56 (24). The FTND was found to be highly reliable in this study with an internal consistency alpha of .79.

#### Demographic Form

Additional socio-demographic information has been collected from participants. These included age, gender, income, education, occupation status, duration of WTS in years and months, amount of WTS per week, cigarette smoking habit, family members WTS usage, and WTS usage of friends regarded as close.

## Statistical Analysis

Antecedent to the statistical analysis, data were checked for outliers and cleaned. To make an overall assessment of the collected data, descriptive statistical calculations (mean, standard deviation, minimum, maximum, range etc.) and frequency analysis were computed. Analysis of reliability and validity were conducted taking the original study as example, except for validation processes regarding salivary cotinine and carbon monoxide measures. An exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed to assess the psychometrics of the translated scale and was interpreted according to seminal literature (27-29). Furthermore, correlational analyses of variables have been conducted with the Pearson's product-moment correlation. In order to analyze the data, IBM SPSS v.23 was used. CFA was conducted using LISREL 8.8 software.

## Results

### Participant Characteristics

The sample consisted of N=401 participants aged between 18 and 62 with a mean age of 26.16 (SD=6.41). There was no distinction made in gender, education level, or marital status. The sample consisted of 71.8% (N=288) males and 28.2% (N=113) females. Of these participants N=298 (74.3%) reported being single. Furthermore, 64.6% (N=259) of the sample stated having a higher educational degree. Whilst 48.6% (N=195) were currently working, N=165 (41.1%) of 401 participants declared being a student.

**Table 1. Exploratory factor analysis for nine items (n=200)**

Item	Factor Loadings	
	Factor 1	Factor 2
Number of days you could spend without waterpipe?	.86	
Number of times you could stop waterpipe for >7 days?	.84	
Number of water pipes you usually smoke per week?	.76	
Do you smoke waterpipe alone?	.70	
Are you ready not to eat in exchange for a waterpipe?	.61	
Percent of income you would spend on waterpipe smoking?	.60	
Do you smoke waterpipe when you are seriously ill?	.50	
Do you smoke waterpipe to relax your nerves?		.93
Do you smoke waterpipe to improve your morale?		.91
Eigenvalues	3.66	1.61
% of variance	40.68	17.90
Cronbach's alpha	.81	.82

Loadings < .40 are suppressed. Item loadings are sorted descending

The mean for time since started consuming their first waterpipe was M=69.21 (SD=48.40) in months with 2.1% (N=9) reporting consumption between 181-240 months. Participants disclosed that the number of WTS on weekly basis equivalent to a mean of M=2.05 (SD=3.30). The majority (N=240) reported consuming between one and three waterpipes per week whilst only 8.8% (N=36) noted smoking seven or more. Of the total, 24.4% (N=99) stated consuming less than one waterpipe on weekly basis. In the whole sample, N=266 (66.3%) reported having no other family members engaging in WTS, however, 86.5% (N=347) of all had a close friend who consumed also waterpipes. Regarding nicotine consumption via cigarettes, N=167 (41.6%) reported smoking cigarettes with a mean of M=12.18 (SD=9.13)

cigarettes per day ranging between 0 and 60. The mean for how long participants have been smoking in months was found  $M=75.72$  ( $SD=62.88$ ).

**Table 2. The Lebanon Waterpipe Dependence Scale (LWDS-11) and The LWDS-TR (15)**

Item	Response options and scoring	LWDS-11 Factor	LWDS-TR Factor
1. Number of times you could stop waterpipe for >7 days?*	None (3) Once (2) Several times (1) It always happens (0)	Physio. nicotine dependence	Physiological dependence
2. Percent of income you would spend on waterpipe smoking?*	1% or less of your monthly income (0) 2–10% of your monthly income (1) 11–50% of your monthly income (2) More than 50% (3)	Physio. nicotine dependence	Physiological dependence
3. Number of days you could spend without waterpipe?*	One day or less (3) 2–3 days (2) 4–7 days (1) More than 7 days (0)	Physio. nicotine dependence	Physiological dependence
4. Number of water pipes you usually smoke per week?*	<1 waterpipe/week (0) 1–2 waterpipes/week (1) 3–6 waterpipes/week (2) 7 or more waterpipes/week (3)	Physio. nicotine dependence	Physiological dependence
5. Do you smoke waterpipe to relax your nerves?*	Yes, absolutely (3) Yes, probably (2) Yes, maybe (1) No (0)	Neg. reinforcement	Psychological dependence
6. Do you smoke waterpipe to improve your morale?*	Yes, absolutely (3) Yes, probably (2) Yes, maybe (1) No (0)	Neg. reinforcement	Psychological dependence
7. Do you smoke waterpipe when you are seriously ill?*	Yes, absolutely (3) Yes, probably (2) Yes, maybe (1) No (0)	Psych. craving	Physiological dependence
8. Do you smoke waterpipe alone?*	Yes, always (3) Yes, most of the times (2) Yes, sometimes (1) No, never (0)	Psych. craving	Physiological dependence
9. Are you ready not to eat in exchange for a waterpipe?*	Yes, absolutely (3) Yes, probably (2) Yes, maybe (1) No (0)	Psych. craving	Physiological dependence
10. Do you smoke waterpipe for pleasure?*	Yes, absolutely (3) Yes, probably (2) Yes, maybe (1) No (0)	Pos. reinforcement	~
11. Do you smoke to please others (conviviality)?*	Yes, absolutely (3) Yes, probably (2) Yes, maybe (1) No (0)	Pos. reinforcement	~

~ Eliminated from LWDS-TR

## Factor Loadings

In order to check the factor validity and psychometric properties of the translated LWDS-11, EFA and CFA were performed on the collected data. We split the whole response data set ( $N=401$ ) randomly into two comparable sets, one subsample to perform EFA on and

the other set for CFA. First, the EFA was conducted to determine the underlying factorial structure of the translated LWDS-11. Following, to assess whether the collected data fitted adequately to the findings provided by the EFA analysis, a CFA was performed. The Kaiser–Meyer–Olkin (KMO) measure and Bartlett Test of Sphericity (BTS) were assessed preceding the factor analysis (i.e., EFA) in order to check whether the data (n=200) were convenient for extraction. Analysis revealed a KMO value of .72 whereas the BTS resulted in  $\chi^2(55)=758.18$ ,  $p < .0005$ , indicating that the collected data were adequate for factorial extraction analyses.

**Table 3. Results of the confirmatory factor analysis (n=201)**

Item	Factor Loadings	
	Factor 1	Factor 2
Number of days you could spend without waterpipe?	.64	
Number of times you could stop waterpipe for >7 days?	.64	
Number of water pipes you usually smoke per week?	.96	
Do you smoke waterpipe alone?	.69	
Percent of income you would spend on waterpipe smoking?	.72	
Are you ready not to eat in exchange for a waterpipe?	.26	
Do you smoke waterpipe when you are seriously ill?	.27	
Do you smoke waterpipe to relax your nerves?		.80
Do you smoke waterpipe to improve your morale?		.84
Average Variance Explained	.41	.67
Construct Reliability	.81	.80

### Exploratory Factor Analysis

A principal component analysis (PCA) was conducted on the 11 items with Promax rotation for a sample of 200 individuals to assess the underlying structure. We checked the eigenvalues, the scree plot, and proportion of each factor contributing to the overall variance in order to elect the most suitable number of factors. Initially, the factor analysis resulted in the loading of the items on four factors with Eigenvalues  $> 1.0$  and which accounted for 68% of the overall variance. This was also supported through visual inspection of the scree plot. All four factors corresponded to the original study, however, the items loaded differently on the factors (19). Item clustering suggested that item 1 – 4 and items 8 and 11 loads on the physiological nicotine dependence factor (Factor 1), items 5 and 6 load on the negative reinforcement factor (Factor 2), loading of items 7 and 9 on the psychological craving factor (Factor 3), and the unique loading of item 10 on the positive reinforcement factor (Factor 4). Preliminary reliability analysis of internal consistency (n=200) resulted in an  $\alpha$  (Cronbach alpha coefficient) of .73. However, The Corrected Item-Total Correlation for item 10 (Do you smoke waterpipe for pleasure?) and 11 (Do you smoke to please others?) were found to be  $< .30$ . Accordingly, we inspected the correlation matrix and individual KMO measures resulted from the PCA. Items 10 and 11 both had no correlation coefficient greater than .30 correlation. Hence, due to this finding, the low Corrected Item-Total Correlations for items 10 and 11, the loading of item 10 on one factor independently, and the increase in internal consistency coefficient when items 10 and 11 were deleted, it was decided to perform a secondary analysis with alterations. Eliminating items 10 and 11, a PCA with nine items was run. The factor analysis resulted in loading of the items on three factors which accounted for 71% of the overall variance. Item clustering resulted in the same structure as the initial analysis, except for the excluded ones. Again, the KMO measure was found .73 with a significant BTS ( $p < .0005$ ). However, analysis showed that several items cross-loaded highly on more than one factor, suggesting a complex



structure. Consequently, re-examining the scree plot, we decided to force an extraction in order to achieve an simple structure (27).

**Table 4. Coefficient alpha of the loaded factors (n=401)**

Factors	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Physiological dependence	.82	.82	7
Psychological dependence	.81	.82	2

**Table 5. Correlation matrix of the scale scores and scale factors used in the study**

	2	3	4	5
1. Mean score on physiological dependence factor	.25*	.95*	.93*	.25*
2. Mean score on psychological dependence factor		.53*	.52*	.02a
3. Mean score on LWDS-TR			.98*	.21*
4. Mean score on LWDS-11				.20*
5. Mean score on FTND				

\*. Correlation is significant at the 0.01 level (2-tailed); a. Correlation is not significant at the 0.05 and 0.01 level (2-tailed); (2) Mean score on psychological dependence factor; (3) Mean score on LWDS-TR; (6) Mean score on LWDS-11; (5) Mean score on FTND.

Table 1 shows the factor loadings after rotation with forced extraction. The analysis indicated a two-factor solution which accounted for 59% of the overall variance. The KMO measure outcome did not change (i.e., .73,  $BTS=p < .0005$ ). Explorations of the item contents resulted in labeling the two factors as physiological dependence (items 1 – 4 and 7 – 9) and psychological dependence (items five and six). As last, the analyses mentioned above were also conducted with Varimax rotation. However, this provided the same results. The factorial structures of both the original LWDS-11 and the translated scale are shown in Table 2. The translated scale has been re-named as the Lebanon Waterpipe Dependence Scale-Turkish (LWDS-TR) in order to differentiate it from Salameh et al. and other variants (16,19).

**Table 6. Correlation matrix of the scale scores and socio-demographics**

	2	3	4	5	6	7	8
1. Since how long WTS in months	.11*	.01 <sup>a</sup>	-.01 <sup>a</sup>	.53**	.14 <sup>a</sup>	.14**	.13**
2. WTS per week		.12*	-.12*	-.01 <sup>a</sup>	.17*	.70**	.72**
3. WTS in Family Y or N			.07 <sup>a</sup>	.16*	.15 <sup>a</sup>	.12*	.13**
4. Close friends WTS?				.20**	.01 <sup>a</sup>	-.12*	-.12*
5. Since how long cigarette in months					.30**	-.06 <sup>a</sup>	-.04 <sup>a</sup>
6. Cigarette per day						.18*	.20*
7. Mean score on LWDS							.98**
8. Mean score on LWDS-TR							

\*. Correlation is significant at the 0.05 level (2-tailed); \*\*. Correlation is significant at the 0.01 level (2-tailed); a. Correlation is not significant at the 0.05 or 0.01 level (2-tailed); (2) WTS per week, (3) WTS in Family Y or N, (4) Close friends WTS?, (5) Since how long cigarette in months, (6) Cigarette per day, (7) Mean score on LWDS, (8) Mean score on LWDS-TR.

### Confirmatory Factor Analysis

To assess whether the collected data fitted adequately to the findings provided by the EFA analysis (i.e., a two factorial structure), we performed a CFA on the second subsample (n=201). Maximum Likelihood (ML) model estimation approach was applied. Recommended fit indices and their recommended cut-off criteria were inspected to assess Goodness-of-fit (26,27). This analysis provided the following fit indices: (1)  $\chi^2$  (24)=46.05,  $p < .0044$ , (2)  $\chi^2 / df=1.92$ , (3) SRMR (standardized root-mean-squared residual)=0.046, (4) GFI (goodness-of-fit index)=0.95, (5) CFI (comparative fit index)=.98, (6) AGFI (adjusted goodness-of-fit

index)=0.91, and (7) RMSEA (root-mean-squared error of approximation)=0.068. The construct reliability was found to be .81 for the physiological dependence domain, and .80 for the psychological dependence. Further, the average variance extracted (AVE) for the physiological dependence factor was .41, and for the psychological dependence factor .67. Thus, the collected data was coherent with the results from the EFA. See Table 3 for an overview. Further, the model is presented in Figure 1.

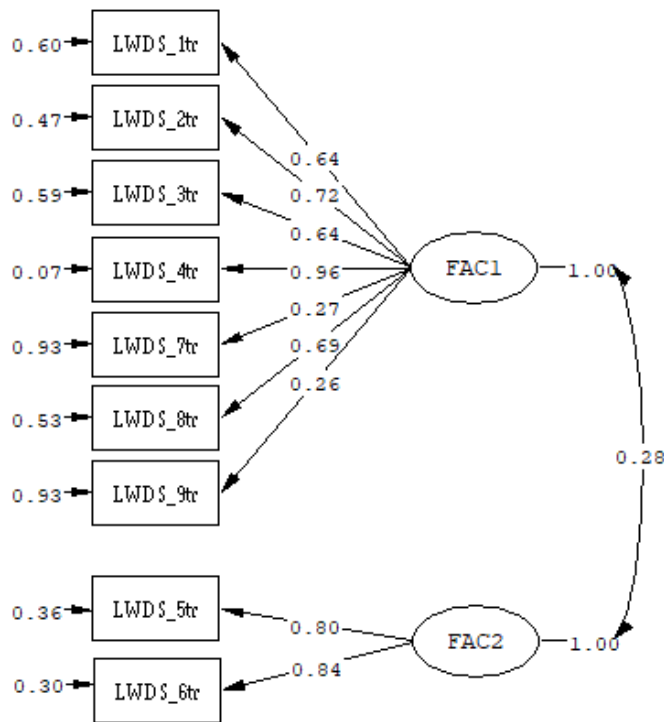


Figure. CFA factor-item relations for translated LWDS

### Instruments Reliability

In order to assess whether the LWDS-TR formed a reliable scale, we checked the internal consistency estimate of reliability. This analysis resulted in an  $\alpha$  of .80 for the whole scale (N=401), indicating that the LWDS-TR has an overall good alpha coefficients value. In addition, the two factors were assessed separately regarding their internal consistency. The results of analyses are shown in Table 4.

### Correlations

#### Correlations among Items of LWDS, Total Score, Factor Scores

We conducted a correlation analysis to check the relation between items of the LWDS-TR and the mean total score of the scale. In addition, for each item a correlation analysis was performed with the mean factor scores. The quantity of weekly smoked waterpipe correlated the highest with the LWDS-TR,  $r(399)=.82, p < .01$ . This finding was followed by a correlation of  $r(399)=.76, p < .01$  for the item representing the number of days responders could spend without a waterpipe. The item evaluating the number of times one could stop WTS for more than seven days correlated as third most with the mean total score of the LWDS-TR,  $r(399)=.74, p < .01$ . The lowest correlation with the mean total score was found to be the item

determining whether the respondent is ready not to eat in exchange for a waterpipe,  $r(399)=.44$ ,  $p < .01$ . Analysis of the correlation between the items and mean scores of each factor has shown that each item correlated correspondingly with their own factor with  $r_s(399) > .46$ ,  $p < .01$ . The highest correlations were found between the psychological dependence factor and the loaded items,  $r(399)=.90$ ,  $p < .01$  for item 5 and  $r(399)=.94$ ,  $p < .01$  for item 6, respectively.

### Correlations among the Scales and Tests

Table 5 shows that scores on the two extracted factors correlated significantly moderate to strong with the LWDS-TR total score,  $r(399)=.95$ ,  $p < .05$  and  $r(399)=.53$ ,  $p < .05$ , respectively. Participants who scored high on the physiological dependence factor also scored high on the overall scale. Moreover, the two factors were also correlated similar with the original LWDS-11 scale,  $r(399)=.93$ ,  $p < .05$  and  $r(399)=.52$ ,  $p < .05$ , respectively.

In addition, Table 5 displays that there is a correlation of .25 between the physiological dependence factor and the FTND scale scores which is significant at the 10% level with a sample size of 167. In contrast, the negative reinforcement factor did not correlate significant with the FTND scale,  $r(165)=.02$ ,  $p > .05$ . Both the LWDS-TR and the original LWDS-11 scores correlated positively with the FTND, indicating that individuals scoring higher on the waterpipe dependence measuring scale also scored higher on the cigarette dependence measure,  $r(165)=.21$ ,  $p < .01$  and  $r(165)=.20$ ,  $p < .01$ , respectively.

### Correlations among Socio-demographics and LWDS

A bivariate correlation was conducted to assess whether, for instance, the amount of waterpipes smoked per week were related with the obtained LWDS scores. Both the original and LWDS-TR scales were evaluated. Table 6 displays the correlation matrix. Assessment provided a strong positive correlation between the amount of waterpipes smoked per week and the LWDS scores,  $r(399)=.70$ ,  $p < .01$  for the original LWDS-11 and  $r(399)=.72$ ,  $p < .01$  for the LWDS-TR. Participants indicating more frequent smoking of waterpipes per week scored higher on the LWDS. In addition, Waterpipe smoking duration in months correlated moderately positive with the duration of cigarette smoking in month,  $r(165)=.53$ ,  $p < .01$ . This finding indicates that the greater time passed since initial waterpipe smoking behavior, the initial cigarette smoking behavior duration in months increased and vice versa.

Assessing whether the two factors of the scale correlated individually with the variables of waterpipes smoked per week and since when the participant engaged in WTS behavior provided significant coefficients. For the physiological dependence factor was found a positive strong relation with the frequency of waterpipes per week,  $r(399)=.78$ ,  $p < .01$ . Thus, participants who smoked waterpipe more frequent scored higher on this factor. A small to moderate positive relation was found for the psychological dependence factor correlated with the "WTS per week" variable,  $r(399)=.13$ ,  $p < .01$ . Duration of WTS behavior in months correlated positively significant with the physiological dependence factor,  $r(399)=.17$ ,  $p < .01$ . However, this relation was found to be weak. There was no significant correlation between the variable and the psychological dependence factor.

## DISCUSSION

To the best of our knowledge, the present study is the first one conducted in Turkey to adapt a measurement tool in assessing the possible dependence level regarding waterpipe tobacco smoking (WTS) in a Turkish sample. The scale is called the Lebanon Waterpipe Dependence Scale-Turkish (LWDS-TR) in order to differentiate it from Salameh et al. and other variants (19,21,30). The administered scale is provided in Appendix A. The main study outcomes can be summarized along the followings lines:

(i) Factor analysis (i.e., explanatory factor analysis, EFA) established that the LWDS-TR measures WTS dependence on a different factorial structure (19,21,30). It is suggested that the scale embodies two domains over a total of nine items. These domains have been labelled Physiological Dependence and Psychological Dependence. Salameh et al. found four dimensions in their validation paper of the LWDS-11, representing physiological nicotine dependence, negative reinforcement, psychological craving, and positive reinforcement (19). Like the original scale, the four items representing nicotine dependence loaded in a similar way on the same factor in our sample. In contrast, the loading of items representing craving differed from Salameh et al. (19). All three items loaded on the physiological dependence factor. Item eight "Do you smoke waterpipe alone?" loaded on the factor characterizing physiological dependence. This finding is supported in the literature which express that smoking alone is indicative of dependence (2,21,30). Accordingly, when correlating item 8 with the FTND overall score, wherein FTND is known to measure physical nicotine dependence (22,23), the obtained coefficient equals a weak but sufficient correlation. However, smoking a waterpipe with others might be used by potential dependents as a disguise because of its social aspect (21,30). This aspect requires further investigation in the Turkish population.

Another finding of this study is that the item "Do you smoke waterpipe when you are seriously ill?" was retained on the physiological dependence factor. This item was derived from the Fagerström Test for Nicotine Dependence (FTND) which probes it in different wording (19). Considering that FTND measures nicotine dependency which is primarily physical in nature, this retention is not confounding since the seminal paper on validation of the scale reports that nicotine deliverance to ones-self when ill is an indicator of physiological dependency (22).

Both studies reporting on the LWDS in different populations, however, disclose eliminating the item "Are you ready not to eat in exchange for a waterpipe?" due to either not loading on a factor or not contributing to the reliability coefficient (i.e., Cronbach's alpha) and construct validity of the scale (21,30). In this study, on the contrary, the Corrected Item-Total correlation for this item was found .36 which exceeds the recommended cut-off points of elimination (31). Furthermore, the relation between this item and the mean scale score was found moderate ( $r(399)=.44, p < .01$ ). In comparison to the psychological factor the item correlated significantly higher on the physiological dependence factor,  $r(399)=.13, p < .01$  and  $r(399)=.46, p < .01$ , respectively. Further, the item correlated significant with the reported amount of WTS per week by participants ( $r(399)=.22, p < .01$ ). Overall, due to the above mentioned and the high loading on the corresponding factor (see Table 1), it was decided to retain the "Are you ready not to eat in exchange for a waterpipe?" item. However, the finding

that 90.8% (n=364) of the sample answered “no” to the item might indicate that only the high scoring individuals endorsed the item. Another explanation might be that the notion of exchanging a basic need of survival for a waterpipe in a country of fair economic welfare (i.e., Turkey) was interpreted as a high dependency characteristic. As Kassim et al. noted, dependency and admittance of it is frowned in the Middle Eastern where Turkey also has roots in (21). Further research to this issue is needed.

The second factor consisted of the items (5) “Do you smoke waterpipe to relax your nerves?” and (6) “Do you smoke waterpipe to improve your morale?”. Salameh et al. reported these items as loading on the negative reinforcement factor (19). Hence the underlying motivation of relieving oneself of distress and promoting psychological subjective states, which are entailed by these items, the factor has been labeled as psychological dependence in this study. Kassim et al. and Primack et al. both discuss having established similar results (21,30). The two items have been considered measuring the relief of individuals who use waterpipe to smoke. Akl and colleagues point out that individuals who engage in WTS behavior indicate doing so because of the relaxation it brings with it (8). In another study, Stanton, Mahalski, McGee and Silva have reported that early adolescents reasoned their smoking behavior by saying that it had relaxing effects (32). Piasecki, Richardson, and Smith have found that college students also report motives of emotion regulation for engaging in WTS, although, not common as other reasons (33). Another study reported findings that the most common motives reported in a general population sample was that of pleasure and alleviation of stress (34). Similar motives were also provided by Turkish samples (35,36). Thus, the loading of these two items on the same factor, which infers alleviation of stress, relaxation, and affect modulation, goes well with earlier findings in the literature. The correlation of the two items with the psychological dependence factor score of the modified scale was found to be strong for item 5 and item 6. The significant contribution of the items to this factor score, representing a dependence level of psychological relief, is taken as reliable evidence regarding the literature.

(ii) In order to evaluate whether the factorial structure derived from the EFA fitted (i.e., matches) the data collected (i.e., the sample/population) we conducted a confirmatory factor analysis (CFA). In addition, this analysis allowed us to assess the construct validity of the LWDS-TR. For an overview see Table 3.

CFA results showed that all items loaded on the derived structure from the EFA correspondingly. However, the items “Are you ready not to eat in exchange for a waterpipe?” and “Do you smoke waterpipe when you are seriously ill?” loaded low on their factor. For the latter, the loading resulted from the EFA and loadings provided by the literature were also found relatively low (21,30). The ready not to eat item was retained, as mentioned above, despite literature findings report eliminating it (21,30). This differentiation may result due to varying interpretations designated to giving up a basic need for something you would do occasionally. Despite these low loadings, all estimations coefficients were found statistically significant. In addition, the Goodness-of-Fit indices obtained from the CFA were found to be well in the recommended parameters (27,28,29). Thus the factorial structure suggested by the EFA and CFA fitted the data obtained from this sample.

To assess the accuracy of what the LWDS-TR theorizes to be measuring (i.e., WTS dependency) we assessed the construct validity by determining whether the CFA provided

convergent and discriminant validity. The average variance extracted (AVE) and construct reliability are both indicators of convergent validity (29). Overall, The CFA in this study found for both indicators that they passed the recommended cut-off (29). The physiological dependence factor, however, fell slight below the recommendation for AVE. This probably results from the two items loading lower on the dimension. In contrast, both the factors passed the cut-off well above the recommendations for construct reliability.

Discriminant validity was assessed by comparing both the AVE values with the square of correlation estimate between these factors (i.e., .28) as reported by the CFA (see Figure). The criteria is that AVE of the factor should be greater than squared correlation between factors (29). When calculated ( $.28^2=.08$ ), both AVE values were found to be much higher. Thus, the two factors of the LWDS-TR exhibited discriminant validity. Further, the CFA provided a factor-item relation model (see Figure) where it can be seen that the model has a two-unidimensional factorial structure. In other words, there are no cross-loading by items on multiple factors and items that are measured in the scale represent only one factor. Both methods have been reported as an indication of discriminant validity (29).

(iii) Besides the CFA, in this study we also evaluated the construct validity and criterion validity by assessing relations between the LWDS-TR factors and the FTND. This method of construct validity is also known as nomological validity (29).

Considering that the FTND measures physiological nicotine dependency, when conducted a bivariate correlational analysis, the LWDS physiological dependence factor correlated significantly with the FTND total score (22,23). As both are accepted measuring the physical nicotine dependence level of participants, a significant relationship between the two constructs implies convergent validity. However, we are cautious with this assumption because physiological dependency is only one of two dimensions of the LWDS-TR. Furthermore, considering the construct validity, this research suggests in line with Primack et al. that the frequency of WTS per week is convergent to the overall score on the LWDS-TR (30). The strong correlation between the whole scale and "WP per week", and between the physiological dependence factor and the frequency of waterpipe per week is considered yielding this assumption. Weighing the correlation coefficient between the psychological dependence factor of the LWDS-TR and the FTND, the study suggests having established a discriminant validity since the two constructs were correlated significantly but not sufficient. Again, caution is warranted with this assumption.

In lack of acceptable criterions regarding dependence measurement tools of waterpipe dependence, the FTND scale was chosen as a concurrent criterion in order to assess the criterion validity of the LWDS-TR. This was found partially established due to the significant positive correlation computed between the FTND and both the original and LWDS-TR scale. We discuss here establishing it partially due to the weak correlation.

(iv) The literature regarding waterpipe tobacco smoking has provided some main indicators of dependence (2,8,16,37). One of these indicators is the frequency of waterpipe usage (2,16). This study has provided that the scale item regarding the frequency of waterpipes smoked per week correlated high and significant with the total score obtained by the LWDS-TR scale. In addition, as mentioned earlier above, in conjunction with the scale item, the frequency averages collected via the socio-demographics form has correlated equally high

with the total score, confirming the relationship between frequency and dependence advocated in the literature.

Certain limitations in this study need to be addressed. We acknowledge that the inquiry has limitations regarding the validity, especially criterion validity. As stated above, there are unfortunately no other acceptable criteria regarding waterpipe dependence assessment means. However, we believe that this study will instigate others to develop tools of waterpipe dependence assessment. Secondly, cigarette smoking is not defined as an exclusion criteria. Thus, it is unclear to what extent dependence on cigarettes may have confounded responses regarding waterpipe dependence. However, this is a limitation of our study, and it can be investigated in future studies whether there is a difference in LWDS scores between both waterpipe and cigarette smokers and waterpipe smokers only. Additionally, the sample of this study does not cover heavy consumers of waterpipes. Individuals who consume waterpipe very infrequently (<1 waterpipes per week) were included in the study. Therefore, it is recommended that future studies focus on heavy WTS samples. Finally, and more importantly, group differentiation and dependence assessment (i.e., cut-off analysis, ROC, sensitivity and specificity) were not performed. However, this study was performed as a take-off point in research and generation of domestic dependence scales regarding waterpipe smoking. We recognize that these analyses are crucial in the validation of instrument development and adaptation, and future research on this aspect is needed.

For future studies, it is recommended to assure a test re-test reliability sample. Also, cut-off analysis and group differentiation assessment should be performed in upcoming research. In addition, the social dependence aspects of waterpipe smoking should be researched more extensively, ensuring a multidimensional inquiry. For example, behavioral aspects regarding waterpipe tobacco consumption, beliefs, and attitudes can be assessed together with the scale. Furthermore, most of the data were collected via the internet using social media. There are popular establishments providing extensive waterpipe service which may be eligible for coming to terms regarding research with their customers, facilitating data acquirement face-to-face.

As a conclusion, being the first adapted measurement tool regarding waterpipe dependence, this study has suggested a reliable Turkish assessment tool with validity in a Turkish sample. The research has provided a differing factorial structure from variants of the LWDS-11. Surely, a central aim of the study was to provide a take-off point in research and generation of domestic dependence scales regarding waterpipe smoking. Although this study suggests implementation of the LWDS-TR scale in a Turkish sample, future research is encouraged to further investigate psychometrics of both scales.

### Acknowledgments

The authors would like to thank Dilek Kılıç of the School of Foreign Languages at Ankara Yıldırım Beyazıt University, Tahir Akyüz, Elif Ergin, and Enes Başoğlu for their efforts in the translation process of the scale. The authors would also like to acknowledge Dr. Yankı Süsen at the Psychology Department of Ankara Yıldırım Beyazıt University. Our special thanks are extended to Prof. Dr. Sinan Canan of the Psychology department at Üsküdar University in Istanbul.

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## Appendix A

### Lebanon Waterpipe Dependence Scale-TR

#### [Lübnan Nargile Bağımlılığı Ölçeği]

##### Yönerge:

Bu ölçek, nargilenin içerdiği nikotinin fiziksel ve psikolojik etkilerini ölçmek için kullanılmaktadır. yer alan maddeleri dikkatlice okuyup, ifadenin altında bulunan seçeneklerden size uygun olanı seçiniz ve içini karalayınız / işaretleyiniz. Burada doğru ya da yanlış yoktur. Lütfen eksiksiz doldurmaya özen gösterin.

Kaç kez 7 günden uzun süreyle kendinizi nargile içmekten alıkoyabildiniz?

- Hiç
- Bir kez
- Birkaç kez
- Her zaman

Gelirinizin yüzde kaçını nargile içmek için harcıyorsunuz?

- Aylık gelirinizin %1'i ya da daha azı
- Aylık gelirinizin %2-10'u
- Aylık gelirinizin %11-50'si
- Gelirinizin %50 den fazlası

Nargile içmeden kaç gün geçirebilirsiniz?

- 1 ya da daha az gün
- 2-3 gün
- 4-7 gün
- 7 günden fazla

Genellikle haftada kaç tane nargile içersiniz?

- Haftada 1'den az
- Haftada 1-2 nargile
- Haftada 3-6 nargile
- Haftada 7 veya daha fazla

Nargileyi sinirinizi yatıştırmak için mi içersiniz?

- Evet, kesinlikle
- Evet, büyük olasılıkla
- Evet, olabilir
- Hayır

Nargileyi moralinizi düzeltmek için mi içersiniz?

- Evet, kesinlikle
- Evet, büyük olasılıkla
- Evet, olabilir
- Hayır

Ciddi derecede hasta olduğunuzda nargile içer misiniz?

- Evet, kesinlikle
- Evet, büyük olasılıkla
- Evet, belki
- Hayır

Tek başınıza nargile içer misiniz?

- Evet, her zaman
- Evet, çoğu zaman
- Evet, bazen
- Hayır, hiçbir zaman

Nargile içebilmek için yemek yemekten vazgeçer misiniz?

- Evet, kesinlikle
- Evet, büyük olasılıkla
- Evet, belki
- Hayır

Nargileyi zevk için mi içiyorsunuz?

- Evet, kesinlikle
- Evet, büyük olasılıkla
- Evet, olabilir
- Hayır

Nargileyi başkalarını memnun etmek için mi içersiniz (ortama uyum sağlamak için)?

- Evet, kesinlikle
- Evet, büyük olasılıkla
- Evet, olabilir
- Hayır