Psychometric evaluation of a new instrument to hookah tobacco smoking-related factors in the Iranian female university students based on the Extended Parallel Process Model

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Abstract:

BACKGROUND: The higher prevalence of hookah tobacco smoking (HTS) has become worrisome in women. Thus, it is essential to identify and measure the perceptions associated with this unhealthy behavior as well as the type of response to risk messages to design the effective programs. This study aimed to psychometric evaluation of a new instrument, named the Extended Parallel Process Model-Hookah Tobacco Smoking Questionnaire (EPPM-HTSQ), for female university students.

MATERIAL AND METHODS: This methodological study was conducted in 2019–2020 in central and western Iran. The first version of the instrument was developed with 97 items. Face, Content, and construct validity methods were used to assess the EPPM-HTSQ validity. The data viability for factorability was guided through Kaiser-Meyer-Olkin (KMO) measure of sample adequacy (Values >0.7) and Bartlett's test of Sphericity ($P < 0.05$). The Exploratory Factor Analysis (EFA) method with varimax rotation and SPSS software was performed to identify the main factors of the questionnaire and interpretable factors. The internal consistency and external reliability were determined. The test–retest was used for evaluating the stability of tools.

RESULTS: During the assessment of the face and content validity 71 items remained in the questionnaire. EFA led to the extraction of nine dimensions: "Focusing on superior rewards," "Response Efficacy," "Perceived physical threat," "Perceived social threat," "Self-efficacy," "Fear control," "Attitude," "Fear," and "Intention" Kaiser-Meyer-Olkin (KMO) test (0.957) and Bartlett's test ($P < 0.001$). Cronbach's alpha (0.871–0.951) and ICC (0.985–0.998) were approved for scale dimensions.

CONCLUSION: Important findings of the present study were the development and validation of the EPPM-HTSQ for measuring EPPM variables in relation to HTS; introducing a new variable "focusing on superior rewards"; as well as, the new classification of the concept of "perceived threat." The final version of the EPPM-HTSQ is a valid and reliable tool, but it is suggested to be re-evaluated in other studies with different populations and sample sizes.

Keywords:

Extended parallel process model, female, psychometrics, students, universities, water pipe smoking

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Received: 29-03-2023
Accepted: 24-05-2023
Published: 29-04-2024

Background

Hookah tobacco smoking (HTS) has become alarmingly popular among young women.[1] Despite many efforts to control tobacco and lower smoking in many countries,[2] the HTS has increased among young people and even reached 65.3% in

some countries.[3] This increase in consumption is more significant in young women, especially university students[4] so that 31.4% of US female college students had ever used hookah tobacco and 8.3% of them had the current use.[5] However, the social acceptance of the HTS is greater in women, especially in the Middle East, for instance, 53.8% of girls reported the HTS compared with 8.3% who reported smoking in Lebanon.[6] A study in Iran indicated that the HTS in female university students was approximately the same as male students (48% vs. 52%, respectively).[7] Another study in Iran indicated that flavored hookah use among women increased from 44.1% in 2009 to 77.1% in 2014, indicating an increase of 75%, while the increase was only 14.4% in men (from 65.6% to 75%).[8] This behavior has become a popular leisure activity of some women, and the growing prevalence of the HTS is worrisome.[4,9]

The higher prevalence of the HTS poses risks to women's health.[10] Women with the HTS are more susceptible to cervical cancer, changes in menstrual function, premature menopause, primary and secondary infertility, ectopic pregnancy, and maternal and fetal risks during pregnancy.[11,12] Because sometimes these concerns increase among young women (15–24 years) when there is a high probability of the HTS among this age group.[4]

Despite the harmful consequences, there are still misconceptions about the safety of the HTS as a reason for its increasing consumption in the world.[13] Each of the researches in different societies has introduced different factors as determinants of smoking, including hookah. Some determinants of smoking, as reported, include the perceived susceptibility, perceived severity, fear, self-efficacy, response efficacy, perceived rewards, perceived costs,[14-17] positive attitude toward the HTS, and behavioral intention[18,19] each of which plays a role in the onset and continuation of consumption in any society. Many studies have also found that educational messages sometimes are not able to provoke the audience's appropriate reactions to avoid smoking and prevent dangers, and sometimes cause excess fear and negative emotions in them. In this case, not only this group does not refuse to consume it, but they also have defensive and maladaptive reactions to their fear control, leading to an increase in their resistance to quitting their current high-risk behavior and a reduction in the impact of subsequent interventions.[20,21]

According to the above explanations, there is a need for a comprehensive framework to understand this behavior.[22] In this regard, the Extended Parallel Process Model (EPPM) can be a good framework because it not only considers the roles of perceptions, but also the roles of attitude and intention in the creation of the behavior and also deals with the roles of emotions and response to them.[23] According to the EPPM, if people believe that their health is at serious risk after educational messages, and if they are confident about the effectiveness of coping strategies and also their ability to adopt preventive behavior and its positive effects, they are more likely to have danger control responses, or changes in attitude, intention and healthy behaviors, but they will have the unpleasant feeling of fear in the case of understanding high threats and low efficacy; and their responses will be in line with the fear control, not the danger control. In this case, they avoid receiving dangerous messages or devalue them.[23,24] Therefore, it seems necessary to recognize the perceptions, emotions, and responses that lead to the spread of the HTS behavior in female university students. Designing an appropriate tool in a relevant scientific framework such as the EPPM[23] can help in this recognition and measure the impact of interventions and educational messages on this behavior and related factors in this group.

Since none of the available tools related to female's HTS behavior have been designed and developed according to EPPM in Iran. Therefore, the present study aimed to provide psychometric evaluation of a tool for measuring perceptions, fears, and types of control responses to risk messages relating to the HTS among female university students.

Material and Methods

This methodological study was conducted from October 2019 to February 2020, and its target population consisted of female university students from two universities Isfahan and Hamadan University located in the center and western of Iran. In the study, the instrument was developed and psychometrically evaluated in three phases: 1) Scale development; 2) Validity assessment; and 3) Reliability assessment [Figure 1].

Scale development process
This step was based on the results of a previous qualitative study (in-depth semi-structured interviews were performed with 34 young women experienced in the HTS) and also through the scientific literature review.[23,25-27] A total of 140 items were obtained according to ten variables in the theoretical framework of the EPPM in addition to a new variable extracted in the qualitative study, called "Focusing on superior rewards" that was added to the default model following the suggestion of the research team, and approval of the expert panel. The process culminated in designing the initial instrument named the EPPM-HTSQ containing 97 items in 11 variables [Figure 2] with demographic characteristics, including eight items.
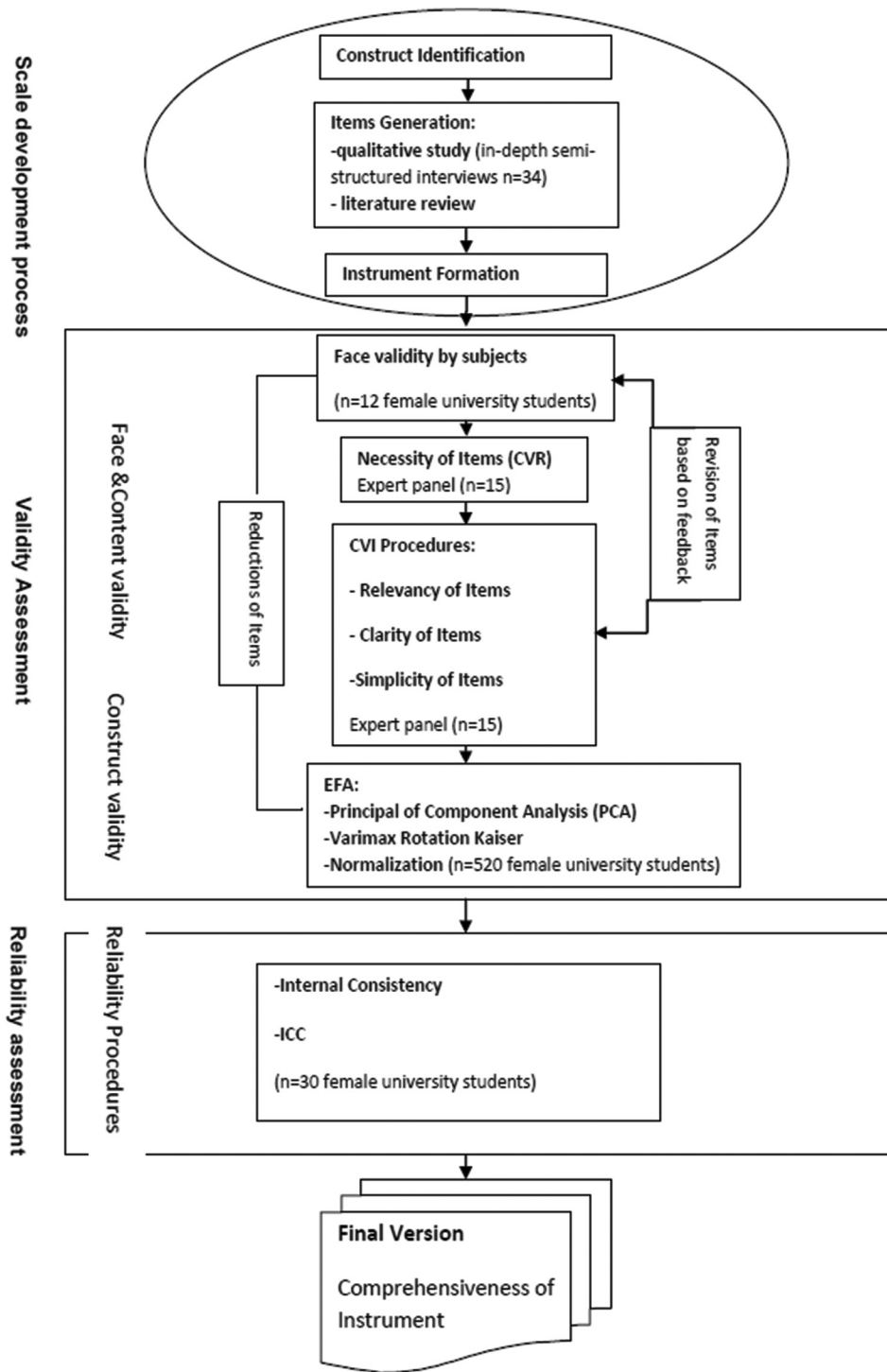
Scale development process

Validity Assessment

Reliability assessment

Face &Content validity

Construct validity

Reliability Procedures

Construct Identification

Items Generation:
-qualitative study (in-depth semi-structured interviews n=34)
- literature review

Instrument Formation

Face validity by subjects
(n=12 female university students)

Necessity of Items (CVR)
Expert panel (n=15)

Revision of Items based on feedback

Reductions of Items

CVI Procedures:
- Relevancy of Items
- Clarity of Items
-Simplicity of Items
Expert panel (n=15)

EFA:
-Principal of Component Analysis (PCA)
-Varimax Rotation Kaiser
-Normalization (n=520 female university students)

-Internal Consistency
-ICC
(n=30 female university students)

Final Version
Comprehensiveness of Instrument

Figure 1: The flowchart of the process of EPPM-HTS Development and Psychometric Properties. Abbreviations: CVR, Content Validity Ratio; CVI, Content Validity Index; EFA, Explanatory Factor Analysis; ICC, Intra-class Correlation Coefficient

The first to fourth dimensions of the EPPM-HTSQ included the perceptions including the "perceived susceptibility" (17 items), "perceived severity" (12 items), "response efficacy" (14 items), and "self-efficacy" (11 items).

In the fifth dimension of the questionnaire for the "Fear" assessment resulting from messages relating to

dangers and diseases caused by the HTS, it included six items, namely, frightened, tense, nervous, anxious, uncomfortable, and nauseous mood adjectives.

The sixth, seventh, and eighth dimensions measured the individual triple responses in the fear control processes, that is, maladaptive responses that dealt with
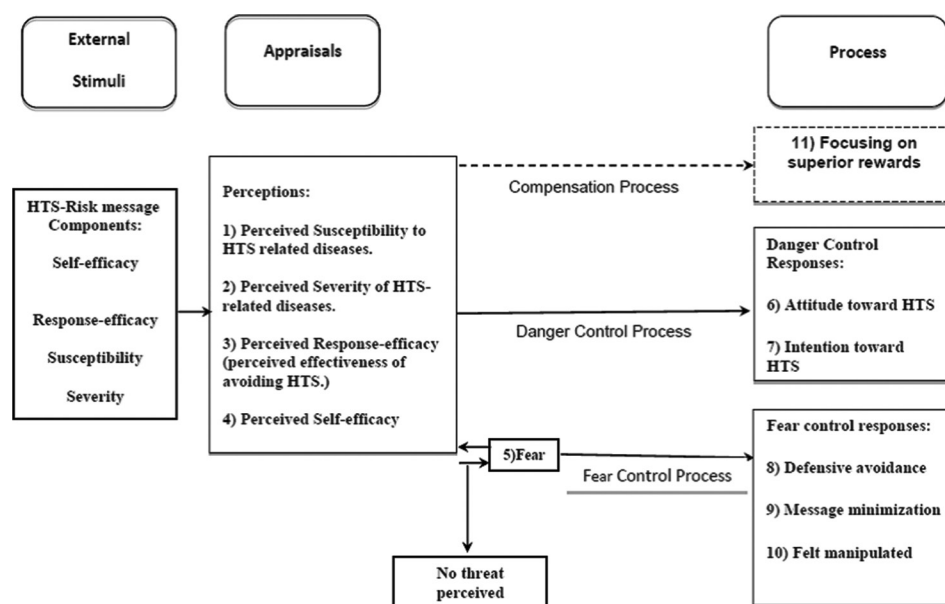
Figure 2: The Baseline Extended Parallel Process Model (EPPM) (24)

the reactance, message rejection, and warning news instead of preventing and control actual dangers.[21] The items for measuring the responses were divided into three sections, namely, "the defensive avoidance" (6 items), "message minimization" (3 items), and "felt manipulated" (4 items).

The ninth and tenth dimensions measured the danger control, or the adaptive responses,[21] and included the "Attitude" (7 items), and "intention" (5 items).

The eleventh dimension was allocated to the new variable, "Focusing on superior rewards" with 12 items; and participants reported it as a reaction to compensate for the dangers of hookah based on findings of the qualitative study. In other words, they compensated for the losses of the HTS by focusing on its superior rewards.

There were responses on a Likert scale, including "strongly agree," "agree," "neutral," "disagree," and "strongly disagree" for all dimensions of the questionnaire, except for the fifth dimension. Responses, namely, "extremely," "very," "moderately," "not at all," and "never" were considered for the fifth dimension, that is, fear.

Validity assessment
Face validity assessment
Using a survey of 12 female university students, the level of difficulty and understanding of concepts, appropriateness of the items as well as the ambiguities and misconceptions in the questionnaire were reviewed, and the necessary corrections were made to clarify the items. Afterwards, the quantitative method and calculation of the impact score (frequency×importance)

were used to determine the importance of items. Items with scores of equal to or >1.5 in terms of the face validity were evaluated as appropriate items and were retained in the questionnaire.[28]

Content validity assessment
The content validity was evaluated in two phases, qualitative and quantitative. In the qualitative phase, an expert panel, including health education specialists (n = 11), Psychology (n = 2), Biostatistics (n = 1), and pediatricians (n = 1) assessed the tool in terms of the wording, item allocation, and grammar and scaling.

The Content Validity Ratio (CVR) and Content Validity Indicator (CVI) were calculated for the quantitative evaluation of the content validity so that the expert panel was asked to select one of the answers, "Essential," "Useful but not essential," and "No Necessary" for each questionnaire item,[29] and then the items with the CVRs of >0.49 ($P < 0.05$) were preserved according to CVR = (Ne-N/2)/(N/2) formula, and the Lawshe table.[30] To determine the CVI, the relevance, simplicity, and clarity criteria were examined for each item of the questionnaire on a 4-point Likert scale; and values >0.79 were accepted.[31]

Construct validity assessment
The construct validity of tools was examined using the cross-sectional study among 520 female university students. The data viability for factorability was guided through Kaiser-Meyer-Olkin (KMO) measure of sample adequacy (Values >0.7) and Bartlett's test of Sphericity ($P < 0.05$). The Exploratory Factor Analysis (EFA) method with varimax rotation and SPSS software were performed to identify the main factors of

the questionnaire and interpretable factors. We retained factors with eigenvalues >1 as cutoff and factor-item loadings values >0.40, which could result in more interpretable factors and explain sufficient amounts of the overall variation.[32]

Reliability assessment

In the present study, the Cronbach's alpha coefficient was calculated to determine the internal consistency of the tool; and values higher than 0.70 were considered as appropriate reliability.[33] The test–retest was used for evaluating the stability of tools. The tool was completed at two stages with an interval of two weeks by a group of 30 female university students; and to evaluate test–retest reliability, the intraclass correlation (ICC) coefficient using two-way mixed model, along with 95% confidence was computed. The coefficient more than 0.70 was considered as excellent stability.[34]

Results

Sample characteristics

At the psychometric stage, the students' mean (SD) age was 20.58 (1.464) years; and the majority of them (90%) were single. About 60% of the students lived in dormitories. More than half of mothers' education (62.3%) and fathers' education (53.7%) were under high school diplomas; the majority of mothers were housewives (88.5%), and more than half of fathers (52.3%) were workers and freelancers [Table 1].

Face validity

Minor changes were made in the literature of some questions in the initial questionnaire in the qualitative face validity phase. Three items were removed due to impact scores <1.5 in the quantitative face validity; hence, the number of items decreased from 97 to 94.

Content validity

The necessary modifications were made to the items in the qualitative content validity and an item was merged due to overlapping with the rest based on comments received from the expert panel. For evaluating the quantitative content validity according to the expert panel (N = 15), the minimum acceptable value was equal to 0.49 for the CVR; and 22 items were removed due to the lower CVR; and eventually, 71 items remained. In the calculation of the CVI, nine items did not get the minimum acceptable score (CVI <0.79) that had an overlap with items deleted in calculating the CVR. Finally, the 71-item questionnaire of the next stage was entered [Additional Table 1].

Construct validity: Explanatory Factor Analysis (EFA)

At this stage, 71 items with appropriate content validity were included in the review of the construct validity.

Table 1: Sample characteristics (*n*=520)

Variables	Number (%) (*n*: 520)
Age (year)	20.58±1.464
Grade	
Associate	96 (18.5)
Undergraduate	415 (79.8)
Postgraduate	9 (1.7)
Marital status	
Single	468 (90)
Married	46 (8.8)
Divorced/widowed	6 (1.2)
Living in dormitory	
Yes	309 (59.4)
No	211 (40.6)
Father's job	
Worker	44 (8.5)
Employee	112 (21.5)
Retired	105 (20.2)
Freelancers	228 (43.8)
Farmer	31 (6)
Mother's job	
Housewife	460 (88.5)
Employed	60 (11.5)
Father's education	
Illiterate	16 (3.1)
Under diploma	263 (50.6)
Diploma	99 (19)
Academic	142 (27.3)
Mother's education	
Illiterate	37 (7.1)
Under diploma	287 (55.2)
Diploma	103 (19.8)
Academic	93 (17.9)

KMO = 0.957 was indicative of the appropriate data size for the EFA. Furthermore, the significant Bartlett's test ($P < 0.001$) indicated the sufficient correlation between the terms. In the next step of the EFA, nine interpretable factors had varimax rotation and eigenvalues of > 1. Given the theoretical basis of the tool and content of the questions, as well as the literature review, the factors were labeled as "Focusing on superior rewards," "Response Efficacy," "Perceived physical threat," "Perceived social threat," "Self-efficacy," "fear control: reacting against the communicator or message," "Attitude," "Fear," and "intention" accounting for 10.98%, 10.91%, 10.38%, 8.46%, 7.84%, 7.64%, 5.13%, 4.80%, and 4.00% of the total variance, respectively [Table 2].

Reliability

The Cronbach's alpha coefficient was in the range of 0.871–0.951 for the EPPM-HTSQ, and 0.931 for the whole questionnaire, indicating the confirmation of the external reliability of the tool. The ICC coefficients for the extracted subscales including "Focusing on superior rewards" (0.996), "Response Efficacy" (0.997), "Perceived physical threat" (0.990), "Perceived social threat" (0.991),

Table 2: Factor loading of the EPPM-HTSQ brief

Items	FSR	REF	PHT	SOT	SEF	FEC	ATT	FEA	INT
My skin will wrinkle if I smoke a hookah.			0.606						
Hookah will cause teeth decay and yellowing.			0.722						
I will get cardiovascular diseases such as heart attacks if I smoke a hookah.			0.753						
I will get osteoporosis if I smoke a hookah.			0.652						
I will get respiratory problems like asthma if I smoke a hookah.			0.779						
I will get various cancers (e.g., lung, stomach, mouth, etc.) if I smoke a hookah.			0.770						
Hookah causes menstrual disorders and gynecological problems in me.			0.571						
I will have problems in family relationships if I smoke a hookah.				0.642					
My ability to perform daily social activities decreases if I smoke a hookah.				0.653					
Hookah smoking causes me to drop out of school.				0.655					
Even with low and occasional use of hookah, I get problems from it				0.528					
As I am young, I am not banned from smoking hookah in society.				-0.432					
The complications of hookah use are very serious for my health.			0.545						
Diseases caused by hookah smoking (e.g. lung and cardiovascular cancer, etc.) are fatal.			0.596						
Hookah smoking during pregnancy can even lead to miscarriage.			0.565						
Hookah smoking increases the number of addicts.				0.468					
Femininity problems caused by hookah use cause infertility.				0.499					
It is difficult to treat diseases caused by hookah smoking.			0.459						
Family problems caused by hookah use lead to exclusion from society.				0.711					
Hookah smoking reduces marriage situations.				0.639					
Hookah smoking can cause premature social death.				0.497					
Not smoking hookah helps me breathe easier and better.		0.645							
Not smoking hookah helps increase my physical ability to perform daily activities.		0.678							
Not smoking hookah helps me stay healthier.		0.663							
Not smoking hookah helps me get better grades and succeed in my education.		0.604							
Not smoking hookah helps to fill my free time with activities such as exercise and reading.		0.628							
Not smoking hookah helps me avoid infertility and its problems.		0.676							
Not smoking hookah helps me find better friends.		0.669							
Not smoking hookah helps me not to be in inappropriate environments (coffeehouse, etc.).		0.653							
Not smoking hookah helps me have a better social status in society.		0.670							
Not smoking hookah helps save on my financial costs.		0.665							
Not smoking hookah helps increase my life expectancy.		0.686							
Not smoking hookah helps maintain my appearance beauty.		0.670							
I can avoid smoking hookah to maintain my health.					0.689				
I can avoid an environment where in the hookah is used.					0.552				
Instead of using a hookah, I can fill my free time with activities such as exercise and reading.					0.679				
I can say no to compliments of other people for using a hookah.					0.813				
I can avoid hookah even if everyone around me uses it.					0.782				
Even if I have access to hookah, I can avoid smoking hookah.					0.777				
If I am in a bad mood, I can avoid smoking hookah.					0.730				
Hookah smoking makes me feel that I am more experienced.	0.812								
Hookah smoking makes me feel independent.	0.792								
Hookah smoking makes me feel more classy and prestigious.	0.790								
Hookah smoking makes me feel superior to others.	0.826								

Contd...

Table 2: Contd...

Items	FSR	REF	PHT	SOT	SEF	FEC	ATT	FEA	INT
Hookah smoking makes me completely forget my worries and problems.	0.767								
Hookah smoking helps relieve stress and anxiety.	0.736								
Hookah smoking makes me have great fun.	0.746								
Hookah smoking creates a more intimate atmosphere among friends.	0.739								
Hookah smoking creates new social networking.	0.792								
Hookah smoking causes more social activities (gatherings, going to coffee shops, etc.)	0.746								
Messages relating to dangers and diseases caused by hookah use make me frightened.								0.842	
Messages relating to dangers and diseases of hookah use make the sense of tense in me.								0.861	
Messages relating to dangers and diseases caused by hookah use make me uncomfortable.								0.850	
Messages relating to dangers and diseases caused by hookah use make me anxious or worry.								0.863	
I avoid hearing messages relating to the dangers of hookah use.					0.612				
I try not to talk about the dangers of hookah use.					0.810				
I prefer not to think about the dangers of hookah smoking.					0.837				
I avoid watching video messages (e.g., movies, posters, and photos) about the dangers of hookah use.					0.847				
I think messages about the dangers of hookah use are exaggerated.					0.817				
I think messages about the dangers of hookah use are overstated.					0.838				
I think messages about the dangers of hookah use are designed to provoke my emotions.					0.774				
I think messages about the dangers of hookah use are distorted and manipulated.					0.797				
I think, hookah smoking is very good/good/neutral/bad/very bad.							0.751		
I think hookah smoking is very pleasant/pleasant/neutral/unpleasant/very unpleasant.							0.725		
I think hookah smoking is very enjoyable/enjoyable/neutral/unbearable/very unbearable.							0.714		
I think hookah smoking is very useful/useful/neutral/harmful/very harmful.							0.708		
I think hookah smoking is very dignifying/dignifying/neutral/far from dignity/very far from dignity.							0.710		
I am going to smoke a hookah in the next month.									0.634
I may take a few puffs on hookah in the next 6 months.									0.731
I may take a few puffs on hookah in the next year.									0.725
I will try never to smoke a hookah.									0.688
Eigenvalue	26.155	6.475	4.313	3.068	2.714	2.205	1.894	1.709	1.300
Explained variance (%)	10.988	10.918	10.386	8.464	7.847	7.642	5.135	4.805	4.002
Cumulative variance (%)	10.988	21.906	32.293	40.757	48.604	56.246	61.381	66.186	70.188

aExploratory factor analysis with Varimax rotation; Factor loadings <0.4 are not shown for simplicity

"Self-efficacy" (0.998), "fear control: reacting against the communicator or message" (0.995), "Attitude" (0.988), "Fear" (0.985), and "intention" (0.993) confirmed the external reliability of the tool [Table 3].

Discussion

The present study aimed to provide a psychometric evaluation of a tool within the framework of the EPPM to measure perceptions, fears, and types of control responses while confronting risk messages in female university students. The first version of the EPPM-HTSQ was developed with 97 items. Three items in terms of the face validity and 23 items in terms of the content validity were removed. The mean score of the CVI was 0.80 and the mean score of the CVR was 0.94 indicating the acceptable validity of the questionnaire. Determining the questionnaire validity and grouping the items[35] was the most important step for determining the construct validity, and thus 71 items entered the EFA within the framework of 11 variables. Using the EFA, nine factors were extracted as discussed below.

Table 3: Cronbach's alpha (*n*=30) and ICC (*n*=30) for EPPM subscales

Factors	Number of items	Cronbach's Alpha	ICC	95% Confidence Interval	
				Lower Bound	Upper Bound
Focusing on superior rewards (FSR)	10	0.951	0.996	0.992	0.998
Response efficacy (REF)	12	0.949	0.997	0.993	0.998
Perceived physical threat (PHT)	11	0.930	0.990	0.979	0.995
Perceived social threat (SOT)	10	0.871	0.991	0.981	0.996
Self-Efficacy (SEF)	7	0.934	0.998	0.996	0.999
Fear Control (FEC)	8	0.919	0.995	0.990	0.998
Attitude (Berg *et al*.)	5	0.926	0.988	0.975	0.994
Fear (FEA)	4	0.910	0.985	0.968	0.993
Intention (INT)	4	0.950	0.993	0.985	0.997

Perceptual factors

Perceived physical threat and perceived social threat

These two exploratory factors were resulted from merging items of two dimensions of the initial questionnaire, including the perceived susceptibility and severity about risks and complications of the HTS, indicating the perceived threat according to the EPPM.[27] The first factor extracted from this section included 11 items about the risk and severity of physical illnesses caused by the HTS labeled with the "Perceived physical threat." The next factor included ten items about the risk and severity of adverse social consequences of the HTS labeled with the "Perceived social threat." The integration of items of two variables was previously reported differently.[36] Researchers reported a very high likelihood of the impact of the perceived threat on tobacco and hookah use.[20,36] For instance, a study reported that young people, who perceived a higher threat from smoking, had a lower intention and consequently less tobacco consumption.[37] Therefore, it is necessary to measure such perceptions in predicting and justifying desired healthy behaviors and avoiding risky behavior.[27] Accordingly, the present tool has a new look at measuring this variable in future studies on threats of the HTS.

Perceived response efficacy

The extractive factor, "perceived response efficacy," means understanding the efficacy of avoidance of the HTS. Based on the EPPM, it can be expected that this perception leads to risk prevention.[27] The role of this variable can be determined in predicting the intention and preventive behavior such as avoidance of the HTS.[36,38] For instance, a study indicated the effective roles of reinforcing messages of self-efficacy and response efficacy to create the intention of smoking cessation.[38] People involved in fear control processes perform the actual control of danger through educational messages focused on the response efficacy.[39] According to studies on different behaviors, having a standard tool to confirm or reject such assumptions seems very necessary for behaviors such as the HTS.[39] Assessing the perception of efficacy induced through educational messages is necessary for a target group.[23]

Perceived self-efficacy

The "Self-efficacy" factor expressed the students' belief in their abilities to avoid HTS. A study found that the low self-efficacy of avoidance increased the likelihood of HTS in students.[40] Furthermore, the low self-efficacy in hookah users decreased the likelihood of quitting this behavior in them and increased the intention to continue the greater consumption.[41] In a systematic review, the self-efficacy variable was introduced as an important predictor of behavior and behavioral intention.[42] Therefore, it is urgent to create a reliable tool for measuring self-efficacy among smokers and developing effective interventions[27] regarding the increase of self-efficacy changing the hookah smoking behavior.

Control responses to risk messages

Fear and fear control responses

Fear

The extractive factor, "fear," is defined as a negative emotional reaction to a perceived threat.[43] The Evidence indicates that fear is a negative consequence of a behavior and an important motivation to change that behavior.[44] A study indicated that campaigns based on the fear were most effective for those who had higher self-efficacy or motivation.[20] A meta-analysis, however, indicated an increase in the attractiveness of fear by enhancing maladaptive responses (fear control).[39] Research reported that the highest level of fear arising from anti-tobacco messages was in the maladaptive group (high threat, low efficacy).[45] According to the EPPM, fear without efficacy may prevent promotion of the healthy behaviors. Research indicated that fear was a fundamental emotional reaction to the risk messages of smoking.[46] Despite the need for accurate measurement of fear for a more accurate classification of the audience in terms of danger control and fear control, there has been low support for it.[43] However, it is claimed that the measurement of fear and its causes based on the EPPM can promote effective healthy behavior.[23,47]

Fear control responses

This part of the questionnaire combines three types of items for measurement of the fear control processes

introduced by Witte[23] indicating all types of maladaptive reactions, including the "defensive avoidance," "message minimization," and "felt manipulated" against risk messages. The factor was called "reacting against the communicator or message." Previous studies indicated that when people perceived low efficacy and believed that there was nothing they could do to reduce risks, they would suffer too much fear and showed maladaptive reactions to fear control against warning messages.[47] Fear control processes are more emotion-based and are adopted rather than actual danger control processes.[23] According to the EPPM, if the individuals' perception of threats is very low, there will be no incentive to adopt healthy behaviors like avoiding the HTS.[23] On the other hand, if their perception of threat is very high and their perception of efficacy is very low, they will only do the fear control instead of adopting the right behavior and reducing danger, and take no action to reduce the threat. As a result, it is necessary to provide a balance between threat and efficacy among components of educational messages. Moreover by developing the right tools and measuring these factors, the adverse effect of messages, and therefore, forming the fear control process could be avoided.[47]

Danger control responses

According to Witte,[23] this type of audience's response to risk messages includes adaptive reactions to actual danger control and a positive change in factors leading to the avoidance of the HTS, like the attitude and intention. The existence of suitable tools for measurement of the attitude, intention, and behavior can generally measure the adaptive reactions for threat control.

Attitude

The "Attitude" factor refers to the individual's general feeling, that is, love or hate behavior, and is a strong variable that explains the behavioral intention for the HTS.[18] In the present study, its concept meant that the less the desirability of the HTS, the more the intention to avoid the HTS. In a recent systematic review, the positive attitude toward the HTS meant fun, pleasure, engagement, and relaxing, and a concerted effort by health professionals, academics, and policymakers was reported to be necessary to address students' misconceptions and provide education for changing the attitude and behavior toward avoiding the HTS.[21,22] Besides, the necessity to develop valid tools for the measurement of attitude toward the HTS was emphasized to monitor the effectiveness of interventions.[22,23]

Intention

The "intention" was another factor extracted in the present tool; its assessment could indicate the success or failure of the using EPPM[23,24,48] and show the reaction to threat control in individuals. On the other hand, it could

be a good predictor of actual behaviors in individuals.[49] If the intention for starting a behavior is weak, it may not lead to the desired performance.[50] The direct correlation between perceived threat and behavioral intention has been already hypothesized,[48] but testing such hypotheses in the field of the HTS requires a tool such as the tool in the present study. A study indicated that the higher perceived threat led to a higher attitude and intention in people with high efficacy.[43] A newer study found that smokers with high levels of efficacy and the perceived threat had a lower positive attitude than novel smokeless tobacco products and probably less intention to consume Snus in the future.[45] On the other hand, research indicated that people, who quitted smoking, might do not change their behavior due to the gap between attitude and behavior.[51] Given the various results, it seems that the EPPM-HTSQ, which specifically addresses the perceptions and behavioral intention, can help make these connections more transparent.

Control process through compensation

In this study, "Focusing on superior rewards" was the new exploratory factor that was added to the default model based on the results of a qualitative study and suggestions of the research and approval of the expert panel team. Hookah users express a kind of reaction to compensate for the dangers of hookah by emphasizing the assumption of superior rewards of the HTS. In some other studies, concepts relatively similar to this factor also mean the impact on individuals by performing unhealthy behavior or not doing the recommended healthy behavior.[52] For instance, the perceived rewards due to the effects of smoking have been reported by researchers.[17,37] A study indicated that young people, who perceived higher rewards about smoking, had higher intentions and more smoking behavior.[37] In a study, students who smoked were somewhat aware of complications and dangers of smoking, but they did not quit smoking because of rewards, including being with friends and accepted by them, having good feelings, filling a gap of loneliness, feeling of happiness among their friends, having a feeling of comfort and relaxation, and having fun received from the unhealthy behavior.[17] According to Rogers, the perceived threat decreased in the threat appraisal process with any reward from doing an unhealthy behavior. Therefore, the more the perception of these rewards is greater than the perception of the severity and susceptibility, the more the maladaptive responses increase.[23] Therefore, it is suggested that this variable be measured in addition to the model's constructs when using EPPM.

Reliability

The internal consistency of the nine dimensions of the questionnaire was at an acceptable level based on Cronbach's alpha (0.87 to 0.95).[33] Calculation of the ICC

indicated that the stability of the questionnaire was from 0.985 to 0.998 for constructs of the model, and 0.997 for the whole instrument. In general, the EPPM-HTSQ is not only desirable in terms of criteria indicating the accuracy and stability of the tool[53] compared to previous tools relating to the HTS,[25,54,55] but it also measures a newer combination of variables within a validated theoretical framework.

Conclusion

The final version of the EPPM-HTSQ with 71 items and 9 factors is a valid and reliable tool to identify factors relating to the HTS in the Iranian female university students. It can be used in various situations by women health researchers and policymakers, especially in the development and evaluation of theory-based interventions in the field of tobacco.

The present study provided a new tool for measuring factors relating to the HTS in women. In addition to ten variables of the EPPM, it included a new fully relevant variable called "Focusing on superior rewards." According to the research team, the new variable was probably an important response to risk messages, indicating the need for further studies to test such a hypothesis. It seems that adding this type of response in the EPPM can increase its ability to explain changes caused by educational messages relating to the HTS. Other strengths of the present study were the new classification of items of perceived threat, and extraction of new variables called the "Perceived physical threat," which expressed the student's perception of the susceptibility and severity of diseases and their physical complications, and the "Perceived social threat" which reflected the social problems and consequences of the HTS. Therefore, the EPPM-HTSQ not only measured the factors relating to the HTS with a new look and combination and an approved theoretical framework but was also better than previous tools in terms of validity and reliability.

This study had some limitations, for instance, the psychometric stages of the questionnaire were performed on a group of female university students, and it is unclear whether investigating the male students will yield similar results. The lack of confirmatory factor analysis was another limitation of the present study; hence, it is suggested in future studies for obtaining higher validity.

List of abbreviations

HTS: Hookah Tobacco Smoking
EPPM-HTSQ: Extended Parallel Process Model-Hookah Tobacco Smoking Questionnaire
EFA: Explanatory Factor Analysis
CVR: Content Validity Rate
CVI: Content Validity Index
ICC: Intraclass Correlation Coefficient.

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