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Research report

Parental feeding practices and associations with child weight status. Swedish validation of the Child Feeding Questionnaire finds parents of 4-year-olds less restrictive [☆]Paulina Nowicka ^{a,*}, Kimmo Sorjonen ^b, Angelo Pietrobelli ^{c,d}, Carl-Erik Flodmark ^{e,1}, Myles S. Faith ^{f,1}^a Division of Pediatrics, Department of Clinical Science, Intervention and Technology (CLINTEC), B62, Karolinska Institute, 141 86 Stockholm, Sweden^b Department of Clinical Neuroscience, Division of Psychology, Karolinska Institute, 171 65 Solna, Sweden^c Pediatric Unit, Verona University Medical School, Policlinic GB. Rossi, P.le LA. Scuro, 1, 37134 Verona, Italy^d Pennington Biomedical Research Center, Baton Rouge, LA, USA^e Childhood Obesity Unit, Childhood Centre Malmö, Skåne University Hospital, 205 02 Malmö, Sweden^f Department of Nutrition, Gillings School of Global Public Health, University of North Carolina – Chapel Hill, 2211 McGavran Greenberg Hall, CB 7461, Chapel Hill, NC 27599-7461, USA

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ABSTRACT

The Child Feeding Questionnaire (CFQ) assesses parental feeding attitudes, beliefs and practices concerned with child feeding and obesity proneness. The questionnaire has been developed in the U.S., and validation studies in other countries are limited. The aim of this study was to examine the psychometric properties of the CFQ in Sweden and the associations between parenting practices and children's weight status. Based on records from the Swedish population register, all mothers of 4-year-olds ($n = 3007$) from the third largest city in Sweden, Malmö, were contacted by mail. Those who returned the CFQ together with a background questionnaire ($n = 876$) received the CFQ again to enable test-retest evaluation; 564 mothers completed the CFQ twice. We used confirmatory factor analysis to test whether the original 7-factor model was supported. Good fit ($CFI = 0.94$, $TLI = 0.95$, $RMSEA = 0.04$, $SRMR = 0.05$) was obtained after minor modifications such as dropping 2 items on restriction and adding 3 error covariances. The internal reliability and the 2-week test-retest reliability were good. The scores on restriction were the lowest ever reported. When the influence of parenting practices on child BMI (dependent variable) was examined in a structural equation model (SEM), child BMI had a positive association with restriction and a negative association with pressure to eat. Restriction was positively influenced by concern about child weight. The second SEM treated parenting practices as dependent variables. Parental foreign origin and child BMI had direct effects on restriction, while pressure to eat was also influenced by parental education. While the results of the study support the usefulness of the CFQ in Sweden, carefully designed cross-cultural comparisons are needed to explain why the levels of restrictive feeding in Swedish families are the lowest reported.

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Abbreviations: BMI, Body Mass Index; CN, Concern about child weight (CFQ factor); CFA, Confirmatory Factor Analysis; CFI, Comparative Fit Index; CFQ, Child Feeding Questionnaire; MLR, Maximum Likelihood with Robust standard errors estimation; MN, Monitoring (CFQ factor); NNFI, Non-normed Fit index; PCW, Perceived Child Weight (CFQ factor); PE, Pressure to Eat (CFQ factor); PPW, Perceived Parent Weight (CFQ factor); PR, Perceived Responsibility (CFQ factor); RMSEA, Root Mean Square Error of Approximation; RST, Restriction (CFQ factor); SD, Standard Deviation; SEM, Structural Equation Modeling; SRMR, Standardized Root Mean Square Residual; TLI, Tucker–Lewis Index.

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Introduction

The Child Feeding Questionnaire (CFQ) is one of the most well-known and frequently used psychometric instruments worldwide to assess parental feeding attitudes, beliefs and practices concerned with child feeding and obesity proneness (de Lauzon-Guillain et al., 2012; Vaughn, Tabak, Bryant, & Ward, 2013). However, assessments of measurement invariance in new populations have nearly always been performed in English-speaking countries. Of the studies using confirmatory factor analysis (CFA), a method of choice when assessing whether a predefined factor structure fits the empirical data (Anderson, Hughes, Fisher, & Nicklas, 2005; Birch et al., 2001; Corsini, Danthiir, Kettler, & Wilson, 2008; Geng et al., 2009; Kaur et al., 2006), only one has been performed in a non-English speaking country, namely in Japan (Geng et al., 2009). Thus, in spite of almost 15 years of use in multiple settings, knowledge about the cross-cultural equivalence of the CFQ is limited. Although not all studies have been able to document differences in parenting based on ethnicity, few behaviors have been deemed so culturally-sensitive as parenting practices (Bornstein, 2012; Cullen et al., 1999; Seth et al., 2007; Spruijt-Metz, Li, Cohen, Birch, & Goran, 2006). A number of recent review papers have urged researchers to conduct careful evaluations of parenting questionnaires when introduced into new ethnic or national settings (Baranowski et al., 2013; de Lauzon-Guillain et al., 2012; Musher-Eizenman & Kiefner, 2013; Vaughn et al., 2013).

Sweden is of particular interest when testing the cultural-equivalence of parenting measures because one might expect to find lower prevalence of restrictive parenting behaviors. Although not scientifically demonstrated, Swedish parenting culture might be linked to a child-centered responsive parenting style, which has famously been described in Astrid Lindgren's books about Pippi Longstocking. A responsive parenting style and less restrictive feeding practices have been associated with healthy weight development in children (Gerards, Sleddens, Dagnelie, de Vries, & Kremers, 2011; Sleddens, Gerards, Thijs, de Vries, & Kremers, 2011; Vollmer, 2013). In Sweden, the prevalence of obesity among children is lower than in most countries in Europe (Pigeot et al., 2009; Wijnhoven et al., 2013) and has been stable since 2000 (Rokholm, Baker, & Sorensen, 2010).

Previous validation studies of the CFQ (Anderson et al., 2005; Birch et al., 2001; Corsini et al., 2008; Geng et al., 2009; Kaur et al., 2006) have shown that several items from the original questionnaire were problematic in the various populations tested; competing factor structures have been proposed. Thus, the first purpose of this study was to evaluate and compare how these different structures would fit our Swedish data. The second purpose of our study was to examine test-retest reliability, as research on the temporal stability of the CFQ is limited (Vaughn et al., 2013). The third purpose of our study was to examine associations between child BMI and parenting in two different models. In the first structural equation model (SEM) we examined the influence of parenting practices on child BMI (dependent variable), and in the second model we chose restriction and pressure to eat – the parenting practices most often associated with high BMI in children (Faith & Kerns, 2005) – as dependent variables. We anticipated that high child BMI would be associated with certain parenting practices, such as restriction. In the second model we hypothesized that parental characteristics would have an impact on parenting practices; for example that restrictive feeding practices would be less often reported by parents born in Sweden who had a high education level. The link between parental education (a usual proxy for socioeconomic status) and childhood obesity is well established (Shrewsbury & Wardle, 2008; Sobal & Stunkard, 1989), even in Sweden (Lakshman et al., 2013), starting already at infancy (Svensson et al., 2014).

In sum, this study will demonstrate whether the psychometric properties of the translated CFQ will justify the future use of the CFQ in Sweden and clarify the associations between parenting practices and children's weight status, adjusting for potential confounders. Thus, this study will fill the gap in knowledge by providing additional evidence on whether questionnaires on parental feeding practices can be used across different cultures, whether they are time-invariant and whether independent associations between parenting and child weight exist. Increased understanding of modifiable familial determinants of child weight status, both universal and cultural-specific, is vital for the development of effective lifestyle interventions.

Methods

Description of factors in the CFQ

The CFQ has been developed to assess parents' perceptions and concerns regarding child obesity, child-feeding attitudes and practices (Birch et al., 2001). It consists of 31 items, loading on 7 factors. Four factors assess parents' perceptions of child and parent weight, as well as concerns about weight; thus, they assess cognitions that may influence parental control in feeding situations. The first factor is Perceived Responsibility (PR), consisting of 3 items assessing parents' perceptions of their responsibility for child feeding, namely:

- (PR1) When your child is at home, how often are you responsible for feeding her?
- (PR2) How often are you responsible for deciding what your child's portion sizes are?
- (PR3) How often are you responsible for deciding if your child has eaten the right kind of foods?

The response options for these items are: 1 = never, 2 = seldom, 3 = half of the time, 4 = most of the time, 5 = always.

The second factor is Perceived Parent Weight (PPW), consisting of 4 items that assess parents' perceptions of their own weight status history, namely during:

- (PPW1) Your childhood (5–10 years old)
- (PPW2) Your adolescence
- (PPW3) Your 20s
- (PPW4) At present

The response options for these items are: 1 = markedly underweight, 2 = underweight, 3 = normal, 4 = overweight, 5 = markedly overweight.

The third factor is Perceived Child Weight (PCW), consisting of 5 items assessing parents' perceptions of their child's weight status history, namely during:

- (PCW1) Your child during the first year of life
- (PCW2) Your child as a toddler
- (PCW2) Your child as a preschooler
- (PCW3) Your child from kindergarten through 2nd grade
- (PCW4) Your child from 3rd through 5th grade
- (PCW5) Your child from 6th through 8th grade

The response options are the same as for the previous factor, PPW.

The fourth factor is parents' Concern about Child Weight (CN), consisting of 3 items that assess parents' concerns about the child's risk of being overweight, namely:

- (CN1) How concerned are you about your child eating too much when you are not around her?

(CN2) How concerned are you about your child having to diet to maintain a desirable weight?

(CN3) How concerned are you about your child becoming overweight?

The response options are: 1 = unconcerned, 2 = a little concerned, 3 = concerned, 4 = fairly concerned, 5 = very concerned.

Three factors assess parents' feeding practices. The first factor is Restriction (RST), consisting of 8 items that assess the extent to which parents limit their child's access to foods, namely:

(RST1A) I have to be sure that my child does not eat too many sweets (candy, ice-cream, cake or pastries).

(RST1B) I have to be sure that my child does not eat too many high-fat foods.

(RST1C) I have to be sure that my child does not eat too much of her favorite foods.

(RST2) I intentionally keep some foods out of my child's reach.

(RST3A) I offer sweets (candy, ice-cream, cake, pastries) to my child as a reward for good behavior.

(RST3B) I offer my child her favorite foods in exchange for good behavior.

(RST4A) If I did not guide or regulate my child's eating, she would eat too many junk foods.

(RST4B) If I did not guide or regulate my child's eating, she would eat too much of her favorite foods.

The response options are: 1 = disagree, 2 = slightly agree, 3 = neutral, 4 = slightly agree, 5 = agree.

The second factor on parenting practices is Pressure to Eat (PE), consisting of 4 items that assess parents' tendency to pressure their children to eat more food, namely:

(PE1) My child should always eat all of the food on her plate.

(PE2) I have to be especially careful to make sure my child eats enough.

(PE3) If my child says "I am not hungry", I try to get her to eat anyway.

(PE4) If I did not guide or regulate my child's eating, she would eat much less than she should.

The response options are the same as for the previous scale (RST).

Finally, the fourth factor on parenting practices is Monitoring (MN), consisting of 3 items assessing the extent to which parents supervise their child's eating, namely:

(MN1) How much do you keep track of the sweets (candy, ice cream, cake, pies, pastries) that your child eats?

(MN2) How much do you keep track of the snack food (potato chips, Doritos, cheese puffs) that your child eats?

(MN3) How much do you keep track of the high fat foods that your child eats?

The response options for this factor are: 1 = never, 2 = rarely, 3 = sometimes, 4 = mostly, 5 = always.

The factor score for each factor is obtained by calculating the mean score for the items loading on that factor. The abbreviations for factors and items used in this paper are consistent with the original abbreviations presented in the first validation paper on the CFQ, table A1. (Birch et al., 2001).

Translation process

Permissions to translate the questionnaire have been obtained from the authors. The process of translation was performed ac-

ording to the guidelines (Beaton, Bombardier, Guillemin, & Ferraz, 2000; de Vet, Terwee, Mokkink, & Knol, 2011). The CFQ was translated by two independent translators. As the questionnaire would be filled out by parents of preschoolers, two items from Perceived Child Weight were not translated due to sample age: item PCW4, asking about the parent's perception of the child's weight in 3rd through 5th grade and item PCW5, asking about the parent's perception of the child weight in 6th through 8th grade. Both translations were checked for any differences between them, and the synthesized version of the translation was back translated into English by two other translators not familiar with the original version of the questionnaire, to assess the appropriateness of translation. An expert committee of the four translators together with the researchers and involved health care professionals reviewed all the translations and agreed on a pre-final version. This version was tested in a reference group consisting of 38 mothers of preschool age children. The mothers were asked to give their opinions about the questionnaire in order to test the comprehensibility of the items. The final version of the questionnaire was reviewed and approved by an expert group including pediatricians, pediatric nurses and dietitians, both from primary care and from the children's hospital in the city (Malmö) where the study was to be performed.

Data collection

The study was approved by the Regional Ethical Board in the south of Sweden. The addresses of all female guardians of children aged 4 years, who had been living in Malmö in July 2009, were obtained from the Swedish Population Registry. Malmö is the third largest city in Sweden, with a population of 280,000. In total 3007 female guardians of children in the targeted age group (from now referred to as "mothers", as 98% reported to be the children's biological mothers) received the questionnaires by mail. One reminder was sent within a week. Out of 3007 mothers, 876 returned the completed CFQ together with a background questionnaire (including questions on parental and child weight and height, age and place of birth, and parental education; all data self-reported). To examine test-retest reliability, the questionnaires were sent again to those who answered the questionnaire in phase 1. In total 564 mothers responded in phase 2.

Statistical analysis

The descriptive statistics are presented as means and SDs, or percentages for categorical variables. These analyses, as well as reliability calculations (Cronbach's alpha and test-retest), were conducted with SPSS version 22. MPlus version 7.11, using Maximum Likelihood with Robust standard errors (MLR) estimation, was used to perform confirmatory factor analysis (CFA) and structural equation modeling (SEM). CFA was chosen to assess the validity of the translated questionnaire as this method is recommended when previous hypotheses about dimensions of the construct are available based on theory and/or previous analysis (de Vet et al., 2011). If one or more items do not load on the original factors after translation, this indicates that these items have a different meaning, either due to the translation, or due to cultural differences. If all the items keep the same meaning after the translation, the instrument should retain the same factor structure in the new population. To evaluate the fit of the hypothesized original seven-factor structure of the CFQ to our data we used four commonly recommended fit indices: the comparative fit index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). Good fit is indicated by CFI and TLI values of 0.95 or higher, the RMSEA of 0.06 or lower and the SRMR of 0.08 or lower (Hu & Bentler, 1999). Using these four

Table 1
Descriptions of all tested models used to reference the current study.

	Sample characteristics	Description of the final model	Fit indices
Model 1 (Birch et al., 2001)	394 parents of 5–9 years old girls, USA	The original basic model with all 31 items, uncorrelated factors, uncorrelated errors.	RMSEA = 0.06 CFI = 0.89 NNFI* = 0.88
Model 2 (Birch et al., 2001)	394 parents of 5–9 years old girls, USA	3 parcels (meaning that ratings from several items were averaged together to function as a single item) on RST items (RSPA1 = RST1A + 1B + 1C, RSPA2 = RST3A + 3B; RSPA3 = RST4A + 4B). Also 2 error covariances were added: between PPW1 and PPW2 and between PCW1 and PCW2.	RMSEA = 0.04 CFI = 0.95 NNFI = 0.94
Model 3 (Birch et al., 2001)	148 parents of 8–11 years old children, USA	The cross loading of RST “reward” items, RST3A and RST3B, was estimated on PE. Also 3 error covariances were added: between PPW1 and PPW2, between PPW1 and PPW3, and between PCW1 and PCW2.	RMSEA = 0.05 CFI = 0.92 NNFI = 0.91
Model 4 (Birch et al., 2001)	126 parents of 7–11 year old children, 90% Hispanic, USA	4 items dropped: PE1 and PE2, and 2 RST3A and RST3B.	RMSEA = 0.05 CFI = 0.91 NNFI = 0.89
Model 5 (Anderson et al., 2005)	101 Black and 130 Hispanic parents of 3-year old children, USA	2 factors were dropped, PPW and PCW and 5 RST items: RST1C, RST2, RST3A, RST3B, and RST4B. No parcels.	RMSEA = 0.04 CFI = 0.96 NNFI = 0.95 SRMR = 0.055
Model 6 (Corsini et al., 2008)	203 parents of 4–5 year old children, Australia	8-factor structure. The new factor “Reward” was created by “reward items” RST3A and RST3B. 2 parcels: RST1A + 1B + 1C and RST4A + 4B.	RMSEA = 0.07 CFI = 0.89 NNFI = 0.86
Model 7 (Geng et al., 2009)	920 parents of 9–12 year old children, Japan	3 error covariances were added, one between PPW1 and PPW2, the second between PPW2 and PPW3, and the third between PCW3 and PCW4. 6 items were dropped: PCW1, RST2, RST3A, RST3B, RST4A and RST4B.	RMSEA = 0.06 CFI = 0.93 NNFI = 0.92 SRMR = 0.05

* NNFI is non-normed fit index; values above 0.9 are recommended for an acceptable fit. NNI is the same as TLI which we present.

indices, in our study we aimed to test all the final models obtained in the previous studies that had used CFA (Anderson et al., 2005; Birch et al., 2001; Corsini et al., 2008; Geng et al., 2009) with the exception of the model obtained by Kaur et al. (2006). Kaur’s population mainly consisted of adolescents (mean age 15 years) and their CFQ was expanded with a new item that was not part of the original questionnaire. It should also be noted that in the original CFA study, the developers, Leann Birch and her colleagues, described CFA in three different populations (Birch et al., 2001); therefore, there are in total 7 models of the CFQ from 5 papers. All the tested models are summarized in Table 1.

SEM was chosen to examine associations between parenting practices and child weight status. SEM as a method has two main advantages compared with ordinary regression: (1) it adjusts for lack of reliability in the measurement of factors and therefore has higher power; (2) the whole model can be measured in one step instead of several steps.

As there are many possible associations and possible directions of influence between the CFQ factors and other variables, such as parental BMI and level of education and child BMI, two different models, besides the CFA, were fitted to the data. The design of these models was based on previous research and discussion within the research group. In the first model, in order to examine the influence of parenting practices on child’s BMI, the CFQ factors (except PCW) were defined as mediators. Parental variables (level of education, foreign background, and mother’s and father’s BMI) were included as exogenous manifest variables (single item predictors) and the child’s BMI was included as a manifest endogenous variable (single item dependent variable). In the second model, we were interested to examine what influenced parenting practices factors. PR, PCW, foreign background, level of education, and child’s BMI were defined as exogenous (independent), PE and RST as endogenous (dependent), and CN as a mediator. A final note on the use of the word “influence” in this paper: we are aware of Reichenbach’s principle (Reichenbach, 1956), and therefore we do not claim to have proven causality, especially considering that we only have cross-sectional data; our use of “influence” reflects our definition of some factors

as independent and others as dependent in relation to each other in the models.

Results

Sample characteristics

The mean age of the mothers was 35.6 years (SD 5.1); their mean BMI was 24.1 (SD 4.2). The children were on average 4.5 years old (SD 0.3); 48% were girls and 52% were boys. Table 2 provides the descriptive characteristics for the sample. For mother’s education, for example, we present the number and percentage (%) of mothers in each of the four categories, from lowest to highest. In the adjacent column, we provide reference data from Swedish population surveys (when available) to assess the representativeness of our sample. The comparison shows that while the respondents resembled the Malmö population quite well with regard to BMI and country of origin, they were more highly educated (59.1% had university of college exam versus 42% in the general population); moreover, among the children, a higher percentage than expected were obese.

The parents in our sample were born in 64 different countries. Of the mothers, 28% were born in a non-Nordic country. Of the fathers, 31% were born in a non-Nordic country. Of the non-Nordic countries the most common were Iraq, Lebanon, Iran, Poland, and Bosnia and Herzegovina.

Of the children, 94% spent most of their daytime in kindergarten. Most of the children (84%) lived with both their biological parents. One third of the mothers worked full time and one third less than full time, 14% studied, 12% were on maternity leave, and 4% were unemployed. Almost 50% of the mothers reported that they were responsible for buying food for the home, 9% reported it was their partner’s responsibility, and 43% reported they shared the responsibility. Likewise, 63% of the mothers reported that in most cases they did the cooking at home, 10% said that their partner did, and 27% said that they did the cooking together. A few mothers attached comments to the completed questionnaires, or called the re-

Table 2
Descriptive characteristics of the population (n = 876).

	Frequency n (%)	Reference data* (%)
Child's country of origin		
Both parents born in Sweden	489 (55.8)	
One of parents born in Sweden	152 (17.4)	
None of parents born in Sweden	231 (26.4)	30
Missing	4 (0.5)	
Mother's country of origin		
Born in Sweden	583 (66.6)	70
Born abroad	285 (32.5)	30
Missing	8 (0.9)	
Mother's education		
Elementary	61 (7)	12
2 year of high school or equivalent	94 (10.7)	26
At least 3 years of high school	190 (21.7)	18
University or college exam	518 (59.1)	42
Missing	13 (1.5)	2
Child's weight status according to BMI reported by mothers. Weight status classified according to international criteria (Cole, Bellizzi, Flegal, & Dietz, 2000)		
Underweight	38 (4.3)	
Normal weight	637 (72.7)	
Overweight	56 (6.4)	7.7
Obese	56 (6.4)	2.3
Missing	89 (10.2)	
Mother's weight status according to self-reported BMI		
Underweight	19 (2.2)	2.7
Normal weight	517 (59.0)	58.7
Overweight	188 (21.5)	24.5**, 27
Obese	59 (6.7)	10.6**, 14
Missing	93 (10.6)	

* The following reference data were used: for child's country of origin, statistics in Sweden (Statistics Sweden, 2008); for child's weight status, statistics from the Child Health Care (Child Health Care Centre, 2011); for mother's country of origin, statistics in Sweden (Statistics Sweden, 2008).

** For mother's weight status, in addition to the statistics from the southern part of Sweden (Rosvall et al., 2008), we provide the statistics for Stockholm County (Kark, Tynelius, & Rasmussen, 2011) as these also include percentages for underweight and normal weight.

search team, to express that it was morally wrong, unethical or scientifically incorrect to target only mothers. It is important to note, however, that as most studies in the field have targeted mothers only, our design allows for the most accurate comparison to previous research.

CFA

The replication of competing models showed that model 4 (Birch et al., 2001) demonstrated the best fit in our sample based on the model indices (CFI, TLI, RSMEA and SRMR). However, a further examination revealed that the two items for measuring pressure to eat (PE34 and PE4) had non-significant loadings. In addition, we were not satisfied that PE only consisted of 2 items. To improve the model, we reintroduced the two PE items (PE1 and PE2) and added 3 error covariances: the first between PPW1 and PPW2, the second covariance between PCW1 and PCW2 and the third covariance between PE3 and PE4. These error covariances were included because they significantly improved the model's fit to data. Error covariances indicate that two items have a stronger association than expected only from their loading on the same factor, which indicates that they are influenced by some other factor not represented in the model. These modifications resulted in an improved, good fit and all loadings ≥ 0.3 . The fit indices for all the tested models are presented in Table 3.

The final model, including all the factor loadings, is presented in Fig. 1.

Table 3
Fit indices for all tested models.

Model	χ^2 (df)	CFI	TLI	RMSEA	SRMR
Model 1 [3]	1522 (329)	0.81	0.78	0.07	0.07
Model 2 [3]	607 (229)	0.92	0.91	0.04	0.05
Model 3 [3]	578 (227)	0.93	0.91	0.04	0.05
Model 4 [3]	345 (166)	0.96	0.94	0.04	0.05
Model 5 [4]	443 (94)	0.90	0.88	0.07	0.06
Model 6 [6]	1187 (321)	0.86	0.84	0.06	0.06
Model 7 [7]	604 (186)	0.91	0.89	0.05	0.06

Descriptive statistics and Cronbach's alphas for CFQ factors were calculated; the internal consistency was adequate (above 0.7) for 5 out of 7 factors (see Table 4).

Test–retest reliability

Six out of seven factors showed excellent 2-week test–retest reliability (correlations above 0.7, all p-values < 0.001), n = 564 (Table 4).

Influence of CFQ factors on child BMI

Our first structural equation model examined the association of parental practices assessed in factors RST, PE, as well PR and PCW with child BMI (dependent variable), while controlling for parental BMI. CN, education and foreign background were defined to influence more proximal determinants of child BMI. The final model (CFI = 0.930; TLI = 0.916; RMSEA = 0.043), which only retained the significant associations, shows that child BMI was negatively related to PE and positively to RST (Fig. 2). Scores on CN were positively related to child BMI through RST. MN, PPW and child's gender are not presented in the model because of lack of influence.

Association of demographic variables and child BMI on restriction and pressure to eat

In a second model, PE and RST were defined as dependent variables, influenced by PR, PCW, foreign origin, education, and child BMI. Most of these independent variables were also defined to influence RST via the mediating effect of CN. The final model provided a good fit (CFI = 0.938; TLI = 0.919; RMSEA = 0.045). RST was positively associated with PE and influenced by PR and CN (Fig. 3). The background factors such as parental education, foreign background and child BMI influence RST directly. CN is the mediator of indirect effects in the model; it partly mediates the effects of the following on RST: foreign origin and child BMI. It fully mediates the effects of the following on RST: PCW and parental education. Even in this model, factors MN and PPW were excluded because of lack of influence.

Table 4
Descriptive statistics, Cronbach's alphas, and test–retest reliability for each factor.

CFQ Factors	M (SD)	Cronbach's alpha	Spearman correlations*
Perceived responsibility	4.02 (0.69)	0.78	0.72
Perceived parent weight	3.05 (0.39)	0.65	0.89
Perceived child weight	2.95 (0.38)	0.75	0.84
Concern about child weight	1.39 (0.77)	0.84	0.71
Restriction	2.72 (0.99)	0.63	0.73
Pressure to eat	2.90 (0.97)	0.70	0.76
Monitoring	3.87 (0.88)	0.76	0.56

* All p-values < 0.001.

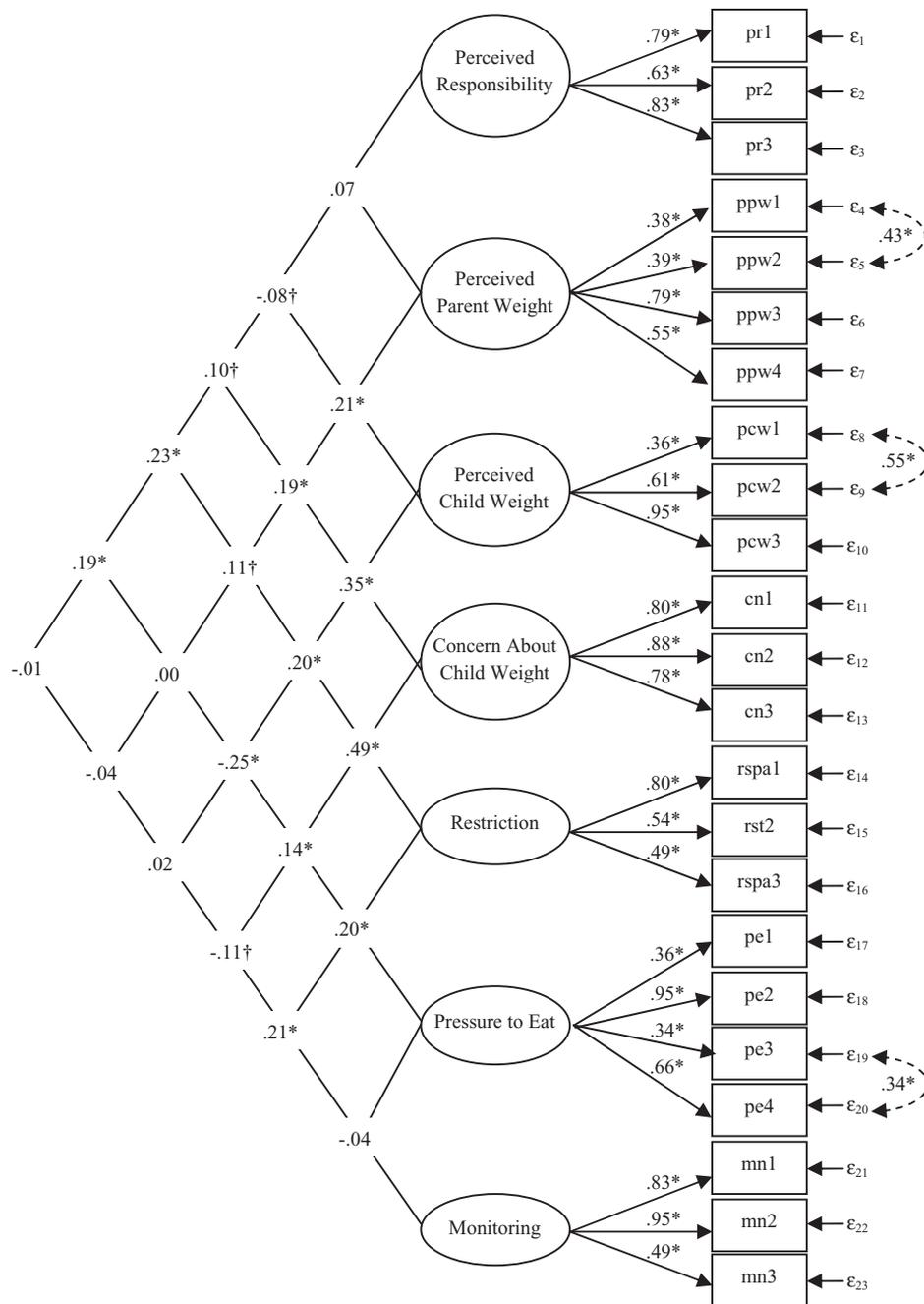


Fig. 1. A Confirmatory Factor Analysis (CFA) of the CFQ with seven latent variables and three added correlations between error terms. The model shows acceptable fit to data, $\chi^2(206) = 448, p < .001$; TLI = .936; CFI = .948; RMSEA = .037 (90% CI: .032–.041). † $p < .05$; * $p < .001$.

Discussion

In this validation study in a sample of nearly 900 mothers of 4-year-olds from Sweden, representing 64 different countries, the original 7-factor model of CFQ was shown to have a good fit after minor modifications. The internal reliability measured with Cronbach’s alpha was adequate to good for the majority of the factors, as well as the 2-week test–retest reliability. Structural equation modeling demonstrated that child’s eating was restricted more and encouraged less for those children who had higher BMI. The mothers who used more controlling strategies were also those who were more concerned about child overweight.

The modification of the instrument during the validation process reflected many of the challenges documented in previous re-

search; in all cases when the CFQ (whole or selected parts) was tested with CFA in new populations (Anderson et al., 2005; Birch et al., 2001; Boles et al., 2010; Corsini et al., 2008; Geng et al., 2009; Kaur et al., 2006), the questionnaire had to be adjusted. The factor causing most problems in all validation studies is Restriction. The two items that were excluded in this study and the majority of previous validation studies, RST3A (“I offer sweets (candy, ice cream, cake, pastries) as reward for good behavior”) and RST3B (“I offer my child her favorite foods in exchange for good behavior”), are known as the “reward” items on RST. These behaviors are not necessarily irrelevant; however, there may be important issues with social desirability more so than the other questions. Today’s parents are aware that rewarding children with food is not recommended. The fact that more than 70% of mothers expressed their disagreement (slight or

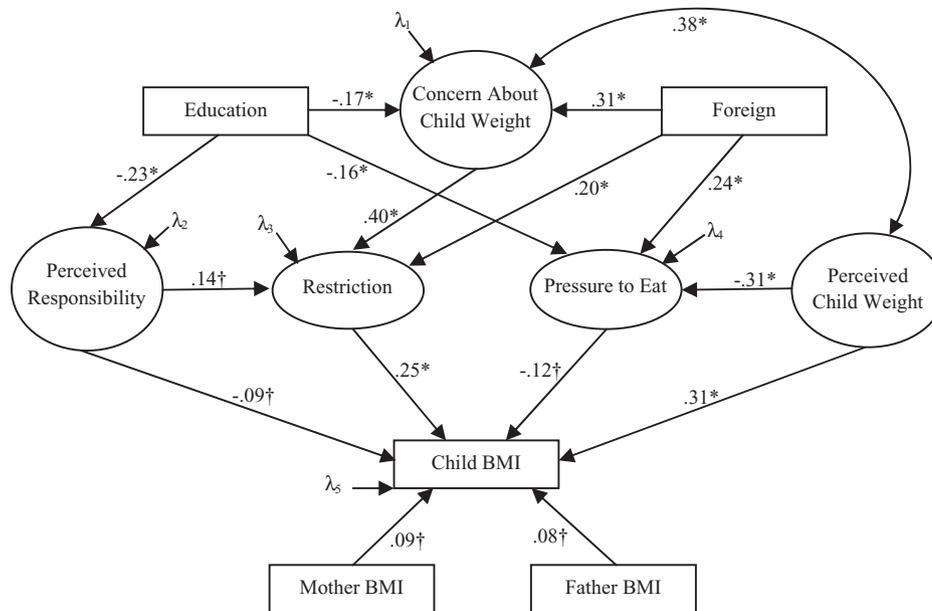


Fig. 2. A Structural Equation Model (SEM) where the CFQ factors (except perceived child weight) are defined as mediators. Level of education, foreign background, and mother’s and father’s BMI are included as exogenous manifest variables and the child’s BMI as a manifest endogenous variable. Only the structural part of the model is shown. The model shows acceptable fit to data, $\chi^2(170) = 399, p < .001$; TLI = .916; CFI = .930; RMSEA = .043 (90% CI: .037–.048). $^\dagger p < .05$; $^* p < .001$.

total) with both reward practices, while only 2% agreed with such practices, demonstrates a quite high floor effect on the item level. Of note, our scorings on the reward items were very similar to the ones reported for an Australian sample (Corsini et al., 2008). Further research about how to measure socially desirable practices is needed, as recently discussed by others (Baranowski et al., 2013; Musher-Eizenman & Kiefner, 2013).

Other problematic factors recognized in most validation studies include the factors Perceived Parent Weight and Perceived Child Weight. Parents’ ability to estimate their own or their child’s weight during different phases of life, especially those in infancy, may be difficult due to memory biases. As Kaur et al. pointed out, the repetitive nature of the questions related to a relatively short age span may lead to strong correlations between questions (Kaur et al., 2006).

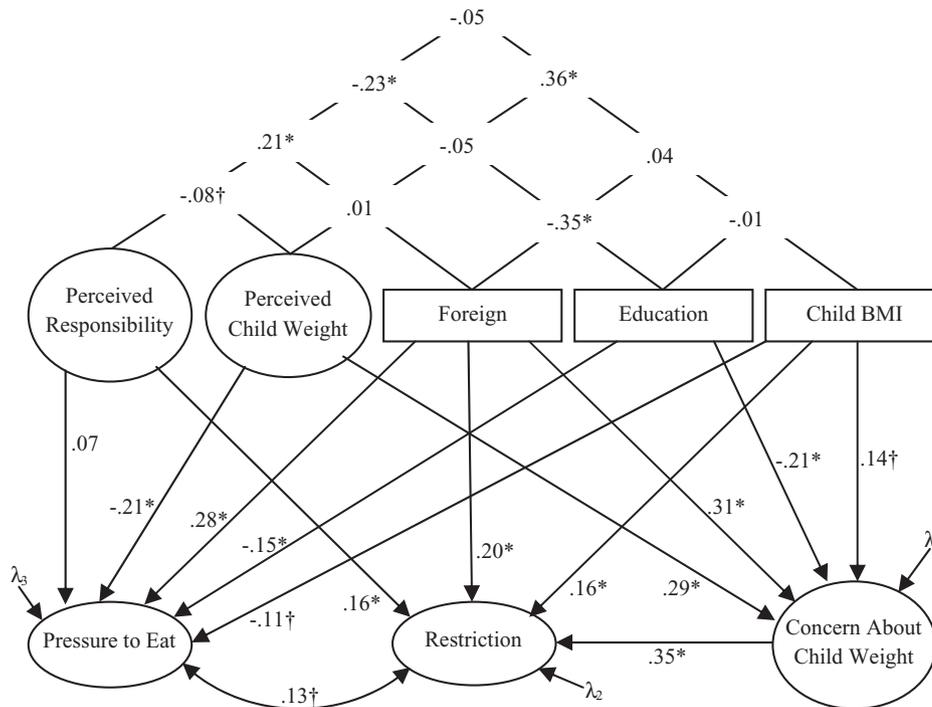


Fig. 3. An alternative Structural Equation Model (SEM) where perceived responsibility, perceived child weight, foreign background, level of education, and child BMI are defined as exogenous, pressure to eat and restriction as endogenous, and concern about child weight as a mediator. Only the structural part of the model is shown. The model shows acceptable fit to data, $\chi^2(129) = 353, p < .001$; TLI = .919; CFI = .938; RMSEA = .045 (90% CI: .039–.050). $^\dagger p < .05$; $^* p < .001$.

Many previous validation studies have therefore decided to exclude them, or link these together by adding error covariances; the latter was also our solution.

We have hypothesized that scores on different factors in this population-based sample in Sweden would differ in comparison to previous studies. When comparing with the studies on parents of preschoolers, our mean values for all the factors were closer to the results from the Australian study (Corsini et al., 2008). In comparison with the American (Birch et al., 2001), and the Japanese sample (Geng et al., 2009) parents in Sweden and Australia had higher scores on perceived responsibility and lower scores on concern about child weight. As hypothesized, the scores on restriction in our sample are among the lowest ever reported (a lower score indicates that parents agree less with using different practices to limit their child's eating). The average in our sample was 2.72 on the scale 1–5; this can be compared with 3.95 in Australia (Corsini et al., 2008), 4.0 in the USA (Birch et al., 2001) and 4.02 in Japan (Geng et al., 2009).

The relative influence of parental background factors was limited. Significant negative association with education was seen only for three factors: PE, PPW and CN. This means that mothers with higher education were less worried about their child's weight and diet but also used less pressure in feeding situations. Foreign background influenced only CN, RST and PE, all in a positive direction. In our second model that examined controlling parenting practices, RST was positively related to CN which in turn was positively associated with PCW, reported child BMI, foreign background and lower education. The independent association between parents' restrictive practices and children's overweight and obesity that we found in our sample is in agreement with evidence from previous research (Jansen et al., 2012; Kaur et al., 2006; Spruijt-Metz, Lindquist, Birch, Fisher, & Goran, 2002); yet our understanding of the role of restriction is far from clear (Carnell & Wardle, 2007; Faith & Kerns, 2005; Keller, Pietrobelli, Johnson, & Faith, 2006; Robinson, Kiernan, Matheson, & Haydel, 2001; Saelens, Ernst, & Epstein, 2000; Spruijt-Metz et al., 2006; Wardle & Carnell, 2007). One possible interpretation is that parents consciously limit a child's feeding when they perceive the child as overweight. Indeed, recent research provides support for the theory that parental feeding behaviors are responsive to child weight status (Webber, Cooke, Hill, & Wardle, 2010a; Webber, Hill, Cooke, Carnell, & Wardle, 2010b), rather than that restriction may promote overeating (Birch, Fisher, & Davison, 2003). It could also be the case that parents may use controlling behaviors more often if they lack other strategies or if such parenting behavior is culturally appropriate (thus the association with foreign background). It is interesting to note that other confounders such as parent's own weight (reported and perceived) and child's gender had no influence on parental practices, in contrast to previous research on the role of parents' BMI (Kaur et al., 2006; Montgomery, Jackson, Kelly, & Reilly, 2006), and child's gender (Robinson et al., 2001), but in line with Montgomery et al. who also have not found any associations with child's gender (Montgomery et al., 2006). This indicates that more research is needed to understand the importance of background factors.

Notably, we found that the Monitoring factor had surprisingly low reliability in the test–retest, and did not influence the models that examined associations with parenting practices and child's weight. No other validation study has reported any problems with this factor; however, the apparent poor replicability of this factor, as seen in the present study, calls for further investigation.

A major strength of this study includes the large number of mothers who participated ($n = 876$). In fact, this is the third largest sample reported, following only the Dutch ($n = 4987$) (Jansen et al., 2012) and the Japanese ($n = 920$) (Geng et al., 2009) validation studies. Additionally, nearly 600 mothers responded to the questionnaire again, in a short time frame, which makes this study exceptional with regard to the possibility of examining the test–

retest reliability. Another unique feature is that parents participating in the study represented 64 different countries of origin. It would be interesting in future research to examine culturally specific groups in more detail (for example, sub-dividing parents not born in Sweden into Nordic and non-Nordic) for further analysis of possible cultural differences in feeding styles within the same Swedish food environment.

An important limitation is that only one third of all mothers who had been contacted responded to the survey. However, response rates of 38–48% are expected in surveys of this nature (Rosvall, Grahn, & Merlo, 2008). There is always the risk of self-selection bias in such situations. We targeted parents based on records from the Swedish population register, and we chose to contact the whole pre-defined population (all female guardians of 4-year-olds in a city) that is well described due to excellent statistics on municipal and national levels; therefore, we were able to examine any systematic differences. The only difference we found was the slightly higher participation of mothers with university-level education as compared to the general population. Another limitation is that we used self-reported data on weight and height for both parents and the child. The difficulty of accurately estimating weight and height is extensively documented (Himes, 2009; Huybrechts et al., 2011), yet self-reported data are often necessary for large samples (Akinbami & Ogden, 2009; Bloom, Cohen, Vickerie, & Wondimu, 2003; Dey, Schiller, & Tai, 2004) for economic and logistical reasons. One of the reasons we decided to study parents of 4-year-olds was because parents to preschoolers are used to frequent contacts with child care and may be more aware of their children's anthropometrics. When the child is 4 years old, all families in Sweden are invited to a voluntary health check-up and most parents (90%) choose to participate. The check-up is organized by the primary child care. A pediatric nurse measures children's weight and height, discusses it with the parents and records it. It is possible that such efforts might promote more correct reporting of their child's weight and height by parents in this sample. It is also possible to assume that if parents do not perceive their child's weight status as problematic, they are more likely to accurately report the child weight documented in the health check-up. Finally, although only 4-year-olds were included in this study, this age likely captures and is representative of preschool aged children.

Another limitation is that the surveys targeted only mothers. Whereas mothers seem to be most involved in buying food and preparing it, the influence of the other parent and the rest of family members (siblings, grandparents) should not be discounted. Additionally, as the relationship between parent and child is bi-directional, to fully understand parenting practices we need to take into account children's characteristics such as their eating behavior (Jansen et al., 2012), temperament (Bergmeier, Skouteris, Horwood, Hooley, & Richardson, 2014a, 2014b; Faith & Hittner, 2010) and appetitive traits (Llewellyn, van Jaarsveld, Johnson, Carnell, & Wardle, 2010). The fact that 94% of the children in this sample spend most of their daytime in kindergarten, thus, outside of the parent's direct influence on feeding, shows that the child care environment is of paramount importance. Finally, the cross-sectional nature of our data needs to be pointed out; only prospective studies can fully demonstrate the direction of the associations found in this study, especially the relationship between child's BMI and restriction. Further research should examine whether the direction of the relationship is continuous with regard to child's BMI (the higher BMI the more restriction) or whether BMI influences restriction at some points and the opposite is true at other points. The role of possible confounding factors such as child's gender and parent's BMI should also be examined. Prospective studies would also allow to investigate whether and how child feeding practices change with increasing child age.

The day-to-day utility of our results for clinicians or health care providers lies mainly in embracing the fact that parental feeding

practices such as restriction and pressure to eat are context- and child-specific. Practices differ depending on parental background and characteristics. Such insight should inspire clinicians to be aware of how and why parents influence their child's eating behavior, in order to provide personalized nutritional advice that takes into account the different parenting styles endorsed by people of varying backgrounds. In addition, as children spend most of their day at child care, regular communication between staff and family about experiences with child feeding strategies should be highly encouraged.

Conclusions

In a large multiethnic sample of mothers of 4-year-olds living in Sweden, the psychometric properties of the translated Child Feeding Questionnaire were confirmed after minor modifications. When examining associations between child weight status and parenting practices in two models through structural equation modeling, we found that parental food controlling practices were influenced by the child's weight status, reported and perceived, as well as directly by the parents' education and foreign origin. Longitudinal studies are needed to further understand the direction of the relationship and to assess to what extent parental feeding practices are modifiable through family-based interventions. Thus, we encourage clinicians and researchers to include the CFQ in the assessment battery. Moreover, carefully designed cross-cultural comparisons could perhaps explain why the levels of restrictive feeding behaviors in Swedish families are the lowest reported, and whether these levels might indeed be related to a child-centered responsive parenting style – such as described in Sweden's iconic Pippi Longstocking books.

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