

Italian validation and Measurement Invariance of the Food Addiction Symptom Inventory (FASI)

Elvira Anna Carbone

Magna Graecia University

Lavinia Rotella

Magna Graecia University

Serena Maria Garofalo

Magna Graecia University

Giorgia Francesca Vizza

Magna Graecia University

Daria Quirino

Magna Graecia University

Renato de Filippis

Magna Graecia University

Marianna Rania

University Hospital Renato Dulbecco, Italy

Ettore D'Onofrio

Magna Graecia University

Ashley N. Gearhardt

University of Michigan

Erica M. LaFata

Oregon Research Institute

Cristina Segura-Garcia

segura@unicz.it

Magna Graecia University

Matteo Aloï

University of Messina

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Abstract

Background

The Food Addiction Symptom Inventory (FASI) is a clinician-administered semi-structured interview developed to assess addiction-like eating behaviors related to ultra-processed food consumption, but a validated Italian version is unavailable. This study aimed to validate the Italian version of the FASI and examine its psychometric properties and clinical correlates in a sample of patients with eating disorders (EDs).

Methods

One hundred and eighteen patients with anorexia nervosa-restrictive subtype and binge-eating spectrum disorder were recruited. Participants completed the FASI interview and questionnaires on eating and general disorder psychopathology (YFAS 2.0, EDE-Q, EBA-O, BES, BDI-II). Confirmatory factor analysis (CFA) tested the dimensional structure of the FASI and the measurement of invariance between diagnostic groups. Reliability and convergent validity were examined.

Results

CFA supported the one-factor structure of the FASI and indicated a good model fit (CFI = 0.958, TLI = 0.947, RMSEA = 0.064 and SRMR = 0.076) and internal consistency ($\alpha = 0.80$). Measurement invariance analyses supported configural and partial metric invariance across restrictive- and binge-spectrum ED groups. Correlations between total FASI symptom criteria and YFAS 2.0 symptom scores supported convergent validity. Moderate-to-strong associations emerged in the overall sample ($r = 0.581$), with somewhat lower convergence observed in the AN group ($r = 0.408$) than the binge-spectrum group ($r = 0.505$).

Conclusion

The Italian version of the FASI demonstrates satisfactory psychometric properties and measurement invariance across ED diagnostic categories, supporting its use for assessing FA in EDs, while findings in the restrictive-spectrum group indicate that distinguishing addictive-like intake from restraint-driven overeating warrants further attention. Future studies with larger, gender- and age-balanced samples and longitudinal designs are warranted to confirm stability and predictive validity for clinical outcomes.

Introduction

Since its first description¹, food addiction (FA) has increasingly attracted greater scientific attention as a construct referring to a pattern of compulsive consumption of foods, particularly highly palatable ones, characterized by cravings, tolerance, loss of control, continued use despite negative consequences, and “withdrawal-like” physiological effects if highly palatable food intake is stopped or reduced². Although the nosological status of FA remains a topic of ongoing debate³, a growing body of clinical, biological, and genetic evidence support the existence of FA as a distinct clinical phenomenon warranted further study⁴. In recent years, interest in FA has expanded due to its reported frequent overlap with obesity and eating disorders (EDs), particularly binge eating disorder (BED)^{5,6,7,8,9}, and Bulimia Nervosa (BN)¹⁰. Recent findings suggest that FA symptoms may also be detected in patients with Anorexia Nervosa (AN)^{11–13}. FA has been also observed to have associations with various overeating behaviors, including binge eating, grazing and night eating, which are commonly reported by individuals who suffer from BED and obesity^{14–16}. Studies have reported that there is a direct relationship between the severity of FA and the associated eating and general psychopathology symptoms in individuals with EDs,^{13,17,18} and it may be a predictor of treatment outcome^{19,20–22} suggesting the need for routine screening in this population.

The most widely used instrument for assessing FA is the Yale Food Addiction Scale (YFAS) 2.0²³, developed to provide a validated measure of addictive-like eating behaviors. The YFAS 2.0 is a self-report tool that assesses the eleven Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria for substance-related and addictive disorders, as well as clinically significant impairment and/or distress associated with problematic eating behaviors. The YFAS 2.0 has generated robust evidence supporting the plausibility and clinical relevance of the construct.²⁴ Across psychiatric conditions, however, even a well-validated questionnaire functions as a screening proxy for symptom presence rather than a sufficient basis for a confirmed diagnosis, and structured clinical interviews have consistently served as a necessary complement to self-report in arriving at clinician-confirmed diagnoses. This complementary role is especially relevant for FA in eating disorder populations, where two recurrent sources of measurement error are difficult to resolve through self-report alone. The first is

the conflation of subjective and objective overconsumption: a respondent who maintains rigid dietary restriction may affirm having eaten beyond what was intended after consuming only a modest amount of UPFs, simply because the intended quantity approached zero, even in the absence of the objective excess that characterizes addictive-like intake. The second is symptom under-recognition among individuals with limited insight, who may not connect their eating to functional consequences and therefore under-endorse criteria such as craving or continued use despite harm. A trained interviewer can mitigate both by clarifying ambiguous reports, calibrating stated intake against objective amounts, and exercising clinical judgment in determining whether each criterion is genuinely met.

The FASI was developed for this purpose, modeled on the substance use disorder modules of the SCID-5.²⁵ It parallels the YFAS 2.0 in assessing the same 11 DSM-5 substance use disorder criteria and in yielding both a continuous symptom count and a dichotomous threshold score, which permits direct comparison between the two measures. Its distinguishing feature is its clinician-administered, semi-structured format, which allows a trained assessor to probe responses and apply clinical judgment when determining whether each criterion is met. Preliminary evidence has supported its promising psychometric properties, including good internal consistency, convergent validity, and an adequate factor structure, suggesting its applicability in both clinical and research settings to explain the overlapping and different features of FA versus and in existing EDs.²⁵

To date, no Italian validation of the FASI is available. Cross-cultural validation of psychometric instruments is essential to ensure semantic, conceptual, and metric equivalence across different cultural settings. In particular, measurement invariance testing is crucial to determine whether an instrument assesses the same construct in the same way across different groups, thereby allowing meaningful comparisons across distinct clinical presentations. Therefore, the present study aims to translate and validate the Italian version of the Food Addiction Symptom Inventory (FASI) in a sample of Italian patients with EDs. Specifically, the study aims are: a) to examine the factorial structure of the instrument; b) to evaluate its internal consistency, convergent and discriminant validity; and c) to test measurement invariance across ED spectrum groups, including restrictive AN (AN-R) and binge-eating spectrum disorders (BN and BED).

Methods

Participants

Patients with EDs were consecutively recruited between January 2025 and March 2026 during their first visit at the Outpatient Unit for Clinical Research and Treatment of Eating Disorders embedded within the Psychiatric Unit of the University Hospital “Renato Dulbecco” in Catanzaro (Italy). Inclusion criteria were aged above 14 years, the ED diagnosis according to DSM-5 TR,²⁶ drug-naïve, willing to participate, and valid informed consent (by parental or legal guardian for minors). Conversely, patients were excluded in case of intellectual disability from mild to severe according to DSM-5 TR ($IQ < 70$), suffering from medical diseases or undergoing treatments that could alter cognitive functions, or drug addiction, pregnancy, current or previous 12 months breastfeeding. The study protocol followed to the ethical principles of the Declaration of Helsinki, and it was approved by the Ethical Committee (identifier: 157/2025).

Procedures

The Italian version of the FASI was developed through a forward–backward translation procedure. Specifically, the original English version was independently translated into Italian by bilingual researchers with expertise in eating disorders, and subsequently back-translated into English by an independent translator unaware of the original version. Discrepancies between the original and back-translated versions were reviewed and resolved by consensus within the research team to ensure semantic and conceptual equivalence. Once this revised version was ready, a small group of 10 patients was interviewed using this reviewed version of the FASI to assess its comprehensibility. Only minor changes were suggested, and the Italian FASI was then considered ready for use in the study.

Measures

Food Addiction Symptom Inventory (FASI)

The Food Addiction Symptom Inventory (FASI)²⁵ is a clinician-administered semi-structured interview developed to assess addiction-like eating behaviors related to ultra-processed food consumption. In the present sample, the FASI demonstrated good internal consistency (Kuder–Richardson $\alpha = 0.80$).

Yale Food Addiction Scale 2.0 (YFAS 2.0)

The Yale Food Addiction Scale 2.0 (YFAS 2.0)^{27,28} was administered to assess convergent validity of the FASI. Similar to the FASI, the YFAS 2.0 is grounded in the DSM-5 substance use disorder framework and evaluates 11 addiction-related symptoms in relation to problematic consumption of highly palatable and ultra-processed foods over the previous 12 months. The questionnaire consists of 35 self-report items rated on an 8-point Likert scale ranging from 0 (“never”) to 7 (“every day”). It is scored in the same way as the FASI, yielding a continuous symptom count (0 to 11) and a dichotomous FA threshold, met when at least two criteria are endorsed together with clinically significant impairment or distress. In the current sample, the YFAS 2.0 demonstrated good internal consistency (Kuder–Richardson $\alpha = 0.89$).

Eating Disorder Examination Questionnaire (EDE-Q)

ED psychopathology was assessed using the Eating Disorder Examination Questionnaire (EDE-Q)²⁹, a widely used self-report measure evaluating the core cognitive and behavioral features of EDs over the previous 28 days. The questionnaire includes four subscales assessing dietary restraint, eating concern, shape concern, and weight concern. Higher scores indicate greater ED psychopathology. In the present sample, internal consistency values were satisfactory to good across subscales (α Global score = 0.86; α Restraint = 0.81; α Eating Concern = 0.80; α Weight Concern = 0.80; α Shape Concern = 0.86).

Eating Behaviors Assessment for Obesity (EBA-O)

The Eating Behaviors Assessment for Obesity (EBA-O)³⁰ is an 18-item self-report questionnaire developed to assess maladaptive eating behaviors commonly associated with obesity and dysregulated eating patterns. The instrument evaluates five dimensions of eating behavior: food addiction, night eating, binge eating, sweet eating, and hyperphagia. Items are rated on an 8-point Likert scale ranging from 0 (“never”) to 7 (“every day”), with higher scores indicating greater severity of dysfunctional eating behaviors. In the present sample, internal consistency was good-to-excellent across the five subscales, with omega coefficients of 0.91 for Food Addiction, 0.86 for Night Eating, 0.91 for Binge Eating, 0.86 for Sweet Eating, and 0.81 for Hyperphagia.

Binge Eating Scale (BES)

Binge eating symptom severity was assessed using the Binge Eating Scale (BES)^{31,32}, a 16-item self-report measure designed to evaluate behavioral, emotional, and cognitive features associated with binge eating. Higher scores reflect greater severity of binge eating symptomatology, with conventional cutoffs indicating minimal symptoms (< 17), possible BED (17–27), and probable BED (> 27). In the current sample, the BES showed excellent internal consistency ($\omega = 0.88$).

Beck Depression Inventory-II (BDI-II)

Depressive symptom severity was evaluated through the Beck Depression Inventory-II (BDI-II)³³, a 21-item self-report instrument assessing cognitive, affective, and somatic symptoms of depression experienced during the previous two weeks. Each item is scored on a 4-point scale from 0 to 3, with higher total scores reflecting greater depressive symptomatology. Standard interpretative ranges indicate minimal (0–9), mild (10–16), moderate (17–29), and severe (≥ 30) levels of depression. In the present sample, the BDI-II demonstrated good internal consistency ($\omega = 0.85$).

Statistical Analysis

All statistical analyses were conducted using RStudio (R Foundation for Statistical Computing)³⁴ and IBM SPSS Statistics version 25. Confirmatory Factor Analysis (CFA) was performed using the weighted least squares mean and variance adjusted estimator (WLSMV), which is recommended for ordinal and dichotomous indicators. The hypothesized unidimensional structure of the FASI was tested. Model fit was evaluated using multiple fit indices and their recommended cut-off criteria. Specifically, Root Mean Square Error of Approximation (RMSEA) values below 0.08 were considered indicative of acceptable fit, whereas Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values above 0.90 and 0.95 indicated acceptable and excellent fit, respectively. Standardized Root Mean Square Residual (SRMR) values below 0.08 were interpreted as acceptable and values below 0.05 as excellent. Measurement invariance across diagnostic spectrum groups was examined through a hierarchical series of multigroup CFAs. Participants were grouped into restrictive-spectrum EDs (AN) and binge-eating spectrum EDs (including BN and BED). Sequential levels of invariance were tested, including configural invariance (same factor structure across groups), metric invariance (equal factor loadings), and scalar invariance (equal item thresholds across groups). Invariance was evaluated by examining changes in model fit indices between nested models. Specifically, invariance was considered supported when $\Delta CFI \leq 0.010$, $\Delta RMSEA \leq 0.015$, and $\Delta SRMR \leq 0.010$ ³⁵. When invariance criteria were not fully met, score tests and modification indices were inspected, and partial invariance models were estimated when theoretically and clinically justifiable. Internal consistency reliability was evaluated using the Kuder–Richardson Formula 20 (KR-20), which is equivalent to Cronbach’s alpha for dichotomous items.

Agreement between dichotomous FA threshold classifications derived from the FASI and the YFAS 2.0 was evaluated by examining the degree of overlap between the two measures within restrictive-spectrum (AN) and binge-eating spectrum (BN/BED) ED groups. Convergent and discriminant validity were subsequently examined through Pearson's correlations between FASI total score and measures of ED psychopathology and related clinical features. Convergent validity was evaluated through associations with FA symptoms, binge eating severity, hyperphagia, sweet eating, night eating behaviors, and eating concern dimensions, given their theoretical overlap with addiction-like eating behaviors. Discriminant validity was examined through associations with depressive symptoms and dietary restraint, which were expected to show weaker or more variable relationships with FASI scores across diagnostic presentations. Correlational analyses were conducted separately within AN and BN/BED spectrum subgroups to further explore potential differences in the phenomenological expression of addiction-like eating behaviors across diagnostic spectrum. Statistical significance was set at $p < 0.05$.

Results

Demographics and clinical characteristics of the sample

The sample comprised 118 patients, including 52 individuals with AN-R and 66 with binge-eating spectrum disorders (BE-S; BN/BED). Table 1 summarizes the sociodemographic and clinical characteristics of the sample. Compared with the AN-R group, patients within the BE-S group showed higher age and BMI values, as well as higher levels of FA symptoms, binge-eating symptomatology, depressive symptoms, and maladaptive eating behaviors assessed through the EBA-O. In contrast, participants with AN-R reported slightly higher levels of dietary restraint. Across both groups, females and single individuals represented the majority of the sample.

Table 1
Characteristics of the sample

		AN-R	BE-S
		N = 52	N = 66
		M (SD)	M (SD)
Age (y)		21.8 (7.1)	31.2 (12.4)
BMI		18.9 (3.8)	32.0 (11.1)
FASI	Total	2.1 (2.6)	6.9 (2.4)
YFAS 2.0	Total criteria	1.7 (2.7)	6.2 (4.1)
EDE-Q	Restraint	3.9 (1.9)	3.3 (1.8)
	Eating Concern	2.9 (1.4)	3.7 (1.5)
	Shape Concern	4.5 (1.7)	5.1 (1.2)
	Weight Concern	3.9 (1.6)	4.6 (1.4)
	Total	3.7 (1.5)	4.2 (1.2)
EBA-O	Night eating	0.9 (1.4)	2.4 (1.9)
	Food addiction	1.4 (1.8)	4.1 (2.0)
	Sweet eating	2.1 (2.0)	4.7 (2.1)
	Hyperphagia	0.7 (1.1)	2.9 (2.4)
	Binge eating	1.5 (2.1)	4.6 (2.2)
	Total	1.3 (1.4)	3.7 (1.6)
BDI-II	Total	26.6 (14.2)	31.7 (10.8)
BES	Total	10.0 (9.6)	28.0 (9.5)
		Fr (%)	Fr (%)
Sex	Female	51 (98.1)	60 (90.9)
	Male	1 (1.9)	6 (9.1)
Civil status	Single	41 (78.8)	46 (69.7)
	Married	4 (7.7)	10 (15.2)
	Co-habitant	0 (0)	1 (1.5)
	Divorced	0 (0)	2 (3.0)
	NA	7 (13.5)	7 (10.6)
Education	Elementary school	2 (3.8)	2 (3.0)
	Middle school I	22 (42.4)	13 (19.7)
	High school II	15 (28.8)	32 (48.5)
	University degree	4 (7.7)	10 (15.2)
	NA	9 (17.3)	9 (13.6)
Occupation	Unemployed	5 (9.6)	6 (9.1)
	Employed	4 (7.7)	15 (22.7)
	Unpaid activity	1 (1.9)	5 (7.6)
	Student	35 (67.3)	28 (42.4)
	NA	7 (13.5)	12 (18.2)

AN-R: Anorexia nervosa-restricter; BE-S: Binge-eating spectrum; M: Mean; SD: Standard deviation; BMI: Body mass index; FASI: Food addiction symptom inventory; YFAS 2.0: Yale food addiction scale 2.0; EDE-Q: Eating disorder examination – questionnaire; EBA-O: Eating behaviors assessment for obesity; BDI-II: Beck depression inventory – II; BES: Binge eating scale.

CFA of the FASI

The results of the CFA supported the one-factor structure of the FASI and indicated a good fit to the data using the WLSMV estimator. The scaled fit indices showed acceptable-to-good model fit, with scaled CFI = 0.958, scaled TLI = 0.947, scaled RMSEA = 0.064 (90% CI [0.025, 0.090]), and SRMR = 0.076. The scaled chi-square test was significant, $\chi^2(44) = 64.88$, $p = 0.022$, although the standard chi-square test was non-significant, $\chi^2(44) = 51.47$, $p = 0.205$. Given the use of ordinal indicators and the WLSMV estimator, greater emphasis was placed on approximate fit indices rather than the chi-square statistic. Overall, the findings supported the adequacy of the one-factor solution.

Standardized factor loadings ranged from 0.443 to 0.906, with all loadings statistically significant ($p < 0.001$), indicating that all items contributed meaningfully to the latent FASI construct. The strongest loading was observed for “Tolerance” criteria ($\lambda = 0.91$), whereas “Use despite interpersonal/social consequences” criteria showed the lowest loading ($\lambda = 0.44$). The graphical representation of the CFA with standardized factor loadings is shown in **Fig. 1**.

Figure 1. Confirmatory Factor Analysis of the FASI

Measurement invariance across diagnostic groups

Multiple-group CFA was performed to examine the measurement invariance of the FASI across restrictive- (AN-R) and binge-spectrum (BN/BED) eating disorder groups. Fit indices for the configural and partial metric invariance models are reported in Table 2. Because the FASI items are dichotomous and estimated using WLSMV, threshold constraints did not represent an additional identifiable level of restriction beyond the metric model. Therefore, interpretation focused primarily on configural and metric invariance models.

Table 2
Fit indices for measurement invariance tests across diagnostic spectrum groups.

Model	Robust model fit indices						Model difference						
	χ^2	df	CFI	TLI	RMSEA	SRMR	ΔM	$\Delta \chi^2$	Δdf	ΔCFI	ΔTLI	$\Delta RMSEA$	$\Delta SRMR$
M1	92.018	88	0.993	0.991	0.028	0.083							
M2*	104.382	96	0.985	0.983	0.039	0.078	M2 VS. M1	7.294	8	-0.008	-0.008	0.011	-0.005

M1: configural invariance; M2*: partial metric invariance.

All the $\Delta \chi^2$ were not significant.

First, configural invariance was tested by estimating the two diagnostic groups without equality constraints. The configural model showed an excellent fit to the data (CFI = 0.993, TLI = 0.991, RMSEA = 0.028, SRMR = 0.083), supporting the assumption that the one-factor structure of the FASI was comparable across restrictive- and binge-spectrum presentations.

Second, metric invariance was examined by constraining factor loadings to equality across AN-R and BN/BED groups. As is common when comparing clinical groups that differ substantially in symptom severity, full metric invariance was not supported, and modification indices identified two non-invariant items whose differential functioning was theoretically anticipated. The first item, “consumed more than planned,” reflects loss-of-control eating, a defining feature of binge-spectrum presentations that may carry a different meaning under the sustained restriction characteristic of AN-R, where exceeding an intended intake need not reflect addictive-like overconsumption. The second item, “use despite physical and emotional consequences,” references the physical health problems of sustained ultra-processed food intake such as elevated body weight and cardiometabolic complications, which are more applicable to the higher-BMI binge-spectrum group than to AN-R and would therefore be expected to load differently across the two presentations. After releasing the equality constraints on these two factor loadings, a partial metric invariance model was achieved. The partial metric model demonstrated good fit to the data (CFI = 0.985, TLI = 0.983, RMSEA = 0.039, SRMR = 0.078). Compared with the configural model, changes in fit indices supported partial metric invariance across diagnostic groups ($\Delta CFI = -0.008$; $\Delta TLI = -0.008$; $\Delta RMSEA = 0.011$; $\Delta SRMR = -0.005$). In addition, the chi-square difference test compared with the configural model was non-significant ($\Delta \chi^2 = 7.25$, $p = 0.51$), further supporting partial metric invariance across diagnostic groups.

Overall, these findings indicate that the FASI demonstrates substantial measurement invariance across restrictive- and binge-spectrum ED presentations, with only two clinically meaningful items showing differential functioning between groups.

Psychometric properties of FASI

Reliability

The FASI interview demonstrated good internal consistency, with a Kuder–Richardson Formula 20 (KR-20) coefficient of .80.

Concordance with YFAS 2.0

Within each diagnostic group, the average number of FA symptoms endorsed was closely comparable across the two instruments. Among participants with AN-R, the FASI and YFAS 2.0 yielded similar mean symptom scores (FASI: M = 2.12, SD = 2.6; YFAS 2.0: M = 1.70, SD = 2.7), as did the two measures within the BE-S group (BN/BED) (FASI: M = 6.88, SD = 2.4; YFAS 2.0: M = 6.20, SD = 4.1). Symptom levels were, as expected, considerably higher in the BE-S group than in AN-R on both instruments, but the FASI and YFAS 2.0 tracked one another closely within each group.

Further, correlations between total FASI symptom criteria and YFAS 2.0 symptom scores supported convergent validity. Moderate-to-strong associations emerged in the overall sample ($r = 0.581$), with somewhat lower convergence observed in the AN-R group ($r = 0.408$) relative to the BE-S group ($r = 0.505$). Finally, rates of meeting the dichotomous FA threshold were broadly comparable across the FASI and YFAS 2.0, although the FASI identified slightly more cases overall. Within the AN-R group, 34.6% of participants met the FASI threshold compared with 28.8% on the YFAS 2.0. In the BE-S group, prevalence rates were substantially higher, with 92.4% meeting the FASI threshold and 83.3% meeting the YFAS 2.0 threshold.

Overall, these findings suggest that the FASI and YFAS 2.0 capture largely overlapping aspects of addiction-like eating, particularly within binge-spectrum EDs, while also reflecting partially distinct features in restrictive-spectrum presentations.

Convergent and discriminant validity

Correlational analyses conducted separately across diagnostic subgroups revealed distinct patterns of association between FASI score and eating-related psychopathology (Table 3). Within the AN-R subgroup, FASI total score showed significant positive associations with EDE-Q dietary restraint ($r = 0.314$, $p < 0.05$), EBA-O night eating symptoms ($r = 0.480$, $p < 0.01$), EBA-O binge eating symptoms ($r = 0.380$, $p < 0.01$), EBA-O sweet eating ($r = 0.441$, $p < 0.01$), EBA-O FA-related symptoms ($r = 0.345$, $p < 0.05$), and BES scores ($r = 0.461$, $p < 0.01$). In contrast, associations with EBA-O hyperphagia were weak and non-significant ($r = 0.080$). Correlations with eating, shape, and weight concerns, as well as depressive symptoms, were generally small and non-significant.

Table 3
Correlations between FASI scores and clinical variables across AN-R and binge-spectrum groups.

FASI	EDE-Q Restraint	EDE-Q Eating Concern	EDE-Q Shape Concern	EDE-Q Weight Concern	BDI-II	EBA- O Night eating	EBA-O Food addiction	EBA- O Sweet eating	EBA-O Hyperphagia	EBA- O Binge eating	BES
BE-S	-0.145	0.093	0.169	0.269	0.073	.283*	.452**	.355**	.339*	.495**	.472**
AN-R	.314*	0.265	0.166	0.122	0.260	.480**	.345*	.441**	0.080	.380**	.461**

** $p < .01$; * $p < .05$

A partially different pattern emerged within the BE-S. FASI total score was significantly associated with EBA-O FA-related symptoms ($r = 0.452$, $p < 0.01$), EBA-O binge eating ($r = 0.495$, $p < 0.01$), EBA-O hyperphagic eating ($r = 0.339$, $p < 0.01$), EBA-O sweet eating ($r = 0.355$, $p < 0.01$), EBA-O night eating symptoms ($r = 0.283$, $p < 0.05$), and BES scores ($r = 0.472$, $p < 0.01$). In contrast to the AN-R subgroup, dietary restraint was not positively associated with FASI score ($r = -0.145$), suggesting a weaker relationship between addiction-like eating and restrictive cognitive features within binge-spectrum presentations.

Discussion

The present study examined the psychometric properties of the FASI in a clinical sample of patients with EDs and evaluated its measurement invariance across restrictive- and binge-spectrum ED presentations. The CFA supported the one-factor structure of the FASI

demonstrating acceptable-to-good fit across multiple robust fit indices, suggesting that this measure captures a coherent latent construct related to FA symptoms. All items significantly loaded on the latent factor, although factor loadings varied in magnitude. In particular, the “*Tolerance*” criteria showed the strongest loading, highlighting the central role of escalating consumption or diminished reward sensitivity in addiction-like eating. By contrast, the “*Use despite interpersonal/social consequences*” criteria showed the weakest loading, likely because patients with EDs, compared to those with substance use disorders, may recognize less readily the social impairment associated with ultra-processed food consumption,³⁶ which the clinician administering the FASI can only partly offset through probing.

The FASI also demonstrated good internal consistency, supporting the reliability and coherence of the underlying latent construct.

Importantly, measurement invariance analyses supported configural and partial metric invariance across restrictive- and binge-spectrum ED groups. These findings suggest that addiction-like eating may be conceptualized as a relatively transdiagnostic construct despite the heterogeneity of ED psychopathology^{10–12,37,38}.

Partial metric invariance analyses revealed that two items showed non-invariant factor loadings across the AN-R and binge-spectrum groups: “*Consumed more than planned*” and “*Use despite physical/emotional consequences*.” This finding is clinically meaningful and theoretically coherent. The “*Consumed more than planned*” criterion reflects overeating beyond intended amounts and loss-of-control eating, which are core features of binge-spectrum disorders,^{39,40} and its meaning is less straightforward under the sustained dietary restriction that characterizes AN-R. In a patient maintaining rigid restriction, intake that exceeds an intended goal of near-abstinence may be reported as eating “more than planned” even when the objective quantity consumed is small, so in this group the item may capture subjective overconsumption tied to restraint rather than the objective loss of control it is intended to assess. This reading is consistent with the associations observed within AN-R, where FASI scores were positively related to dietary restraint, an association that was absent in the binge-spectrum group, and we return to its implications below.

Likewise, the “*Use despite physical/emotional consequences*” criterion may be more strongly associated with binge-spectrum conditions, particularly BED presentations. This item explicitly refers to the physical and emotional consequences related to sustained ultra-processed food consumption, which are more applicable to the higher-BMI binge-spectrum group in this sample (Table 1) than to AN-R^{37,46}. Further, binge episodes in particular are frequently accompanied by negative emotional and somatic consequences that may reinforce maladaptive eating.^{41–44} Despite these localized differences in item functioning, partial metric invariance was supported, indicating that the overall latent construct remained substantially comparable across restrictive- and binge-spectrum ED groups. Overall, these findings strengthen the utility of the FASI within transdiagnostic ED research.

Convergent validity was supported by the association between FASI score and YFAS 2.0 symptom counts. Moderate correlations emerged between the two tools, demonstrating overlap in the construct assessed. However, convergence was somewhat lower in the AN-R group compared to the BE-S group, indicating that the two instruments overlap less in restrictive presentations. Threshold-based classifications showed a similar pattern: agreement was high in the binge-spectrum group, where the FASI identified somewhat more cases than the YFAS 2.0 (92.4% vs 83.3%), and the two measures also diverged in AN-R, where the FASI again identified more cases (34.6% vs 28.8%). The direction of this latter difference is notable, because a clinician-administered interview would be expected to be more conservative than self-report in a highly restrictive group, by distinguishing subjective from objective overconsumption.²⁵ The lower convergence and divergent thresholds in AN-R could reflect either the FASI capturing addictive-eating features that self-report misses or the clinician-administered format admitting restraint-related endorsements in this group. We consider these alternatives, together with the restraint associations reported above, in the following section.

Convergent and discriminant validity findings also provide important insights into the clinical significance of FA symptoms across ED phenotypes. In the BE-S subgroup, FASI score were strongly associated with binge eating, hyperphagia, sweet eating, and other maladaptive eating behaviors. This is in line with literature demonstrating that FA often is related to altered eating behaviors^{14–16,47} and support the close relationship between addiction-like eating and loss-of-control eating phenomena²⁴. Dietary restraint was not positively associated with FASI scores in this group, replicating the discriminant pattern reported in the original validation.²⁵ Thus, in the binge-spectrum presentations for which the FASI was first developed, the instrument behaved as intended, relating to overconsumption while remaining independent of restrictive cognition.

The AN-R subgroup showed a different pattern that warrants careful interpretation. For AN-R patients, FASI scores were positively associated with dietary restraint, an association specific to this group and absent in the binge-spectrum sample, and the threshold and convergence findings diverged from those in binge-spectrum presentations. One interpretation is that restrictive and addictive processes coexist in a subgroup of AN characterized by heightened ultra-processed food preoccupation and alternating restraint and loss of control,^{12,48} possibly marking incipient crossover toward a binge-purging presentation.¹¹ This interpretation cannot be excluded in a cross-sectional design, and

the moderate associations between FASI scores and binge-related symptoms in this group are consistent with some degree of genuine addictive-like eating. However, it does not account for the restraint association or for the direction of the threshold difference. The clinician-administered format is intended to reduce endorsement relative to self-report in a highly restrictive group, by identifying and excluding subjective reports of overconsumption that do not reflect objective intake, rather than to increase it. That the FASI instead identified more cases than the YFAS 2.0 in AN-R, alongside its positive association with restraint, suggests that in at least some cases intake-based criteria were coded present when intake was objectively minimal and restraint was primary, the configuration the FASI is specifically intended to screen out.

This pattern points to a measurement challenge specific to FA. Interviews for substance use disorders need not confirm that a substantial quantity is consumed, because problematic use entails consumption and no presentation involves distress around negligible intake. Addictive-like eating differs. An AN-R patient may experience genuine distress and a subjective sense of loss of control around small amounts of ultra-processed foods in the absence of objective overconsumption, a configuration with no direct analogue in the substance use disorder framework from which the FASI and its SCID-5 source were adapted. Assessing FA therefore depends on the clinician distinguishing objective addictive-like intake from restraint-driven subjective overeating, a distinction rarely needed in binge-spectrum presentations but central in restrictive ones. This deduction was part of how the FASI was developed and validated, and its discriminant performance in binge-spectrum samples is consistent with that design. Its extension to a purely restrictive group, not represented in the original validation, identifies the presentation in which this judgment matters most.

Interestingly, depressive symptoms and body-related concerns showed limited associations with FASI score, particularly within the AN-R group. This pattern may indicate that the FASI captures behavioral and motivational aspects of eating pathology more specifically related to reward processing and compulsive consumption, rather than general psychological distress or body image dissatisfaction.

Strengths, limitations, and future directions

A key strength of the study is the inclusion of a clinically heterogeneous ED sample which allowed a comprehensive evaluation of the FASI across different manifestations of eating pathology. Another important strength is the use of robust psychometric methods, including CFA and measurement invariance testing, which supported the structural validity and cross-group comparability of the instrument. Moreover, the integration of interview-based and self-report measures strengthened evidence for convergent and discriminant validity of the FASI. Finally, the transdiagnostic perspective adopted in the present study contributes to a broader understanding of addiction-like eating across restrictive- and binge-spectrum ED presentations.

Despite these strengths, some limitations should be acknowledged. First, the cross-sectional design precludes conclusions regarding the temporal stability, sensitivity to change, or predictive validity of FASI scores. Second, the relatively small number of male participants and the recruitment of patients from a single specialized clinical center prevented testing measurement invariance across sex and may limit the generalizability of the findings. Future studies should further examine the longitudinal and cross-cultural validity of the FASI, as well as its applicability across broader ED populations and clinical settings. A further limitation concerns the interpretation of FA in the AN-R group. The present design could not fully distinguish genuine addictive-like eating from restraint-driven subjective reports of overconsumption, because objective UPF intake was not measured and the study relied on the EDE-Q rather than the EDE interview, precluding separation of objective from subjective loss-of-control episodes. In addition, interrater reliability was not established within the restrictive-spectrum subgroup, where the clinical judgment described above is most demanding.

These limitations point to two developments that would strengthen the FASI across the ED spectrum. First, a standardized administration guide would specify a coding rule currently left to clinical judgment: an intake-based criterion should be endorsed only when overconsumption is objectively present, not when restriction makes a small intake feel like overeating. Such guidance would also support interrater reliability across sites and across cultural and linguistic adaptations, including the present Italian version. Second, the FASI could incorporate a probe anchoring the relevant criteria to objective intake before they are coded. Consistent with the unresolved status of objective consumption thresholds even for gold-standard SUD interviews, such a probe should anchor clinical judgment to objective intake rather than impose a fixed cutoff. These refinements would be valuable whether the AN-R pattern reflects measurement contamination or a genuine restrictive-addictive subgroup, since both call for clearer separation of objective intake from subjective experience. Future work should also evaluate the FASI against an objective measure of ultra-processed food intake and in larger restrictive-spectrum samples.

Conclusions

The Italian version of the FASI demonstrates satisfactory psychometric properties, including a coherent one-factor structure, good internal consistency, and partial measurement invariance across ED diagnostic categories, supporting its use for assessing FA in EDs. Convergent validity and discriminant performance were consistent with the original instrument in binge-spectrum presentations, while findings in the

restrictive-spectrum group indicate that distinguishing addictive-like intake from restraint-driven overeating is more difficult in this population and warrants further attention. These results contribute to the growing literature supporting a transdiagnostic conceptualization of addictive eating and highlight the potential clinical relevance of assessing FA symptoms in this population, while underscoring the need for clearer separation of objective intake from subjective experience in restrictive presentations. Future studies with larger, gender- and age-balanced samples and longitudinal designs are warranted to confirm stability and predictive validity for clinical outcomes.

What is already known on this subject?

Food addiction (FA) is increasingly recognized as a clinically relevant construct in eating disorders (EDs), particularly among individuals with binge-eating behaviors. The Food Addiction Symptom Inventory (FASI) is a clinician-administered interview designed to assess addiction-like eating behaviors related to ultra-processed food consumption and has shown promising psychometric properties in its original version. To date, no validated Italian version of the FASI has been available, limiting its use in Italian-speaking clinical and research settings.

What this study adds?

This study provides the first validation of the Italian version of the FASI in a clinical sample of patients with restrictive- and binge-spectrum eating disorders. Findings support a unidimensional factor structure, good internal consistency, and measurement invariance across ED diagnostic groups, indicating that the instrument measures the same construct across different clinical presentations.

The Italian FASI demonstrated convergent validity with established measures of food addiction and eating disorder psychopathology, supporting its utility for assessing FA in ED populations. Lower convergence between FASI and self-reported food addiction symptoms in restrictive-spectrum EDs suggests that differentiating addictive-like eating from restraint-driven overeating may require particular clinical attention.

Declarations

Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee (identifier: 157/2025).

Consent to participate

Informed consent was obtained from all individual participants included in the study and from the parents or legal guardian for minors.

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Author Contribution

All authors whose names appear on the submission made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work; drafted the work or revised it critically for important intellectual content; approved the version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. More specifically the involvement was as follows: - Conceptualization: CSG; - Methodology: CSG, EAC, MA; - Formal Analysis: MA; - Investigation: EAC, ED, MR, RdF; - Data Curation: LR, SMG, GFV, DQ; - Writing-Original Draft Preparation: EAR, MA; - Writing-Review and Editing: CSG, EAR, MA, ANG, EML; - Supervision & Project administration: CSG;

Data Availability

References

1. Randolph, T. G. The descriptive features of food addiction; addictive eating and drinking - PubMed. *Q J Stud Alcohol* 17, 198–224 (1956).
2. Gordon, E. L., Ariel-Donges, A. H., Bauman, V. & Merlo, L. J. What Is the Evidence for “Food Addiction?” A Systematic Review. *Nutrients* 10, (2018).
3. Oliveira, J., Bestetti, G. C., Stelmo, I. D. C., Antunes, L. & Vilella, P. R. Questioning the validity of food addiction: a critical review. *Front. Behav. Neurosci.* 19, (2025).
4. Florio, L. et al. Food Addiction: A Comprehensive Review. *J. Nerv. Ment. Dis.* 210, 874–879 (2022).
5. Piccinni, A. et al. Food addiction and psychiatric comorbidities: a review of current evidence. *Eat. Weight Disord.* 26, 1049–1056 (2021).
6. Pursey, K. M., Stanwell, P., Gearhardt, A. N., Collins, C. E. & Burrows, T. L. The prevalence of food addiction as assessed by the Yale Food Addiction Scale: a systematic review. *Nutrients* 6, 4552–4590 (2014).
7. di Giacomo, E. et al. Disentangling binge eating disorder and food addiction: a systematic review and meta-analysis. *Eat. Weight Disord.* 27, 1963–1970 (2022).
8. Long, C. G., Blundell, J. E. & Finlayson, G. A Systematic Review of the Application And Correlates of YFAS-Diagnosed ‘Food Addiction’ in Humans: Are Eating-Related “Addictions” a Cause for Concern or Empty Concepts? *Obes. Facts* 8, 386–401 (2015).
9. Ivezaj, V., White, M. A. & Grilo, C. M. Examining binge-eating disorder and food addiction in adults with overweight and obesity. *Obesity (Silver Spring)* 24, 2064–2069 (2016).
10. de Vries, S. K. & Meule, A. Food Addiction and Bulimia Nervosa: New Data Based on the Yale Food Addiction Scale 2.0. *Eur. Eat. Disord. Rev.* 24, 518–522 (2016).
11. Sanchez, I. et al. Food addiction in anorexia nervosa: Implications for the understanding of crossover diagnosis. *Eur. Eat. Disord. Rev.* 30, 278–288 (2022).
12. Aloj, M. et al. Disentangling food addiction-related symptom profiles in anorexia nervosa: a latent class analysis and clinical implications. *J. Eat. Disord.* <https://doi.org/10.1186/S40337-026-01611-Z> (2026) doi:10.1186/S40337-026-01611-Z.
13. Cinelli, G. et al. Food Addiction in a Group of Italian Adolescents Diagnosed for Eating Disorder. *Nutrients* 12, (2020).
14. Davis, C. et al. Evidence that ‘food addiction’ is a valid phenotype of obesity. *Appetite* 57, 711–717 (2011).
15. Gearhardt, A. N., White, M. A., Masheb, R. M. & Grilo, C. M. An examination of food addiction in a racially diverse sample of obese patients with binge eating disorder in primary care settings. *Compr. Psychiatry* 54, 500–505 (2013).
16. Gearhardt, A. N. et al. An examination of the food addiction construct in obese patients with binge eating disorder. *Int. J. Eat. Disord.* 45, 657–663 (2012).
17. Granero, R. et al. Food addiction in a Spanish sample of eating disorders: DSM-5 diagnostic subtype differentiation and validation data. *Eur. Eat. Disord. Rev.* 22, 389–396 (2014).
18. Tran, H. et al. FOOD ADDICTION AS A PROXY FOR ANOREXIA NERVOSA SEVERITY: NEW DATA BASED ON THE YALE FOOD ADDICTION SCALE 2.0. *Psychiatry Res.* 293, (2020).
19. Munguía, L. et al. Food Addiction in Eating Disorders: A Cluster Analysis Approach and Treatment Outcome. *Nutrients* 14, (2022).
20. Ben-Porat, T. et al. Food Addiction and Binge Eating During One Year Following Sleeve Gastrectomy: Prevalence and Implications for Postoperative Outcomes. *Obes. Surg.* 31, 603–611 (2021).
21. Ben-Porat, T. et al. Food Addiction and Binge Eating Impact on Weight Loss Outcomes Two Years Following Sleeve Gastrectomy Surgery. *Obes. Surg.* 32, 1193–1200 (2022).
22. Romero, X. et al. Is food addiction a predictor of treatment outcome among patients with eating disorder? *Eur. Eat. Disord. Rev.* 27, 700–711 (2019).
23. Gearhardt, A. N., Corbin, W. R. & Brownell, K. D. Development of the Yale Food Addiction Scale Version 2.0. *Psychol. Addict. Behav.* 30, 113–121 (2016).
24. Schulte, E. M., Wadden, T. A. & Allison, K. C. An evaluation of food addiction as a distinct psychiatric disorder. *Int. J. Eat. Disord.* 53, 1610–1622 (2020).
25. LaFata, E. M. et al. Development of the Food Addiction Symptom Inventory: The first clinical interview to assess ultra-processed food addiction. *Psychol. Assess.* 36, 654–664 (2024).
26. First, M. B. & American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5-TR.* (2022).

27. Gearhardt, A. N., Corbin, W. R. & Brownell, K. D. Development of the Yale Food Addiction Scale Version 2.0. *Psychol. Addict. Behav.* 30, 113–121 (2016).
28. Aloï, M. *et al.* Validation of the Italian version of the Yale Food Addiction Scale 2.0 (I-YFAS 2.0) in a sample of undergraduate students. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* 22, 527–533 (2017).
29. Calugi, S. *et al.* The eating disorder examination: reliability and validity of the Italian version. *Eat. Weight Disord.* 20, 505–511 (2015).
30. Segura-Garcia, C. *et al.* Development, validation and clinical use of the Eating Behaviors Assessment for Obesity (EBA-O). *Eat. Weight Disord.* 27, 2143–2154 (2022).
31. Ricca, V. *et al.* Screening for binge eating disorder in obese outpatients. *Compr. Psychiatry* 41, 111–115 (2000).
32. Gormally, J., Black, S., Daston, S. & Rardin, D. Binge Eating Scale. *PsycTESTS Dataset* <https://doi.org/10.1037/T08303-000> (2012) doi:10.1037/T08303-000.
33. Ghisi M, F. G. M. A. S. E. & S. C. *Beck Depression Inventory-II. Manuale Italiano.* (Organizzazioni Speciali, 2006).
34. R Core Team. *R: A Language and Environment for Statistical Computing.* (R Foundation for Statistical Computing, Vienna, Austria, 2021).
35. Chen, F. F. Sensitivity of Goodness of Fit Indexes to Lack of Measurement Invariance. *Struct. Equ. Modeling* 14, 464–504 (2007).
36. Rogers, P. J. Food and drug addictions: Similarities and differences. *Pharmacol. Biochem. Behav.* 153, 182–190 (2017).
37. Carbone, E. A. *et al.* The relationship of food addiction with binge eating disorder and obesity: A network analysis study. *Appetite* 190, (2023).
38. Aloï, M. *et al.* Using latent class analysis to identify different clinical profiles according to food addiction symptoms in obesity with and without binge eating disorder. *J. Behav. Addict.* 13, 262–275 (2024).
39. Reivan Ortiz, G. G. *et al.* Beyond diagnosis: a network approach to the emotional and control processes involved in the binge eating spectrum disorders. *Sci. Rep.* 16, 13234 (2026).
40. Forester, G. *et al.* Evaluating the role of binge planning and binge inevitability within affect regulation models of binge eating. *Appetite* 203, (2024).
41. Micanti, F. *et al.* The relationship between emotional regulation and eating behaviour: a multidimensional analysis of obesity psychopathology. *Eat. Weight Disord.* 22, 105–115 (2017).
42. Zhou, A., Xie, P., Tian, Z. & Pan, C. The influence of emotion on eating behavior. *Advances in Psychological Science* 29, 2013–2023 (2021).
43. Devonport, T. J., Nicholls, W. & Fullerton, C. A systematic review of the association between emotions and eating behaviour in normal and overweight adult populations. *J. Health Psychol.* 24, 3–24 (2019).
44. Rania, M. *et al.* Reactive hypoglycemia in binge eating disorder, food addiction, and the comorbid phenotype: unravelling the metabolic drive to disordered eating behaviours. *J. Eat. Disord.* 11, (2023).
45. Puttevils, L., Vanderhasselt, M. A., Horczak, P. & Vervaeke, M. Differences in the use of emotion regulation strategies between anorexia and bulimia nervosa: A systematic review and meta-analysis. *Compr. Psychiatry* 109, (2021).
46. di Giacomo, E. *et al.* Disentangling binge eating disorder and food addiction: a systematic review and meta-analysis. *Eat. Weight Disord.* 27, 1963–1970 (2022).
47. Şengör, G. & Gezer, C. Food addiction and its relationship with disordered eating behaviours and obesity. *Eating and Weight Disorders* 24, 1031–1039 (2019).
48. Elran-Barak, R. *et al.* Dietary Restriction Behaviors and Binge Eating in Anorexia Nervosa, Bulimia Nervosa and Binge Eating Disorder: Trans-diagnostic Examination of the Restraint Model. *Eat. Behav.* 18, 192–196 (2015).

Figures

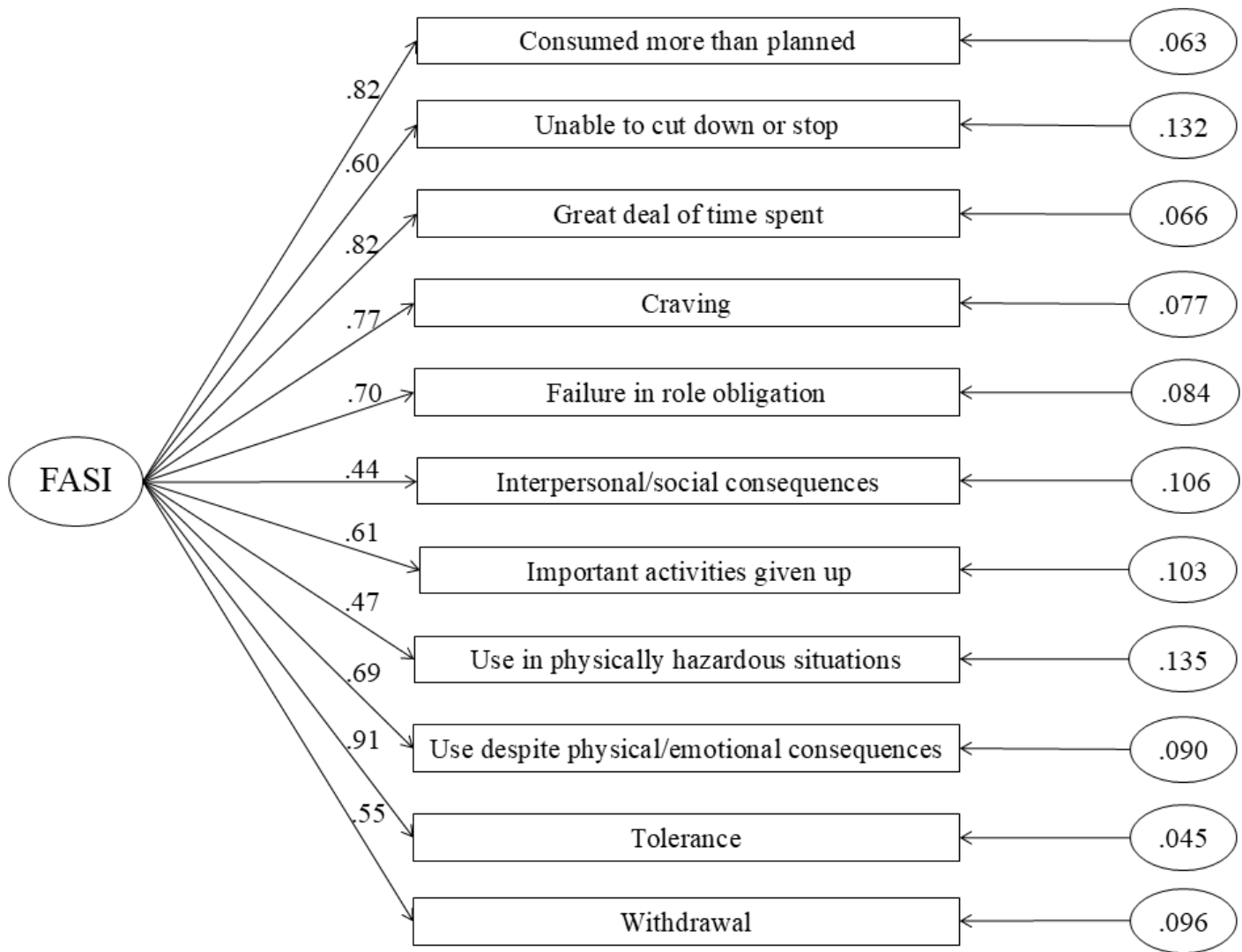


Figure 1

Confirmatory Factor Analysis of the FASI