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Metabolic syndrome index measurement tool (MSI): scale development, reliability and validity study

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Abstract

Aim Identifying the risks of metabolic syndrome (MetS) can lead to early targeted interventions and thus contribute to improved quality of life by reducing the risk of developing MetS, diabetes or heart disease in the future. We aimed to develop a valid and reliable measurement tool to measure the MetS risk of the population.

Materials and methods In the methodological study, an item pool was created by reviewing the literature. Pre-application was performed after the weighting of the items whose content validity was ensured by taking expert opinions. Data were collected from 43 patients with MetS from a state hospital affiliated to the Ministry of Health and 405 individuals without MetS from the community, from a total of 448 individuals using the Individual Information Form, Finnish Diabetes Risk Scale (FINDRISC) and Metabolic Syndrome Index (MSI). The data obtained were evaluated using SPSS 22.0 and MedCalc 19.1 statistical programmes. Scale discrimination was analyzed by independent samples t-test between the upper and lower 27% groups. The cut-off point of the scale score in predicting the diagnosis of MetS was tested by ROC analysis. Correlation analysis was performed with the parallel form for criterion validity.

Results As a result of the ROC analysis, a perfectly compatible scale with a sensitivity of 100%, a specificity of 85.43% and a cut-off score of 48 was obtained. When the correlation analyses between MSI and FINDRISC scores were examined for criterion validity, a positive moderate ($r=0.632$, $p<0.001$) correlation was found between FINDRISC and MSI. When the discrimination of the scale was analysed, it was found that there was a significant difference between the lower 27% and upper 27% groups ($p<0.05$) and it was revealed that the MSI made sensitive measurements to discriminate.

Conclusions The MSI scale is a valid and reliable tool for early detection of MetS risk.

Keywords Metabolic syndrome, Diabetes mellitus, Cardiovascular disease, Measurement tool

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Background

MetS, a multiple risk factor for atherosclerotic cardiovascular disease, is defined as a clinical condition in which biochemical and metabolic factors coexist. MetS is characterized by insulin resistance and is also known as insulin resistance syndrome [1]. The World Health Organization (WHO), the National Cholesterol Education Programme III (NCEP-ATP III) and the International Diabetes Federation (IDF) have made definitions focusing on different metabolic changes [2]. The definitions of WHO and IDF are glucose and obesity centred, the definition of NCPE-ATP III is cardiovascular centred, and the common point is that it includes at least three of the risk factors. These risk factors are abdominal obesity, hypertriglyceridemia, high blood pressure, low high-density lipoprotein (HDL) and glucose intolerance [3]. The main cause of the syndrome is the accumulation of adipose tissue and insulin resistance as a result of tissue dysfunction [4]. Proinflammatory cytokines such as tumour necrosis factor, leptin, adiponectin, adiponectin, plasminogen activator inhibitor and resistin are released from the enlarged adipose tissue and the condition adversely affects insulin utilization. Insulin resistance and upper body fat accumulation lead to the development of MetS as vascular and autonomic damage [5].

The prevalence of MetS varies depending on the region, urban or rural environment, the composition of the population studied and the definition of the syndrome used [6]. It is estimated that approximately one quarter of the world's population is affected by MetS and its prevalence is expected to increase in the coming years [7]. The National Health and Nutrition Examination Survey reports that the overall prevalence of MetS is 34–35% [8]. Complications related to Diabetes Mellitus (DM), which is known to be associated with MetS, are known to cause 3.2 million deaths every year in the world. Again, Cardiovascular Diseases (CVD) and their complications, which are among the main components of MetS, are increasing globally and impose a great burden on health systems. It is predicted that the incidence of DM will double in 2025 and the incidence of CVD will increase in parallel with DM [9].

MetS is reported to be associated with an approximately twofold increase in CVD risk and a fivefold increase in DM diabetes risk [10]. MetS is important not only because of its high prevalence rate worldwide, but also because it can help predict the development of DM and CVD [11].

The study conducted by Bulut et al. to determine the MetS risk factor of medical students was carried out with the questionnaire questions asked with the JAMRISC (Japanese Metabolic Syndrome Risk Score) scale and no adaptation study of the related scale to Turkish culture was found [12]. Metabolic Syndrome Research Form (MSAF) was developed by Dr Onur Erdogmus in 2005 and the form consists of 14 questions. The answers to the questions consist of two options as "yes" and "no" and the score varies between 0 and 14. As the score increases, the risk of MetS also increases. The score evaluation shows that those with a score of 0–4 have "low risk", those with a score of 5–8 have "medium risk" and those with a score of 9–14 have "high risk". The source of the validity and reliability study of this form is not available. Studies using this form [13, 14] use the publication of Karadeniz et al. (2007) in their references [15]. Although an internet extension was added for the source where the MSAF could be accessed in the study of Karadeniz et al. who first used the form, this internet extension could not be accessed either. In addition, in the sample to which the form was applied, a total of 0 points is obtained in case of answering no to all questions. Since 0–4 points are low risk according to the MSAF scale, a total score of 0 is in the low risk group instead of no risk [15].

Given the increase in chronic diseases in MetS patients and the fact that MetS is still underdiagnosed in clinics, early detection is very important [16]. Given its high prevalence and serious complications, early identification and control of risk factors is valuable in preventing the development of MetS and its progression to CVD. In the light of this information, it was aimed to develop the MSI Measurement Tool as a valid and reliable data collection tool to eliminate the uncertainty about the MetS risk level of the population [7] due to the worldwide spread of overweight and sedentary lifestyle.

Method

Purpose and type of research

The study was conducted to develop a valid and reliable measurement tool to measure the MetS risk of individuals. It was conducted methodologically for the purpose of developing the MSI measurement tool.

Place and time of the research

This study was carried out between November 2023 and January 2024 with patients admitted with a diagnosis of MetS in Bayburt State Hospital affiliated to the Ministry of Health and individuals without a diagnosis of MetS in the community in this province.

Population and sample of the study

The population of the study consisted of patients admitted to Bayburt State Hospital in Bayburt province with a diagnosis of MetS and individuals without a diagnosis of MetS in the community in this province. In methodologically designed studies, it is recommended that the sample size should be 5–10 times the number of items in the scale or at least 300 samples should be reached [17]. In this study, it was aimed to reach 300 samples in

line with the relevant literature. Individuals who were over 18 years of age and who volunteered to participate in the study were included in the sample. In addition, patients with a diagnosis of MetS (ICD (International Statistical Classification of Diseases and Related Health Problems) diagnosis code was taken as basis in the selection of patients with the diagnosis) were included in the sample, provided that they were conscious and able to communicate. A total of 448 individuals who completed the questionnaire form completely were included in the study after 34 individuals who did not complete the data collection form were excluded from the study. Of the 448 individuals included in the study, 43 were individuals diagnosed with MetS and 405 were individuals without a diagnosis of MetS.

Data collection tools

Individual Information Form, Finnish Diabetes Risk Scale (FINRISC) and Metabolic Syndrome Index (MSI) were used as data collection tools.

Individual information form

The questions in this form, which was created by reviewing the literature, consisted of 6 questions including age, gender, height, weight (for BMI calculation), waist circumference and MetS diagnosis [18].

Fin diabetes risk scale (FINRISC)

It is a population-based scale developed as a result of a cohort study in Finland in 2003 to investigate the risk of diabetes in adults, consisting of eight questions and showing the risk of diabetes in the next ten years. The score range of the scale is between 0 and 26. A score below 7 points indicates a low risk of diabetes, 7–11 points indicates a mild risk, 12–14 points indicates a moderate risk, 15–20 points indicates a high risk and 20 points and above indicates a very high risk [19]. The questionnaire, which is used in community-based diabetes risk screening by the IDF, has been translated into Turkish by the Turkish Society of Endocrinology and Metabolism (TEMD) and is recommended for use in diabetes screening in adults [20].

Metabolic syndrome index (MSI)

Metabolic Syndrome Index was structured as 21 items in line with expert opinion and content validity. The items were scored in line with the weighting of each item in the MSI and the MSI was made ready for the data collection process within the scale development stages.

Literature review and creation of the item pool

In the study, a literature review was conducted by considering all dimensions of MetS risks and an item pool was created. When the literature is examined, it is thought that the increase in body fat distribution and insulin resistance with age contributes to the increase in the prevalence of MetS [21–23]. In a study conducted, although the prevalence of MetS did not show significant gender-specific differences, it was revealed that men tended to have a higher prevalence of MetS than women in the 30–49 age group, while women showed a higher prevalence than men in the 50–69 age group. Accordingly, menopause is thought to be one of the factors contributing to this change in the prevalence of MetS [21, 24]. On the other hand, increasing Body Mass Index (BMI) and the resulting obesity and increased waist circumference are important risk factors that increase the risk of MetS [25]. These problems lead to other cardiometabolic risk factors such as hypertension, hyperglycemia and dyslipidemia that increase the risk of MetS and are also seen as a consequence of these factors [26]. Since MetS increases morbidity and mortality associated with chronic diseases such as cardiovascular disease (CVD), the presence of chronic disease was added to the item pool [27]. Considering the role of genetics in the development of chronic diseases, an item questioning the presence of chronic diseases in relatives was also added [28]. In addition, items questioning smoking, alcohol consumption and physical inactivity, which increase the risk of cardiovascular disease (CVD) and diabetes and play a key role, were also added [29, 30]. However, the association between alcohol and smoking and MetS is not consistent. While excessive consumption of alcohol is significantly associated with increased waist circumference, elevated blood pressure, triglycerides and fasting glucose levels [31], one study showed a 43% reduction in the risk of MetS in alcohol users compared to those who never drank alcohol [32]. Studies have shown that regular tobacco use is associated with MetS and endothelial dysfunction, abnormal lipoprotein metabolism and insulin resistance [33, 34]. However, in one of these studies, no significant association was found between smoking and MetS [33], whereas in another, current smokers were 2.24 times more likely to develop MetS than never smokers [34]. Behavioural factors have an important role in explaining the increasing prevalence of MetS. It has been stated that every hour of sedentary behaviour increases the risk of MetS in American adults [35]. Again, in Puerto Rican and Dominican older adults, every hour of television viewing was associated with a 19% increased likelihood of MetS [36]. Dietary factors play an important role in MetS and less consumption of vegetables, fruits and milk and more consumption of red meat have been reported to increase the risk of MetS [29, 37]. In particular, high consumption of red meat, processed foods, saturated animal fats and sweets has been associated with a higher prevalence of MetS in Mexican Americans [38]. Water consumption was added to the item pool because it is seen as a

factor affecting the development of MetS in the literature [39]. In addition, an item questioning the level of stress was added because a stressful life is a risk factor for the development of metabolic syndrome [40]. The fact that insulin resistance is considered a risk for both DM and MetS necessitated its addition to the pool [41]. Sleep disordered breathing, characterized by breathing difficulties such apnea or hypopnea during sleep, is linked to increased blood pressure, dyslipidemia and insulin resistance, which increase the risk of MetS in all genders [42–44]. Care was taken to ensure that each item was simple, clear and understandable, that an item did not contain more than one thought, had the predicted features, did not create different meanings, and was directly understandable [45]. As a result, an item pool consisting of 32 items was created with the support of the literature.

Ensuring content validity

Since the risk level will be determined within the scope of the scale, the experts were asked to score each question from 1 to 10 (1 being the lowest for the least risky question and 10 being the highest for the highest risky question) in order to determine whether the predetermined risk factors were risk factors or not. In addition, the items that were seen as risk factors but not included in the list were also requested to be written. The scale form, which was prepared as 32 items for content validity, was submitted to the opinions of 20 experts in total, including 3 specialists in internal medicine, 3 specialists in cardiology, 6 specialists in family medicine, 2 academicians in internal medicine nursing, 3 academicians in public health nursing, and 3 academicians in the department of nutrition and dietetics. Content validity index is calculated by dividing the content validity rate of all items by the number of items. It is recommended that the content validity ratio and content validity index should be greater than 0.80 [45]. Using the Davis technique for content validity, content validity ratios, content validity index and weighting values and ratios for impact are given in the Table 1. According to the expert opinion, factors with a mean score of 3 and below out of 10 points were not included in the scoring and 11 items in total (4, 10, 19, 20, 21, 22, 24, 27, 28, 29, 30) were removed from the pool. In the final version of the index, 21 items were decided. The content validity ratios for the factors ranged between 0.9 and 1 and the Content Validity Index (CVI) was found to be 0.98 (Table 1).

Preliminary study

After the expert opinions, the scale should be prepared for the data collection process and a preliminary study should be carried out by applying it to a small sample group representing the target group [17]. In this direction, a preliminary study was conducted with 20 individuals. This group of individuals were excluded from the sample. The item pool was organized in line with the feedback on clarity and comprehensibility and made ready for application.

Data collection

The data of the study were collected by interviewing patients diagnosed with MetS in the outpatient and inpatient clinics of Bayburt State Hospital affiliated to the Ministry of Health. After explaining the research to the individuals who met the inclusion criteria, they were given questionnaire forms and asked to fill them out. Similarly, individuals without a diagnosis of MetS in the community were also given forms and asked to fill them out. Of the 448 individuals included in the study, 43 were patients with metabolic syndrome and 405 were healthy individuals. Waist circumference, one of the questionnaire items, was measured by the researcher using a tape measure and recorded on the form (Fig. 1).

Data evaluation

The data obtained in the study were analysed using SPSS 22.0 and MedCalc 19.1 statistical programmes. Scale discrimination was analysed by independent samples t-test between the upper and lower 27% groups. The cut-off point of the scale score in predicting the diagnosis of MetS was tested by ROC analysis. As a result of the ROC analysis, Youden Index value was used to determine the most appropriate cut-off point. Correlation analysis was performed with the parallel form for criterion validity.

Results

Characteristics of participants

The content validity of the questions in the item pool consisting of 32 items with the support of the literature was ensured by taking expert opinions and the weighting of the items was completed. Content validity and weightings are shown in Table 1.

The mean age of the individuals participating in the study was 27.510±14.534, 60% were normal weight, 90.4% were diagnosed of MetS individuals and 65.6% were women. The mean BMI of the participants was 24.123±6.270 and the mean waist circumference was 82.360±20.346 (Table 2).

The cut-off point for predicting MetS according to the MSI values was found to be 48. The sensitivity of the MSI reached 100% and the specificity was 85.43%. When analysed by ROC analysis, the area under the ROC curve (AUC) was 0.960. The areas under the ROC curves were statistically significant ($p<0.05$) (Fig. 2). Youden index J=0.812 (0<J=0.854<1). The ability of risk scores to discriminate the occurrence of MS was found to be quite high (Std error: 0.009 and 95% G.I: 0.93–0.976, z statistic: 52.349). (Table 3).

Table 1 Validity of coverage and weighting for metabolic syndrome index

Item No	Items	*I-CVI	Weighting	Weight Ratio (%)
MSI1	Age	1,000	7,05	5
MSI2	BMI	1,000	9,45	7
MSI3	Waist circumference	1,000	9,55	7
MSI4	Gender	1,000	1,35	-
MSI5	Chronic disease (lasting 3 months or more)	1,000	7,45	5
MSI6	Smoking	0,950	7,5	5
MSI7	Alcohol use	1,000	6,8	5
MSI8	Sleep duration	1,000	5,6	4
MSI9	Sleep quality	1,000	5,65	4
MSI10	Bedtime at night	1,000	3,12	-
MSI11	Level of fulfilment of activities of daily living	1,000	5,25	4
MSI12	Daily fluid consumption	1,000	5,4	4
MSI13	Stress level	0,900	6,45	5
MSI14	"Eating more than normal and feeling of not being full, frequent urination, feeling of dryness in the mouth and consequently excessive desire to drink water, increased need for frequent urination at night, unplanned weight loss, feeling of hunger, blurred vision, numbness and tingling in the hands and feet, feeling extremely tired, late healing of wounds, dry skin, mood changes such as being irritable, frequent and excessive hunger, intolerance to hunger, blurred vision"	1,000	8,7	6
MSI15	"Headache starting from the nape of the neck and radiating towards the top, chest pain, dizziness, difficulty breathing, nausea, vomiting, nosebleeds, weakness, blurred vision or changes in vision, anxiety"	1,000	7,05	5
MSI16	The presence of close relatives with cardiovascular disease, hypertension or diabetes in the family	1,000	7,2	5
MSI17	Feeling the need to sleep after eating	0,950	6,6	5
MSI18	Bread preference	0,900	5,75	4
MSI19	Frequently favoured cooking method	1,000	2,96	-
MSI20	Daily salt preference	1,000	2,64	-
MSI21	Frequency of weekly fruit consumption	0,950	2,39	-
MSI22	Frequencyof weekly vegetable consumption	0,950	3,06	-
MSI23	Weekly milk and dairy product consumption frequency	1,000	4,55	3
MSI24	Frequency of fast food or packaged food consumption	1,000	3,21	-
MSI25	At least 100–150 min of physical activity per week	1,000	7,5	5
MSI26	At least 40 min of aerobic activity per week (such as running, swimming, cycling, jumping rope, climbing stairs)	1,000	7,1	5
MSI27	Eating at night	1,000	2,71	-
MSI28	Meal skipping status	0,900	2,99	-
MSI29	Difficulty in losing weight despite regular exercise	1,000	2,58	-
MSI30	Regular breakfast intake	0,950	2,42	-
MSI31	Number of meals per day	1,000	4	3
MSI32	Frequency of weekly consumption of legumes and whole grain products	0,900	4	3
		**S-CVI = 0.980		Total=%100

*I-CVI: Item Content Validity Index, ** S-CVI: Scale Content Validity Value, BMI: Body Mass Index

Criterion validity

When the correlation analyses between MSI and FINDRISC scores were examined, a positive moderate ($p<0.001$) correlation of $r=0.632$ was found between FINDRISC and MSI (Table 4).

Distinctiveness

The t-test results between the upper 27% and lower 27% groups showed a significant difference between the mean scores for all items ($p<0.05$). According to these results, it was revealed that MSI performed sensitive measurements to discriminate (Table 5).

Discussion

The findings related to the MSI scale development process, which aims to develop a valid and reliable measurement tool to measure the MetS risk of individuals, were discussed in line with the literature.

Content-content validity and construct (predictive) validity were examined to ensure validity. Firstly, content

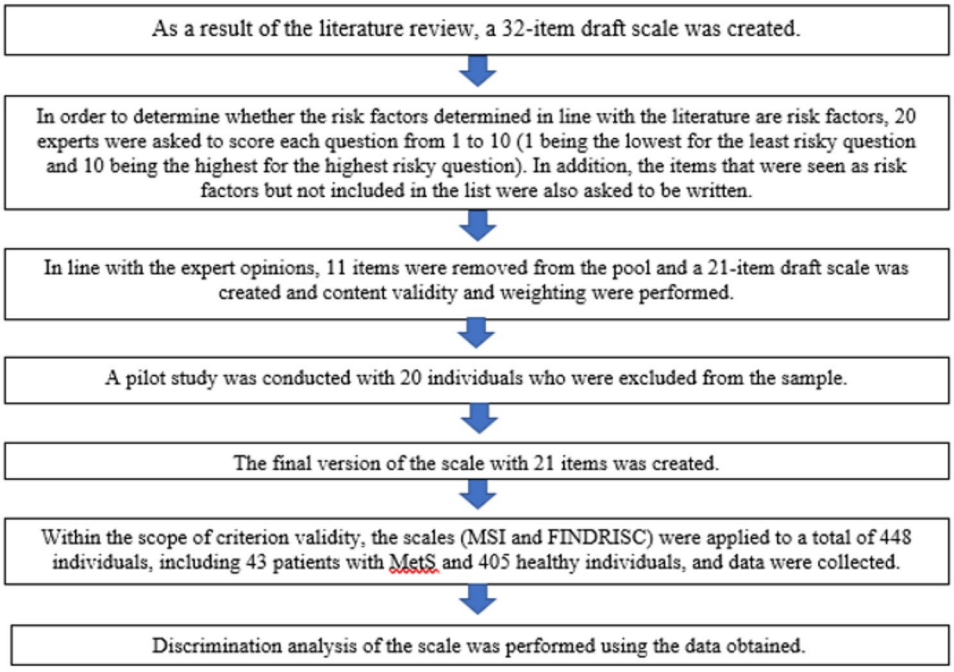

Fig. 1 Flow Chart for the implementation of the research design

Table 2 Descriptive characteristics of participants

Descriptive Characteristics	Frequency (*n*)	Percent (%)
Diagnosis of MetS		
No	405	90,4
Yes	43	9,6
Gender		
Woman	294	65,6
Male	154	34,4
BMI		
Weak	39	8,7
Normal weight	269	60,0
Overweight	82	18,3
Grade I obese	36	8,0
Grade II obese	12	2,7
Morbidly obese	10	2,2
	X	**SD**
Age	27,510	14,534
BMI	24,123	6,270
Waist circumference	82,360	20,346

BMI: Body Mass Index, X: Arithmetic Mean, SD: Standard Deviation

validity is performed to see whether the scale meets all the content required according to the variable appropriately. Content validity is defined as the degree to which the items that make up the scale represent the feature to be measured and is evaluated in the context of expert opinions [46]. Although there are no strict criteria in the selection of experts, it is recommended that the field of study, duration of experience and education level of the individual should be taken into consideration and the number of experts should be five or more [47]. The draft MSI 20 was submitted to the expert opinion and prequalified and 11 questions were removed as a result of expert opinions. In the study, Davis technique was used to evaluate the appropriateness of the items in the scale according to expert opinions. Since the content validity ratio of the items in the scale varied between 0.90 and 1 and the content validity index was calculated as 0.98, it is thought that there is a consensus among the experts and content validity is ensured.

When developing the MSI, data were first analysed and risk factors were confirmed by ROC curve analyses. In our study, the cut-off point of 48 and above had a sensitivity of 100% and a specificity of 85.43% in predicting MetS risk. For our parallel form FINDRISC with a cut-off point of 12 or above, sensitivity and specificity were 60.8% and 62.4%, respectively. These results are not surprising since FINDRISC was applied in an undiagnosed population, the number of questions was limited and first-degree relatives of individuals with type 2 diabetes were selected for the population. On the other hand, while the mean age of the population to which FINDRISC was applied was 42 years, the fact that the mean age was 27.5 years in our study is considered as a factor that increases sensitivity and specificity [48]. In another scale development study (JAMRISC) conducted to evaluate the risk of MetS in the Japanese population, the cut-off point was set as 20 and the sensitivity and specificity were found to be 90% and 74%, respectively. Although a large population was included in JAMRISC, no comparison was made between the diagnosed and undiagnosed population [18]. In this direction, it is thought that our measurement tool has

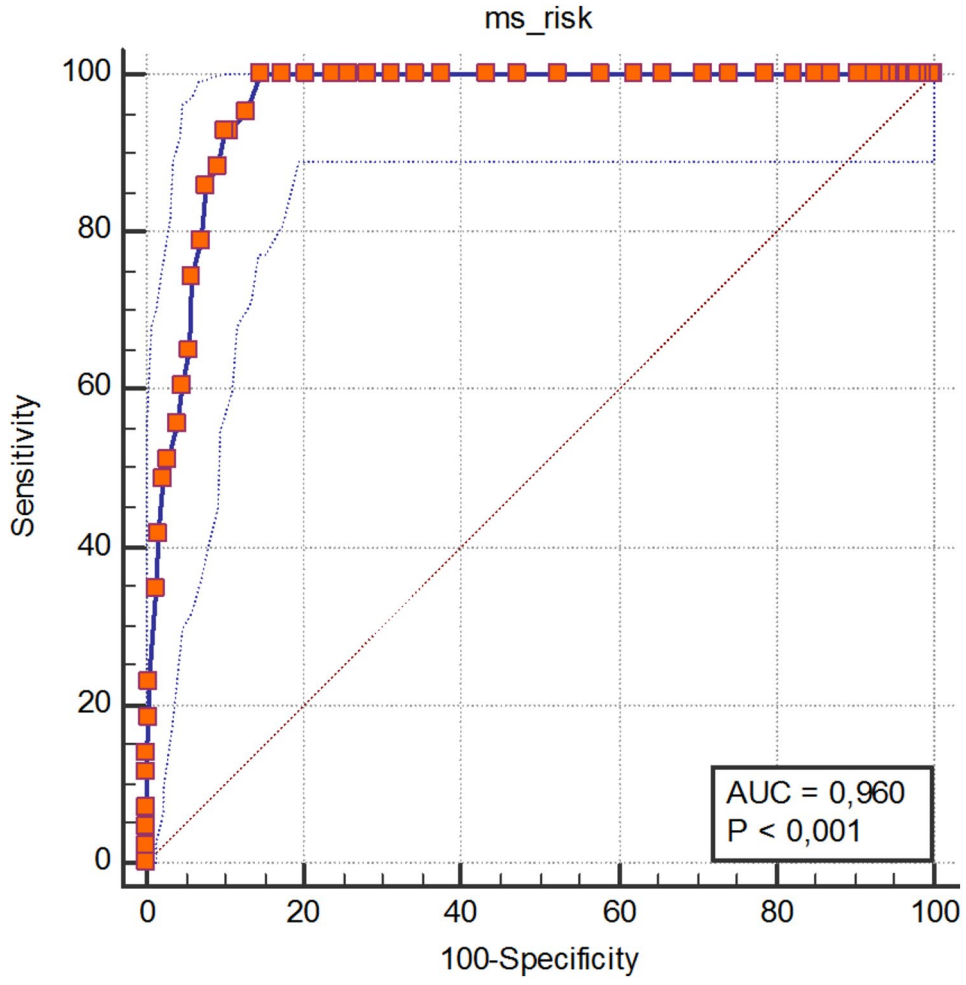

Fig. 2 ROC Analysis for metabolic syndrome index

Table 3 Significance of ROC curve for metabolic syndrome index

Significance Items	Values
Area under the ROC curve (AUC)	0,960
Standard Error	0,009
95% Confidence interval	0.938 to 0.976
z statistic	52,349
p	< 0,0001
Youden index J	0,854
Cut-off Value	> 48
Sensitivity	100,00
Specificity	85,43

Table 4 Correlation analysis for metabolic syndrome index and FINDRISC

	X	SD	*r*	*p*
MSI	40,748	11,246	-	-
FINDRISC	7,902	6,472	0,632**	*< 0,001*

FINDRISC: Finnish Diabetes Risk Scale, MSI: Metabolic Syndrome Index, X: Arithmetic Mean, SD: Standard Deviation, r = Pearson Correlation Analysis

Table 5 Metabolic syndrome Index Upper 27%, Lower 27% score means and scores Independent groups t-Test results

Lower 27% (*n* = 121)		Upper 27% (*n* = 121)		t	*p*
X	SD	X	SD		
28,099	4,864	55,521	6,348	-37,717	< 0,001

MSI: Metabolic Syndrome Index, X: Arithmetic Mean, SD: Standard Deviation, t: Independent Groups T-Test

the sensitivity and specificity to distinguish individuals with MetS risk. In the metabolic syndrome severity score developed by Wiley and Carrington (2016), blood pressure, triglyceride, cholesterol and blood glucose assessments require intervention. In this context, our new scale is a cost-effective screening tool that does not require painful applications or interventional procedures. On the other hand, it may contribute to the prevention of diseases since there is no measurement tool that measures the risk of MetS in the Turkish population [49].

In the study, parallel (equivalent) forms method was used to ensure criterion validity and FINDRISC was used as a parallel form. It was found that there was a

statistically significant, positive and moderate correlation between FINDRISC, which was used as a parallel form, and the scores obtained from MSI ($r=0.632$; $p<0.001$). Developed in Finland, FINDRISC was developed to screen individuals at high risk of developing type 2 diabetes and to reduce its incidence through early intervention [19]. In addition, the scale [50, 51], which has been adapted to different cultures around the world, was first developed as a diabetes risk test, but is also used to assess the risk of MetS [52]. It was assumed that a correlation coefficient between 0.70 and 1.00 showed a high level of relationship, between 0.70−0.30 showed a medium level of relationship and between 0.30 and 0 showed a low level of relationship [53]. It can be said that these results indicate that the MSI has criterion validity.

Item analysis technique based on the difference between upper and lower group means (based on internal consistency criterion) was applied to 32 items in the trial form of the scale. While selecting the items with this method, the scale scores of the individuals were ranked from higher to lower and according to this ranking, 121 people who constituted the first 27% of the group of 448 people were determined as the upper group and 121 people who constituted the last 27% were determined as the lower group. A significant difference between the lower and upper groups indicates that the discrimination of the scale is high [53]. According to these results, it was determined that the scale had internal consistency and made sensitive measurements to discriminate. In our study, the measurement of waist circumference, which is objective data, as well as question items based on the statements of individuals, increases the sensitivity of our measurement tool.

The limitation of the study is that it consisted only of patients diagnosed with MetS in a state hospital. It is important to apply this study in different sample groups in future studies. In this way, it will be possible to determine the risk of MetS in every segment of the society. In addition, the scale developed will be useful in terms of enriching the MetS literature.

Conclusion and recommendations

In conclusion, MSI is a measurement tool that can be used by researchers and clinicians to diagnose MetS risk more easily without the need for more than height, weight and waist circumference. It is recommended that individuals who score above 48 points on the measurement tool should be enrolled in a prevention program. In addition, it is considered to be of great importance to develop a measurement tool that will contribute to the diagnosis of MetS risk, the incidence of which is increasing day by day. In this context, it is thought that if this measurement tool is used in the assessment of MetS risk, time and labor can be saved and interventional procedures can be reduced. MSI can be used in clinical and epidemiologic studies. For potential future studies, it can be used to examine the determinants of MetS risks and to evaluate the effectiveness of educational programs. MSI is a new scale with high sensitivity. Longitudinal and intervention studies using the MSI to reduce or prevent incidence, mortality and hospitalization due to MetS would be useful.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-21304-7.

Supplementary Material 1

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Author contributions
Testing and data collection were performed by Z. A and E.A. Drafted the manuscript were performed by Z. A were performed. Data analysis performed by Z.A and E.A. Critical revisions were performed by Z.A. All authors approved the fnal version of the manuscript for submission.

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Data availability
The datasets are available from the corresponding authors on request.

Declarations

Ethics approval and consent
Before starting the study, ethical approval (Date: 8.11.2023, Decision No: 34) and written permission (E-97634879-799-230547991) were obtained from Bayburt University Non- Interventional Clinical Research Ethics Committee and Health Directorate of Bayburt Province. The individuals included in the study were informed about the research subject and data collection tool and their written consent was obtained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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