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Article

Psychometric Properties of the Dutch Version of the Eating Competence Satter Inventory (ecSI 2.0™) in Community Adolescents

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Abstract: Eating competence can play a role in helping adolescents navigate their food choices and attitudes toward eating in a healthy and balanced way. In the present study, we investigated the psychometric properties of the Dutch translation of the Eating Competence Satter Inventory 2.0™ (ecSI 2.0™), which was developed to assess eating attitudes and behaviors. A sample of 900 Flemish adolescents completed the ecSI 2.0™ DUTCH and two self-report measures on eating disorder symptoms and identity functioning (i.e., confusion and synthesis). Confirmatory factor analysis confirmed the four-factor structure of the ecSI 2.0™ DUTCH, and the resulting four subscales (Eating Attitudes, Food Acceptance, Internal Regulation, and Contextual Skills) showed acceptable to excellent reliability (α ranging from .69 to .91). The ecSI 2.0™ also showed to be scalar invariant across sex and age (<17 years, \geq 17 years). Boys reported significantly higher ecSI 2.0™ DUTCH scores than girls on the four subscales and the total scale. The two age groups did not differ significantly on the ecSI 2.0™ DUTCH scales. Finally, scores on the ecSI 2.0™ subscales showed no or small negative correlations with adolescents' BMI, large negative correlations with eating disorder symptoms and identity confusion, and large positive associations with identity synthesis. The Dutch translation of the ecSI 2.0™ is a valid and reliable instrument to assess eating competence skills in male and female adolescents.

Keywords: eating competence; adolescents; reliability; validity; eating disorders; identity

1. Introduction

Adolescence is a critical period of development during which young individuals are susceptible to societal pressures, body image concerns, and changes in eating habits [1,2]. Besides the physical maturation processes, adolescents also undergo psychological maturation processes and need to develop a personal identity. Adopting the principles of eating competence can help adolescents develop a healthy relationship with food and their bodies. By learning to listen to their bodies, make informed food choices, and maintain a positive relationship with food, adolescents can establish healthy habits that extend into adulthood [3].

1.1. The Satter Eating Competence model

The Satter eating competence model (ecSatter) is an evidence-based and practice-based conceptualization of the interrelated spectrum of eating attitudes and behaviors [3]. According to Satter [3] (p. S142), competent eaters are “positive, comfortable, and flexible with eating and are

matter-of-fact and reliable about getting enough to eat of enjoyable and nourishing food". The Satter eating competence model breaks eating competence down into four components: (1) attitudes about eating and food; (2) food acceptance skills; (3) internal regulation skills; and (4) skills and resources for managing the food context and orchestrating family meals [3] (p. S142). Positive eating attitudes refer to a positive interest in food/eating, attunement to inner (e.g., appetite) and outer (e.g., food attractiveness and availability) food experiences, and self-trust about managing food [3]. Food Acceptance skills refer to feeling comfortable in the presence of novel food, and being willing to experiment with unfamiliar food and learn to like it, i.e. not being a picky eater [3]. Internal Regulation skills refer to the experiential processes of hunger, appetite, and satiety, which attend to physiological homeostatic mechanisms that support constitutionally appropriate body weight [3]. Dieting requires ignoring these homeostatic mechanisms and triggers counterregulatory mechanisms leading to weight gain [3]. Contextual Skills refer to meal planning (structure) and support in choosing preferred food and eating it in amounts that satisfy hunger/appetite [3]. Maintaining a pattern of regular meals depends on the three other competencies, i.e. positive attitude towards eating, accepting food, and being attuned to signs of hunger, appetite and satiety (regulation) [3].

1.2. The construction of the Eating Competence Satter Inventory (ecSI) and its different adaptations (ecSI/LI, ecSI 2.0, ecSI 2.0TM)

To assess the four aforementioned eating competencies, Satter developed the Eating Competence Satter Inventory (ecSI) [3]. The ecSI consisted of 16 items divided over four subscales, capturing the four eating competences: Eating Attitudes (5 items), Food Acceptance (3 items), Internal Regulation (3 items), and Contextual Skills (5 items). Each item needs to be answered on a five-point scale with the response options *always* (score 3), *often* (score 2), *sometimes* (score 1), *rarely* (score 0) and *never* (score 0). The total ecSI score can range from 0 to 48, and an ecSI total score ≥ 32 indicates eating competence [4]. Lohse et al. [4] validated the ecSI in a community sample of 863 adults (78.7 % female) and could replicate the theoretical four-factor structure of the ecSI utilizing exploratory factor analysis. Results showed that all four subscales were reliable: Eating Attitudes ($\alpha=.84$), Food Acceptance ($\alpha=.65$), Internal Regulation ($\alpha=.75$), and Contextual Skills ($\alpha=.74$) [4]. Participants scoring high on eating competence (ecSI total score ≥ 32) were generally older, reported lower BMI, fewer eating disorder symptoms, more physically activity, and made more healthy food/ meal choices [4]. Stotts and Lohse [5] investigated the test-retest reliability (interval 2 to 6 weeks) of the ecSI in 259 white females, which revealed moderate-to-high Spearman rank correlation coefficients: ecSI total score ($r_s = .68$), Eating Attitudes ($r_s = .70$), Food Acceptance ($r_s = .65$), Internal Regulation ($r_s = .52$), and Contextual Skills ($r_s = .70$).

In 2011, Krall and Lohse [6] investigated the validity of the ecSI in women with low income (N=25). Four items of the ecSI were misinterpreted due to wording and clarity problems [6]. These four misinterpreted items were revised based on participants' feedback, retested and combined with the 12 unaltered items in the ecSI for Low-Income (ecSI/LI). Krall and Lohse [6] validated the ecSI/LI in 507 females with low income and showed that eating competent women (ecSI/LI total score ≥ 32) reported more physical activity, more fruit and vegetable intake, better food planning, a lower BMI, less body weight dissatisfaction and less eating disorder symptoms compared to non-eating competent women.

In 2015, Lohse [7] examined whether the ecSI/LI could also be used in the general population, which was not considered low-income. She administered both the ecSI and the ecSI/LI (with four altered items) to 127 participants; the correlation between both versions of the instruments was very high ($r = .98$). The author concluded that the ecSI/LI was also applicable in the general population, and renamed the ecSI/LI as Eating Competence Satter Inventory 2.0 (ecSI 2.0). In 2015, Tilles-Tirkkonen and colleagues [8] validated a preliminary Finnish translation of the ecSI 2.0 in a Finnish sample of 976 adolescents (54% girls) aged 10-17 years old. They could replicate the four-factor structure of the ecSI 2.0 using confirmatory factor analysis and showed that the total scale and the four subscales were reliable: Total ecSI 2.0 ($\alpha=.92$), Eating Attitudes ($\alpha=.87$), Food Acceptance ($\alpha=.78$), Internal Regulation ($\alpha=.83$), and Contextual Skills ($\alpha=.81$). Eating competent adolescents (ecSI 2.0 total

score ≥ 32) reported a higher level of self-esteem and a stronger sense of identity coherence; were less dissatisfied about their body size, and had less often tried to lose body weight. They also reported higher meal frequency, more consumption of fruits and vegetables, and more health-promoting family meals.

More recently, Godleski, Lohse, and Krall [9] investigated the factor structure of the ecSI 2.0 in 2010 adults. The findings of the confirmatory factor analysis confirmed the four-factor structure of the ecSI 2.0, but suggested a migration of item 9 *"I trust myself to eat enough for me"* from the Internal Regulation subscale to the Eating Attitudes subscale. The migration of item 9 improved model fit and reduced the magnitude of the correlation between the Eating Attitudes and the Internal Regulation subscales (e.g., in sample A from $r = .90$ to $r = .75$). In sum, the final ecSI2.0TM still consists of 16 items divided over four subscales but with different item numbers: Eating Attitudes ($n_{\text{items}}=5+1=6$), Food Acceptance ($n_{\text{items}}=3$), Internal Regulation ($n_{\text{items}}=3-1=2$), and Contextual Skills ($n_{\text{items}}=5$). The correlational patterns of the ecSI2.0/ecSI2.0TM (sub)scales with other variables remained very similar [9]. Given that the ecSI 2.0TM is used both at the total and the subscales level, Godleski et al. [9] also investigated a second-order factor model in which each of the subscales loaded on one higher-order latent factor (Eating Competence). The data fitted this higher-order model well, and the subscales loaded on the overall higher-order factor as follows: Eating Attitudes (.96), Food Acceptance (.62), Internal Regulation (.83), and Contextual Skills (.82). Finally, de Queiroz and colleagues [10] investigated the validity and reliability of the Brazilian Portuguese version of the ecSI2.0TM. Confirmatory factor analysis confirmed the four factor structure of the ecSI2.0TM BR and the internal consistency coefficients of the subscales were: ecSI2.0TM BR total score ($\alpha = .87$), Eating Attitudes ($\alpha = .79$), Food Acceptance ($\alpha = .73$), Internal Regulation ($\alpha = .53$), and Contextual Skills ($\alpha = .82$) [10].

As far as we know, no studies investigated (1) the factor structure, (2) reliability, (3) measurement invariance across sex and age, and (4) validity of the ecSI 2.0TM DUTCH in adolescents. Gaining insight in the eating attitudes and behaviors of adolescents is however important, given that those attitudes and behaviors impact their relationship with food and their bodies. Adolescents who have positive eating attitudes, particularly if they score high in food acceptance skills, may be less vulnerable to food fads and good-food-bad-food thinking. Adolescents who score high in internal regulation are less likely to engage in restrictive dieting and compensatory overeating. Adolescents who give evidence of contextual skills may be more resourceful and confident in providing for their nutritional needs [3].

Therefore, it is important to investigate whether the ecSI 2.0TM DUTCH is a valid and reliable instrument to assess eating competence skills in adolescents, whether it is measurement invariant across sex and age, and to examine its' association with dysregulated eating behaviors, body attitude and identity development, which are closely related with each other [11,12]. Up till now, several studies investigated the association between disordered eating and eating competence [4,6]; however, only one study investigated the association between identity development and positive eating attitudes and behaviors in adolescence [8], although both, healthy eating attitudes and behaviors and identity development are core developmental tasks in adolescence [1,2].

1.3. The present study

Therefore, in the present study, we investigated (1) the four-factor structure of the ecSI 2.0TM DUTCH and the higher order model with one latent construct (eating competence) as well as the correlations between the latent factors in a sample of Flemish adolescents, (2) the reliability of the total scale and the subscales, (3) the measurement invariance of the ecSI 2.0TM DUTCH across sex and age; and (4) the associations between the ecSI 2.0TM DUTCH total/subscales and Body Mass Index (BMI), eating disorder symptoms (Drive for Thinness, Bulimia, Body Dissatisfaction) and identity measures (diffusion/synthesis), to investigate convergent/divergent validity.

Based on the existing literature, (1) we expected to find a four factor structure of the ecSI 2.0TM DUTCH with a slightly better fit for a factor solution in which item 9 *"I trust myself to eat enough for me"* belongs to the Eating Attitudes scale [9] compared to a second factor solution with item 9 belonging to the Internal Regulation scale [7]. We also expected that the correlation between the Eating Attitudes

and the Internal Regulation subscales would be lower in the first factor solution ($r = \pm .75$) compared to the second factor solution ($r = \pm .90$) based on a study in adults [9]. Finally, we also hypothesized that a second-order model in which each of the subscales loaded on one higher-order latent factor (i.e. Eating Competence) would fit the data well [9]. (2) Concerning the reliability of the subscales, we expected acceptable ($\alpha \geq .70$) internal consistency for the Food Acceptance subscale, good/excellent ($\alpha \geq .80/90$) internal consistency coefficients for the Contextual Skills and Eating Attitudes subscales, and poor internal consistency of the Internal Regulation subscale [10]. (3) Given the lack of previous studies on the measurement invariance across sex and age of the ecSI 2.0TM DUTCH, no concrete hypotheses could be forwarded. (4) Finally, with respect to convergent/divergent validity, we expected that the total ecSI 2.0TM DUTCH and its subscales would be unrelated or negatively related to BMI, and negatively associated with eating disorder symptoms [4,6] and identity confusion [8]; whereas the scales would be positively related to identity synthesis [8].

2. Materials and Methods

2.1. Participants & procedure

In total, 923 adolescents participated in the first wave of the IDentity and Embodiment in Adolescents – Longitudinal study (IDEAL-study). Of this sample, 23 adolescents did not fill out the ecSI 2.0TM DUTCH and were excluded from the study. Of the remaining 900 adolescents, 58.8% ($n=529$) identified as female, 40.8% as male ($n=367$), 0.2% ($n=2$) did not want to disclose their sex, and 0.2% ($n=2$) did not answer the question. The latter four participants were not included in the analyses in which we examined sex invariance of the ecSI 2.0TM DUTCH. The mean age of the 900 adolescents was 16.19 years ($SD_{age} = 1.31$, range: 13-21 years), and the mean BMI of the adolescents was 21.08 kg/m², ($SD_{BMI} = 3.42$, range: 14.34 – 42.44 kg/m²). To examine age invariance of the ecSI 2.0TM DUTCH, we divided the sample in two age groups: an adolescent group (< 17 years, range: 13-16 years, $N = 500$) and an emerging adulthood group (≥ 17 years, range: 17-21 years, $N = 400$).

The study took place in three secondary schools in Belgium between April and May 2022. The study was approved by the Social and Societal Ethics Committee of KU Leuven. Prior to data collection, all adolescents read and signed an informed consent form, with parental consent obtained for adolescents younger than 16 years. For older adolescents, parents were informed about the participation of their adolescents in the study. Adolescents filled out the questionnaires during school hours while researchers were present in the classroom to answer their questions. After completing the questionnaires, the adolescents handed them in in a sealed envelope. Adolescents who were absent on the day of the data-collection, were invited via e-mail to fill out the questionnaire online (Qualtrics). To thank the adolescents for their participation in the study, they all received a movie ticket.

2.2. Instruments

2.2.1. Eating Competence Satter Inventory 2.0TM-Dutch version (ecSI 2.0TM DUTCH)

Eating competence was assessed by means of the ecSI 2.0TM DUTCH. The ecSI 2.0TM DUTCH is the Dutch translation of the ecSI 2.0TM [9] which was translated into Dutch by permission of Barbara Lohse and Ellyn Satter. First, the items were translated into Dutch, and back-translated into English. The back-translated items were checked and approved by Barbara Lohse and Ellyn Satter. The ecSI 2.0TM consists of 16 items to be rated on a 5-point answer scale. The 16 items are divided over four scales being Eating Attitudes ($n_{items}=6$), Food Acceptance ($n_{items}=3$), Internal Regulation ($n_{items}=2$), and Contextual Skills ($n_{items}=5$) [9]. The psychometric evaluation of the ecSI 2.0TM DUTCH is the goal of the present study.

2.2.2. Body Mass Index

To assess the BMI of the adolescents, we requested their height in meters and their weight in kilogram. We calculated their BMI by dividing their weight in kilogram by their squared length in meters [weight in kilogram/(length in meters)²].

2.2.3. Eating Disorder Symptoms

To assess eating disorder symptomatology, we made use of three eating-disorder specific subscales of the Eating Disorder Inventory-3 and the Interceptive Deficits scale, which can also be used in community samples (EDI-3) [13,14]. Each of the 34 items is rated on a six-point Likert scale ranging from 1 (*never*) to 6 (*always*). The Drive for Thinness scale consists of 7 items and measures a desire to be thinner and concerns about dieting, weight preoccupation and fear of weight gain (e.g., 'I'm thinking about going on a diet'; $\alpha = .93$ in the present study). The Bulimia scale consists of 8 items and assesses binge eating and eating in response to negative emotions (e.g., 'I eat when I'm upset'; $\alpha = .87$ in the present study). The Body Dissatisfaction Scale consists of 10 items and measures dissatisfaction about size and shape of particular body regions, such as buttocks, stomach, hips (e.g., 'I think my stomach is too fat'; $\alpha = .89$ in the present study). Finally, the Interceptive Deficits scale consists of 9 items which focus on deficits in recognizing and reacting to emotional stimuli (e.g., 'I have feelings that I can't quite place'; $\alpha = .89$ in the present study).

2.2.4. Identity functioning

To assess identity functioning, we administered the Erikson Psychosocial Stage Inventory (EPSI) [15]. The EPSI consists of 12 items to be rated on a five-point rating scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Six items measure identity confusion (e.g., 'I feel mixed up', $\alpha = .76$ in the present study), and six items measure identity synthesis (e.g., 'I know what kind of person I am', $\alpha = .79$ in the present study).

2.3. Analyses

First, we performed Confirmatory Factor Analysis (CFA) using Mplus version 8.8 [16] to test the four-factor structure of the ecSI2.0TM DUTCH as described in Godleski et al. [9], the original model as described by Lohse [7], and a second-order model with the four subscales loading on one higher order latent construct (Eating Competence). Model parameters were estimated with the Weighted Least Square Mean and Variance adjusted (WLSMV) estimation algorithm as the data were ordinal. Two criteria were used to evaluate model fit: (1) the Comparative Fit Index (CFI) with values between .90 and .95 indicating acceptable fit and values $> .95$ indicating good fit; and (2) the Standardized Root Mean Square Residual (SRMR) for a relative fit with values $< .08$ indicating acceptable fit and values $< .06$ indicating good fit [17].

Second, we examined the reliability or internal consistency of the ecSI2.0TM DUTCH total and subscales by means of the Cronbach's α coefficient. Alpha coefficients above .70, .80 and .90 indicate respectively acceptable, good and excellent reliability [18].

Third, measurement invariance for sex and age (<17 years, ≥ 17 years) was investigated. According to Chen [19], measurement invariance examines whether a questionnaire measures the same construct across different groups. Configural invariance examines whether each latent factor is associated with identical items across sex/age; metric invariance investigates whether factor loadings of items on the latent factor can be constrained to be equal across sex/age, and scalar invariance tests whether intercepts of latent factor indicators (i.e., items) can be constrained to be equal across sex/age [19]. To test for metric and scalar invariance, we relied on two fit indices: (1) the change in CFI (Δ CFI), for which values $< .01$ refer to measurement invariance, and (2) the change in RMSEA (Δ RMSEA), for which values $< .015$ refer to measurement invariance [19]. If scalar invariance across sex/age is obtained, mean differences across sex/age groups can be meaningfully interpreted.

Fourth, correlations between ecSI2.0TM DUTCH subscales and BMI, eating disorder symptoms (drive for thinness, bulimia, body dissatisfaction, interoceptive deficits), and identity (diffusion,

synthesis) were calculated using Pearson correlation coefficients, with $r < .20$ referring to small effects, r between .20 to .30 (medium effects), and $r > .30$ referring to large effects [20].

3. Results

3.1. Factor structure of the ecSI2.0TM DUTCH

Table 1 displays the fit indices of the different confirmatory factor analyses. We tested both, the four-factor model with item 9 loading on the Eating Attitudes subscale [9] (CFI = .967; SRMR = .045) as well as the original four-factor model with item 9 loading on the Internal Regulation subscale (CFI = .968; SRMR = .044). Both models fitted the data equally well based on the fit indices (CFI > .95 and SRMR < .08). Given that recent studies [9,10] used the factor structure with item 9 belonging to the Eating Attitudes subscale, we continued to use this model.

Table 1. Results of the Confirmatory Factor Analyses on the ecSI2.0TM DUTCH items.

Model	CFI	SRMR	χ^2	df	RMSEA	90% CI RMSEA
First-order four-factor model with item 9 loading on EA (Godleski et al., 2009)	.967	.045	836.605	98	.092	.086-.097
First-order four-factor model with item 9 loading IR	.968	.044	816.486	98	.090	.085-.096
First-order three-factor model with items of EA and IR loading on one factor	.962	.047	936.681	67	.096	.090-.102
Second-order model with the four ecSI2.0 TM subscales loading on one higher-order factor	.965	.049	897.362	100	.093	.087-.099
EA = Eating Attitudes subscale; IR = Internal Regulation subscale; CFI = Comparative Fit Index; SRMR = Standard Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; 90% CI = 90% Confidence Interval						

In Table 2, the standardized factor loadings of the items on each of the four subscales are displayed. All items have factor loadings above .60.

Table 2. Eating Competencies Satter Inventory (ecSI 2.0TM) and Factor Loadings.

Items/first-order factors loading on...	Factor loadings
<i>Eating Attitudes</i>	
1. I am relaxed about eating	.84
2. I am comfortable about eating enough.	.89
4. I feel it is okay to eat food I like.	.80
8. I am comfortable with my enjoyment of food and eating.	.92
9. I trust myself to eat enough for me.	.89
14. I enjoy food and eating.	.80
<i>Food Acceptance</i>	
5. I experiment with new food and learn to like it.	.65
6. If the situation demands, I can make do by eating foods I do not much care for.	.70
7. I eat a wide variety of foods.	.78
<i>Internal Regulation</i>	
10. I eat as much as I am hungry for.	.90
13. I eat until I feel satisfied.	.86
<i>Contextual Skills</i>	
3. I have regular meals.	.68
11. I tune into food and pay attention to eating.	.63
12. I make time to eat.	.86
15. I consider what is good for me when I eat.	.60
16. I plan for feeding myself.	.93

Table 3 shows the correlations between the four latent factors for both models. In line with Godleski et al. [9], the correlation between Eating Attitudes and Internal Regulation was nearly identical in the model of Godleski et al. [9] compared to the original model ($r = .88$ vs. $r = .91$). Based on the high intercorrelation, we also fitted the model in which Eating Attitudes and Internal Regulation subscales were collapsed (three-factor model) (see Table 1). However, this model obtained a slightly lower model to data fit.

Table 3. Correlations between the latent factor scores of the ecSI2.0TM DUTCH subscales for the model with item 9 loading on EA (first line) and item 9 loading on IR (second line).

	Eating Attitudes	Food Acceptance	Internal Regulation
Eating Attitudes	-		
Food Acceptance	.56*** (.55***)	-	
Internal Regulation	.88*** (.91***)	.49*** (.54***)	-
Contextual Skills	.70*** (.67***)	.59*** (.59***)	.70*** (.74***)

*** $p < .001$, EA = Eating Attitudes, IR = Internal Regulation.

Additionally, we also tested a second-order model in which the four subscales loaded on one higher-order latent factor (Eating Competence), which fitted the data well (see Table 1). The factor loadings of each of the subscales on the higher-order latent factor were as follows: Eating Attitudes (.92), Food Acceptance (.63), Internal Regulation (.94), and Contextual Skills (.77), which resembles the findings of Godleski et al. [9]. The mean ecSI2.0TM DUTCH total score was equal to 30.39 ($SD = 10.53$), and 51.2% of the adolescents scored above the cut-off score of ≥ 32 , meaning that they are eating competent.

Finally, model comparisons showed that the four factor model (with item 9 belonging to the Eating Attitudes subscale) fitted the data significantly better than the three-factor model ($\chi^2_{(3)}$ difference test = 83.06, $p < .001$) and slightly better than the second-order model ($\chi^2_{(2)}$ difference test = 39.41, $p < .001$).

3.2. Reliability of the ecSI2.0TM DUTCH

With regard to the reliability of the ecSI2.0TM DUTCH, Cronbach’s alpha coefficient for the total scale was .91 and Cronbach’s alpha coefficients for the Eating Attitudes, Food Acceptance, Internal Regulation, and Contextual Skills subscales were .91, .69, .81, and .80, respectively.

3.3. Measurement invariance of the ecSI2.0TM DUTCH across sex and age

Table 4 displays the goodness-of-fit statistics for the measurement invariance testing across sex of the ecSI2.0TM DUTCH. As changes in CFI and RMSEA values comparing configural, metric and scalar models were below the cut-off values suggested by Chen [19], scalar invariance for sex was obtained.

Table 4. Goodness-of-fit Indices for Testing Measurement Invariance Across Sex.

	χ^2	df	CFI	Δ CFI	RMSEA	Δ RMSEA
Configural	895.222	196	.964		.089	
Metric	874.584	208	.965	.001	.085	-.004
Scalar	926.942	236	.964	-.001	.081	-.004

df = Degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation

Overall, we found significant sex differences for the four subscales [Wilks’Lambda = .872, $F(4, 891)=32.688$, $p<.001$, partial $\eta^2 = .128$] (see Table 5). Boys scored significantly higher than girls on the four ecSI2.0TM DUTCH subscales; with a strong effect size for Eating Attitudes, a medium effect size for

Internal Regulation, and small effect sizes for Contextual Skills and Food Acceptance. Also for the total scale, boys scored significantly higher than girls on Eating Competence. The mean total score of boys ($M = 34.44$, $SD = 8.50$) was situated above the cut-off score for competent eating (total score ≥ 32); whereas this was not the case for girls ($M = 27.56$, $SD = 10.90$).

Table 5. Means (standard deviations) of the ecSI2.0TMDUTCH subscales for girls and boys.

	Girls (N=529)		Boys (N=367)		$F(1, 894)$	Partial η^2
	M	(SD)	M	(SD)		
Eating Attitudes	10.93	(5.27)	14.55	(3.63)	129.70***	.127
Food Acceptance	5.22	(2.33)	5.84	(2.12)	16.65***	.018
Internal Regulation	3.68	(1.89)	4.72	(1.46)	78.74***	.081
Contextual Skills	7.72	(3.79)	9.33	(3.65)	40.27***	.043
ecSI2.0 TM DUTCH total score	27.56	(10.90)	34.44	8.50	102.99***	.103

* $p < .05$, ** $p < .01$, *** $p < .001$

The reference values for effect sizes for Partial Eta Squared: small effect = 0.01; medium effect = 0.06; and large effect = 0.14.

Table 6 displays the goodness-of-fit statistics for the measurement invariance testing across age groups (< 17 years, ≥ 17 years) of the ecSI2.0TMDUTCH. As changes in CFI and RMSEA values comparing configural, metric and scalar models were below the cut-off values suggested by Chen [19], scalar invariance for age was also obtained.

Table 6. Goodness-of-fit Indices for Testing Measurement Invariance Across Age.

	χ^2	df	CFI	Δ CFI	RMSEA	Δ RMSEA
Configural	908.987	196	.969		.090	
Metric	878.166	208	.971	.002	.085	-.005
Scalar	901.198	236	.971	.000	.079	-.006

df = Degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation

Overall, we did not find significant age differences for the four subscales [Wilks' Lambda = .995, $F(4, 895) = 1.133$, $p = .340$, partial $\eta^2 = .005$] (see Table 7). Also for the total scale, we did not find a significant difference between both age groups. The mean total score of adolescents (< 17 years) ($M = 29.95$, $SD = 10.72$) as well as the mean total score for emerging adults (≥ 17 years) ($M = 30.92$, $SD = 10.27$) were situated below the cut-off score for competent eating (total score ≥ 32).

Table 7. Means (standard deviations) of the ecSI2.0TMDUTCH subscales for age groups.

	Adolescents (< 17 years) (N=500)		Emerging adults (≥ 17 years) (N=400)		$F(1, 898)$	Partial η^2
	M	(SD)	M	(SD)		
Eating Attitudes	12.16	(5.10)	12.75	(4.84)	3.05	.003
Food Acceptance	5.48	(2.17)	5.49	(2.39)	.01	.000
Internal Regulation	4.01	(1.83)	4.23	(1.74)	3.34	.004
Contextual Skills	8.31	(3.78)	8.46	(3.84)	.37	.000
ecSI2.0 TM DUTCH total score	29.95	10.72	30.92	10.27	1.91	.002

* $p < .05$, ** $p < .01$, *** $p < .001$

The reference values for effect sizes for Partial Eta Squared: small effect = 0.01; medium effect = 0.06; and large effect = 0.14.

3.4. Associations between the ecSI2.0TM DUTCH and BMI, ED symptoms and identity

Finally, we correlated the ecSI2.0TM DUTCH subscales and total scores with adolescents’ BMI, eating disorder symptoms and identity (see Table 8).

Table 8. Correlations between the ecSI2.0TM DUTCH subscales and BMI, eating disorder symptoms and identity.

	Eating Attitudes	Food Acceptance	Internal Regulation	Contextual Skills	ecSI2.0 TM DUTCH total score
BMI	-.18**	-.05	-.06	-.08	-.14**
EDI					
Drive for Thinness	-.75**	-.23**	-.54**	-.36**	-.63**
Bulimia	-.52**	-.18**	-.35**	-.33**	-.46**
Body Dissatisfaction	-.66**	-.26**	-.47**	-.39**	-.59**
Interceptive Deficits	-.59**	-.27**	-.46**	-.43**	-.57**
EPSI					
Identity Confusion	-.47**	-.19**	-.35**	-.36**	-.45**
Identity Synthesis	.46**	.21**	.35**	.38**	.46**

BMI = Body Mass Index (N=890); EDI = Eating Disorder Inventory-3 (N=897); EPSI = Erikson Psychosocial Stage Inventory (N=889).

****p<.001**

BMI showed small, significant correlations with Eating Attitudes and the total score; but no significant correlations with the other ecSI2.0TM DUTCH subscales. Additionally, all subscales and the total scores showed large negative correlations with all eating disorder symptoms; the higher the scores on eating competence skills, the lower the scores on Drive for Thinness, Bulimia, Body Dissatisfaction and Interceptive Deficits. All subscales and the total score also showed large positive correlations with identity synthesis, as well as large negative correlations with identity confusion. In sum, the ecSI2.0TM DUTCH subscales were unrelated to BMI (except Eating Attitudes), negatively related to eating psychopathology, and positively associated with a sense of personal coherence in adolescence.

4. Discussion

In the present study, we investigated the psychometric properties of the Dutch version of the ecSI2.0TM, which consists of four subscales: Eating Attitudes, Food Acceptance, Internal Regulation, and Contextual Skills. We were able to replicate the four-factor structure of the ecSI2.0TM as defined by Godleski et al. [9] in our Flemish sample of adolescents. All four subscales had acceptable (FA), good (IR, CS), or even excellent (EA) reliability, in line with the findings of Godleski et al. [9] and de Quieroz et al. [10]. The second-order model with one higher-order latent factor, based on the subscales and items of the ecSI2.0TM also fitted the data well, meaning that we can also utilize the ecSI2.0TM total score besides the different subscale scores. Based on the ecSI2.0TM total score (≥ 32) more than half of our sample of adolescents (51.2%) was considered eating competent; which resembles the findings of Tilles-Tirkkonen et al. [8] who found that 58% of Finnish adolescent scored eating competent.

Additionally, scalar invariance across sex and age (<17 years; ≥ 17 years) was obtained for the four-factor ecSI2.0TM DUTCH, meaning that mean difference between groups with respect to eating competence skills can be meaningfully interpreted. We did not find significant age differences on the ecSI2.0TM DUTCH subscales and total scale. However, boys scored significantly higher on all ecSI2.0TM subscales compared to girls, which parallels the findings of other studies in adolescents, college

students, and adults [21–23]. However, other studies showed that girls were more eating competent than boys [8]; and Lohse et al. [4] did not find a significant association between eating competence and sex. So further studies are needed to clarify the role of sex in eating competence. One of the reasons why girls report less eating competent behaviors than boys, can be due to the fact that girls are more sensitive to appearance ideals and experience more body dissatisfaction compared to males [24,25]. As a consequence, they start to engage in dieting behaviors, and deny eating competent behaviors (e.g., eating when feeling hungry, eating a variety of food, eating regular; [3]). Several studies have indeed shown that eating competent attitudes and behaviors are negatively associated with disordered eating behaviors which are also more prevalent among girls [4,6]. In line with these findings, we also found strong negative associations between the ecSI2.0™ subscales and disordered eating behaviors, such as drive for thinness, bulimia, body dissatisfaction and interoceptive awareness deficits. Dysregulated eating behaviors such as dieting, lead to food restriction (i.e., lack of Food Acceptance); bulimic behaviors (like binge eating) disturb the Internal Regulation or homeostasis of hunger/satiety feelings; and adolescents with dysregulated eating patterns often do not have positive Eating Attitudes, and avoid eating together with others (lack of Contextual Skills) [3].

Consistent with the literature, we found non-significant or small negative associations between adolescents' BMI and ecSI2.0™ subscales [4,6,22,26], showing that eating competent adolescents rather have a lower weight than their non-eating competent counterparts. Further, we showed that all ecSI2.0™ subscales were strongly negative related to identity confusion and positively related to identity synthesis. These findings are in line with Tilles-Tirkkonen et al. [8], who also showed that eating competent adolescents report higher levels of self-esteem and sense of coherence. This is not surprising, given that identity synthesis is related to more positive body attitudes and less eating disordered behaviors; whereas the opposite holds for identity confusion [11,12,27].

Taken together, we can conclude that the ecSI2.0™ can be considered as a valid and reliable instrument to assess Eating Attitudes, Food Acceptance, Internal Regulation, and Contextual Skills in Flemish adolescents. The instrument can be helpful to detect adolescents who are struggling with their eating attitudes and behaviors. Additionally, the instrument can also be used by dietitians and psychologists to help adolescents struggling with weight issues identify what holds true for them with respect to their past and present weight, activity, food intake patterns, and eating competence [28]. Based on that assessment, adolescents can consider their options for change [28]. Such an analysis can support identity synthesis during adolescence.

Several limitations should be acknowledged when interpreting the study findings. First, this is the first time that the ecSI2.0™ was utilized in a Flemish sample of adolescents; future studies need to investigate the psychometric features of this instrument also in other samples, including emerging adults and adults, and participants who are struggling with weight- and body-related issues (e.g., eating disorders; obesity). Second, all variables were assessed by means of self-report measures, which can increase the associations between the variables due to shared method variance. Therefore, future studies could also make use of a multi-method and multi-information approach, by objectively measure anthropomorphic variables (e.g., weight, lengths), by observing real-life eating behaviors, or by using other informants (e.g., parents, teachers, partners). Third, the data that we used was based on a cross-sectional design, so the directionality of effects between variables could not be determined (e.g., does identity confusion leads to lower eating competences; or vice versa). Therefore, longitudinal studies are needed to determine the directionality of effects between variables and to investigate the co-development of these variables over time (e.g., eating competences, body dissatisfaction, eating disordered behaviors).

5. Conclusions

However, in the meantime, the ecSI2.0™^{DUTCH} can be used in Flemish youth, given that it seems to be a valid and reliable measure to assess four important eating competence skills, which can help to prevent and treat disordered eating behaviors in our youth.

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