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Validation of the Child Feeding Questionnaire among Saudi pre-schoolers in Jeddah city

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Abstract

Objective: To examine the psychometric properties of an Arabic version of the Child Feeding Questionnaire (CFQ-A) in a sample of Saudi pre-schoolers and their mothers.

Design: Cross-sectional study. Mothers completed questionnaires over the telephone and child anthropometry was measured objectively using standardized procedures; BMI *Z*-scores (BMIZ) were calculated based on the age- and sex-specific WHO growth standards and reference data. Confirmatory factor analysis was used to examine the original seven-factor CFQ model, as well as a modified nine-factor model. Cronbach's α was calculated to examine the internal consistency of each factor; Spearman correlation was used to examine 2-week retest reliability. Factor–factor and factor–child BMIZ correlations were examined.

Setting: Jeddah, Kingdom of Saudi Arabia.

Participants: A total of 209 mothers and children were recruited from eight different pre-schools.

Results: Both the original seven-factor and modified nine-factor CFQ-A exhibited good fit (root-mean-square-error of approximation < 0·05). Six out of nine factors had excellent internal consistency and all factors showed excellent 2-week test–retest reliability. There were significant correlations between child BMIZ and five out of the nine factors; Perceived Child Weight, Perceived Parent Weight, Restriction and Monitoring were each positively correlated with child BMIZ, while Concern about Child's Diet was negatively correlated with child BMIZ.

Conclusions: The study provided evidence supporting the validity and reliability of the original seven-factor and modified nine-factor CFQ-A. Future studies are needed to further establish the psychometric properties of the CFQ-A in addition to other feeding assessment tools.

Keywords
Validation
Maternal feeding
Pre-schoolers
BMI Z-score

Globally, the troubling burden of obesity continues to be evident among both children and adults[1] as the prevalence of elevated BMI and its associated morbidity and mortality continue to soar[1,2]. Since childhood is a critical period for shaping lifelong obesity risk[3], identifying modifiable risk factors at an early age is vital for the promotion and maintenance of a healthy weight status[4].

Characteristics of the mealtime environment and the behaviour of family members around food have been associated with child eating behaviours and weight status in several predominantly developed countries, including the USA, the UK and Australia[5–10]. For example, overly demanding maternal feeding behaviours and restriction, such as use of punishments and rewards, were found to be inversely associated with children's ability to self-regulate food intake, which can lead to overeating and weight gain[11–14]. Indulgent feeding behaviours and low involvement in child feeding have also been associated with higher weight status among children[6,15]. Although evidence supporting causal associations between maternal feeding behaviours and child obesity is lacking[16], results from several studies show that the association between maternal feeding and child eating behaviours is bidirectional; mothers may adjust and adapt the way they approach feeding in response to the child's temperament, behaviour and weight status[9,17,18] and the mother's approach to feeding can in turn influence the child's counter-response and behaviour around food[19]. Therefore, maladaptive feeding and eating behaviours of

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mothers and their children may be described as a viscous cycle of obesogenic events that can ultimately promote an unhealthy weight status. Hence, validated instruments that aid in the evaluation of both maternal feeding and child eating behaviours are needed in order to efficiently identify maladaptive behaviours and subsequently promote a healthier mealtime environment.

As seen in many countries around the world, the prevalence of obesity and obesity-related diseases (e.g. type 2 diabetes) in the Kingdom of Saudi Arabia (KSA) has been increasing alarmingly[20]. The prevalence of overweight and obesity among children is concerning, where about 32 % of children were found to be overweight or obese[21]. Moreover, KSA is classified as a country experiencing advanced nutrition transition, such that dietary patterns are changing rapidly and drastically to mimic those seen in Western countries[22,23]. It is hypothesized that these changes in dietary intake are secondary to changes in socio-economic status and social and familial norms[24]. Although these sociocultural adaptations are likely to be accompanied by changes in the family mealtime environment, family mealtimes and the behaviour of family members around food in Saudi society have not been efficiently explored. Although one study found that Saudi mothers of pre-school children may use restriction and pressure to eat in feeding[25], we were unable to identify any other studies evaluating maternal feeding behaviours and practices as they relate to child weight status. Additionally, we were able to identify only one study that evaluated initial validity of a child feeding assessment tool in a convenience sample of highly educated Saudi mothers living in the USA[25].

The Child Feeding Questionnaire (CFQ) is a feeding behaviour assessment tool that was first developed by Birch *et al.* in 2001 to assess parental beliefs, attitudes and practices relating to child feeding in a US cohort of parents of 2–11-year-old children[26]. The questionnaire consists of thirty-one items with 5-point Likert response scales and generates seven factors: Perceived Responsibility; Perceived Parent Weight; Perceived Child Weight; Concern about Child Weight; Restriction; Pressure to Eat; and Monitoring. Although some studies involving CFQ subscales have shown poor or mediocre model fit[27] and problematic structure of some factors (mainly Restriction)[27–30], several studies have reported evidence of validity and reliability in US[26,31,32] and non-US samples[10,29,30,33,34].

Given the immediate need for valid and reliable, culturally sensitive instruments to assess feeding in KSA, the objective of the present study was to examine the psychometric properties of an Arabic version of the CFQ (CFQ-A) in a sample of Saudi pre-schoolers and their mothers by: (i) testing the original seven-factor CFQ-A model in addition to a modified nine-factor CFQ-A model and examining model fit and internal reliability of subscales; (ii) examining test–retest reliability of CFQ-A factors; and (iii) examining intercorrelations among CFQ-A factors as well as correlations with child BMI *Z*-score (BMIZ).

In developing the modified nine-factor CFQ-A model, we hypothesized that Saudi mothers are more invested and indulgent in feeding and that they like to ensure that their children are 'eating enough food' and that they are at the heavier end of the normal weight range[25,35,36]. We therefore added the two additional factors, Use of Food as a Reward and Concern about Child's Diet. Moreover, we hypothesized that Perceived Child Weight, Concern about Child Weight and Concern about Child's Diet are correlated with feeding practices including Restriction, Pressure to Eat, Monitoring, Perceived Responsibility and Use of Food as a Reward, and that these maternal perceptions and practices are also correlated with child BMIZ[37]. Results from the present study can help provide evidence regarding the appropriateness of use of an Arabic version of the CFQ in Saudi Arabia. Findings can also help identify and inform future work needed for further development of efficient feeding assessment tools among Saudi/Arab populations.

Methods

Sample and procedures

A total of 209 mothers and children were included in the present study. Participants were recruited from eight different pre-schools around the city of Jeddah, KSA. Schools were randomly selected based on location; two schools were located in the northern area, two in the southern area, two in the eastern area and two in the western area. Of the eight pre-schools, four were public (government-subsidized) and four were private pre-schools. A description of the study and consent forms were placed in the backpacks of all students enrolled in the pre-schools. Research assistants contacted mothers who returned signed consent forms and completed the study questionnaire with them over the telephone. The study questionnaire included the CFQ-A, questions that assessed use of food as a reward and concern about child's diet, and questions that assessed demographic characteristics.

Within 1 week of completing the questionnaire, the study team performed school visits in order to obtain weight and height measurements of participating children. Study inclusion criteria were as follows: child is Saudi or a permanent resident of KSA; between 3 and 5 years old; resides with his/her mother and is healthy with no serious medical problems or history of food allergies; and mother is an Arabic speaker. In order to examine test–retest reliability, forty randomly selected mothers (19 %) completed the questionnaire for a second time approximately 2 weeks after the initial telephone call.

Measures

Demographic characteristics

Mothers were asked questions that assessed demographic characteristics including the child's sex, birthdate and

nationality; the mother's birthdate, educational level, employment status, marital status and nationality; as well as the family's total monthly income. Birthdates and dates of interviews were used to calculate child and maternal age.

The Arabic version of the Child Feeding Questionnaire

Mothers completed the CFQ-A in Arabic language, following a forward–backward translation process conducted by bilingual professionals[10,38]. The final version of the CFQ-A was pretested using a different sample consisting of sixty mothers of pre-school children and was reviewed by an expert committee of four health-care professionals. Clarifications were made to wording of questions and response options based on comments from mothers and expert committee members.

Use of food as a reward and concern about child's diet

Saudi mothers may be more indulgent in feeding, traditionally use food as a reward to encourage desirable behaviours and may consciously or subconsciously follow the traditional belief that heavier children are healthier[25,35,36]. We therefore elected to evaluate a modified CFQ-A model that assessed Use of Food as a Reward as a separate construct, rather than including these items with the Restriction subscale, as employed in the original questionnaire[26]. This approach yielded satisfactory results among a sample of Chinese mothers[33]. Furthermore, we included a separate subscale for assessing Concern about Child's Diet.

Mothers completed questions that were adapted from the Meals in Our Household Questionnaire, a questionnaire developed to assess family meals in the households of 3–11-year-old children[40]. Questions included six items that assessed Use of Food as a Reward (FR; response options ranging from 1 = 'never' to 5 = 'always')[39]. These items were: FR1, 'I give my child food to keep him/her quiet when shopping or travelling'; FR2, 'I give my child food to reward him/her for good behaviour'; FR3, 'I withhold a food my child likes as a consequence for bad behaviour'; FR4, 'My child expects to be given a favourite food as a reward'; FR5, 'I give my child a special food to celebrate an achievement'; and FR6, 'I give my child food to persuade him/her to do something he/she does not really want to do'. In addition, mothers completed seven out of seventeen items that assessed Concern about Child's Diet (CD; response options ranging from 1 = 'not at all concerned' to 6 = 'extremely concerned')[39]. We selected items that reflected concern about child's diet in general, rather than those that measured concern about child's consumption of specific food types (e.g. CD14 and CD17 concerning eating vegetables and meat). These items were: CD1, 'Child is not eating enough'; CD2, 'Child is eating too much'; CD3, 'Child eats a lot of junk food'; CD4, 'Child eats only a few types of food'; CD5, 'Child is not getting good nutrition'; CD6, 'Child has poor eating habits'; and CD7, 'Child will not try new foods'.

The same translation and pretesting process was utilized with these items, which were used to construct a modified nine-factor CFQ-A model as described in following sections.

Child BMI Z-score

Trained staff members followed standardized procedures to measure children's weights and heights. Calibration of the instruments was checked periodically. Shoes and heavy clothing were removed and the child was asked to stand still on a digital scale, with his/her weight equally distributed on both feet. Each child was weighed twice and if the two readings were inconsistent by more than 0·1 kg, the child was weighed two more times and the average of the two measurements was calculated. Similarly, height was measured twice and if the measurements differed by more than 0·5 cm, two more measurements were taken and the average of the two measurements was calculated. BMI was calculated for each child by dividing weight (in kilograms) by the square of height (in metres)[40]. BMIZ were calculated based on the age- and sex-specific WHO growth standards for children aged ≤5 years and the WHO growth reference data for children who were between 5 and 6 years old[41,42]. Two children had missing weight and height data due to transferring to other schools and were therefore excluded from analyses involving child BMI data.

Statistical analysis

Analyses were conducted using the statistical software package IBM SPSS Statistics version 21.0. Descriptive statistics were used to examine sample characteristics, as well as the distribution of questionnaire factors, maternal BMI and child BMIZ.

To examine internal reliability, Cronbach's α was calculated for each factor in the seven- and nine-factor CFQ-A models. A Cronbach's α value of 0·70 or higher is considered favourable[43,44]. Spearman correlation coefficients were calculated to examine the 2-week test–retest reliability of the CFQ-A factors.

To assess validity of the seven- and nine-factor models, confirmatory factor analysis was performed using lavaan version 0.5-23[45] in R version 3.3.1. Diagonally weighted least squares was used to estimate model parameters. Diagonally weighted least squares was specifically designed for ordinal data and is more appropriate/recommended for use with Likert-type scales[46,47].

Fit indices were estimated for each of the models by calculating the root-mean-square error of approximation, Tucker–Lewis index, comparative fit index, standardized root-mean-square residual, and the likelihood ratio test or the minimum sample discrepancy function/df[48,49]. The suitability of confirmatory factor analysis was assessed prior to conducting the analysis, and inspection of the correlation matrix showed that all variables in both the seven-factor and nine-factor models had correlation coefficients greater than 0·30.

Table 1 Summary of factors and subscales of the original seven-factor and modified nine-factor Arabic version of the Child Feeding Questionnaire (CFQ-A)

Original seven-factor CFQ-A	Modified nine-factor CFQ-A
Perceived Responsibility (PR) Items: PR1, PR2, PR3 Response options: 1 = never; 2 = seldom; 3 = half of the time; 4 = most of the time; 5 = always	Perceived Responsibility (PR) Items: PR1, PR2, PR3 Response options: 1 = never; 2 = seldom; 3 = half of the time; 4 = most of the time; 5 = always
Perceived Parent Weight (PPW) Items: PPW1, PPW2, PPW3, PPW4 Response options: 1 = markedly underweight; 2 = underweight; 3 = normal; 4 = overweight; 5 = markedly overweight	Perceived Parent Weight (PPW) Items: PPW1, PPW2, PPW3, PPW4 Response options: 1 = markedly underweight; 2 = underweight; 3 = normal; 4 = overweight; 5 = markedly overweight
Perceived Child Weight (PCW) Items: PCW1, PCW2, PCW3, PCW4 (PCW5 and PCW6 not included due to sample age) Response options: 1 = markedly underweight; 2 = underweight; 3 = normal; 4 = overweight; 5 = markedly overweight	Perceived Child Weight (PCW) Items: PCW1, PCW2, PCW3, PCW4 (PCW5 and PCW6 not included due to sample age) Response options: 1 = markedly underweight; 2 = underweight; 3 = normal; 4 = overweight; 5 = markedly overweight
Concern about Child Weight (CN) Items: CN1, CN2, CN3 Response options: 1 = unconcerned; 2 = a little concerned; 3 = concerned; 4 = fairly concerned; 5 = very concerned	Concern about Child Weight (CN) Items: CN1, CN2, CN3 Response options: 1 = unconcerned; 2 = a little concerned; 3 = concerned; 4 = fairly concerned; 5 = very concerned
Restriction (RST) Items: RST1A, RST1B, RST1C, RST2, RST3A, RST3B, RST4A, RST4B Response options: 1 = disagree; 2 = slightly disagree; 3 = neutral; 4 = slightly agree; 5 = agree	Restriction (RST) Items: RST1C, RST2, RST4A, RST4B Response options: 1 = disagree; 2 = slightly disagree; 3 = neutral; 4 = slightly agree; 5 = agree
Pressure to Eat (PE) Items: PE1, PE2, PE3, PE4 Response options: 1 = disagree; 2 = slightly disagree; 3 = neutral; 4 = slightly agree; 5 = agree	Pressure to Eat (PE) Items: PE1, PE2, PE3, PE4 Response options: 1 = disagree; 2 = slightly disagree; 3 = neutral; 4 = slightly agree; 5 = agree
Monitoring (MN) Items: MN1, MN2, MN3 Response options: 1 = never; 2 = rarely; 3 = sometimes; 4 = mostly; 5 = always	Monitoring (MN) Items: MN1, MN2, MN3 Response options: 1 = never; 2 = rarely; 3 = sometimes; 4 = mostly; 5 = always
	Use of Food as a Reward (FR) Items: FR1, FR2, FR3, FR4, FR5, FR6 Response options: 1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = very often
	Concern about Child's Diet (CD) Items: CD1, CD2, CD3, CD4, CD5, CD6, CD7 Response options: 1 = not at all concerned; 2 = a little concerned; 3 = somewhat concerned; 4 = quite concerned; 5 = very concerned; 6 = extremely concerned

Table 1 summarizes factors and subscales of the original seven-factor CFQ-A, as well as the modified nine-factor CFQ-A. The modified nine-factor CFQ-A model includes two additional factors: Use of Food as a Reward and Concern about Child's Diet[39]. As described earlier, items relating to using food as a reward were removed from the Restriction subscale and were included only in the Use of Food as a Reward subscale in the modified nine-factor model. These items were RST3A and RST3B. Scores for all factors were calculated as the mean of contributing items, with higher scores reflecting more of the given behaviour[26].

Intercorrelations among the modified CFQ-A factors as well as correlations with child BMIZ were examined. Interpretation of the correlation coefficients were based on Cohen's guidelines[50]; correlations between 0·5 and 1·0 were considered large, correlations between 0·3 and 0·5 as medium and correlations between 0·1 and 0·3 as small. Only children with complete BMIZ data (*n* 207) were included in the correlation analysis between CFQ-A factors and child BMIZ. For all statistical analyses, the significance level was set at 0·05.

Results

Sample characteristics

Mean child age was 4·79 years (SD = 0·79 years), and about half of the sample (51·7 %) was male. The majority (approximately 70 %) of children and mothers were Saudi. Of the sixty-four non-Saudi children, about half (*n* 29, 45·3 %) were Egyptian, ten (15·6 %) were Syrian, eight were Yemeni (12·5 %), six were Jordanian (9·4 %), five (7·8 %) were Lebanese, five (7·8 %) were Palestinian and one (1·6 %) was Sudanese. In addition, the majority

Table 2 Characteristics of the sample of pre-schoolers and their mothers (*n* 209) recruited from eight different pre-schools in Jeddah city, Kingdom of Saudi Arabia, October 2017–April 2018

Variable	Mean or *n*	SD or %
Child age (years)	4·79	0·79
Child sex		
Male	108	51·7
Female	101	48·3
Child nationality		
Saudi	145	69·4
Non-Saudi	64	30·6
Child BMI *Z*-score	0·17	1·34
Total monthly income		
<5000 SR	21	10·0
5000–10 000 SR	74	35·4
>10 000 SR	114	54·5
Maternal age (years)	33·05	4·98
Maternal nationality		
Saudi	140	67·0
Non-Saudi	69	33·0
Maternal education		
Middle school	3	1·4
High school	39	18·7
College	142	67·9
Postgraduate	24	12·0
Maternal employment		
Employed	84	40·2
Housewife	107	51·2
Student	15	7·2
Other	3	1·4

Data are presented as mean and SD for continuous variables or as *n* and % for categorical variables.

of mothers (80 %) had a college education or higher, and about half (51·2 %) reported that they were housewives (Table 2).

Table 3 shows the distribution (including mean, SD and range) of questionnaire factors.

Internal and test–retest reliability

Table 3 shows the respective Cronbach's α for each factor of the seven- and nine-factor CFQ-A models. For the seven-factor CFQ-A model, three factors fell below the 0·70 threshold: Perceived Parent Weight (Cronbach's $\alpha = 0{\cdot}67$), Restriction (Cronbach's $\alpha = 0{\cdot}60$) and Pressure to Eat (Cronbach's $\alpha = 0{\cdot}49$). These same factors were also below the 0·70 threshold for the nine-factor CFQ-A model: Perceived Parent Weight (Cronbach's $\alpha = 0{\cdot}67$), Restriction (Cronbach's $\alpha = 0{\cdot}62$) and Pressure to Eat (Cronbach's $\alpha = 0{\cdot}49$). All factors showed excellent 2-week test–retest reliability, with Spearman correlations > 0·70 (all $P < 0{\cdot}05$).

Confirmatory factor analysis

The seven-factor CFQ-A model

Forced extraction of seven factors explained 19·53, 13·71, 10·17, 9·12, 7·10, 6·07 and 4·84 % of the total variance, respectively. The seven-factor solution explained 70·5 % of the total variance. The root-mean-square error of approximation of 0·02 indicates good fit[51]. The Tucker–Lewis index and comparative fit index were calculated to be 0·96 and 0·97, respectively. The seven-factor model is illustrated in Fig. 1.

The nine-factor CFQ-A model

Forced extraction of nine factors had explained 15·42, 13·43, 11·84, 7·57, 6·79, 5·01, 4·16, 3·62 and 3·59 % of the total variance, respectively. The nine-factor solution explained 71·4 % of the total variance. The root-mean-square error of approximation of 0·04 indicates good fit[51]. The Tucker–Lewis index and comparative fit index were estimated to be 0·90 and 0·88, respectively. The nine-factor model is illustrated in Fig. 2. A comparison of fit indices of the seven- and nine-factor models is shown in Table 4.

Factor–factor and factor–child BMI Z-score correlations

As shown in Table 5, the highest correlations between factors were between Restriction and Monitoring ($r = 0{\cdot}50$, $P < 0{\cdot}001$), Perceived Responsibility and Monitoring ($r = 0{\cdot}40$, $P < 0{\cdot}001$) and Perceived Responsibility and Restriction ($r = 0{\cdot}30$, $P < 0{\cdot}001$). There were small positive correlations between Perceived Child Weight and Restriction ($r = 0{\cdot}20$, $P < 0{\cdot}001$) and Perceived Child Weight and Monitoring ($r = 0{\cdot}17$, $P = 0{\cdot}01$), as well as between Concern about Child's Diet and Concern about Child Weight ($r = 0{\cdot}18$, $P < 0{\cdot}001$) and Concern about Child's Diet and Use of Food as a Reward ($r = 0{\cdot}16$, $P = 0{\cdot}01$). Although marginally significant, Perceived Responsibility was also positively correlated with Perceived Child Weight ($r = 0{\cdot}13$, $P = 0{\cdot}06$) and Pressure to Eat ($r = 0{\cdot}12$, $P = 0{\cdot}07$).

We detected negative correlations between Perceived Responsibility and Concern about Child's Diet ($r = -0{\cdot}24$, $P < 0{\cdot}001$) and between Perceived Responsibility and Use of Food as a Reward ($r = -0{\cdot}19$, $P < 0{\cdot}001$). Furthermore, Concern about Child's Diet was negatively correlated with Perceived Parent Weight ($r = -0{\cdot}15$, $P = 0{\cdot}03$) and Perceived Child Weight ($r = -0{\cdot}23$, $P = 0{\cdot}001$). Concern about Child Weight was negatively correlated with Pressure to Eat ($r = -0{\cdot}14$, $P = 0{\cdot}04$).

There were significant correlations between child BMIZ and five out of the nine factors; Perceived Child Weight ($r = 0{\cdot}49$, $P < 0{\cdot}001$), Perceived Parent Weight ($r = 0{\cdot}30$, $P < 0{\cdot}001$), Restriction ($r = 0{\cdot}21$, $P < 0{\cdot}001$) and Monitoring ($r = 0{\cdot}16$, $P = 0{\cdot}02$) were each positively correlated with child BMIZ, while Concern about Child's Diet was negatively correlated with child BMIZ ($r = -0{\cdot}18$, $P = 0{\cdot}01$; Table 5).

Discussion

Our study including 209 Saudi mothers and their pre-school children provides initial evidence of the validity and reliability of a modified nine-factor CFQ-A model. Our

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Table 3 Distribution and internal consistencies of factors of the Arabic version of the Child Feeding Questionnaire (CFQ-A) in the sample of pre-schoolers and their mothers (*n* 209) recruited from eight different pre-schools in Jeddah city, Kingdom of Saudi Arabia, October 2017–April 2018

					Cronbach's α	
	Minimum	Maximum	Mean	SD	Seven-factor model	Nine-factor model
Perceived Responsibility	1·00	5·00	4·23	0·93	0·74	0·74
Perceived Parent Weight	2·00	5·00	3·20	0·47	0·67	0·67
Perceived Child Weight	2·00	4·75	2·90	0·35	0·70	0·70
Concern about Child Weight	1·00	5·00	1·62	1·17	0·88	0·88
Restriction	1·00	5·00	4·40	0·94	0·60	0·62
Pressure to Eat	1·00	5·00	3·91	1·14	0·49	0·49
Monitoring	1·00	5·00	4·44	0·80	0·86	0·86
Use of Food as a Reward	1·00	5·00	2·22	1·01	–	0·73
Concern about Child's Diet	1·00	5·00	2·26	1·14	–	0·82

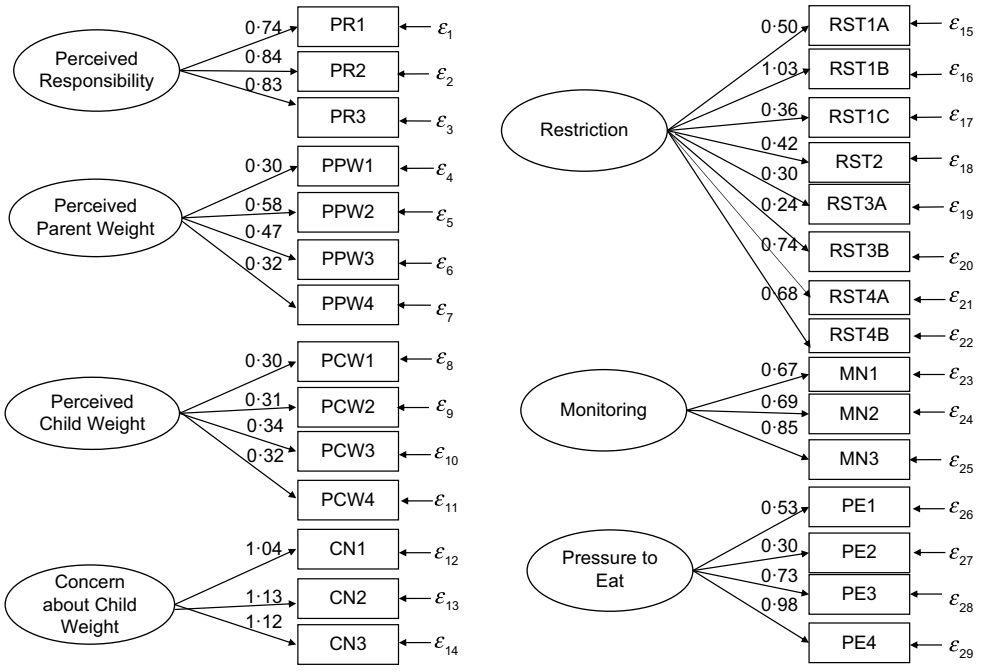

Fig. 1 Seven-factor model of the Arabic version of the Child Feeding Questionnaire (CFQ-A), with the factors Perceived Responsibility, Perceived Parent Weight, Perceived Child Weight, Concern about Child Weight, Restriction, Monitoring and Pressure to Eat (see Table 1 for a description of the factors and subscales). Fit indices: root-mean-square error of approximation = 0·02 (95 % CI 0·00, 0·04), Tucker–Lewis index = 0·96, comparative fit index = 0·97, standardized root-mean-square residual = 0·07, χ^2 = 267·7 (P < 0·001), minimum sample discrepancy function/df = 1·10 (ε_1–ε_{29} are error terms)

results suggest that modifying the restriction subscale and including a separate subscale to assess using food as a reward may be suitable for Saudi mothers. This approach has previously provided satisfactory results among a sample of Chinese mothers of pre-schoolers[33], suggesting that parenting/feeding strategies among Middle-Eastern and Asian families might be comparable. Indeed, when comparing our restriction factor mean with that of the study involving Chinese mothers[33] (total mean scores out of 5), we observed that they are almost similar (mean = 4·40, SD = 0·94 and mean = 4·18, SD = 0·80, respectively), whereas a larger difference is seen when comparing with Western samples of pre-school (mean = 2·72, SD = 0·99)[10] and school-age children (mean = 2·50, SD = 0·95)[26]. Likewise, perceived responsibility was higher among our Saudi mothers (mean = 4·23, SD = 0·93), as well as Chinese (mean = 4·26, SD = 0·71) and Turkish mothers (mean = 4·14, SD = 0·67), compared with US (mean = 3·40, SD = 0·95) and Swedish (mean = 4·02, SD = 0·69) mothers. Interestingly, monitoring among our sample of Saudi mothers (mean = 4·44, SD = 0·80) was noticeably higher than that of other samples of Chinese (mean = 3·68, SD = 1·12), Turkish (mean = 2·96, SD = 0·70), US (mean = 3·60, SD = 0·90) and Swedish (mean = 3·87, SD = 0·88) mothers. These cross-cultural similarities/differences might be attributed to societal norms regarding the role and responsibility of mothers in feeding

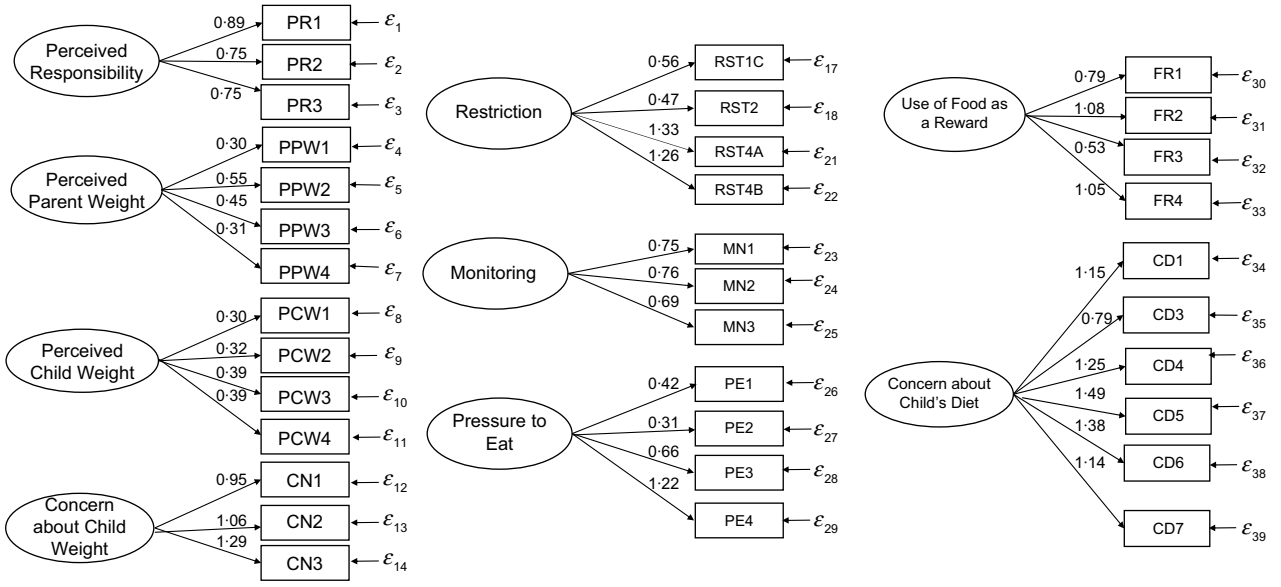

Fig. 2 Nine-factor model of the Arabic version of the Child Feeding Questionnaire (CFQ-A), with the factors Perceived Responsibility, Perceived Parent Weight, Perceived Child Weight, Concern about Child Weight, Restriction, Monitoring, Pressure to Eat, Use of Food as Reward and Concern about Child's Diet (see Table 1 for a description of the factors and subscales). Fit indices: root-mean-square error of approximation = 0·04 (95 % CI 0·03, 0·05), Tucker–Lewis index = 0·88, comparative fit index = 0·90, standardized root-mean-square residual = 0·07, χ^2 = 694·0 (P < 0·001), minimum sample discrepancy function/df = 1·41 (ε_1–ε_{18} and ε_{21}–ε_{39} are error terms)

Table 4 Comparison of fit indices between the seven-factor and nine-factor models of the Arabic version of the Child Feeding Questionnaire (CFQ-A) in the sample of pre-schoolers and their mothers (n 209) recruited from eight different pre-schools in Jeddah city, Kingdom of Saudi Arabia, October 2017–April 2018

Model	CMIN/df	χ^2	P value	TLI	CFI	SRMR	RMSEA	95 % CI
Seven-factor	1·10	256·7	<0·001	096	0·97	0·07	0·02	0·00, 0·04
Nine-factor	1·41	694·0	<0·001	0·89	0·90	0·07	0·04	0·03, 0·05
$\Delta\chi^2$	–	437·3	–	–	–	–	–	–

CMIN, minimum sample discrepancy function; χ^2, chi-square statistic; TLI, Tucker–Lewis index; CFI, comparative fit index; SRMR, standardized-root-mean square residual; RMSEA, root-mean-square error of approximation.

their children, as well as availability and access to quality early childhood care centres (e.g. daycare centres and pre-schools), which affects the amount of time mothers spend being in charge of feeding their children.

Both the original seven-factor model as well as the modified nine-factor model showed good fit to data (root-mean-square error of approximation < 0·05)[52]. Furthermore, our findings suggest adequate internal reliability for six out of the nine factors in the modified nine-factor CFQ-A model. The three factors with Cronbach's α that fell below the 0·70 cut-off were: Perceived Parent Weight, Restriction, and Pressure to Eat. This is consistent with results from other validation studies that also found lower internal reliability for the Restriction and Pressure to Eat factors[10,27]. One possible explanation for the less satisfactory estimates for the Restriction and Pressure to Eat subscales could be the variation between mothers in defining some phrases used in questionnaire items, such as 'I have to be sure that my child does not eat too many high-fat foods'. For example, while one mother might define 'being sure' as actively or physically removing food items from the child's reach, another might define this as more subtle behaviours such as stating the harms of high-fat foods in front of the child. In line with previous studies, ours showed evidence of adequate test–retest reliability[10].

Overall, intercorrelations between factors in the modified model were in the expected direction and give support to our hypothesis that perceived child weight and concern about child weight and diet are each associated with feeding practices among Saudi mothers. Results suggest that mothers who apply higher restriction may monitor their children's eating to a greater extent. Mother who perceive that they are highly responsible for their children's eating may apply greater restriction. Although the original CFQ study by Birch *et al.* did not find a correlation between perceived responsibility and restriction[26], our findings are consistent with those of a study involving Turkish mothers[53]. In line with our findings, both the original CFQ study and the Turkish study reported a positive correlation between perceived responsibility and monitoring[26,53]. Additionally,

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Table 5 Factor–factor and factor–child BMI Z-score (BMIZ) correlations of the modified nine-factor model of the Arabic version of the Child Feeding Questionnaire (CFQ-A), October 2017–April 2018

	Perceived Responsibility	Perceived Parent Weight	Perceived Child Weight	Concern about Child Weight	Restriction	Pressure to Eat	Monitoring	Use of Food as a Reward	Concern about Child's Diet	Child BMIZ (*n* 207)
Perceived Responsibility	1									
Perceived Parent Weight	−0·02	1								
Perceived Child Weight	0·13*	0·09	1							
Concern about Child Weight	−0·03	0·09	0·05	1						
Restriction	0·30***	0·03	0·20***	−0·009	1					
Pressure to Eat	0·12*	−0·12*	−0·20***	−0·14**	0·06	1				
Monitoring	0·40***	−0·07	0·17**	−0·09	0·50***	0·08	1			
Use of Food as a Reward	−0·19***	−0·12*	−0·009	−0·07	−0·03	−0·03	−0·09	1		
Concern about Child's Diet	−0·24***	−0·15**	−0·23***	0·18***	−0·09	−0·09	−0·11*	0·16**	1	
Child BMIZ (*n* 207)	0·11*	0·30***	0·49***	0·02	0·21***	−0·12*	0·16**	0·05	−0·18**	1

n 209 unless otherwise specified.
$*P < 0·10$, $**P < 0·05$, $***P < 0·01$.

our findings suggest that mothers who perceive their children to have a higher weight status may apply higher restriction and monitoring, and mothers who are more concerned about their children's weight may be more concerned about their diet.

Furthermore, we found that mothers who perceive that they are highly responsible for their children's eating also reported lower concern about their child's diet. This is probably due to these mothers exerting higher restriction and monitoring, leading them to feel more in control of what their children eat. Additionally, some of the Concern about Child's Diet items were related to the child receiving 'good nutrition' and him/her having 'poor eating habits', which can be relevant to both underweight and overweight children. This might explain the negative correlation between Concern about Child's Diet and Perceived Child Weight. Our results showed a negative correlation between Concern about Child Weight and Pressure to Eat, which is consistent with results from previous studies in Western samples[10,11,26].

Correlations detected between the modified CFQ-A factors and child BMIZ also give support to our hypothesis that maternal perceptions and practices around feeding are associated with child BMIZ in a sample of Saudi mothers and pre-schoolers. While some studies did not detect an association between restriction and child BMI[33,37] consistent with our results, others have reported a link with overeating and obesity risk[13,14,54]. Furthermore, although only marginally significant, our finding of a negative correlation between pressure to eat and child BMIZ is consistent with those of previous studies[33,55] suggesting that mothers may pressure their children to eat more when they are thinner.

Since the present analyses did not take potential confounders into account, further studies that test adjusted statistical models are needed to further establish the association between maternal feeding behaviours and child BMI in a Saudi sample. Our findings, in addition to evidence from previous studies[25,36], suggest that Saudi mothers may feel great responsibility towards their role in feeding their families. Future studies that characterize feeding behaviours and examine associations with weight status are needed to help inform intervention studies aiming to enhance adaptive feeding practices and promote healthy eating behaviours among children in Saudi Arabia[56].

Our study was the first to evaluate validity and reliability of an Arabic version of the CFQ in a cohort residing in KSA. We were able to slightly modify the CFQ in order to better capture traditional feeding practices among Saudi mothers. Child anthropometry was objectively measured, and the sample was recruited from eight different pre-schools with varying degrees of socio-economic status. Limitations of the study included that our sample size was relatively small. Mothers were recruited through an opt-in approach by placing consent forms in children's backpacks. This might have increased the likelihood of

self-selection bias, such that mothers who were more interested in the topic of feeding might have been more inclined to participate. Administration of the questionnaire over the telephone might have increased the likelihood that mothers will give socially desirable responses, although this approach can help minimize missing data. Furthermore, since the majority of mothers in our study had a college degree or higher, our results may not be generalizable to other population groups with lower educational levels.

Future studies with larger sample sizes that include mothers with different educational backgrounds and studies that employ different recruitment strategies are warranted. Longitudinal designs are also needed in order to evaluate the effect of feeding behaviours over time and draw inferences regarding causal associations. Additionally, qualitative studies and those that include direct observation of mother–child interactions during mealtimes may be useful in identifying unique feeding behaviours among Saudi and Arab families.

Conclusion

Identifying characteristics of the mealtime environment and how they relate to child eating behaviours and weight status can help inform effective prevention and intervention strategies among Saudi families. Culturally sensitive assessment tools are needed in order to evaluate feeding behaviours among Saudi mothers. Our study provides evidence that supports the validity and reliability of the original seven-factor CFQ-A as well as a modified nine-factor CFQ-A model. Future larger studies are needed to further establish the psychometric properties of the CFQ-A as well as other feeding assessment tools.

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