Validity and Reliability of Socio-Cognitive Determinants of Water Intake Questionnaire in Kidney Stones Patients

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Abstract

Background Developing a valid and reliable questionnaire is an important step in field studies. This study aimed to evaluate the psychometric propertiesof the socio-cognitive determinants of water intake questionnaire behaviors among patients with kidney stones in the west of Iran.Methods Construct items were elicited from interviews with kidney stones patients, experts and socio-cognitive items pool-related similar questionnaires. Internal consistency, face, content, and construct validity were evaluated. Data were analyzed by SPSS (ver. 20.0).Results Based on Eigenvalues of ≥ 1.00 and factor loadings of ≥ 0.40, five determinants were extracted. The calculated Kaiser–Meyer–Olkin (KMO) value was 0.697. The socio-cognitive determinants of water intake questionnaires were found to have acceptable internal consistency (Cronbach alpha of determinants between 0.65-0.85) and the theoretical assumptions for face, content, and construct validities were confirmed. The Intra-class Correlation Coefficient (ICC) of socio-cognitive determinants was high (ICC between 0.810 - 0.911). Overall, the five studied socio-cognitive determinants explained 73.83% of the variance in the proposed model.Conclusions The socio-cognitive determinants of water intake questionnaire were revealed to have an acceptable psychometric evaluation. The questionnaire could be used to predict or explain water intake behavior in order to develop programs to increase water intake behavior among kidney stones patients.

Background

A kidney stone is the most common disorder of the urinary tract.[1] Due to changes in diet (high fat, salt, animal protein diet), obesity, and a lack of physical activity, and generally in lifestyle the prevalence of kidney stones increasing gradually.[2],[3] The calcium oxalate ($C_2H_2CaO_5$) accounted for 80% of all kidney stones and may be caused by infections, environmental and metabolic factors. [4] symptoms of the kidney stones consisting; hematuria (blood in the urine), blockage of urine flow, kidney colic, urinary tract infections, flank pain, and or nausea/vomiting; In addition, kidney stones have been associated with an increased risk of major chronic diseases such as cardiovascular.[5] Kidney stone affects approximately 12% of the world population.[6] The relapse rate of kidney stones reported 32% after 5 years and 53% after 10 years.[7] the majority of the diagnosed kidney stones

patients are middle-ages, around 30 to 60 years and males are the most affected, 10-20% versus 3-5% of females.[8] Prevention of kidney stones is necessary and in this regard, previous studies showed that inadequate water intake is associated with more incidence of kidney stones.[9] According to the American Urological Association Medical Management of Kidney Stone Guidelines, stone former should have a minimum urine output of 2.5 L, daily.[10]Increasing in water intake is a cost-benefit prevention strategy for kidney stones; however, despite this simple prevention strategy, most of patients not intake an adequate fluids. [11]Motivating patients with kidney stones to maintain increased water intake behavior first requires an understanding of the determinants influencing this behavior. [12, 13] In water intake promotion development programs, it would be useful to health educators know how cognitive related determinants, such as barriers, social norms or beliefs are responsible to explain behavior. [14, 15] Additionally, certain cognitive determinants, such as attitude, subjective norm, and perceived self-efficacy seem to be significant determinants in determining the probability of adopting or rejecting a healthy behavior. [12] As a result, it is important to identify the cognitive determinants that may determine the water intake among kidney stones patients. [16-20].

According to the absence of studies in developing countries, our study focused on evaluate the initial validity and reliability of a socio-cognitive determinants questionnaire related to water intake in a sample of kidney stone patients in Iran.

Methods

Item Generation

The water intake questionnaire for kidney stones patients was developed to evaluate cognitive determinants that explain water intake behavior among kidney stones patients. Items were at first generated according to the interviews with 38 kidney stones patients and 12 experts, such as health educator and promoter, nephrology, health policy maker, health care management, nurses, and renal dieticians. As well as, our items pool were developed from the questionnaires of socio-cognitive determinants related to the water intake.[16],[17],[18],[19],[20]Interviews with kidney stones patients and experts were collected by one MSc health education and promotion student in a face-to-

face interview style (15–25 min). After explaining the study's subjects, the participants signed consent forms, were interviewed separately by the interviewer. Plus, the interviewers had been trained to ensure that the participants completely realized their words.

The socio-cognitive determinants related to the water intake including; 23 items that measured the five constructs of 1) three items measured the perceived severity (e.g. "Inadequate water intake increases the probability of kidney stones relapse."). Four items measured the positive attitude towards water intake (e.g. "Water intake decreases the probability of kidney stones relapse."). Five items measured the subjective norms encouraging for water intake (e.g. "My family encourages me to drinking water").Five items measured the self-efficacy towards water intake (e.g. "I am confident drink water before feeling thirsty."). Six items measured the perceived barriers (e.g. "I don't drink water if I don't feel thirsty."). In order to facilitate subjects responses to the items, all items were scored based on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Validating the Questionnaire: Use of Face, Content and Construct Validities

The validity of the questionnaire was evaluated by using of face validity, content validity, and constructs validity.

Face Validity

The qualitative method was used for evaluating face validity. In order to evaluate the face validity, a panel of 12 experts, such as health educator and promoter, nephrologists, health policy maker, health care management, and nurses were face-to-face interviewed to approve the difficulty, relevancy, clarity, and ambiguous of the questionnaire. Comments from the expert group were taken and minor modifications were made to some of the items based on expert opinions.

Content validity

Content Validity Ratio (CVR) and Content Validity Index (CVI) were used to evaluate content validity. [21]For this purpose, the questionnaire was given to a panel of 12 experts, including from six health educators, two health policymakers, two psychologists, and two urologists. From the experts were asked to score each item by the following rankings as "completely necessary", "useful but unnecessary", and "unnecessary". So, the CVR was calculated using the "necessity" and "total item

scores". To evaluate CVI, from the experts were asked to answer the following question, "did the items measure what they were intended to measure?" using a 4-point Likert scale in order to evaluate relevancy. A CVI value of each item was computed by dividing the number of experts who rated it as content valid (a ranking of 3 or 4) to the total number of experts. The total CVI value was calculated by dividing the sum of the "3" and "4" scores from each expert to the total number of experts. According to the Lawshe table the minimum value for acceptable CVR and CVI were considered 0.62 and 0.79, respectively. [22]

Construct Validity

To evaluate the construct validity, firstly, the Classical Item Analysis (CIA) was used. In the CIA method, the mean, standard deviation, and Corrected Item-Total Correlation (CITC) of each item were calculated. Secondly, the Exploratory Factor Analysis (EFA) with VARIMAX rotation using factor loadings of 0.40 was used to allocate items and to determine the degree which this factor structure replicated the original. The Kaiser–Meyer–Olkin (KMO) measured the sampling adequacy. The factorability of items was evaluated using the Bartlett test. Scree plot was used to confirm the strengths of the exploratory agents. Likewise, to determine agents, the values were equal or greater than 1.3 was considered.[23] The EFA evaluated by conducting a cross-sectional study of 115 kidney stone patients during 2018. Participants selected based on a convenience sampling method among kidney stone patients who referred to Imam Reza Hospital (IRH) in Kermanshah, the west of Iran. Only the subjects who diagnosed with the kidney stone were eligible to participate in the study. In addition, participants with incomplete personal or medical information and/or did not formally consent to participate, were excluded. Among the 115 kidney stone patients, 100 patients signed the consent form and voluntarily agreed to participate in our study. Therefore, the response rate was 86.9%.

Known-group validity

To evaluate the known-group validity of the questionnaire, the association between water intake status and socio-cognitive determinants was tested using an independent sample t-test (Table 5). The respondents were categorized into 2 water intake adherence groups based on their water intake per day: poor (lower than 2-liter) and good (2-liter and more).

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Reliability

The reliability of the questionnaire was evaluated by examining its internal consistency via

Cronbach's alpha. Considering Cronbach's alpha, a threshold of 0.70 was acceptable. Moreover,

means and standard deviations (SD) were used for both the test-retest reproducibility between the

two periods using the Intra-class Correlation Coefficient (ICC) with its 95% confidence interval. In

order to evaluate ICC the number of 20 patients was randomly selected from the participants in the

current study to perform test-retest after two weeks.

Statistical Analysis

All data analysis was performed using the statistical package for social sciences (SPSS) (Version 20.0;

IBM Corporation, Chicago, USA). A probability value (p-value) of less than 0.05 was considered

statistically significant.

Results

The mean age of respondents was 45.35 years [95% CI: 42.56, 48.13], ranged from 20 to 70 years.

More details of demographic characteristics of the participants are shown in **Table 1**.The mean water

intake of respondents was 930.01 cubic centimeter (cc) [95% CI: 804.96, 1055.03], ranged from 200

to 3000 cc. In addition, only 9% of participants reported they had 2 and more liters water intake

during a day.

Table 1: Distribution of the demographic characteristics among the participants

Variables	Percent
Sex	
Female	29
Male	71
Marital status	
Married	90
Single	10
Education	
Illiterate	21
Primary school (1-6 grade)	36
High school (7-12 grade)	21
Academic (13-16 grade)	22
Economic status	
Independent	65
Dependent	35
Health insurance	
Yes	88
No	12
Location	
Urban	74
Rural	26

The item impact method of all the sentences was more than 1.5 and, so; none of the twenty three items were omitted. Based on Lawshe's table, the acceptable lower limit for the CVR have been considered 0.62 and for CVI was 0.79.Indicating content validity ratio and index for the all items was acceptable. In the CIA method, we found that one item from attitude construct, three items from attitude construct perceived barrier, one item from perceived self-efficacy construct, and one item from subjective norms construct had CITC less than 0.40, and were deleted (**Table 2**).Therefore, eighteen finalized items were applied for the explanatory and confirmatory factor analysis.

Table 2: Items deleted in CIA

No	Item	Construct	Reason of deleted
1	Water intake is beneficial in prevention of kidney stone relapse.	Attitude	CITC under 0.4
2	I'm not sure that the water city's is healthy.	Perceived Barrier	CITC under 0.4
3	Control of urinary for me more important than of kidney stone disease.	Perceived Barrier	CITC under 0.4
4	I do not like to water intake.	Perceived Barrier	CITC under 0.4
5	My friends encourage me to extra water intake.	Subjective Norms	CITC under 0.4
6	I can ask from my friends about the benefits of water intake.	Perceived Self-efficacy	CITC under 0.4

The reliability of socio-cognitive determinants expressed in the Intra-class Correlation Coefficient was

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shown in **Table 3**.

Table 3: Evaluation of ICC (Test-retest study)

Constructs	ICC	95% CI for ICC
Perceived Severity	0.856	0.545-0.948
Attitude	0.883	0.729-0.952
Subjective norm	0.810	0.586-0.920
Perceived self-efficacy	0.911	0.793-0.964
Perceived Barrier	0.870	0.704-0.946

In addition, as can be seen in Table 4, estimates of the reliability by using Cronbach's coefficient alpha, and our result showed the reliability coefficient for the all cognitive variables suggested that the internal consistency was adequate. The seventeen items were factor analyzed. The KMO test, which is the efficiency index of the sampling, was measured at 0.697. Bartlett's Test was also significant ($P<0.001$) which indicated the data are suitable for the factorial analysis. Based on Eigen values of ≥ 1.00 and factor loadings of ≥ 0.40, five factors were extracted, accounting for 73.83% of the variation. More details of exploratory factor analysis are shown in Table 2. Furthermore, the scree plot diagram of factors is shown in Figure 1.

Table 4: Obtained result of the exploratory factor analysis

No	Items	1	2	3	4
	(4) Perceived Severity				
1	Inadequate water intake increases the probability of kidney stones relapse.				0.716
2	Inadequate water intake may lead to the chronic kidney diseases.				0.710
3	Inadequate water intake increases the severity of my disease.				0.825
	(3) Attitude				
1	Water intakedecreases the probability of kidney stones relapse			0.748	
2	Water intake could be usefulness for kidney stones prevention.			0.828	
3	Water intakemaycontrol the complications of kidney stones.			0.868	
	(5) Subjective norm				
1	My family encourages me to water intake.				
2	Health care members encourage me to water intake.				
3	Other patients encourage me to water intake.				
4	Most persons who are important to me think I should increase water intake.				
	(1) Perceived Self-efficacy				
1	I am confident drink water before feeling thirsty.	0.810			
2	I am confident to consult with my doctor about a benefit of water intake.	0.977			
3	I am confidentdrink water even I do not desire.	0.964			
4	I believe that I am confident daily drink at least 2 L water in order to prevent kidney stones.	0.962			
	(2) Perceived Barrier				
1	I forget to drink water, occasionally.		0.687		
2	I don't drink water if I don't feel thirsty.		0.951		
3	I don't drink water at least 2 L daily, because of need to void frequently.		0942		
-	Variance (%)	24.20	17.89	13.39	10.75
-	Total Variance	73.83			
-	Alpha coefficient of the structures	0.73	0.80	0.65	0.85

Finally, the results related to known-group validity of the questionnaire and sex differences in socio-

cognitive determinants of water intake among the participants were shown in Table 5.

Table 5: Known-group validity of the questionnaireand sex differences in socio-cognitive determinants of water intake among the participants

	Perceived Severity Mean (SD)	Attitude Mean (SD)	Subjective norm Mean (SD)	Perceived self-efficacy Mean (SD)	P M
Known-group validityof the questionnaire					
Poor (lower than 2-liter)	4.95 (2.38)	13.66 (2.09)	17.02 (3.53)	8.37 (4.44)	6.
Good (2-liter and more)	6.11 (3.37)	13.44 (2.01)	16.22 (5.19)	13.66 (5.31)	3.
P-value	0.186	0.761	0.537	0.001	0.
Differences in socio-cognitive determinants of water intake					
Women	4.37 (1.69)	13.96 (2.11)	17.53 (4.01)	8.41 (4.25)	6.
Men	5.33 (2.70)	13.51 (2.06)	16.71 (3.55)	9.02 (4.95)	5.
P-value	0.036	0.328	0.323	0.560	0.

Discussion

The aim of current study was to determine the psychometric evaluation of socio-cognitive

determinants of water intake questionnaire among kidney stones patients. Our finding suggested that the socio-cognitive determinants of water intake questionnaire were found to have acceptable internal consistency (Cronbach alpha of determinants between 0.65-0.85) and the theoretical assumptions for face, content, and construct validities were confirmed. Furthermore, the ICC of socio-cognitive determinants was high (ICC between 0.810 - 0.911).This result is similar to the results reported by other studies. For example, Lindberg and Fernandes carried out research on 113 Portuguese hemodialysis patients with the aim of assessment fluid intake appraisal inventory and indicated the psychometric evaluation of the questionnaire is acceptable. [18] As well as, Arya et al showed their questionnaire for measuring the fluid intake, output, behavior, and urinary symptoms are valid and reliable. [19]In addition, Crary et al carried out the study with aim of psychometric analysis of a functional oral intake questionnaire for stroke patients and indicated this questionnaire had adequate reliability, validity, and sensitivity to change in functional oral intake. [24]Our findings suggested that our questionnaire has adequate reliability and validity.

Known-group validity also showed that patients who consumed 2 liters or more of water per day had significantly higher self-efficacy and lower perceived barriers. In line with our study, Gordon et al stated that the perceived barrier was important determinants in fluid intake among patients with kidney stones.[26] An important strategy to increase fluid intake was fluid intake when they do not feel thirsty. Moreover, McCauley et al, in their study indicated important barriers to fluid intake were categorized into three general categories including (a) not knowing the benefits of fluid intake, (b) disliking the taste of water and lack of thirst, and (c) need to void frequently.[16] Furthermore, Tarplin et al, reported patients successful at fluid intake were less likely to report the barriers.[26] In addition, self-efficacy is one of the determinants for better understanding how patients with kidney stones adherence to fluid intake.[16] Tarplin et al indicated only 32.7% of patients repotted being very successful with their fluid intake.[26] It seems tailoring education toward an individual's specific barriers and self-efficacy to behavior change could be increasing their chances at success.

Leung et al in their study states that the having valid and reliable tools is necessity for develop effective theory-based health promotion programs.[27]Our questionnaire could be used to predict or

explain water intake behavior in order to develop programs to increase water intake behavior among kidney stones patients.A benefit to using this tool is that the information obtained can be used in clinical practice to tailor interventions program for patients with kidney stones.

Our findings showed that the mean score of perceived severity among women patients was significantly lower than men patients. Other determinants did not show significant statistical between sex differences. Several studies showed that the perceived severity was important factor that predict behavior.[28],[29] Our findings also indicated patients who are good water intake (2-liter and more) compared with poor water intake group (lower than 2-liter) reported higher perceived severity. Based on this finding, it seems that educational interventions are needed to improve perceived severity, especially among women patients.

Our findings indicated only 9% of patients reported they had 2 and more liters water intake during a day. In this regards, Gordon et al in their study reported that the majority of patients (about 60%) unsuccessful to fluid intake.[25]Increased fluid intake has been proposed as an inexpensive strategy to prevent kidney stones.[30]The comparison of our findings with similar studies conducted abroad showed the water intake is much lower among Iranian kidney stones patients compared to develop countries. These findings can be warning to health policy makers in Iran; and should be the focus of special attention. These results indicated the necessity to provide training among Iranian kidney stone patients about the easiest way to prevent relapse (more than two liters per day).

The present study has limitations. First, our sample included kidney stones patients in the west of Iran. Nevertheless, representatives of other populations were not available in the current study. Second, according to the non-probability of data collection; our findings may be not generalized to other groups of kidney stone patients. Third, not evaluation of the external validity of questionnaire was another limitation in our study. Future studies to evaluation external validity are necessary. Fourth, Predictive validity of urinary frequency questionnaire has not been assessed. Finally, another limitation in the present study was the lack of attention to the threshold of thirst.

Conclusion

Moussa and Chakra in their study among patients with kidney or ureteral stone in Beirut reported that

most patients were not receiving kidney stones prevention counseling.[31]Urologists and clinical nurses play an important role in advice for patients' prevention of kidney stones. Additionally, design evidence-based intervention to kidney stone patients in order to increase water intake is important. Our study has provided significant information for health planning programmers to develop water intake promotion programs among kidney stone patients. In other words, the use of our scale may be useful for guiding implementers to evaluation the determinants related to water intake and the development of effective health promotion programs among Iranian kidney stone patients. In general, we have found that using the current questionnaire helps us to identify the predictors of low water intake in patients with kidney stones. Knowing exactly where the problems with water intake occur can be helpful in focusing interventions for the patient with kidney stones. Finally, the validity and reliability of the instrument proposed for the cognitive constructs are adequate to support using this questionnaire in research of prediction of water intake among Iranian kidney stones patients.

Abbreviations

ICC	Intra-class Correlation Coefficient
CIA	Classical Item Analysis
CITC	Corrected Item-Total Correlation
CVI	Content Validity Index
CVR	Content Validity Ratio
EFA	Exploratory Factor Analysis
KMO	Kaiser–Meyer–Olkin
IRH	Imam Reza Hospital
SPSS	Statistical Package for Social Sciences

Declarations

Ethics approval and consent to participate

The research ethics committee at deputy of research of the Kermanshah University of Medical Sciencesin the west of Iran had approved the study protocol (KUMS.REC.1397.045). Further, the participants had been given the participant information statement, and had signed the written consent form. Individual personal information was kept confidential.

Consent for publication

Not applicable.

Availability of data and material:

Please contact the corresponding author for data requests.

Competing interests

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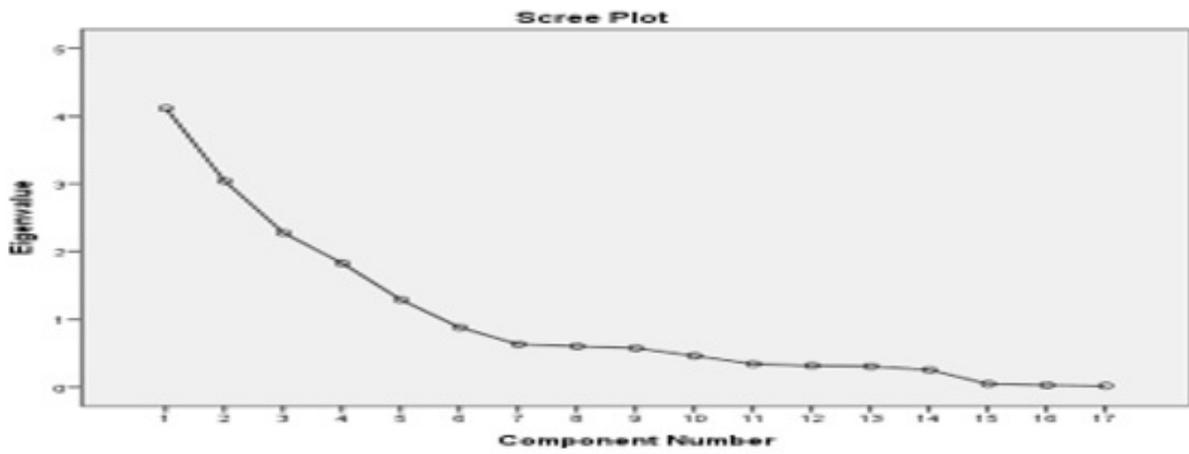emergency medicine. 2019; 19(1):48.

Figures

Figure 1

The scree plot of the structures studied among the participants. The scree plot diagram of

factors is shown in Figure 1.