Validation of the Turkish Version of the Orthorexia Nervosa Inventory (ONI) in Adult Population: Its Association with Psychometric Properties

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Abstract

Purpose

It was aimed to examine the reliability and validity of the Orthorexia Nervosa Inventory (ONI) the Turkish version in a large adult population.

Methods

In this cross-sectional study, 710 individuals were included between the ages of 18–65 years living in Turkey. Individuals were reached via an online questionnaire (including ONI, Eating Attitudes Test-26 (EAT-26) and sociodemographic characteristics). Confirmatory factor analysis (CFA) was used to test the validity of ONI. ONI contains three sub-factors (behaviors, emotions and impairments). Analyzes were made with Lisrel 8.80 program and Statistical Package for Social Sciences 22.0 package program.

Results

The Cronbach's alpha coefficient was 0.906 for ONI total factor scores and Cronbach's alpha values for "behaviours", "impairements", and "emotions" were found to be 0.821, 0.842, and 0.809, respectively. Confirmatory factor analysis performed supported the three-factor structure of the ONI obtained in the first sample. The CMIN / df = 5.65 and the model generally fits well to the structure (RMSEA = 0.081, CFI = 0.94, NFI = 0.91, GFI = 0.86, AGFI = 0.83). A positive and moderate relationship (r = 0.418) was found between ONI and EAT-26. A positive and low level (r = 0.160) correlation was found between ONI and body mass index. There is no statistically significant difference between ONI scores according to gender (p = 0.22).

Conclusion

The findings suggest Turkish version of the ONI is a valid and reliable scale for determining the tendency for orthorexia nervosa in Turkish adult population.

Level of evidence

Level V, descriptive cross-sectional study

Introduction

Eating disorders are defined as serious psychiatric disorders that are "characterized by persistent disturbance in eating or eating-related behavior that results in changes in consumption or absorption of food and significantly impairs health or psychosocial functioning" [1, 2]. Anorexia nervosa (AN) and bulimia nervosa (BN) are the leading eating disorders. Another eating behavior disorder with semptoms which a few of which are similar to AN and BN, and several that are unique is orthorexia nervosa (ON) [3]. In the late 1990s, ON was first described by Bratman as an obsession with eating healthy food to be

healthier [4]. ON, which literally means "proper appetite", is derived from the Greek words orthos (correct) and orxis (appetite) [5]. Although ON has been described in the scientific literature, it is not formally recognized as a formal psychiatric diagnosis. Currently, there is no accepted definition and confirmed diagnostic criteria for ON [6]. There has been controversy over whether ON should be included in the published edition of Diagnostic and Statistical Manual of Mental Disorders-V (DSM-V) or not [7]. However, it was not included as a psychiatric diagnosis due to the lack of robust empirical data required for the diagnosis in DSM-V [8].

Generally the term ON has been defined as "an obsessive focus on dietary practices believed to provide optimum well-being through healthy eating (inflexible dietary rules, repetitive and persistent food-related preoccupations, compulsive behavior), with "consequent, clinically significant, impairment (e.g. medical or psychological complications, great distress, and / or impairment in important areas of functioning)" [9]. Striving for optimal health is an admirable goal for both individual, community and healthcare professionals. However, some people's food restrictions and attitudes that lead to eating disorders can create life-threatening problems [10]. These problems can emerge resulting in social isolation, imitation of learned and accepted irregular eating habits, transmission to other family members (especially children), obsessive-compulsive disorder, addiction, and a poor quality of life [4, 11].

The prevalence of ON reported in Turkey differs in studies. In a study conducted with 474 university students, 49.8% of female students and 32.2% of male students had a tendency to ON [12]. In a study in which nutrition and dietetics department students participated, it was observed that 76.7% of these students had a tendency to ON [13]. In a study conducted with nursing students, it was determined that 45.3% of the students were risky in terms of ON [14]. As seen in the studies, the prevalence of orthorexia nervosa is not considered as a definitive psychiatric diagnosis and there is currently no standard diagnostic scale.

Four consensus diagnostic criteria have been proposed for ON. Criterion A is preoccupation with a healthy nutrition and preoccupation with rigidly following a restrictive "healthy" diet (which the individual believes to be healthy and pure), strictly avoiding foods believed to be unhealthy. Criterion B is violation of restrictive dietary guidelines that cause extreme emotional distress combined with feelings of guilt, shame and / or anxiety. Criterion C is physical impairments where nutritional deficiencies could lead to significant weight loss, malnutrition and / or physical health complications. And criterion D is psychosocial disorders in social, occupational, and / or academic functionality that may result from other diagnostic criteria [11, 15]. Scales such as Bratman Orthorexia Test (BOT) [5], ORTO-15 [16], Eating Habits Questionnaire (EHQ) [17], Duesseldorf Orthorexia Scale (DOS) [18] are used to diagnose ON. However, none of these scales included the four consensus diagnostic criteria defined above for ON. Therefore, the fact that there are no thoroughly vetted measures of ON measurements with clear psychometric features makes it difficult to obtain reliable estimates of its prevalence.

The aim of the present study was to examine the reliability and validity of the ONI the Turkish version, which includes sufficient numbers of items to evaluate each of the four consensus diagnostic criteria for

ON, in the adult Turkish population.

Method

Participants

This cross-sectional study, enrolled 710 participants between the ages ranged from 18 to 65 years in Turkey. The frequency distributions and descriptive statistics of the demographic information of the individuals participating in the research are given in Table 1. The majority of the sample were 503 females (70.8%). 58.5% of the individuals are single. The mean age of individuals was 30.15 ± 7.47 years. In addition, 91.1% of the individuals participating in the study were undergraduate and graduate. Physical activity status of 47.6% of the individuals were lightly physical activity. The rates of smoking were 15.9% and the mean Body Mass Index (BMI) of individuals were 23.56 ± 4.04 kg/m^2.

Table 1: Basic demographic characteristics of study individuals

Variables	n (%) or mean ± SD
Age (years)	30.15 ± 7.47
BMI (kg/m^2)	23.56 ± 4.04
Gender	
Female	503 (70.8)
Male	207 (29.2)
Marital status	
Single	415 (58.5)
Married	295 (41.5)
Education level	
Primary school	12 (1.7)
High school	51 (7.2)
Undergraduate	196 (27.6)
Graduate	451 (63,5)
Smoking status	
Yes	113 (15.9)
No	597 (84.1)
Physical activity status	
Inactive or Insufficiently active	236 (33.2)
Lightly active	338 (47.6)
Moderate active	123 (17.3)
Highly active	13 (1.8)

Values are expressed as n(%) or mean ± SD, BMI: Body Mass Index

Study design

This study, conducted between November and December 2020. The online questionnaire was openly accessible for two months. An online survey was circulated on different online lists and social media platforms randomly. International Test Commission (ITC) stated that a sample size of less than 200 may not be sufficient to reveal the psychometric structure. The ITC emphasized that 300 people should be reached to reveal the factor structure of a test, and ideally more than 500 samples should be taken [19].

Therefore, 720 participants, who are Turkish adults were involved in the study, and 10 individuals were excluded from the study because of their excluding factor (aged 18 under and aged 65 over, pregnant/lactating).

The data were collected through online surveys (Google Forms®). The procedures used in this study are in line with the principles of the Declaration of Helsinki and informed consent was obtained from the participants in electronic form prior to data collection. The research protocol of the study was approved by the Ethics Committee of the Ondokuz Mayıs University (number: B.30.2.ODM.0.20.08/765).

Questionnaire

The Turkish questionnaire consists of two parts. The first part evaluated the sociodemographic characteristics (age, gender, marital status, education level, physical activity status, etc.) of the participants included. BMI was calculated by dividing weight (in kg) by height in square meters (in meters) [20]. The second part includes the scales (Orthorexia Nervosa Inventory and Eating Attitude Test-26) used in this study.

Orthorexia Nervosa Inventory

The "Orthorexia Nervosa Inventory (ONI)" was developed by Oberle et al. (2020) to measure the presence of ON [21]. The scale is a 4 point likert-type and includes 24 questions that take the values "1=not at all true, 2=slightly true, 3=mainly true, 4=very true". The minimum score possible for each item is 1 point, and the maximum is 4 point. A total score is calculated by adding up each item score. ONI consists of a total score and separate sub-factors. The first sub-factor is "behaviors" (items 2, 4, 6, 8, 11, 15, 17, 18, 22). Second sub-factor is "impairments" (items 3, 5, 7, 10, 12, 14, 16, 19, 20, 24). Third sub-factor is "emotions" (items 1, 9, 13, 21, 23).

Eating Attitudes Test-26 (EAT-26)

The "Eating Attitudes Test-26 (EAT-26)" was developed by Garner et al. (1982) to assess food attitude [22]. EAT-26 was validated for the Turkish population by Ergüney-Okumuş and Sertel [23]. EAT-26 which is a 6 point likert-type englobes 26 questions with answers graded from 0 (never, almost never and infrequently) to 3 (always). Scores equal or higher than 21 indicate possible abnormal eating attitude. In this study, it was used to test the construct validity of ONI and the reliability coefficient of the scale was found α = 0.79.

Translation procedure

Several steps were taken to translate the ONI. First, ONI translated in Turkish by five academics (English-Turkish). The translations were evaluated. Later, a bilingual professional (Turkish-English) back-translated. Second, an expert panel of three members evaluated both translation looking for any inconsistencies between the two versions [24-26]. Third, the ONI was piloted on 10 individuals (five womens and five mens) to obtain initial assessment of the scale and to determine the time required and

the difficulty involved in responding. Feedback has been requested for participants to suggest any changes that might be necessary. No further changes were in fact made as the pilot participants indicated no changes were needed.

Statistical analysis

The validity and reliability analysis of the ONI, which was adapted to Turkish, was conducted. In the study, confirmatory factor analysis (CFA) was used to test the validity of the adapted scale with Lisrel 8.80 program and the other data (demographic characteristics of the individuals participating) was made with the Statistical Package for Social Sciences (SPSS) 22.0 package program. The maximum likelihood estimation method was used for CFA analysis. Before the analysis, it was checked whether there was missing data or not, and no missing data was found. For the extreme value, the standard z-value transformation of each item was made and since there was no value other than -4 and +4, the extreme value was not found [27]. Since the scale data is categorical, the maximum likelihood estimation method technique was preferred in the estimation stage. In order to evaluate the internal consistency of the ONI, Cronbach Alpha reliability analysis was performed. In addition, whether there is a relationship between variables was obtained by the Pearson correlation coefficient, which is the method used when all variables are continuous. In addition, independent samples t-test was used to examine the relationship of adapted scale score scores with gender. This method is a parametric test and it was preferred because the number of data in each group was large enough (n> 30).

Results

This section investigates the reliability and validity of the ONI. First, reliability scores are obtained for all sub-factors and factors in ONI. Then, factor structure is sought for ONI. In the adaptation study of the ONI, the validity analysis was analyzed with the confirmatory factor analysis (CFA). The final scale was obtained with three sub-factors. CFA was used to verify this structure. The reason for this is that the dimensions in the original scale were analyzed by exploratory factor analysis (EFA) and the relevant structure was specified. In addition, outlier control was made for all items in the scale. First of all, among the factors related to the three sub-factors structure obtained, the regression path coefficients for the items were obtained statistically significant. The t values for the standard regression coefficients of each item were examined and obtained outside the critical value of ± 1.96 at 0.05 significance level. Regression coefficients were obtained in the range of 0.29 - 0.58 (Figure 1). Factor_1, factor_2 and factor_3 show the sub-factors which are behaviors, emotions and impairments, respectively.

There are many model data fit indexes in the literature for model data fit. In this study, among these fit indices, the most frequently used fit indices are given. In this study, fit indices which are Relative Chi-square ($x2 / df$), the Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI) and Incremental Fit Index (IFI) are given. (Table 2).

Table 2. Model Fit Indexes

Index	Perfect Fit Measure	Good fit measure	Research finding	Conclusion
CMIN / df	0-3	3-5	5.65	Acceptable
RMSEA	$0.00 \leq RMSEA \leq .05$	$0.05 < RMSEA \leq .10$	0.081	Good
CFI	$0.95 \leq CFI \leq 1.00$	$0.90 \leq CFI < 0.95$	0.94	Good
NFI	$0.95 \leq NNFI \leq 1.00$	$0.90 \leq NNFI < 0.95$	0.93	Good
SRMR	$0.00 \leq SRMR \leq 0.05$	$0.05 < SRMR \leq 0.08$	0.066	Good
GFI	$0.80 \leq CFI$	$0.90 \leq CFI$	0.86	Good
AGFI	$0.80 \leq AGFI$	$0.90 \leq AGFI$	0.83	Good
IFI	$0.85 \leq IFI$	$0.95 \leq IFI$	0.94	Good

CMIN / df = Relative Chi-square, RMSEA = Root Mean Square Error of Approximation, NFI = Normed Fit Index, CFI = Comparative Fit Index, SRMR = Standardized Root Mean Square Residual, GFI = Goodness of Fit Index, AGFI = Adjusted Goodness of Fit Index, IFI = Incremental Fit Index

A ratio of Chi-square (X^2) to degrees of freedom below 3 indicates perfect fit, and a value below 5 indicates a good fit [28]. In this study, the CMIN / df result was obtained as 5.65, indicating an acceptable fit. According to the statistics related to the other model data fit indices, the model generally fits well to the structure (RMSEA = 0.081, CFI = 0.94, NFI = 0.91, IFI = 0.94, SRMR = 0.066, GFI = 0.86, AGFI = 0.83, IFI = 0.94) [29]. Although the first CMIN / df result was out of the specified range, no modification was required as the other fit indices fit well. Therefore ON of three sub-factors compared to the CFE adaptation of the inventory analysis work sample structure it was also confirmed in Turkey.

Reliability coefficient for each factor and the whole scale was examined with Cronbach's alpha coefficient. The Cronbach's alpha coefficient was over 0.80 in sub-factors and total factor scores for ONI. The Cronbach's alpha coefficient was 0.906 for ONI total factor scores and Cronbach's alpha values for "behaviours", "impairements", and "emotions" were found to be 0.821, 0.842, and 0.809, respectively. Cronbach alpha reliability coefficient is expected to be above 0.70 [30]. Accordingly, the whole scale and its sub-factors were obtained reliably.

There is a statistically significant relationship between the total scores of ONI and the total scores of EAT-26 ($p < 0.01$). A positive and moderate relationship (r = 0.418) was found between ONI and EAT-26. In addition, the correlation coefficient between ONI and BMI was found to be statistically significant ($p < 0.01$). A positive and low level (r = 0.160) correlation was found between ONI and BMI. In other words, as ONI scores increase, both BMI and YTT-26 scores increase or vice versa.

Table 3. ONI relationships with EAT-26 and BMI

	ONI Total	ONI Behaviors	ONI Impairments	ONI Emotions
EAT-26	0,418**	0.311**	0.374**	0.401**
BMI	0,160**	0.62	0.221**	0.150**

EAT-26 = Aating Attitue Test-26, BMI = Body Mass Index, ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level

Skewness and kurtosis are statistics that provide information about the normality of the data distribution, and when it is between -2 and +2, the data distribution is normal [31]. Accordingly, the skewness and kurtosis value for women and men was 1.050 / 0.059, and 0.808 / 0.725 respectively. So the data distribution is normal. Whether there is a difference according to gender is shown in Table 4.

Table 4. ONI relationships with gender

Gender	n	Mean		SD	t	df	p
Women	503	39.03	±	9.99	-1.227	708	0.22
Men	207	40.04	±	10.04			

Values are expressed as n or mean±SD

There is no statistically significant difference between ONI scores according to gender ($t_{(708)}$=-1.227, p = 0.22, p < 0.05). The average ONI of female and male are similar. In other words, female and male of ONI scores are at similar levels.

Discussion

The present study, it was aimed to investigate the psychometric properties of a translated Turkish version of the ONI among a heterogeneous population sample. This study was the first attempt to validate the original version translated into Turkish language. The Turkish form of the scale was sent online to adult individuals and the data of the obtained 710 participants were analyzed.

In the study, it was suggested a three-factor solution while retaining all 24 items from the original ONI. With regard to the results based on CFA, it found the ONI had good performance on all psychometric indicators. An acceptable internal consistency of the Turkish test had been found with a Cronbach's alpha of 0.906 and for Cronbach's alpha values "behaviours", "impairements", and "emotions" sub-factors were found to be 0.821, 0.842, and 0.809 respectively. This demonstrates that the Turkish version of the ONI is a reliable screening scale. The ONI developed by Oberle et al. (2020) was the internal consistency coefficient of the envantery was found to be 0.94 and ranged from 0.88 to 0.90 for three sub-factors of Cronbach's alpha values [21]. The Cronbach's alpha coefficient of the ORTO-15 scale adapted to Turkish is 0.62 [32]. Internal consistency of this scale was found to be greater than ORTO-15.

ON, which tends to shift from a healthy nutrition to an obsessive nutrition, is closely associated with eating disorders. It was found positive correlations between the EAT-26 scores and the scores on the ONI and sub-factors similar to the study of Obler et al. (2020). These results are consistent with the results of numerous studies showing that ON symptomatology involves disordered eating above and beyond a simple commitment to healthy eating behaviors is associated with more disorder eating [21, 33–37]. Similar to the literature, the tendency of ONI according to gender did not significantly differ in our study [38]. It was found low positive correlations between the scores of ONI and the BMI. The relationship between BMI and ONI score is controversial [21, 39]. Although there are studies that show positive correlation like our results in the literature. Different results can be found in scales evaluating orthorexia nervosa tendency, especially when there are questions evaluating physical condition and when different groups are selected as samples.

Limitations

Although, the various strengths of the study (the sample is generally relatively heterogeneous in Turkey, representative sample of the population etc.) is as great a few limitations should be noted. First, the findings of this study were based on self-report data. There is a risk of resource bias. Second, there are no clear diagnostic criteria for ON for both researchers and clinicians. This envantery should be used not for diagnosis but for assessing the risk of ON in the Turkish population. Third, the majority of the sample consists of women and well-educated, which may affect the generalizability of the findings.

Conclusion

This indicates that the scale can measure the presence of orthorexic tendencies and behaviors in the Turkish population as a whole not for diagnosis. Values obtained from the validation and psychometric properties of ONI appropriate fit indices support the quality of the scale, which has been approved for good internal consistency and proper structural compatibility.

What is already known on this subject?

The 24-item of ONI is the first inventory to evaluate each of the four consensus diagnostic criteria for ON in scientific research.

What does this study add?

Our study is the first study to validate and report the Turkish version of the ONI and ONI demonstrated high reliability and acceptable validity in the Turkish adult population. Further studies could determine the tendency of individuals in the adult Turkish population to orthorexia nervosa and it could be applied to different groups. Also, to determine orthorexia nervosa trend, increasing in the whole world and in Turkey this inventory is thought to be important.

Declarations

Ethics declarations

Conflict of interest

All authors declare that they have no conflict of interest.

Ethical approval

The procedures used in this study are in line with the principles of the Declaration of Helsinki and The research protocol of the study was approved by the Ethics Committee of the Ondokuz Mayıs University (number: B.30.2.ODM.0.20.08/765).

Informed consent

In the study, informed consent was obtained from the participants in electronic form prior to data collection.

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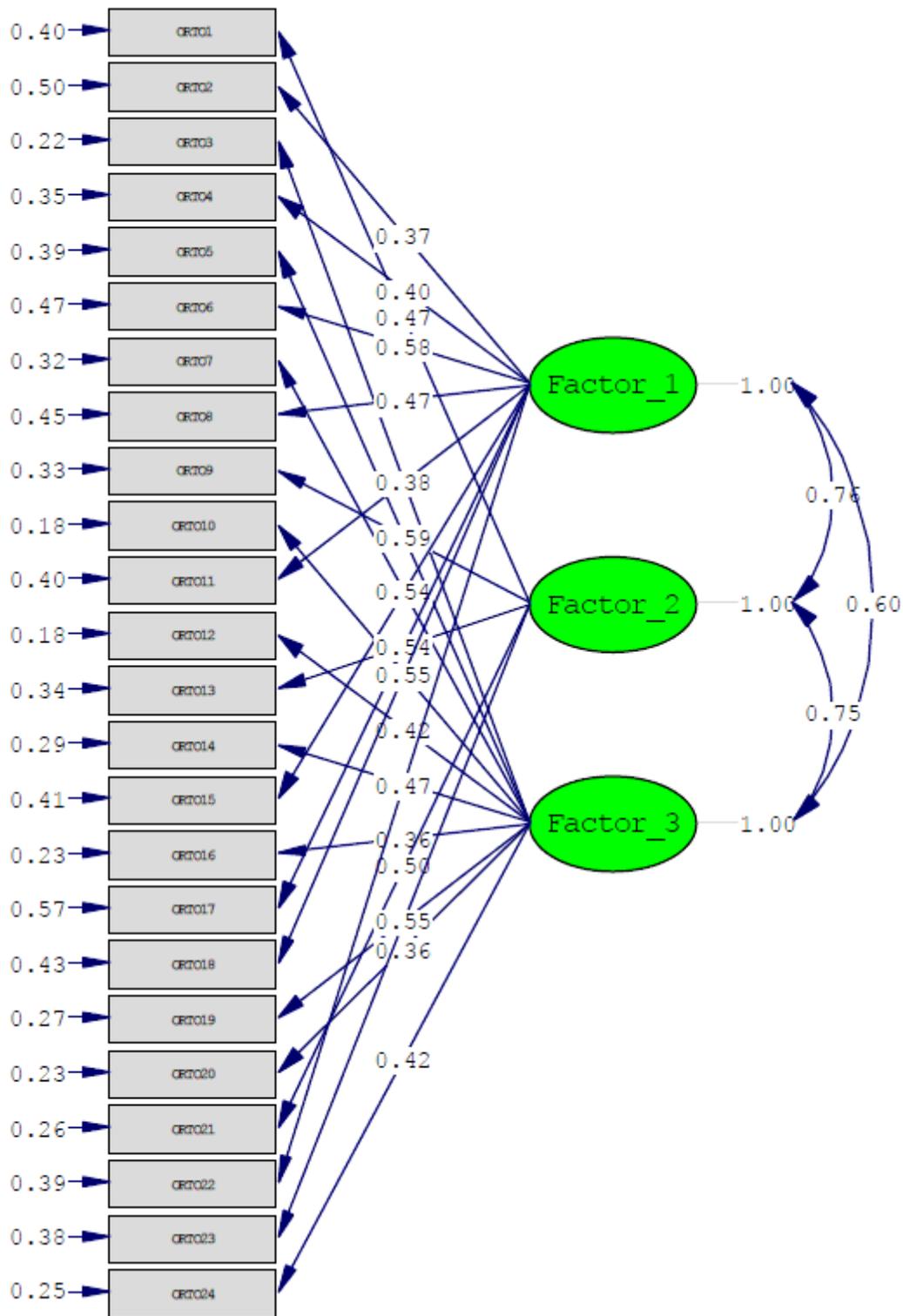
Figures

Figure 1

The confirmatory factor analysis loading of ONI. Factor_1 = ONI behaviors, factor_2 = ONI emotions, factor_3 = ONI impairiments, Chi-square = 1406.16, df = 249, p value = 0.0000 RMSEA = 0.081