ORIGINAL RESEARCH PAPER

Health Science

DEVELOPMENT OF "METABOLIC SYNDROME KNOWLEDGE LEVEL SCALE (METS-KS)" AND ITS VALIDITY AND RELIABILITY STUDY FOR TURKEY

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ABSTRACT

Aim: We aimed to develop the Metabolic Syndrome Knowledge Level Scale (MetS-KS) for Turkey, and to determine the validity and reliability of this scale.

Material-Methods: This study has been carried out in two stages. The first stage: MetS-KS was developed and its validity and reliability were studied. The second stage: The construct validity of MetS-KS was retested by Confirmatory Factor Analysis (CFA) on another study group.

Results: Of 477 individuals who constituted the study group, 250 (52.4%) were males. The item difficulty indices of the items of MetS-KS were between 0.40 and 0.74. Correlation coefficients of the corrected items ranged from 0.46 to 0.82. In our study, 27% of the upper group have higher median score (22.0 (min: 20.0, max: 25.0) than 27% of the lower group (1.0 (min: 0.0, max: 15.0), (z=15.558; p<0.001). For MetS-KS, the Cronbach's alpha coefficient was 0.95. When any of the items were removed, the Cronbach alpha coefficient was not significantly increased (p>0.05). *Confirmatory Factor Analysis (CFA)* was performed to test the construct validity of MetS-KS in *Exploratory Factor Analysis (EPA)*. In CFA, the following results were obtained: 2 / df value was 2.26. *Root Mean Square Error of Approximation* (RMSEA) was 0.06. *Standardized Root Mean Square Error* (SRMR) was 0.04. *Comparative Fit Index* (CFI) was 0.92. *Goodness of fit Index* (GFI) was 0.86, and *Adjusted Goodness of fit Index* (AGFI) was 0.83.

Conclusion: MetSKLS is a valid and reliable measurement tool for assessing MetS knowledge level for Turkish population.

Introduction:

All over the world, Metabolic Syndrome (MetS) is an important public health problem that is increasing in frequency in recent years. Chronic problems such as abdominal obesity, dyslipidemia, hypertension, hyperglycemia is found as comorbidity in MetS [1]. There are also different names for MetS such as Syndrome X, insulin resistance syndrome, and several diagnostic guidelines have been developed for MetS [2]. There are five criteria according to *National Cholesterol Education Program-Adult Treatment Panel-3 (NCEP ATP III)* : "1) Abdominal obesity (waist circumference is 102 cm in males and 88 cm in females), 2) Blood pressure height (systolic blood pressure > 140 mmol / L, and diastolic blood pressure > 90 mmol / L), 3) hyperglycemia (≥ 110 mg / dL of fasting blood glucose), 4) hypertriglyceridemia (≥150 mg / dL), and 5) low HDL (<40 mg / dl in males and < 50 mg / dl in females)" . If there are three of five criteria, diagnosis is as MetS [1]. The etiology for MetS has not been fully elucidated. Genetic factors, advanced age, gender (females), physical inactivity, atherogenic diet, obesity and insulin resistance are the most important risk factors [3, 4]. Unhealthy lifestyle behaviors, such as high calorie nutrition and physical inactivity, as cause obesity and insulin resistance, have been facilitating the development of MetS. In addition, with cause of leading to both insulin resistance and lipid metabolism disorders, some genetic disorders are the basis for MetS [3, 5].

Studies conducted in recent years have reported that the frequency of MetS increases with the increase in the frequency of obesity. "Obesity and Mets" comorbidity also increases the frequency of other risk factors such as Type 2 Diabetes Mellitus.

MetS risk factors are also risk factors for cardiovascular diseases. Risk of cardiovascular disease and mortality rates increase in individuals with MetS [2, 6].

In the United States, the prevalence of MetS is reported as 20% among twenty and upper, and as 40% among sixty and upper years group adults [7, 8]. In other studies, MetS prevalence has been reported to vary between 7.9% and 43%, with 56% in females and 7% in males. For Turkey, MetS prevalence has been reported as 45.0% in females and 32.2% in males [9-14].

MetS is a preventable and treatable clinical problem. For individuals with MetS, primary prevention measures such as lifestyle changes, personalized nutrition recommendations, and exercise programs are priorities. Due to both side effects and high cost, pharmacological treatment methods are considered as secondary prefers for individuals with MetS [4, 15]. Increased knowledge of the clinical status of Patients with MetS has been reported to improve treatment compliance. It has also been reported that these patients are more likely to apply the recommended lifestyle behaviors and have a better disease course [16, 17]. Likewise, individuals with MetS may be more likely to practice healthy lifestyle behaviors, that is the most important step in the prevention / treatment of MetS [4].

For these reasons, it is necessary to first determine current status for the knowledge level of the MetS in the planning of health education. Prior to this study, researchers could not find an accepted, widely used, valid and reliable scale for determining the MetS knowledge level in literature for Turkey.

For this reason, we aimed to develop the Metabolic Syndrome Knowledge Level Scale (MetS-KS) for Turkey, and to determine the validity and reliability of this scale.

Material-Method:

This study has been carried out in two stages. The first stage: MetS-KS was developed and its validity and reliability were studied. The second stage: The construct validity of MetS-KS was retested by Confirmatory Factor Analysis (CFA) on another study group.

Development of MetS-KS and the Construct Validity:

Firstly, a comprehensive literature search was performed for preparing of MetS-KS. A pool of questions was established according to the NCEP ATP III criteria. Afterwards, MetS-KS was created by selecting 30 items from the question pool in the direction of expert opinions [1, 2, 9, 10, 13, 16]. The items prepared by using the English sources were first translate to Turkish and then re-translated to English. A pre-study was conducted on the group with 15 people to see if there were any statements that could not be understood in the 30-item form. After the pilot study, it was seen that two items of the scale, that were "*Metabolic syndrome treatment reduces the risk of cardiovascular disease*" and "*Metabolic syndrome is an infectious disease*" were not understood enough. It was decided to remove these items from the scale by consulting the experts.

Study design, Study area, Study group and Procedure:

This study was a methodological study, and conducted in adults who applied to the Family Health Centers (FHCs), between 01.10.2017-30.10.2017 in the center of Eskisehir city in Turkey.

Eskisehir is located in the Central Anatolia region of Turkey. The total population is 844,842. Male's population is 421,580 (49.9%), and female's population is 423,262 (50.1%). And 86.7% of the population lives in the city center. People's subsistence is based industry in the city center, and agriculture and animal husbandry in the periphery districts [18].

There are two districts in the center of Eskisehir: Odunpazari and Tepebasi. There are 29 FHCs in Odunpazari and 26 FHCs in central Tepebasi. With randomization method, 3 FHCs of the Odunpazari (Emek, Kemal-Nurhan Mani, Yenikent) and 3 FHCs of Tepebasi (Fevzi Cakmak, Batikent, Camlica) were selected.

The number of individuals to be reached in a validity-reliability study of a new scale should be 10-20 times the number of items on the scale [19]. In this study, the study group consists of 477 individuals.

The development of MetS-KS was carried out in two stages. In the first step, the validity and reliability analyzes of MetS-KS were conducted by interviewing 477 individuals. In the second step, a CFA was performed on a separate study group of 300 individuals, giving the final shape to MetS-KS.

In the study, a questionnaire form was prepared for the purpose of the collecting data.

The first part of the questionnaire is related to some sociodemographic characteristics (age, sex, education level etc.), and MetS risk factors in the first degree relatives.

The second of the questionnaire consists of the elements of MetS-KS that created by researchers.

Interviews with the participants were held in a quiet room in FHCs. The questionnaire was filled by the researchers with face-to-face interview technique. Each process took about 15-20 minutes.

Defines:

In the study, those who have had any of the previous tests such as blood pressure measurement, lipid profile measurement, measurement of waist circumference, starvation blood glucose were accepted as "individual who made health screening".

In parents / children, if the presence of any of the clinical conditions such as lipid profile impairment, hypertension, hyperglycemia, and high waist circumference (102 and upper centimeters in males, 88 and upper centimeters in females), it was accepted as "There is a risk of MetS in his / her family members".

Validity-Reliability Analyses
Item Analysis:

For decide which materials should be included in the evaluation tool, from item analysis methods, "*item difficulty index*", "*corrected item-total correlation coefficient*" and "*comparison of item averages for upper and lower 27% groups*" were used [19].

Determination of construct validity:

In order to determine the construct validity of MetS-KS, "*Exploratory Factor Analysis (EFA)*" was performed in the first stage. The overall significance of the *correlation matrix* obtained with EFA was assessed by *Bartlett's sphericity test*. The suitability of the sampling for factor analysis was assessed by *Kaiser-Meyer-Olkin* (KMO), which is a measure of sampling adequacy.

The *Factor Load Value*, which is the correlation coefficient that defines the relation of the items with the related factor, was found to be at least 0.50. The factor structures obtained with EFA were tested with CFA.

Internal consistency:

The *Cronbach alpha coefficient* was calculated to determine the internal consistency of the developed MetS-KS.

Predictable validity:

For predictable validity, the scores from MetS-KS were compared with the level of education, age group, health screening status and risk factors for MetS in first-degree relatives.

Scoring of the Scale:

Three items were removed according to EFA result. And 28 items dropped to 25 items. The final form of MetS-KS consists of *25 items* and a sub-dimension. The 5th, 12th, 15th, 21st, 25th items are the reverse proposals. Each *correct answer* is awarded a "1" score. "*Wrong / Do not know*" answers are scored as "0". MetS-KS has no cut-off value. As the score increases, the level of knowledge increases.

Permits:

Eskisehir Osmangazi University Non-Interventional Clinical Research Ethics Committee was approved for this study. Eskisehir Provincial Health Directorate received written permission. Verbal approvals of all participants were received.

Statistical Analysis:

The data obtained in our study was evaluated in the *IBM SPSS (version 20.0)* package program in computer environment. *Mann Whitney U* and *Kruskal Wallis* tests were used in the analysis of the data. Statistical significance level was evaluated as $p < 0.05$.

Results:

Of 477 individuals who constituted the study group, 250 (52.4%) were males, and 227 (47.6%) females. The mean age of the study group was 42.56 ± 15.66 years (min: 18, max: 85). The number of individuals who have middle school and then lower education level was 236 (49.5%). The number of individuals who have health screening for MetS risk factors was 279 (58%).

Results of item analyses:

The item difficulty indices of the items of MetS-KS were between 0.40 and 0.74. Correlation coefficients of the corrected items ranged from 0.46 to 0.82. In our study, 27% of the upper group have higher median score (22.0 (min: 20.0, max: 25.0) than 27% of the lower group (1.0 (min: 0.0, max: 15.0), ($z=15.558$; $p<0.001$).

Factor Analysis:

According to the 0.966 KMO value handled from EFA, and Bartlett's test results ($p < 0.001$), it was decided that the obtained

data were suitable for factor analysis.

In EFA, since the factor loads of 2nd, 9th, and 13rd items was less than 0.50, it was subtracted from the scale. MetS-KS' 25 items were collected under one dimension. In addition, it accounts for 47.4% of the variance. Factor loads of 25 items ranged from 0.50 to 0.85.

Factor loads of the items of MetS-KS, and reliability analysis results are presented in Table 1.

Internal consistency:
For MetS-KS, the Cronbach's alpha coefficient was 0.95. When any of the items were removed, the Cronbach alpha coefficient was not significantly increased (p>0.05).

Confirmatory Factor Analysis:
Confirmatory Factor Analysis was performed to test the construct validity of MetS-KS in EFA. In CFA, the following results were obtained: 2 / df value was 2.26. *Root Mean Square Error of Approximation* (RMSEA) was 0.06. *Standardized Root Mean Square Error* (SRMR) was 0.04. *Comparative Fit Index* (CFI) was 0.92. *Goodness of fit Index* (GFI) was 0.86, and *Adjusted Goodness of fit Index* (AGFI) was 0.83.

Measured model for MetS-KS is presented in Figure 1.

Predictable validity:
MetS-KS scores were were lower in those who had: Being in advanced age, having low education level, not having health screening, and not having MetS risk factors in the first degree relatives (for each one p<0.05).

Comparison of MetS-KS scores according to some characteristics of the study group was presented in Table 2.

Discussion:
Today, the burden of non-communicable diseases is increasing due to urbanization, unhealthy lifestyle and aging of communities. Each year, approximately 40 million deaths, including 15 million premature (70% of global deaths) are due to non-communicable diseases. Cardiovascular diseases, cancers, respiratory system diseases and diabetes are responsible for 80% of premature deaths [20]. Behavioral causes such as unhealthy nutrition, smoking-alcohol consumption, physical inactivity, and metabolic causes such as hyperglycemia, overweight / obese, hypertension, dyslipidemia are risk factors for non-communicable diseases [21].

MetS is a clinical condition that occurs when multiple metabolic risk factors come together. In addition, it is a multiplex risk factor for atherosclerotic cardiovascular diseases [22].

Just as in non-communicable diseases, to provide healthy lifestyle behaviors to individuals is a priority in both treatment and prevention for MetS also [20]. According to the information-attitude-behavior theory, knowledge levels must be sufficient in order to bring an attitude towards a person. Increasing the level of knowledge causes the development of attitudes and behaviors [23]. As a result of the literature review, it was seen that the studies and measurement tools that assessed the level of MetS knowledge were not sufficient. For this reason, our study aimed to develop

MetS-KS, and its validity and reliability. Items of measurement tools that are prepared to determine the level of knowledge are required no to be very easy or no difficult (item difficulty index). For an item no to be very difficult, at least 20% of those in the study group should have responded correctly. Along with that, for an item no to be very easy, at least 80% of those in the study group should have responded correctly [24]. In our study, the correct response percentage of each item of MetS-KS is moderate and falls within the desired range. Items of a valid and reliable scale should have the ability to distinguish between knowers and unknowns (item discrimination index). For this reason, item discrimination index should be over 0.30. In addition, the 27% upper group's scores should be higher than the 27% lower group's scores [19, 25]. Results from this study show that MetS-KS is distinctive.

EFA was done to determine the structure of MetS-KS. If the higher the factor load in EFA, which determines the relation of each item to the factor structure, the item is more close related to the factor. The item factor load is ≥0.30, which is acceptable. However, ≥0.50 indicates that the item-factor relationship is better [19]. In our study, Because MetS-KS is newly developed and there is no benchmarking tool to compare, the item factor load value is accepted as ≥0.50. In EFA, each item's cumulative variance, which related with the load value and the number of dimensions of the structure, is proposed as 30% and above [26]. In the study, the cumulative variance was calculated as 47.4%. Given the fact that the MetS-KS is one-dimensional and the item factor loads are sufficient, it has been concluded that this cumulative variance value is sufficient.

A reliability analysis, the Cronbach alpha coefficient, which indicates the consistency of the answers given by the study group to the scale items, is ≥0.70 satisfactory, and ≥0.90 indicates that the internal consistency is very good [27]. In our study, the Cronbach alpha coefficient was calculated to be 0.95. This value indicates that the scale items are consistent with each other and with the conceptual structure for MetS-KS.

CFA was performed to confirm the 25-item, one-dimensional factor structure of MetS-KS revealed by EFA. The results of the compliance measures can be interpreted as follows: RMSEA and SRMR are lower than 0.1. And X2 / df value is less than five. Other compliance values are higher than 0.80. All these results show that the metric model proposed for MetS-KS is compatible with the data obtained [28, 29].

Results in our study support that being in advanced age, having low education level, not having health screening, and not having MetS risk factors in the first degree relatives will score lower than MetS-KS. To our knowledge, this is the first scale development study for MetS.

Limitations:
The most important limitation is that no comparative research can be found in the written literature.

Conclusion:
MetS-KS is a valid and reliable measurement tool for assessing MetS knowledge level for Turkish population. However, there is a need to develop of MetS-KS in different societies and different study groups.

Table 1. Factor loads of the items of MetSKLS, and reliability analysis results

Items	Item Difficulty Values	Corrected item total correlation	Cronbach alpha coefficient when the item is removed	Item Factor Load
1. MetS is a clinical condition with high blood pressure, impaired blood lipids, increased waist circumference, and elevated blood glucose levels.	0.55	0.53	0.95	0.56
2. MetS is a common clinical condition.	0.48	0.47	0.95	0.51
3. MetS prevalence increases as age increases.	0.63	0.65	0.95	0.68
4. MetS can be seen in all age groups.	0.65	0.60	0.95	0.63
5. When family members have heart disease, the risk of MetS is reduced.	0.41	0.46	0.95	0.50

6. The waist circumference for MetS is different in males and females.	0.65	0.66	0.95	0.70
7. MetS is more common in females.	0.50	0.51	0.95	0.54
8. A diet rich in saturated fatty acids such as margarine increases the risk of MetS.	0.72	0.69	0.94	0.73
9. Individuals with MetS have a high risk of having a heart attack.	0.71	0.77	0.94	0.80
10. The thickness of the waist circumference is an important component of MetS.	0.56	0.61	0.95	0.65
11. High calorie nutrition is one of the risk factors for MetS.	0.70	0.78	0.94	0.81
12. There is no need to measure blood fat in MetS.	0.47	0.55	0.95	0.57
13. MetS is more common in smokers.	0.58	0.55	0.95	0.60
14. Blood pressure is higher than 130/85 mmHg, one of the components of MetS.	0.56	0.58	0.95	0.62
15. There is no relationship between the amount of alcohol consumed and MetS formation (reverse proposal).	0.50	0.64	0.95	0.53
16. Individuals with MetS are at increased risk of having diabetes.	0.61	0.72	0.94	0.74
17. Physical inactivity (sedanter life) facilitates the formation of MetS.	0.63	0.68	0.94	0.72
18. MetS is a treatable clinical condition.	0.73	0.81	0.94	0.84
19. MetS is preventable.	0.73	0.80	0.94	0.83
20. Changes in lifestyle play an important role in protecting MetS.	0.73	0.81	0.94	0.83
21. Individuals with MetS are less likely to have cancer (reverse proposal).	0.40	0.47	0.95	0.50
22. If lifestyle changes are insufficient in MetS, drug treatment can be applied.	0.68	0.73	0.94	0.76
23. MetS is less common in individulas who are fed adequately and balanced.	0.74	0.82	0.94	0.85
24. Individulas with MetS have a high risk of stroke.	0.61	0.65	0.95	0.69
25. MetS is less common in overweight individuals (reverse proposal).	0.60	0.64	0.95	0.67

Table 2. Comparison of MetSKLS scores according to some characteristics of the study group

Characteristics	MetS-KS Score Median (min - max)	Test value KW/z; p
Age groups (year)		
<40	19.0 (0.0-25.0)	25.131; 0.000
40-59	18.0 (0.0-25.0)	
≥60	13.0 (0.0-23.0)	
Educational level		
Middle school and under	17.0 (0.0-25.0)	42.675; 0.000
Collage	18.0 (0.0-25.0)	
University	20.0 (0.0-25.0)	
Heath screening		
Yes	19.0 (0.0-25.0)	2.112; 0.034
No	18.0 (0.0-25.0)	
MetS risk factors in the first degree relatives		
Yes	19.0 (0.0-25.0)	2.841; 0.005
No	18.0 (0.0-24.0)	
Total	**18.0 (0.0-25.0)**	
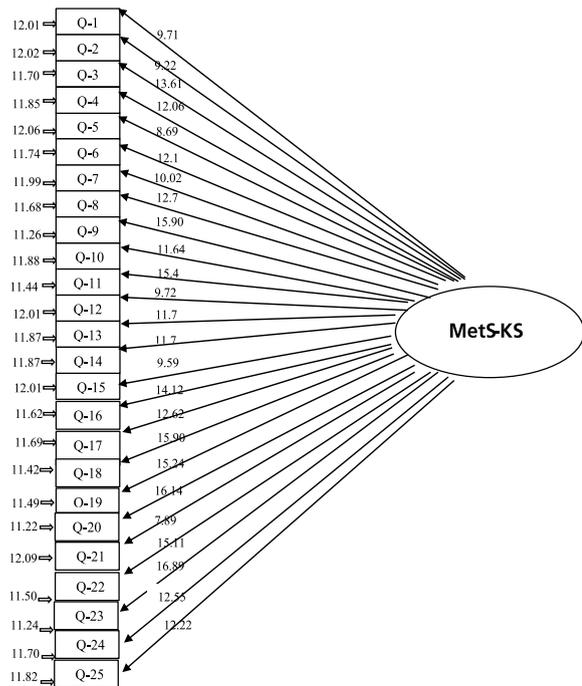
Chi-Square=622.45, df=275, p-value=0.00000, RMSEA=0.065

Figure 1. Measured model for MetS-KS

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