BIOLOGY OF EXERCISE
VOLUME 5.1, 2009

Factor analysis and cut-off score of the 26-item eating attitudes test in a greek sample

D.O.I: http:doi.org/10.4127/jbe.2009.0025

ANGELIKI DOUKA, EIRINI GRAMMATOPOULOU
EMMANOUIL SKORDILIS, DIMITRA KOUTSOUKI

Department of Physical Education and Sport Sciences, Kapodistrian University of Athens

ABSTRACT

Objective: The study examined the cross-cultural validity of the Eating Attitudes Test (EAT-26) in Greece, with 26 items under three subscales ('Dieting', 'Bulimia and Food Preoccupation', 'Oral Control').

Method: A total of 167 Greek undergraduate students (19 to 23 years old), and 20 female patients with Eating Disorders (13 to 42 years old) were examined with exploratory and confirmatory factor analysis.

Results: The factor analysis of the EAT-26 revealed a 13 items EAT model, with the three subscales 'Food Preoccupation', 'Dieting' and 'Important Others' fit the data ($\chi^2/df = 1.24$, AGFI = .91). Cronbach alpha and test retest reliability coefficients were at the appropriate range. The groups of patients and undergraduate students differed significantly (Wilks' Lambda = .52, $p < .05$) and 12 emerged as a new cut-off score for EAT-13.

Conclusion: Cultural adaptation of the EAT-26 showed a new 13 item model which appears to be valid and reliable for the detection of eating disorders in Greek population.

KEY WORDS: *eating disorders, cross-cultural adaptation, factor analysis, reliability, validity.*

INTRODUCTION

Eating disorders (ED) have gathered scientific interest lately (1). Accordingly, a number of diagnostic instruments have been developed to examine the tendency of individuals to exhibit ED (2-5). Garner and Garfinkel (2) developed the Eating Attitudes Test (EAT-26) for the detection of someone's tendency to exhibit ED. Garner, Olmstead and Polivy (3) created the Eating Disorder Inventory (EDI) for the detection of ED. Heinberg, Thompson and Stormer (4) created the Socio-cultural Attitudes towards Appearance Questionnaire (SATAQ), to evaluate the women's appearance with respect to the social model. In addition, Thompson, Van den Berg, Roehrig, Quarda and Heinberg (5) revised the Socio-cultural Attitudes towards Appearance Questionnaire to SATAQ-3, in order to examine the social influences of body image and ED. All the above instruments described, are mainly survey questionnaires, designed to evaluate the attitudes, behavior, and habits of individuals towards eating.

More specifically, the Eating Attitudes Test (EAT-26) was developed in USA (2) for the detection of ED (Anorexia Nervosa, Bulimia Nervosa, Eating Disorder Not Otherwise Specified –EDNOS and Binge Eating Disorder), in the general population. The EAT-26 incorporates 26 items, classified under the following subscales: 1) 'Dieting', 2) 'Bulimia and Food Preoccupation' and 3) 'Oral control'.The higher the score the higher the tendency to exhibit ED.

Garner (6) stated that EAT-26 is considered the most reliable and valid instrument used for the evaluation of the tendency to exhibit ED. In addition, the validity of the EAT-26, was examined with a confirmatory factor analysis (7), in a sample of 785 university students. The researchers (7) found that the EAT model, with 16 items under 4 factors (body image, dieting, bulimia and food preoccupation, and oral control), fit the data and was considered valid for the detection of ED.

Further, a variety of studies in USA, Europe, Australia and Asia have used the EAT-26 to detect ED in different populations. (6, 8-16) Garner (6) stated that the EAT-26 was the instrument used for the National Eating Disorders Screening Program in USA. People, who scored at, or above the cut-off score of 20, were referred to a diagnostic interview. Giannakoulia (9), on the other hand, used the EAT-26, along with the Dutch Eating Behavior Questionnaire (17) to separate ballet dancers into two different groups, either with or without ED, in Greece. The researcher implemented an intervention program aiming towards the development of positive attitudes towards food and body. Koidou (10) used the EAT-26 to detect ED among elite athletes in Greece. Wang et al. (12) examined the association between socioeconomic status, ethnicity, body dissatisfaction, and eating behaviors of children and adolescents, aged from 10 to 18 years old, in Australia (N=768). Wang et al. (12) concluded that age and gender differences in body image and problems in eating behavior were evident among children and

adolescents. There was no significant difference in the proportion of participants with ED among separate categories of socioeconomic status or ethnicity (Caucasian, Chinese, Vietnamese, Italian or Greek).

Nakamura et al. (8) conducted a study in order to estimate the prevalence of eating problems and associated factors in a group of 3,032 Japanese high school girls. The researchers stated that older age, higher body mass index, obsessive-compulsive tendency, and some familial issues were independently related to eating pathology. The above factors in some cases resulted in a distorted body image and had the greatest influence on eating problems (8). Bachner-Melman, et al. (11) examined the association between eating pathology and the vasopressin receptor (AVPR1A) in Israel. The researchers found that biological determinants interact with cultural cues in the etiology of ED. Al-Subaie et al. (14) assessed the validity of EAT-26 in female students, aged 7 to 12 years old, in Saudi Arabia. The researchers found that the EAT-26 may be a useful tool for the screening of ED in large populations. Choudry Mumford and Phil (16) examined 271 school girls in Pakistan. The prevalence of ED assimilated previous reports from surveys conducted in Asia. Berland, Thompson and Linton (15) examined the correlation between EAT-26 with other relevant measures, such as EAT-40 and EDI. The researchers found that EAT-26 was highly correlated with the other measures, suggesting, therefore, sufficient concurrent validity evidence. Finally, Jackson, Keel and Lee (13) found that Asian populations exposed to Western culture (second generation Korean-Americans, Korean immigrants and native Koreans), exhibited behaviors related to eating disorders.

The development of EAT-26 (2) based on the examination of individuals from the USA, has been used extensively, in a variety of populations and countries. Since the initial work of Garner and Garfinkel (2) and the validation study of Ocker et al. (7) few recent studies have reported specific reliability and validity evidence for the populations examined (14-16). According to the sample-specific validity and reliability evidence theory (18-21), it is necessary to provide certain validity and reliability indexes for different samples. Further, Giannakoulia (9) reported the importance of providing a valid and reliable measuring instrument for the detection of ED in Greece. Therefore, the present study was designed to examine the cross-cultural validity and reliability of the EAT-26, in a sample of Greek undergraduate students. Based on previous research findings (2, 7, 14, 15), we anticipated that the EAT-26 would be valid and reliable for university students in Greece.

MATERIAL AND METHODS

Procedure

Translation validity: Three bilingual professors, teaching at the department of physical education and sport sciences, in the University of Athens, Greece,

translated initially the English version of EAT-26 in Greek. Back translation was administered afterwards, from a Professor in the English literature. A final committee of 2 bilingual doctorate students and 2 bilingual PhD professors in Adapted Physical Activity, agreed for the final shape of EAT-26 in Greek (22).

The translated EAT-26 was administered to 14 adolescent girls and 11 boys, all bilingual athletes of gymnastics, both in Greek and English, with a time interval of two weeks (23-25). The response agreement, between the English and Greek versions, was higher than 80% (26, 27) providing therefore, translation validity evidence for the Greek EAT-26.

Accordingly, the EAT-26 was administered to undergraduate students and patients with ED. The undergraduate students, all volunteering to participate in the study, were tested twice in one month period. The primary researcher explained the purposes of the study and administered the questionnaire personally. Anonymity was assured, and the students were instructed to respond honestly.

The patients were tested in their respective clinics from their physicians as part of their regular treatment. The primary researcher visited initially the clinics, explained the purposes of the study to parents and patients, and distributed the questionnaires to physicians who were willing to cooperate. Again, anonymity was assured and the researcher visited the above clinics after testing to collect the questionnaires from the physicians. Further, all university students and patients responded to a demographic data sheet and signed the informed consent form. The Research Ethics Committee of the 'Aiginiteio' Hospital had approved our study protocol.

Participants

Participants were: a) 167 second year undergraduate students (90 women and 77 men), at the Department of Physical Education and Sport Sciences, in Athens, Greece (19-23 years of age), and b) 20 women, patients with eating disorders (ED), from university psychiatric clinic, (13-42 years of age). The student's and patient's BMI mean scores were 21.76 (SD = 2.28) and 15.55 (SD = 2.05) respectively.

Measuring Instrument

The Eating Attitudes Test (EAT-26) (2) was used for the purposes of the present study. According to other researchers (2, 3, 7, 12, 28-30) EAT-26 may be used for the detection of ED in the general population and athletes. Further, it is probably the most widely used standardized measure of symptoms and characteristics of ED.

The EAT-26 incorporates 26 items in a 4 point Likert scale, were the participants indicate the extent of their agreement or disagreement. Answers range from 3: always, 2: usually, 1: often, 0: sometimes, 0: rarely to 0: never (e.g.: 'I engage in dieting behavior'). The 26 items are classified under the following three separate subscales: 1) 'Dieting', 2) 'Bulimia and Food Preoccupation' and 3) 'Oral control'.2 The responses on the 26 items are summed at the end and a total score, ranging from 0 (minimum) to 78 (maximum), is extracted. The respondents, who score exactly at, or above, the cut off score of 20, belong to the group of people who has the tendency to develop ED. Further, responses in each subscale are extracted from the sum of its respective items. Although the EAT-26 does not provide a specific diagnosis of ED, studies have shown that it may be an efficient screening instrument for the detection of ED (2, 8, 12).

Statistical Analysis

Exploratory factor analysis, with oblique rotation, was initially applied to the data (Statistical Package for Social Sciences, SPSS) (31). Eigen values above 1.00 were used to decide upon the number of subscales (either 3 or 4 subscales solution) (32). Further, factor loadings, scree plot and alpha reliability were examined as well. The criterion for factor loadings was set at .40, since this value is acceptable in the social sciences (33). Therefore, only items with factor loadings above .40 with their respective subscale were retained. Items with: a) low factor loading (<.40), b) double factor loading and c) high (> .40) factor loading with the wrong factor, were excluded (26, 34). The scree plot was used, as a separate criterion, to confirm the number of subscales extracted (35). Finally, Cronbach alpha was used to present internal consistency evidence for the subscales extracted.

The EQS software, with subsequent confirmatory factor analysis, was used to confirm the factorial structure (36). For that reason, the following absolute and incremental fit indexes were used to estimate the sufficiency of the measurement model emerged from the exploratory factor analysis (37) a) high square ($\chi 2$) and b) $\chi 2$/ df ratio (38), c) Nonnormal Fit Index, d) Comparative Fit Index (CFI) = .97, e) Incremental Fit Index (IFI), f) Adjusted Goodness of Fit Index (AGFI), g) Standarized Root Mean Square Residual (RMR), h) Root Mean Squared Residual, i) Root Mean Square Error of Approximation (RMSEA), and j) 90% confidence interval of RMSEA (39-41).

The Pearson correlation coefficient (test retest method) was used to examine the reliability of the validated measuring instrument across time (26). Specifically, the questionnaire was administered twice, to a sample of 20 undergraduate students, with a time interval between the two measures of 10-15 days. The 10-15 days distance was considered appropriate for students to respond for second time without learning, practice or motivation effect (22, 42, 43, 26).

The SPSS software (31) with a multiple analysis of variance (MANOVA) was utilized to analyze the differences between undergraduate students and patients with ED from University clinic. A discriminant function analysis was utilized, as a post hoc test, to determine the subscales significantly separating the participants as either undergraduate students or patients with ED (32, 41). Finally, the independent samples t-test was used to examine the differences between undergraduate students and patients in the total score of the measuring instrument. The 95% confidence interval of differences was used to extract the cut off score of the measuring instrument. The .05 level of significance was selected to test the statistical hypotheses.

RESULTS

Exploratory factor analysis and alpha reliability

For the exploratory factor analysis we used the responses of the first measurement. The responses were subjected to exploratory factor analysis, with oblique rotation, pre hypothesized for a final three or four subscale solution (2, 7). According to the eigen values and the scree plot, the solution was clear for three subscales. Specifically, only three emerging subscales had eigen values above the 1.00 criterion (32). Further, the elbow at the scree plot appeared on the fourth subscale (35). Moreover, the three-subscale solution explained 53.88% of total variability, whereas the four- subscale solution explained 55%. It was clear that the three subscale model explained better the factorial structure of the scale, since the fourth subscale: a) increased only by 1.12% the total percentage of explained variability and b) had eigen value less than 1.00 (44).

Further content analysis and examination of factor loadings were used to decide upon the items which did not fit under the three subscales. As a result, thirteen (13) items were excluded from the initial EAT-26 (items 1, 2, 3, 4, 5, 7, 9, 15, 21, 23, 24, 25 and 26), leading to EAT-13. Only item 18 had low factor loading (< .40) and high skewness, above + 2.00 (45), but had suitable content with the first subscale and was retained. The respective mean scores of the two groups of undergraduate students and patients, in the three subscales and the total EAT-13, may be found in Table 1.

The first subscale grouped the following six items: No10, 11, 12, 14, 18 and 22 (e.g. No10: 'I feel extremely guilty after eating', No14: 'I am preoccupied with the thought of having fat on my body', No22: 'I feel uncomfortable after eating sweets'). Eigen value was 3.33 with 25.61% of explained variability and Cronbach a = .77. Overall, the six items had all relevant content and fitted under the first subscale named 'Food Preoccupation'.

The following items were grouped under the second subscale: No6, 16, 17 and 19 (e.g. No6: 'I am aware of the calorie content of foods I eat', No16: 'I avoid food with sugar in them', No17: 'I eat diet foods'). Eigen value was 2.09, with 16.06% of explained variability and Cronbach α = .69. These four items were fitting together and constituted the second subscale of 'Dieting'. Finally, three items were grouped together under the third subscale: No8, 13 and 20 (e.g. No8: 'I feel that the others would like me more if I eat less', No13: e.g. 'Other people think I am too thin', No20: 'I feel that others pressure me to eat'). Eigen value was 1.06 with 12.20% of explained variability and Cronbach α = .61. The three items (No8, 13 and 20), indicating the perceived importance of other people and the pressure to gain weight, constituted the subscale 'Important Others' (46). The overall results from the Exploratory Factor Analysis, leading to the development of the EAT-13, are presented in Table 2. Table 3 presents the 26-item EAT and the 13-item Greek version. The correlation matrix, with the three subscales and the total EAT-13 score, may be found in Table 4.

Table 1. *Means scores of students and patients, in the three subscales and the total EAT-13 score for the first measurement*

Variable	Mean	SD	N
Food preoccupation			
students	3.31	3.75	167
patients	9.05	6.75	20
Dieting			
students	1.88	2.34	167
patients	6.30	3.54	20
Important Others			
students	0.92	1.62	167
patients	5.65	2.66	20
Total score EAT-13			
students	6.12	5.23	167
patients	21.00	11.16	20

Table 2. *Results of the exploratory factor analysis of EAT-26, leading to EAT-13 (item loadings above 0.20 are presented)*

Item	'Bulimia and Food Preoccupation (BFP)	'Dieting' (D)	'Oral Control' (OC)
10(D[a])	.81		
11(D[a])	.76		
12(D[a])	.61		
14(D[a])	.66		
18(BFP[a])	.47		
22(D[a])	.79		
6(D[b])		.78	
16(D[b])		.73	
17(D[b])		.67	
19(OC[b])		.72	
8(OC[c])			.80
13(OC[c])			.68
20(OC[c])			.77
1(D[d])	.37		.34
2(OC[d])		.36	
3(BFP[d])	.35	–.36	
4(BFP[d])	.38	–.34	
5(OC[d])			.28
7(D[e])		.40	.48
9(BFP[f])			.53
15(OC[d])			.24
21(BFP[d])	.36		
23(D[d])	.34	.36	
24(D[d])	.33		
25(D[f])			.45
26(BFP[d])		.21	

a High loadings to the proposed factor 'Bulimia and Food Preoccupation' (BFP)
b High loadings to the proposed factor 'Dieting' (D)
c High loadings to the proposed factor 'Oral Control' (OC)
d Low factor loading
e Double factor loadings
f High loadings to wrong factor

Table 3. *Presentation of the 26-item and 13-item EAT*

26-item EAT	18-item EAT
Bulimia and Food Preoccupation Items: No 3, 4, 9, 18, 21, 26	Food Preoccupation Items: No 10, 11, 12, 14, 18, 22
Dieting Items: No 1, 6, 7, 10, 11, 12, 14, 16, 17, 22, 23, 24, 25	Dieting Items: No 6, 16, 17, 19
Oral Control Items: No 2, 5, 8, 13, 15, 19, 20	Important Others Items: No 8, 13, 20

Table 4. *The correlation matrix, with the three subscales ('Food Preoccupation', 'Dieting' and 'Important Others') and to total EAT-13 score, for the sample of Greek undergraduate students*

	FP	D	IO	Total EAT-13
FP	1.00	.17*	.08	.82*
D		1.00	.16*	.62*
IO			1.00	.44*
Total EAT-13				1.00

FP: 'Food Preoccupation', D: 'Dieting', IO: 'Important Others'
*: Significant at the .05 level

Table 5. *Results of Confirmatory Factor Analysis, for the EAT-13 model*

Fit Index	Value
χ^2	77.13
df	62
p	.09
χ^2/df	1.24
NNFI (Nonnormed Fit Index)	.96
CFI (Comparative Fit Index)	.97
SRMR (Standardized Root Mean Square Residual)	.06
RMSEA (Root Mean Square Error of Approximation)	.04

Confirmatory factor analysis

For the confirmatory factor analysis we used the responses of the second measurement. The factor structure for the EAT-13 model was examined afterwards, using confirmatory factor analysis, through the EQS software (36). The following indices therefore, were used to examine the total fit: a) The extracted chi-square value was not significant (χ^2 = 77.13, p = .09) for 62 degrees of freedom. b) The ratio of high square to its respective degrees of freedom (χ^2/df = 77.13/62 = 1.24) was at the appropriate range (38), c) The Bentler-Bonett Nonnormal Fit Index = .96, Comparative Fit Index (CFI) = .97, Bollen Incremental Fit Index (IFI) = .97, Adjusted Goodness of Fit Index (AGFI) = .91, Standarized Root Mean Square Residual (RMR) = .06, Root Mean Squared Residual = .04, Root Mean Square Error of Approximation (RMSEA) = .04, 90% confidence interval of RMSEA = .00 until .06, were all at the appropriate ranges (39-41). Results from the confirmatory factor analysis are presented in Table 5 and Figure 1.

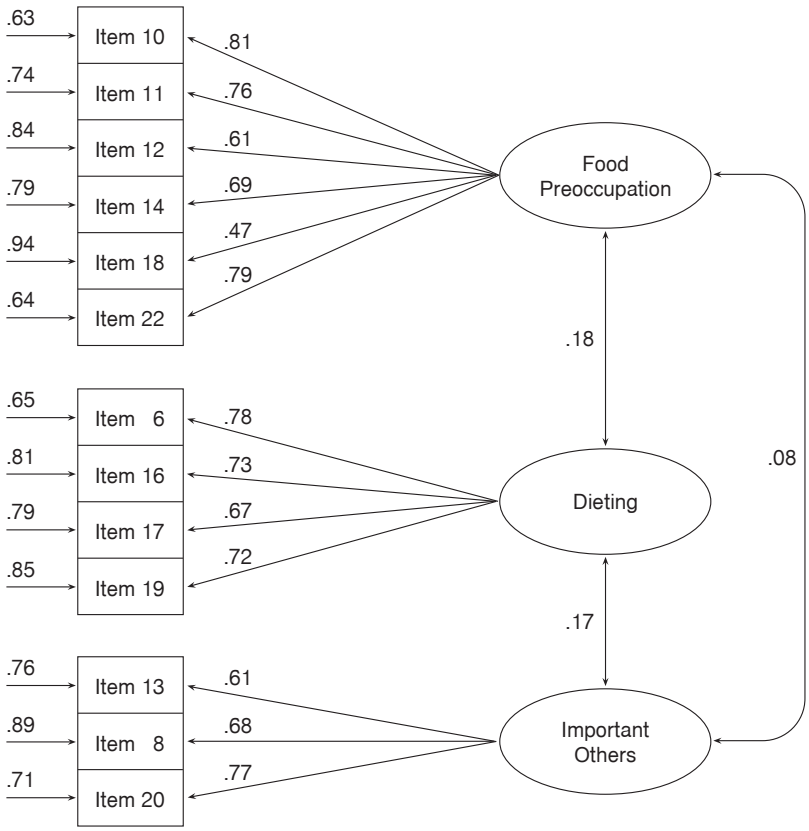

Figure 1: *Confirmatory factor analysis for the EAT-13 model, including error variance, loadings, and intercorrelations among the three subscales.*

Test – retest reliability

Correlation coefficient between the two testing sessions was statistically significant for the three EAT-13 subscales ($p < .01$). Values ranged from .89 to .90 for the 'Food Preoccupation' and 'Dieting' subscales respectively. Only for the third subscale ('Important Others') a lower test retest reliability coefficient of .63 was found. Finally, the test retest reliability coefficient for the total EAT-13 score was .85 ($p < .01$).

Differences between university undergraduate students and patients with ED

The MANOVA used to examine the differences between university undergraduate students and patients with ED, in the three EAT-13 subscales, revealed significant differences between the two groups (Wilks' $\Lambda = .53$, $p < .05$, $\eta^2 = .47$). Further univariate findings indicated significant differences between the two groups in 'Dieting' ($F = 56.23$, $p < .05$, $\eta^2 = .23$), 'Food Preoccupation' ($F = 33.90$, $p < .05$, $\eta^2 = .15$) and 'Important Others' ($F = 129.45$, $p < .05$, $\eta^2 = .41$). Examination of the respective mean scores revealed that the group of patients scored significantly higher than the group of undergraduate students.

Accordingly, a discriminant function analysis was used, as a post hoc method for the MANOVA. The statistical analysis revealed that the 'Important Others' and 'Dieting' were the two major subscales separating the two groups of undergraduate students and patients. The canonical correlation coefficient ($R = .68$) was indicative to the fact that 46.24% of the total variability was explained from group differences. The equation for predicting group membership was $Y = -1.08 + .47$ Ximpothers $+ .18$ Xdiet, and the percentage of correct classification was 93%. The above percentage was due to the 85% of patients and 94% of university students classified correctly. Only 3 patients (15%) and 10 undergraduate students (6%) did not classify properly at their respective groups.

Further discriminant function analysis was conducted to examine the prediction of participants, either with or without ED, based on their total EAT-13 responses. Accordingly, the EAT-13 responses could correctly classify 86.6% of the participants. The 86.6% ratio was attributed to the correct classification of 88.6% of undergraduate students (without ED) and 70% of patients (with ED) respectively. Further, 19 undergraduate students were classified in the ED (patient) group (11.4% of false positives), while 6 patients were classified into the non ED (undergraduate) group respectively (30% of false negatives) (44, 47).

Independent groups t-test was used to examine the differences between patients and university students, in the total EAT-13 score. The t value was significant ($t = 8.35$, $p < .05$), indicating that patients ($M = 18.65$) scored significantly higher than university students ($M = 6.28$). The 95% confidence in-

terval of the differences lied between 7.29 and 17.45. The above is indicative to the fact that 95% of the differences between the two groups, lied between the above limits. Median within the interval was 12.08, leading, therefore, to introduce a new cut-off score of 12 for EAT-13. Therefore, individuals scoring at, or above 12, in EAT-13, may have the tendency to exhibit ED.

DISCUSSION

The EAT-26 (2) was revised to EAT-13, with the three subscales of 'Food Preoccupation', 'Dieting' and 'Important Others', for a sample of Greek undergraduate students. These subscales emerged from exploratory and confirmatory factor analysis, grouping 13 items, according to their respective content. The EAT-13 therefore, may be considered as valid for the detection of eating disorders in a Greek population of undergraduate students.

Garner and Garfinkel (2) suggested the use of 'Dieting' (13 items), in EAT-26, as a brief and economical substitute of the general questionnaire, under specific circumstances. Further, according to researchers (9, 2) 'Dieting' is relevant to avoidance of fat food, involvement with dieting techniques, concern with the calories consumed, etc. The 'Dieting' subscale, in EAT-13, has 4 items, with content relevant to the EAT-26 described above.

'Bulimia and Food Preoccupation' (6 items), in EAT-26 (2) incorporates an intense interest for food and aliments, as well as bulimic behavior. In EAT-13, we have the same number of items (6) under 'Food Preoccupation', which declare preoccupation with food and associated emotions, while the bulimia element was excluded. Overall, it appears, that bulimia did not fit under the above subscale, according to the responses of Greek undergraduate students.

The 'Oral Control' subscale, in EAT-26 (7 items) (2) is related to the self-control and the pressure received from the environment concerning someone's weight (9). Three items formed the respective subscale in EAT-13 (items 8, 13, 20), which was named 'Important Others'. The content of the subscale deals exclusively with the pressure from the intimate environment to the person concerning his/ her weight.

Ocker et al. (7) found that the EAT model, with 16 items and 4 subscales (body image, dieting, bulimia and food preoccupation, and oral control), fit the data and was considered valid for the detection of ED. In the present factor analysis however, the solution was clear for three subscale solution and the fourth subscale increased only by 1,122% the total percentage of explained variability. Accordingly, body image, as a fourth subscale (7), did not fit the data for the sample of Greek undergraduate students.

The discriminant analysis revealed that the 'Important Others' and 'Dieting' were the two major subscales separating the two groups. The above findings

are partially in agreement with Garner and Garfinkel (2) who suggested that 'Dieting' is a brief and economical substitute of the general questionnaire. Further examination revealed that the EAT-13 responses classified correctly 86.6% of the total sample of undergraduate students and patients. The correct classification was higher for the group of students (88.6%) compared to patients (70%). The EAT-13 therefore may be used with confidence in general populations, such as the undergraduate sample in the present study, for the detection of the tendency to exhibit ED. Contradictory findings were referred by Al-Adawi, Dorvo, Burke, Moosa and Bahlani (48) in a relevant survey study of anorexia nervosa, using the Arabic version of EAT-26 along with personal interviews, among Omani adolescents in Saudi Arabia. The researchers tried to investigate the relationship between false positives and false negatives at various cut-off points of the questionnaire. The EAT-26 identified 29% of the subjects as probable anorexic cases, while 9.5% were identified during the structured interview. Al-Adawi et al. (48) concluded that although EAT-26 is the most widely used screening instrument in cross-cultural studies, it does not appear to be reliable in identifying probable cases of anorexia among Omani adolescents.

Certain limitations in the present study were: a) purposive sample selection, b) limited sample size, c) same sample for exploratory and confirmatory factor analysis, and d) difficulty to generalize our findings because of the fact that the sample examined was not from the general population. The purposive and not random sampling selection was chosen because there was a need for young adults, where the prevalence of ED is commonly detected. Another major limitation of this study was the small size of the sample used for conducting the factor analysis. However, the number of participants used in this study was 6/item, slightly beyond the acceptable ratio participants/variables (5/1) referred in the literature (49). Moreover, our decision to use the first measurement for the exploratory and the second for the confirmatory factor analysis, was based on the following criteria: a) validity and reliability are not static properties of an instrument by itself, but of the measurement (with different psychometric properties) that is produced in a given sample and b) the outcome from a 4-week within-subject measurement is considered a priori as having different psychometric properties (50). Finally, referring to the difficulty of the generalization of our findings, the participants were involved in athletics, as part of their daily program in the university where is widely known that athletes or college students exhibit ED during their studies (51-53).

Future research efforts are required to strengthen the present findings and provide validity and reliability evidence in different populations, such as adults, competitive athletes, adolescents, etc. Further, the EAT-13 may be used in different countries and cultures, in order to support its factorial structure and provide the scientific community with a solid measuring instrument for the detection of ED.

At this point, it appears that the EAT-13 is a valid and reliable instrument for the detection of ED among Greek university students. Further, it may be used from educators, teachers, coaches, or therapists, along with interview, BMI and/ or other clinical measures. Individuals, who score at or above 12 in EAT-13, may have the tendency to exhibit ED, and possibly require immediate treatment.

REFERENCES

1. Manos E. Basic Elements of Clinical Psychiatry. Thessaloniki: University Press; p. 339-349, 1997.
2. Garner DM, Garfinkel P. Eating Attitudes Test (EAT-26). Available at: http: // www.eatingdisorders-toledo.com/cgi-bin/test.cfm, 1997.
3. Garner DM, Olmstead PM, Polivy J. Development and validation of a multidimensional eating disorder inventory for anorexia and bulimia. Journal of Eating Disorders 2: 15-34, 1983.
4. Heinberg JL, Thompson JK, Stormer S. Development and validation of the sociocultural attitudes towards appearance questionnaire. International Journal of Eating Disorders 17: 81-89, 1995.
5. Thompson JK, Van den Berg P, Roehrig M, Quarda SA, Heinberg L. The sociocultural attitudes towards appearance scale-3 (SATAQ-3): Development and validation. International Journal of Eating Disorders 35: 293-304, 2004.
6. Garner DM. Self report measures for eating disorders. Current Contents 8:8, 1993.
7. Ocker LB, Lam ET, Zhang JJ, Jackson AS, Pease DG. Confirmatory Factor Analysis for the Eating Attitudes Test (EAT-26). Available at: http:// www.eatingdisorders-toledo.com/OrderEAT26.html, 1987.
8. Nakamura K, Hoshino Y, Watanabe A, Honda K, Niwa S, Tominaga K, Shimai S, Yamamoto M. Eating problems in female Japanese high school students: A prevalence study. International Journal of Eating Disorders 26:91-95, 1999.
9. Giannakoulia, M. Eating Behavior and Body Composition in young ballet dancers: planning, application and evaluation of a dietary intervention program. Doctoral thesis, Department of Nutrition and Dietetics, Harokopeio University, Athens, 2002.
10. Koidou E. Eating Disorders and Body Image of Elite Athletes. Doctoral thesis Department of Physical Education and Sports Science. Aristoteleio University, Thessaloniki, 2002.
11. Bachner-Melman R, Zohar AH, Elizur Y, Nemanov L, Gritsenco I, Konis D, Epstein R. Association between a vasopressin receptor AVPR1A promoter region microsatellite and eating behavior measured by a self-report

questionnaire (eating attitudes test) in a family-based study of a non-clinical population. International Journal of Eating Disorders 36: 451-460, 2004.
12. Wang Z, Byrne NM, Kenardy JA, Hills AP. Influences of ethnicity and socio-economic status on the body dissatisfaction and eating behaviour of Australian children and adolescents. Eating Behaviours 6: 23-33, 2005.
13. Jackson S, Keel P, Lee YH. Trans-cultural comparison of disordered eating in Korean women. International Journal of Eating Disorders 39: 498-502, 2006.
14. Al-Subaie A, Al-Shammari S, Bamgboye E, Al-Sabhan K, Al-Shehri S, Bannah AR. Validity of the Arabic version of the eating attitude test. International Journal of Eating Disorders 20: 321-324, 2006.
15. Berland NW, Thompson JK, Linton PH. Correlation between the EAT-26 and the EAT-40, the eating disorders inventory, and the restrained eating inventory. International Journal of Eating Disorders 5: 569-574, 2006.
16. Choudry IY, Mumford DB, Phil M. A pilot study of eating disorders in Mirpur (Pakistan) using an Urdu version of the eating attitudes test. International Journal of Eating Disorders 11: 243-251, 2006.
17. Van Strien T, Frijters J, Bergers G, Defares P. The Dutch eating behavior questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. International Journal of Eating Disorders 5: 295-315, 1986.
18. Sherrill C, O' Connor J. Guidelines for improving adapted physical activity research. Adapted Physical Activity Quarterly 16: 1-8, 1999.
19. Sawilowsky S. Psychometrics versus datametrics: Comment on Vacha-Haase's 'reliability generalization' method and some EPM editorial policies. Educational and Psychological Measurement 60: 174-195, 2000.
20. Thompson B, Vacha-Haase T. Psychometrics is datametrics: The test is not reliable. Educational and Psychological Measurement 60: 174-195, 2000.
21. Yun J, Ulrich D. Estimating measurement validity: A tutorial. Adapted Physical Activity Quarterly 19: 32-47, 2002.
22. Beaton ED, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 25: 3186-3191, 2000.
23. Osgood CE. Cross cultural compatibility in attitude measurement via multilingual semantic differentials. In: Fishbein M, Ed. Readings in Attitude Theory and Measurement. New York, Wiley Publications, p. 108-116, 1967.
24. Oppenheim AN. Questionnaire design and attitude measurement. London, Pinter Publication, p. 120-130, 1994.
25. Lienert C, Sherrill C, Myers B. Physical educators' concern about integrating children with disabilities: A cross-cultural comparison. Adapted Physical Activity Quarterly 18: 1-17, 2001.

26. Thomas J, Nelson J. Research methods in physical activity. Champaign, Illinois, Human Kinetics, p. 184-191, 1996.
27. Schmidt S, Bullinger M. Current issues in cross-sectional quality of life instrument. Archives of Physical Medicine and Rehabilitation 84: 29-34, 2003.
28. Harris M, Greco D. Weight control and weight concern in competitive female gymnasts. Journal of Sport and Exercise Psychology 12: 427-433, 1990.
29. Koff E, Sangani P. Effects of coping style and negative body image on eating disturbance. International Journal of Eating Disorders 22: 51-56, 1997.
30. Button EJ, Loan P, Davis J, Sonuga-Barke EJ. Self-esteem, eating problems, and psychological well being in a cohort of schoolgirls aged 15-16: A questionnaire and interview study. International Journal of Eating Disorders 2: 39-47, 1997.
31. Norusis MJ. SPSS for windows: Professional statistics release 6.0. Chicago, Illinois, Human Kinetics, 1993.
32. Stevens J. Applied Multivariate Statistics for the Social Sciences. NJ: Lawce Erlbaum Associates, Publishers, p. 385-454, 2002.
33. Jöreskog K, Sorbom D. LISREL 8: Structural Modeling with the SIMPLIS Command Language. Hillsdale, New Jersey, Erlbaum, 1993.
34. Hellandsig ET. Motivational predictors of high performance and discontinuation in different types of sports among talented teenage athletes. International Journal of Sport Psychology 29: 27-44, 1998.
35. Steinger JH. Structural model evaluation and modification: An interval estimation approach. Multivariate Behavioral Research 25: 173-180, 1998.
36. Bentler PM. EQS structural equations program manual. Los Angeles, BMDP Statistical Software; 1995.
37. Hoyle H, Panter T. Writing about structural equation models. In Hoyle R H, Ed. Structural equation modeling: Concepts, issues and applications. Thousand Oaks, Sage, p. 158-176, 1995.
38. Bentler PM, Bonett G. Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin 88: 588-606, 1980.
39. Bentler PM. Comparative fit indexes in structural models. Psychological Bulletin 107: 238-246, 1990.
40. Browne W, Cudeck R. Alternating ways of assessing model fit. In Bollen KA, Long JS (Eds). Testing structural equation models. Newbury Park, Sage, pp. 136-162, 1993.
41. Tabachnick BG, Fidell LS. Using multivariate statistics. New York, Harper Collins, p. 66-73, 1998.
42. Guilford J, Fructer B. Fundamental statistics in psychology and education. New York, McGraw-Hill, p. 92-98, 1978.

43. Hopkins KD. Educational and psychological measurement and evaluation Boston, Allyn & Bacon, p. 35-42, 1998.
44. Pedhazur E, Pedhazur-Schmelkin L. Measurements, design, and analysis: An integrated approach. Hillsdale, NJ: Erlbaume, p. 53-71, 1991.
45. West SG, Finch JF, Curran PJ. Structural equation models with no normal variables: Problems and remedies. In Hoyle RH (ed). Structural equation modelling: Concepts, issues and applications. Newbury Park, Sage, pp. 56-75, 1995.
46. Stevens J. Applied Multivariate Statistics for the Social Sciences. Lawce Erlbaum Associates, Publishers, 350-415, 1996.
47. Safrit M. Introduction to Measurement in Physical Education and Exercise Science. Boston, Mosby College Publishing, p. 141-152, 1990.
48. Al-Adawi S, Dorvlo AS, Burke DT, Moosa S, Al-Bahlani S. A survey of anorexia nervosa using the Arabic version of the 26 and "gold standard' interviews among Omani adolescents. Eating and Weight Disorders 7: 304-311, 2002.
49. Juniper, E.F. Guyatt, G.H. Streiner, D.L. & King, D.R. Clinical impact versus factor analysis for quality of life questionnaire construction. Journal of Clinical Epidemiology 50, 233-238, 1997.
50. Grammatopoulou, E. Skordilis, E. Koutsouki, D. & Baltopoulos, G. An 18-item standardised Asthma Quality of Life Questionnaire-AQLQ(S). Quality of Life Research 17, 323-332, 2008.
51. Sundgot-Borgen J. Weight and eating disorders in elite athletes (editorial). Scandinavian Journal of Medicine & Science in Sports 12 :259-260, 2002.
52. Sundgot-Borgen J. Eating disorders, energy intake, training volume, and menstrual function in high-level modern rhythmic gymnasts. International Journal of Sport Nutrition 6: 100-109, 1996.
53. Sundgot-Borgen J, Torstveit MK. Prevalence of eating disorders in elite athletes is higher than in the general population. Clinical Journal of Sport Medicine 14: 25-32, 2004.

Address for correspondence:
Angeliki Douka
National and Kapodistrian
University of Athens
Greece
E-mail: geldouka@phed.uoa.gr