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Turkish Adaptation, Validity and Reliability Study of The MIND Diet Scale for Delaying Neurodegeneration

Nörodejenerasyonun Geciktirilmesinde MIND Diyet Ölçeğinin Türkçe'ye Uyarlanması, Geçerlik ve Güvenirlik Çalışması

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ABSTRACT

Background: MIND diet is a nutritional model that has positive effects on neurological diseases, cognitive function and mental health, as it contains nutrients with antioxidant properties. The MIND diet scale was developed to evaluate the diet's adherence with the MIND nutritional model principles. **Objectives:** This study aimed to adapt the MIND Diet Scale into Turkish and assess validity, reliability of the scale in the Turkish population. **Method:** Language adaptation of the scale was provided and the serving sizes in the scale items were adapted to our country. Then, the scale was applied to volunteer participants aged 18 and over. The data of 150 participants were analyzed. Content, concurrent validity and reliability of the scale was tested. Cronbach's α (internal consistency) and test-retest reliability were used to assess the reliability. **Results:** The Cronbach's Alpha value of the 15-item MIND diet scale was 0.626 and the scale was found to have moderate reliability. Test and retest correlation also shows that the MIND diet scale is a reliable scale ($r=0.591$; $p<0.001$) The MIND diet scale mean score was 7.17±2.13 points. Finally, it was found that there was a statistically significant positive correlation between MIND total scores, Mediterranean Diet Adherence Scale and DASH diet index scores. **Conclusion:** This study is the first to evaluate the validity and reliability of the MIND diet scale in Turkish population. Study results showed that the scale was valid and moderately reliable tool.

Keywords: MIND diet, Neurological diseases, Turkish adaptation, Reliability, Validity

ÖZ

Giriş: MIND diyet, antioksidan özelliklere sahip besinleri içermesi nedeniyle nörolojik hastalıklar, bilişsel işlev ve mental sağlık üzerinde olumlu etkileri olan bir beslenme modelidir. MIND diyet ölçeği, diyetin MIND beslenme modeli ilkelerine uygunluğunu değerlendirmek için geliştirilmiştir. **Amaç:** Bu çalışmada MIND Diyet Ölçeği'nin Türkçe'ye uyarlanması ve ölçeğin Türk toplumunda geçerlik ve güvenirliğinin değerlendirilmesi amaçlanmıştır. **Yöntem:** Ölçeğin dil uyarlaması sağlanmış ve ölçek maddelerindeki porsiyon boyutları ülkemize göre uyarlanmıştır. Türkçe uyarlama ve kapsam geçerliliğinden sonra ölçek 18 yaş ve üzeri gönüllü katılımcılara uygulanmıştır. Çalışma 150 katılımcı ile tamamlanmıştır. Ölçeğin eş zamanlı geçerliliği ve güvenirliği test edilmiştir. Güvenilirliği değerlendirmek için Cronbach α (iç tutarlılık) ve test-tekrar test güvenilirliği kullanılmıştır. **Bulgular:** 15 maddelik MIND diyeti ölçeğinin Cronbach Alpha değeri 0,626 olup ölçeğin orta düzeyde güvenilirliğe sahip olduğu belirlenmiştir. Test-tekrar test korelasyonu da MIND diyeti ölçeğinin güvenilir bir ölçek olduğunu göstermektedir ($r=0,591$; $p<0,001$). MIND diyeti ölçeği puan ortalaması 7,17±2,13'tür. Son olarak MIND diyet ölçeği toplam puanı, Akdeniz Diyeti Uyum Ölçeği ve DASH diyet indeksi puanları arasında istatistiksel olarak anlamlı pozitif korelasyon olduğu tespit edilmiştir. **Sonuç:** Bu çalışma MIND diyeti ölçeğinin Türk toplumunda geçerlik ve güvenirliğini değerlendiren ilk çalışmadır. Araştırma sonuçları ölçeğin geçerli ve orta derecede güvenilir bir araç olduğunu göstermektedir.

Anahtar Kelimeler: MIND diyet, Nörolojik hastalıklar, Türkçe uyarlama, Güvenilirlik, Geçerlik

Ethical permission was obtained from Gazi University Ethics Commission (Research Code No: 2022 – 1383, meeting decision dated 13.12.2022 and numbered 21). This work was supported by Tübitak 2209-A - Research Project Support Program for Undergraduate Students.

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INTRODUCTION

In recent years, the MIND (Mediterranean-DASH intervention for neurodegenerative delay) diet is recommended as a nutritional model. MIND diet is important in preventing the development of neurodegenerative diseases and it has positive effects on cognitive function and reduces the risk of depression.[1-6] In a study conducted with the older age group, it was reported that individuals with high MIND diet adherence had less decrease in physical functions and higher muscle strength.[7] In addition, it was shown that MIND diet adherence was associated with a reduction in the risk of stroke[8] and cardiovascular disease.[9] Studies show that the MIND diet can have many health effects, especially neurological and mental health. The principles of this diet model are as follows:

- ✓ Whole grains (at least 3 servings/day)
- ✓ Green leafy vegetables (6 servings/week)
- ✓ Other vegetables (at least 1 serving/day)
- ✓ Berries (at least 2 servings/week)
- ✓ Fish (at least 1 portion/week)
- ✓ Poultry (at least 2 portions/week)
- ✓ Beans (>3 servings/week)
- ✓ Nuts (at least 5 servings/week)
- ✓ Olive oil
- ✓ Recommendations for limiting consumption of red meat, processed meat products, cheese, butter, margarine, fried and sugary foods.[10, 11]

The most important feature of the MIND diet is the inclusion of foods with high antioxidant content. For example, berries are rich in phenolic compounds such as phenolic acids, flavonols and anthocyanins. Therefore, they show anti-inflammatory and immunomodulatory effects and play a protective role against many diseases such as cardiovascular diseases, intestinal diseases and cancer.[12] Another prominent food in this diet is green leafy vegetables. Green leafy vegetables are important in the protection of cardiovascular diseases and cognitive function due to their dietary fiber, vitamin C (ascorbic acid), vitamin K (phylloquinone), magnesium and potassium content.[13] To reduce the saturated fatty acids, it is recommended to limit the consumption of foods such as red meat, processed meat products, butter, and cheese. Instead of saturated fatty acids, the intake of omega-3 fatty acids, is increased by consuming fish at least once a week, and the intake of monounsaturated fatty acids is increased with the recommendation of olive oil[14] and nuts.[15] Finally, increased production of short-chain fatty acids by the gut microbiota with consumption of whole grain products is associated with many health benefits.[16]

Today, the increase in average life expectancy brings an increase in the incidence of neurodegenerative diseases.[17] And the change in our eating habits towards a western diet has resulted in an increase in the inflammatory load of our diets.[18] For this reason, it is important to take preventive measures and slow down the progression of the diseases. As stated in the literature, MIND diet can be a dietary model that can be used to prevent neurodegenerative diseases and slow down progression. In addition, studies evaluating the effect of the MIND diet for other than neurodegenerative disease are insufficient. Therefore, our aim in this study is to adapt the MIND Diet Scale into Turkish and evaluate its validity and reliability.

MATERIAL AND METHODS

This study is a methodological study carried out to adapt the MIND Diet Scale to Turkish and evaluate its validity and reliability. Developing the original form of the scale, Prof. Dr. David A. Bennet was contacted via e-mail, and written permission was obtained for the validity-reliability study.

Study Group

Our research was conducted with individuals aged 18 and over who voluntarily

agreed to participate in the research. The necessary data for the study were collected between January 2023 and July 2023. Ethical permission was obtained from Gazi University Ethics Commission (Research Code No: 2022 – 1383, meeting decision dated 13.12.2022 and numbered 21).

There are different opinions about determining the size of the sample in the pilot study. While Evci and Aylar[19] found it sufficient to apply the pilot study approximately 5% of the target group, Şeker and Gençdoğan[20] stated that it would be sufficient to include 30 to 50 participants representing the target group in the pilot study. According to another opinion, it is stated that 5-10 times the size of the scale items should be considered when calculating the sample size methodologically in validity and reliability studies.[21] From this point of view, it is sufficient to include participants in the study sample at a rate of at least ten times (15×10) the number of items in the scale. Our study was completed with a total of 165 participants. However, due to missing and inconsistent data, the analysis was conducted on 150 participants.

Data Collection

The structured questionnaire created by the researchers was applied to the individuals by face-to-face interview. The questionnaire form includes questions for general information (age, education level, employment status, socio-economic level, smoking-alcohol use, etc.), anthropometric measurements such as body weight and height, and the MIND Diet Scale with language validity.

MIND Diet Scale

The MIND Diet Scale was developed by Morris et al.[22] The scale was developed in three steps: 1) determination of Mediterranean and DASH diet components that may be associated with the prevention of dementia and improvement in cognitive functions as a result of the literature review, 2) determination of food consumption frequency components that may be associated with the MIND diet, 3) taking into account the published studies, determination of daily portions and components to be used in the scoring of the diet.

Ten of the MIND diet components represent important healthy food groups for the brain (green leafy vegetables, other vegetables, nuts, berries, beans, whole grain products, fish, poultry, olive oil and wine) and the other 5 unhealthy food groups (red meat and processed meat products, butter and margarine, cheese, pastries and sweets, and fast-food/fried foods). Except for olive oil, three categories were created based on the weekly or daily consumption of each dietary component, and the categories were scored as 0, 0.5 or 1 point. For olive oil, 1 point was given if it was specified as the main oil source, and 0 points were given otherwise. Therefore, the total MIND diet adherence score ranges from 0 to 15 points.[22]

Turkish Adaptation Protocol

The scale was translated into Turkish by researchers whose mother tongue is Turkish, and who are fluent in English and have a good command of the terminology in the field. Afterwards, a panel of six experts was formed, and the panel was asked to evaluate the translation. The aim at this stage is to identify and resolve inadequate expressions/concepts and inconsistencies in the translation. After the expert panel's suggestions for translation were combined by the researchers and a consensus was reached on the scale items, the scale items were translated back into English by a linguist who knows both languages at the mother tongue level. Afterwards, an expert was consulted with the original version of the scale in English and the version translated into English, and this expert compared both versions in terms of meaning and similarity. After the suggestions from the experts, the relevant changes were made, and the scale was given its final shape.

Determination of Serving Sizes

Scoring in the MIND diet scale is made according to the amount of consumed serving size or the frequency of consumption. However, no information on serving sizes was given in the original version. Since the scale

was developed in the USA, the serving sizes in the scale items were adapted to our country. The amount corresponding to one serving size of each food group was obtained from the "MyPyramid Equivalents Database"[23] and the guide prepared by the United States Food and Drug Administration for the labeling of foods and serving sizes.[24] However, since the portion sizes for some foods are expressed in units such as cups and ounces, these units are converted to grams through the "Nutritionist Pro" program, and the expression is provided over the measurement units in our country (tablespoon, ladle, etc.).

Assessment of Content Validity

After the language validity of the scale was completed, an e-mail was sent to four faculty members who are experts in the field of Nutrition and Dietetics for content validity. For each question in the scale, experts have been asked mark on a form that includes (a) "Appropriate", (b) "The item should be lightly revised", (c) "The item should be reviewed seriously", and (d) "The item is not suitable" (Davis technique). In the Davis technique, the content validity indexes calculated by dividing the number of experts who marked options a and b for each item by the total number of experts are expected to be above 0.80.[25] For this study, the content validity index was shown as 1 for each item, as the experts marked the options "Appropriate" or "The item should be lightly revised" for each item.

Assessment of Concurrent Validity

It is a comparison of the results of alternative tools used to measure the same construct. In this study, the Mediterranean Diet Adherence Scale[26] and the DASH diet index[27] were used for assessment of concurrent validity. The relationships between the scales were examined with the Pearson Correlation Coefficient.

Reliability

The reliability of the scale was evaluated through internal consistency and test-retest reliability. The alpha coefficient method, developed by Cronbach (1951), is a frequently used technique to estimate the internal consistency of Likert-rated scales. If Cronbach's Alpha value is in the range of 0.80-1.00, the test has high reliability; in the range of 0.60-0.79, the test is quite reliable; in the range of 0.40-0.59, the reliability of the test is low and in the range of 0.00-0.39, the test is unreliable.[28]

When the scale is applied to the same participants at different times, getting similar answers indicates the test-retest reliability.[29] In this study, the scale was re-applied to 40 participants 2 weeks later and test-retest reliability was evaluated with the Pearson Correlation Coefficient. Statistical analyzes were performed with SPSS v27 (IBM Inc., Chicago, IL, USA) and R Project v3.6.1 (R Core Team, Vienna, Austria) software. The adaptation protocol, validity and reliability stages for the MIND Diet Scale were given in Figure 1.

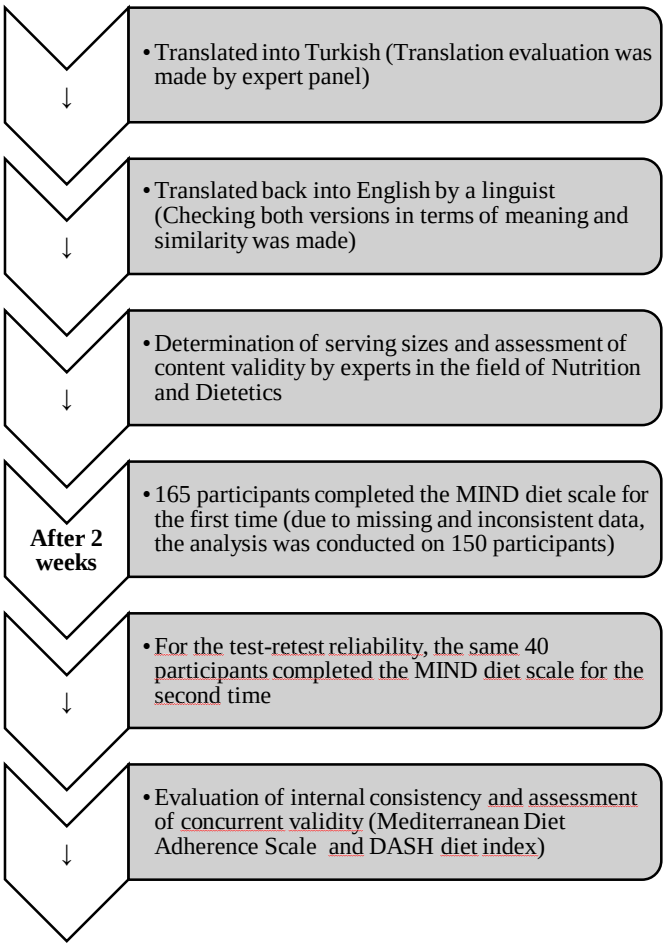

Figure 1. The Adaptation Protocol, Validity and Reliability Stages for The MIND Diet Scale

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RESULTS AND DISCUSSION

In this study, Turkish adaptation, validity, and reliability study of the MIND diet scale for delaying neurodegeneration was completed with a total of 150 participants (80.7% female, 19.3% male). Descriptive statistics of demographic, health, BMI and other characteristics findings of the participants were given in Table 1. The mean age of the participants was 27.4±8.49 years. In terms of educational status, the percentage of participants who have an associate degree or above was more than 80% in both genders. The percentage of male participants (58.6%) was higher than females (46.3%) according to working status. The marital status of 72.7% of the participants was single. The income of 49.3% of participants was equal to their expenses. 68.7% of the participants had no diagnosis of a chronic disease. 85% or more of the participants answered no for smoking and alcohol use. According to the body mass index classification, 55.2% of male participants were recorded as overweight and 77.7% of females were recorded as normal.

Cronbach's α Coefficient – Internal Consistency

In this study, the Cronbach's Alpha value of the 15-item MIND diet scale was 0.626 and the scale was found to have moderate reliability.[28, 30] Additionally, Cronbach's Alpha values of items were found to be between 0.563 and 0.646 according to the results of item analyses. Since there is no item with a value of <0.30; it is not necessary to remove any item from the scale (Table 2). However, if it is desired to increase the reliability of the scale, there is a reference that recommends reviewing the α value for each item and the removal of whichever item's α value reduces the total α value.[30]

Table 1. Descriptive Statistics of Demographic, Health, BMI and Other Characteristics Findings of The Participants

Variables	Male (n=29)		Female (n=121)		Total (n=150)	
	n	%	n	%	n	%
Age (year) ($\bar{X} \pm SD$)	27.7±7.62		27.3±8.71		27.4±8.49	
Working Status						
Yes	17	58.6	56	46.3	73	17
No	12	41.4	65	53.7	77	12

Table 1. (Continued)

Variables	Male (n=29)		Female (n=121)		Total (n=150)	
	n	%	n	%	n	%
Educational Status						
Primary school	-	-	1	0.8	1	0.7
High school	3	10.3	20	16.5	23	15.3
Associate degree	12	41.4	33	27.3	45	30.0
Bachelor's degree	6	20.7	38	31.4	44	29.3
Postgraduate	8	27.6	29	24.0	37	24.7
Marital Status						
Married	8	27.6	33	27.3	41	27.3
Single	21	72.4	88	72.7	109	72.7
Socio-economic status						
Income less than expenses	6	20.7	23	19.0	29	19.3
Income equal to expense	12	41.4	62	51.2	74	49.3
Income more than expenses	11	37.9	36	29.8	47	31.3
Chronic Disease Diagnosis						
Yes	3	10.3	44	36.4	47	31.3
No	26	89.7	77	63.6	103	68.7
Chronic Disease*						
Diabetes	-	-	2	3.8	2	3.6
Cardiovascular diseases	1	33.3	3	5.8	4	7.3
Kidney diseases	-	-	2	3.8	2	3.6
Digestive system diseases	1	33.3	3	5.8	4	7.3
Respiratory system diseases	-	-	6	11.5	6	10.9
Mental disorders	-	-	2	3.8	2	3.6
Vitamin/mineral deficiencies	-	-	9	17.3	9	16.5
Non-Diabetes Endocrine diseases	-	-	6	11.5	6	10.9
Neurological diseases	1	33.4	7	13.5	8	14.5
Other	-	-	12	23.2	12	21.8
Smoking						
Yes	14	48.3	7	5.8	21	14.0
No	15	51.7	114	94.2	129	86.0
Alcohol						
Yes	13	44.8	9	7.4	22	14.7
No	16	55.2	112	92.6	128	85.3
Water Consumption (ml/day) ($\bar{X} \pm SD$)	1600.0±744.50		1468.6±617.90		1494.0 ±643.71	
BMI Classification						
Underweight	-	-	8	6.6	8	5.3
Normal	12	41.4	94	77.7	106	70.7
Overweight	16	55.2	9	7.4	25	16.7
Obese	1	3.4	10	8.3	11	7.3
BMI (kg/m^2) ($\bar{X} \pm SD$)	25.0±3.27		22.6±3.39		23.0±3.50	

** Multiple response **BMI: Body mass index*

Table 2. Cronbach's Alpha Value and Item Total Statistics of The MIND Diet Scale

Cronbach's Alpha	N (number of items)
0.626	15

Item	Scale means if item deleted	Mean of variance if item deleted	Corrected item-Total correlation	Cronbach's alpha if item deleted
M1	6.8767	3.929	0.425	0.586
M2	6.8400	3.941	0.333	0.596
M3	6.9300	4.007	0.267	0.606
M4	6.7233	3.938	0.340	0.595
M5	6.5367	3.457	0.467	0.563
M6	6.5500	4.127	0.161	0.624
M7	6.6833	4.431	-0.008	0.646
M8	6.6867	4.344	0.041	0.641
M9	6.8367	3.878	0.361	0.591
M10	6.6900	4.160	0.235	0.612
M11	6.5267	3.795	0.371	0.587
M12	6.3933	4.311	0.080	0.634
M13	6.4600	4.029	0.284	0.604
M14	6.5533	3.886	0.331	0.595
M15	7.0933	4.538	-0.060	0.641

Test-Retest Reliability

It was found that there was a statistically significant positive (r=0.591; p<0.001) correlation between the MIND test and retest scores of the participants. The correlation coefficients are given in Table 3.

Table 3. Correlation Coefficient Between MIND Diet Scale Test and Retest Scores

	MIND total score: final test	
	r	**p**
MIND total score: pre-test	0,591	<0,001***

r: Pearson Correlation Coefficient

***p<0.001

Concurrent Validity

Since the MIND diet is a nutritional model that combines the Mediterranean and DASH diet principles, in this study, the Mediterranean Diet Adherence Scale and the DASH diet index were used for assessment of concurrent validity. It was found that there was a statistically significant positive medium correlation between MIND total scores and Mediterranean Diet Adherence Scale total scores (r=0.494; p<0.001), and a significant positive weak correlation between DASH diet index scores (r=0.174; p<0.05). When the results were examined, it was found that as MIND total scores increased, Mediterranean Diet Adherence and DASH diet index total scores increased by 49.4% and 17.4%, respectively (Table 4).

Table 4. Correlation Coefficient Between MIND Diet Scale and Mediterranean Diet Adherence Scale and The DASH Diet Index

	MIND total score	
	r	**p**
Mediterranean Diet Adherence Scale	0,494	<0,001***
DASH diet index	0.174	0.033*

r: Pearson Correlation Coefficient
*p<0.05

***p<0.001

MIND Total Score Summary Statistics

In this study, it was found that the MIND total score varied between 2.5 and 11.5, and mean score was 7.17±2.13 points (Table 5).

Table 5. MIND Total Score Summary Statistics

	$\bar{X} \pm SD$	Median (min-max)
MIND total score	7.17±2.13	8 (2.5-11.5)

This study aimed to adapt the MIND Diet Scale into Turkish and assess the validity, reliability of the scale in the Turkish population. In this study, the Cronbach's Alpha value of the 15-item MIND diet scale was 0.626 and the scale was found to have moderate reliability. Also, test-retest reliability of the MIND Diet Scale has been acceptable. For concurrent validity, it was found that there was a statistically significant

positive medium correlation between MIND total scores and Mediterranean Diet Adherence Scale total scores (r=0.494; p<0.001), and a significant positive weak correlation between DASH diet index scores (r=0.174; p<0.05).

There is only one study in the literature regarding the validity and reliability of the MIND diet scale. The stated study aimed to conduct confirmatory factor analysis of the MIND diet scale in elderly Greek participants with dementia. The confirmatory factor analysis revealed that the score of the nine of the fifteen items (green leafy vegetables, berries, nuts, butter and margarine, whole grains, fish, wine, fast fried foods, pastries and sweets) could discriminate the participants with dementia from the healthy control group (Cronbach's alpha=0.67).[31]

In this study, it was found that the MIND total score varied between 2.5 and 11.5, and mean score was 7.17±2.13 points. Similarly, in a study evaluating the effect of the MIND diet on metabolic health, the mean MIND diet score of individuals was found to be 7.1 ± 2.0 points.[32] In another study evaluating MIND diet adherence in adults with a mean age of 34.1 ± 6.0 years, the result was recorded as 7.3 ± 1.9 points.[33]

CONCLUSION AND RECOMMENDATION

As a result, the MIND diet scale is a content and concurrent valid and reliable scale. We could not perform explanatory factor analysis. However, this scale will allow future studies to perform this test. In future studies, we recommend increasing the sample size and ordering the portion sizes from smallest to largest in reverse questions (items 6, 7, 12, 13 and 14). In addition, since the MIND diet is a nutritional model used especially in neurological diseases and in the evaluation of mental health, it is recommended to perform a validity and reliability studies in these disease groups or elderly population.

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