



Estimating and differentiating maternal feeding practices in a country ranked first in childhood obesity

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Abstract

Objective: Mexico ranks first in childhood obesity worldwide. However, little is known about the factors influencing maternal feeding practices. The present study aimed to estimate the prevalence of feeding practices and explore associations between weight concern, weight perception, sociodemographic characteristics and those feeding practices.

Design: Cross-sectional.

Setting: North-eastern Mexico.

Participants: Mothers aged ≥ 18 years who were in charge of feeding a singleton child aged 2–6 years with no endocrine disease or visible genetic malformations (n 507). Information on six maternal feeding practices, concern and perception of the child's weight and demographics were collected by interview. The mother's and child's height and weight were measured. The feeding practices questionnaire was subject to content, construct and convergent validity analysis. Then, mean feeding scores were obtained and prevalence and 95 % CI were determined for scores ≥ 3 ; multivariate logistic regression was performed.

Results: Not modelling (63.5 %; 95 % CI 59.2, 67.8 %) and pressuring to eat (55.6 %; 95 % CI 51.2, 60.0 %) were the most frequent feeding practices, followed by easy access to unhealthy foods (45.4 %; 95 % CI 40.9, 49.8 %) and child control (43.2 %; 95 % CI 38.8, 47.6 %). They prevailed despite concern about the child's excess weight or a perception of the child as overweight/obese. Education was associated with the highest number of practices (educated mothers used more pressuring to eat, less regulation and less easy access; or monitoring was less absent).

Conclusions: The frequency of certain feeding practices needs to be improved. Emphasis on the child's weight concern, obesity perception and maternal education is essential for optimizing intervention planning.

Keywords
Parenting
Feeding practices
Prevalence
Determinants
Child obesity

Overweight and obesity in all stages of life have become a public health problem worldwide. In 2016, more than 40 million children aged 0–5 years suffered from overweight or obesity worldwide; if this tendency continues, the number could increase to 70 million by 2025⁽¹⁾. UNICEF ranks Mexico first on the incidence of childhood obesity⁽²⁾. In Mexico, the prevalence increased from 7.8 to 9.7 % between 1988 and 2012. In the Northern region the prevalence has reached 13 %^(3,4). The origin of childhood obesity is multifactorial and the role of parents in pre-school

feeding is critical for promoting positive habits⁽⁵⁾. Feeding practices are specific behaviours that characterize mealtime interactions and parental control is a key factor for limiting or encouraging eating. Parents can decide to use direct control methods, for example pressuring to eat, restricting, punishing and rewarding; or indirect control methods, for example promoting healthy home environments. What parents tend to choose is meaningful because feeding control produces either a positive or negative outcome. For example, restrictive feeding practices are

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likely to be associated with overeating⁽⁶⁾ and modelling or monitoring to be associated with healthy eating^(7,8). Further, concerns and perceptions of the child's weight play a key role in prompting the use of certain feeding practices. For example, parents with greater concerns or perceptions of overweight might use more restrictive feeding practices^(9–11), even though this approach does not necessarily contribute to weight management. Restrictions can modify the child's food preferences as well as his/her natural response to signals of hunger–appetite–satiety; higher intake of restricted foods in the absence of hunger might occur^(12–14).

In children of pre-school age, almost all studies related to feeding practices have been conducted in first-world countries, such as the UK⁽¹⁵⁾, Australia⁽¹⁶⁾, Sweden⁽¹⁷⁾ or the USA and France⁽¹⁸⁾. Two studies have focused on Hispanic families within the USA^(19,20), whereas only one has been conducted in a Latin American country (Chile)⁽²¹⁾. Feeding practices vary by country, as suggested by a study which revealed that, while monitoring and restriction were more prevalent in France, using food as reward was more prevalent in the USA⁽¹⁸⁾. Moreover, feeding practices might differ by sociocultural background, as shown by Somaraki *et al.*⁽²²⁾ in Sweden. They documented that non-European-born mothers were more concerned about their child's weight than European-born mothers; and maternal concerns explained 52% of the difference in restriction between Swedish-born and non-European-born mothers. Hispanic and Mexican-origin mothers are reportedly prone to misinterpreting overweight as a synonym for good health^(23,24). Latina mothers worry more about underweight than overweight and prefer their child to be heavier^(24–26). In addition, Mexican mothers show affection to their family through food and the Mexican culture has been generally described as one emphasizing respect for authority, where parents predominantly employ an authoritarian feeding style⁽²⁷⁾.

Little is known about which feeding practices prevail and what factors differentiate mothers who use certain feeding practices focused on parental control in Mexico. Therefore, the present study aimed to expand current research by estimating the prevalence of six feeding practices and exploring the associations between mothers' concern about their child's excess weight, mothers' perception of their child's overweight/obesity, sociodemographic characteristics and those feeding practices of Mexican mothers with children aged 2–6 years. Such estimations are essential to shedding light on modifiable family factors and developing effective interventions to promote healthy child eating habits and preventing obesity in pre-school children.

Methods

The present cross-sectional study was conducted between August and December 2016 in north-eastern Mexico. A consecutive selection was made of mothers aged at least

18 years who had singleton children aged 2–6 years with no endocrine disease, medical restriction on certain foods (e.g. lactose or gluten intolerance, allergy) or visible genetic malformations (e.g. Down syndrome; *n* 507). The mother had to be the primary person caring for the child feeding, without full-time help from a grandmother or nursery daycare. Mothers of young children were recruited from primary-care clinics selected to ensure participants from every urban municipality of the metropolitan area of Monterrey (seven districts). In the primary-care clinic waiting rooms, potential participants were approached by a member of the research team who invited them to participate. The sample size was large enough for a CI of 95% and a margin error of 4%, given prevalence results were between 30% (regulation and not monitoring) and 60% (not modelling)⁽²⁸⁾. The protocol was submitted for approval and registration to the Committees of Research, Ethics, and Biosecurity. All participants were verbally informed about the aims and procedures of the study and they provided oral informed consent before enrolment; their children also provided verbal assent. Research team members were available to answer any questions.

Maternal feeding practices

We found several instruments for measuring feeding practices in the literature, among them the Child Feeding Questionnaire (CFQ) and the Preschooler Feeding Questionnaire (PFQ)^(16,19,20,29–31), whose Spanish versions have been administered to Hispanic mothers within the USA^(20,30). The CFQ has been used in Chile⁽²¹⁾. In particular, the Comprehensive Feeding Practices Questionnaire (CFPQ) includes twelve feeding practices and it has been validated in English with a sample of highly educated White participants⁽³²⁾. We assembled a short but wide-ranging questionnaire that was subject to content, construct and convergent validity analysis prior to estimating the feeding practices' prevalence and before exploring associations. Participants responded using a 5-point Likert scale (1 = 'never', 5 = 'always').

The content validity stage consisted of a compilation of items selected per category of interest, as follows:

1. Pressure to eat, with items identified in the CFQ and CFPQ. These were mixed because we were interested in some items of the CFPQ not available in the CFQ and vice versa, although some coincided.
2. Restriction, with items identified in the CFQ and CFPQ. These were also mixed because we were interested in some CFPQ items not available in the CFQ and vice versa; some coincided.
3. Child control, with items identified in the CFPQ and PFQ (they were unavailable in the CFQ); most of them coincided.
4. Regulation, with items identified in the CFPQ, PFQ and Parental Feeding Style Questionnaire⁽¹⁵⁾; most of them coincided.

5. Monitoring, with items identified in the CFQ and CFPQ (they were unavailable in the PFQ); most of them coincided.
6. Modelling, with items identified in the CFPQ (they were unavailable in the CFQ and PFQ). We also considered energy-dense food discouraging and nutrient-dense food encouraging items identified in an instrument developed by Murashima *et al.*⁽³³⁾; only one item coincided.

A panel of public health experts then eliminated duplicate items and selected three to five items per category after a thorough examination of the contents. The proposed items were translated back to English to verify their equivalence to the content in the original language.

The construct validity consisted of an exploratory factor analysis, which revealed twenty-two items with factor loadings of ≥ 0.30 constituted in six dimensions. Proposed items for Pressuring to Eat, Regulation, Child Control and Monitoring subscales were maintained, but some Modelling and Restriction items experienced changes. The Modelling subscale initially consisted of five items but ended with three; two from the Murashima *et al.*⁽³³⁾ instrument and one originally planned for the Restriction subscale. The Restriction subscale retained only two items that both belonged to the CFPQ. These concerned access to unhealthy foods and the subscale's name was adjusted to 'Food Restriction'. Convergent validity was assessed with the Caregiver's Feeding Styles Questionnaire. As expected, Pressuring to Eat (always) correlated positively and Monitoring (never) correlated negatively with how strongly parents encouraged eating (demandingness dimension⁽³⁴⁻³⁶⁾; $\rho = 0.60$ and $\rho = -0.20$, respectively; $P < 0.01$). In addition, both subscales differentiated authoritarian and uninvolved mothers⁽³⁴⁾; pressure to eat was greater in mothers exhibiting the authoritarian style than in those exhibiting the authoritative, indulgent or uninvolved style (mean (SD): 3.7 (0.9), 3.3 (0.8), 2.6 (0.8) and 2.5 (0.9), respectively; $P < 0.0001$). Monitoring was lower in mothers exhibiting the uninvolved style than in those exhibiting an authoritative style (mean (SD): 2.5 (1.2) and 2.0 (1.0), respectively; $P < 0.01$). In summary, the subscales were established as follows: Monitoring (extent to which the mother keeps track of her child's eating; three items, $\alpha = 0.7$); Modelling (extent to which the mother eats unhealthy foods eating in front of the child; three items, $\alpha = 0.4$); Pressuring to Eat (mother's attempts to increase her child's food intake by insisting on eating more, especially during mealtimes; five items, $\alpha = 0.6$); Regulation (use of food for rewarding or modifying the child's emotional status; four items, $\alpha = 0.4$); Food Restriction (extent to which the mother allows the child easy access to unhealthy snack foods; two items, $\alpha = 0.8$); and Child Control (extent to which the mother allows the child take control of his/her eating behaviour; five items, $\alpha = 0.6$).

Maternal perceptions and demographics

The mother's concern for the child's weight was measured by asking what she was most concerned about: (i) her

child's excess weight; (ii) her child's low weight; or (iii) neither one. The perception of the child's weight was measured by showing the mother sketches designed for parents of children aged 2–5 years, matched with the child by sex⁽³⁷⁾. There were seven figures arranged in order from least to most body weight (1 = extreme thinness, 7 = obesity). The mother was asked to indicate which figure looked more like her son's/daughter's weight. Then, the perceived child's weight was classified as underweight, normal weight, overweight or obese. We did not try to measure misperception; therefore, the weight perception was not necessarily aligned with the child's actual weight. The mothers also provided information on their own age, education, occupation and marital status; and their child's age, sex and birth order.

Other study variables

The eating style of the child was evaluated using the Food Responsiveness subscale of the Children's Eating Behaviour Questionnaire, based on the child's response to signals of desire to eat⁽³⁸⁾. This variable was included for statistical control purposes, given its positive correlation with feeding practices, in particular food restriction^(39,40). Participants responded using a 5-point Likert scale with higher scores indicating greater food responsiveness ($\alpha = 0.8$).

Anthropometric data

The mother's and child's height (in centimetres) and weight (in kilograms) were measured using a Taylor® (USA) portable digital scale calibrated daily and a wall stadiometer. Measurements were taken without shoes and with light clothing, with feet together, and with the heels, back and hips touching the wall. The mothers' BMI was calculated as weight/height² (kg/m²) and was classified as follows: underweight or normal weight, < 25 kg/m²; overweight, 25–29 kg/m²; and obesity, ≥ 30 kg/m². The children's age- and sex-specific BMI Z-scores were calculated using the WHO 2006 Child Growth Standards as a reference and the Anthro plus Software v1.0.4 (nutritional survey module)^(41,42). The children's weight status classification was based on BMI percentiles for age and sex. BMI < 5 th percentile was considered underweight, BMI = 5th–84th percentile as normal weight, BMI = 85th–94th percentile as overweight and BMI ≥ 95 th percentile as obesity.

Procedures

Mothers were interviewed by trained personnel using a structured interview protocol. Interviews were conducted in a private room in the clinic before or after the clinic visit, and ranged in duration from 15 to 20 min. At the end of the interview, the mother's and child's weight and height were measured, following standardized anthropometric techniques. The trained personnel consisted of one registered dietitian and two medical interns.



Plan for analysis

The analysis consisted of descriptive statistics and *t* tests for comparing quantitative variables. When the distribution of a variable was not normal, the Mann–Whitney test was applied. Mean scores were obtained for every feeding practice (possible range 1–5). Then, the scores were dichotomized: utilizing the code of 1 for scores of ≥ 3 to indicate moderate-to-high use; and the code 0 for scores of < 3 to indicate low-to-non-use. Before dichotomization, the monitoring scores were reversed so that the moderate-to-high use category for all practices denoted a less-than-optimal practice (not monitoring, not modelling, pressuring to eat, regulation, easy access to unhealthy foods, child control). Subsequently, the point prevalences and 95 % CI were estimated and a multivariate logistic regression analysis was performed; the feeding practice being examined was the dependent variable, whereas the independent variables were concern and perception of the child's weight, age, education and obesity status, for mothers; and age, sex and birth order, for children. Six separate multivariate logistic regression models were run; all were adjusted for food responsiveness. Concern about the child's weight was the only variable with 8 % missing values, which corresponded to ambiguous answers that were excluded (mothers expressed they were concerned about their child's low weight and their child's excess weight. After a few interviews, the question was rephrased to 'most concerned about').

Results

Children's profile

The children's mean age, sex, birth order and weight status results are presented in Table 1. The mean (SD) food responsiveness score was 2.5 (1.2) (possible range 1–5); 15.4 % registered the highest score (child was always/ almost always asking for food or if allowed to, would be eating most of the time).

Mothers' profile

The mothers' mean age, education, occupation, marital and weight status results are also presented in Table 1. More than half of the mothers (58 %) were concerned about their child's low weight and the rest were concerned about their child's excess weight; 0 % answered neither one. Furthermore, 26.0 % perceived their child to be underweight, 47.9 % perceived their child as normal weight and 26.0 % perceived their child as overweight or obese.

Maternal feeding practices prevalence

The item response distribution is presented in Table 2. The individual maternal feeding practice with the highest use was 'My child should always/almost always eat all of the food on his/her plate' (Pressuring to Eat subscale),

Table 1 Children's and mothers' sociodemographic characteristics; mothers aged ≥ 18 years who were in charge of feeding a singleton child aged 2–6 years ($n=507$), north-eastern Mexico, August–December 2016

	Mean, SD or %
Children's profile	
Age (years)	
Mean	4.0
SD	1.2
Sex, female (%)	46.4
Firstborn (%)	52.9
Overweight/obese (%)	36.0
Mothers' profile	
Age (years)	
Mean	29.5
SD	5.5
Education (%)	
Elementary	1.6
Junior high school	31.8
High school	41.2
College or graduate school	25.4
Housewife (%)	56.4
Married (%)	87.0
Overweight/obese (%)	70.0

followed by 'I always/almost always drink sweetened beverages in front of my child' (Modelling subscale), independently of the mother's concern about her child's excess weight or the mother's perception of her child as overweight/obese (Fig. 1).

The mean scores for maternal feeding practices are presented in Table 3. The mothers' concern about their child's excess weight generated differences in pressuring to eat ($P < 0.001$) and in food restriction ($P < 0.05$; there was greater pressuring to eat and greater easy access to unhealthy foods if the mother had no concern about her child's excess weight). The mothers' perception of the child as overweight/obese generated differences in modelling ($P < 0.001$) and in pressuring to eat ($P < 0.0001$; there was less modelling even if the mother perceived her child as overweight/obese; there was greater pressuring to eat if the mother did not perceive her child as overweight/obese). After categorization, the most frequent maternal feeding practices were not modelling and pressuring to eat, followed by food restriction (easy access to unhealthy foods) and child control; these practices prevailed even if the mother was concerned about her child's excess weight or perceived her child as overweight/obese (Fig. 2).

Maternal feeding practice characterization according to potential motivators and sociodemographic profile

The multivariate analysis revealed associations that varied across maternal feeding practices. The odds of easy access to unhealthy foods were > 1 even if the mother was concerned about her child's excess weight (OR = 1.5; 95 % CI 1.1, 2.3). Perception of the child's obesity was associated with less pressuring to eat (OR = 0.6; 95 % CI 0.4, 0.9),

Table 2 Item response distribution, according to maternal feeding practices, among mothers aged ≥ 18 years who were in charge of feeding a singleton child aged 2–6 years ($n=507$), north-eastern Mexico, August–December 2016

	Frequency (%)		
	Never, almost never	Sometimes	Always/almost always
Monitoring			
I keep track of my child's sugary drinks intake	13.6	22.1	64.3
I keep track of my child's high-fat foods intake	17.3	23.5	59.1
I keep track of my child's sweet foods intake	21.7	18.9	59.4
Modelling			
I eat sweets, candy or salty snacks in front of my child	33.5	17.0	49.5
I drink sweetened beverages in front of my child	28.8	16.8	54.4
I go to fast-food restaurants with my child	51.7	17.2	31.2
Pressuring to Eat			
I guide my child's eating otherwise he/she would eat much less	60.2	10.7	29.2
If my child eats only a small helping, I try to get him/her to eat more	32.7	21.5	45.7
If my child says 'I'm not hungry', I try to get him/her to eat anyway	48.1	26.2	25.7
My child should eat all of the food on his/her plate	25.1	13.8	61.1
I try to get my child to eat more even if he/she says he/she is finished eating	33.0	19.9	47.1
Regulation			
I offer my child favourite foods in exchange for good behaviour	52.7	23.5	23.8
I offer my child dessert in exchange for healthy foods	50.3	22.9	26.8
I comfort my child when he's/she's been hurt by giving him/her something to eat	64.9	18.3	16.8
If my child is upset, I make him/her feel better by giving him/her something to eat	53.1	19.5	27.4
Food Restriction			
I keep sweets, candy or salty snacks where my child can reach them	62.2	8.7	29.2
I keep sugar-sweetened beverages where my child can reach them	55.1	9.7	35.3
Child Control			
I let my child choose the foods from what was served	39.7	20.3	40.1
I make something different if my child doesn't like what was served	43.4	22.3	34.3
I make special meals because my child is a picky eater	65.7	17.8	16.6
I allow my child to eat an hour before meals	36.9	29.2	33.9
I let my child eat between meals whenever he/she wants	27.6	31.8	40.7

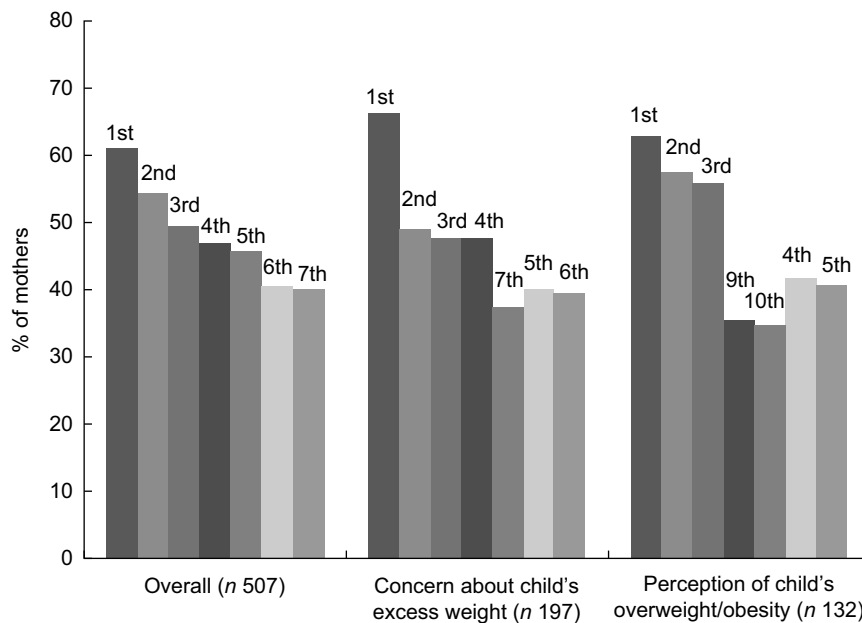


Fig. 1 Individual maternal feeding practices† (■, PE4; ■, M2; ■, M1; ■, PE5; ■, PE2; ■, CHC5; ■, CHC1), overall and according to mother's concern about excess weight and mother's overweight/obesity perception, among mothers aged ≥ 18 years who were in charge of feeding a singleton child aged 2–6 years ($n=507$), north-eastern Mexico, August–December 2016. †PE, Pressuring to Eat; M, Modelling; CHC, Child Control. PE4, My child should always/almost always eat all of the food on his/her plate; M2, I always/almost always drink sweetened beverages in front of my child; M1, I always/almost always eat sweets, candy or salty snacks in front of my child; PE5, I always/almost always try to get my child to eat more even if he/she says he/she is finished eating; PE2, If my child eats only a small helping, I always/almost always try to get him/her to eat more; CHC5, I always/almost always let my child eat between meals whenever he/she wants; CHC1, I always/almost always let my child choose the foods from what was served

Table 3 Descriptive statistics, overall and according to mother's concern about excess weight and mother's perception of child's overweight/obesity, among mothers aged ≥ 18 years who were in charge of feeding a singleton child aged 2–6 years ($n=507$), north-eastern Mexico, August–December 2016

Feeding practice	Overall ($n=507$)		Concern about child's excess weight				Perception of child's overweight/obesity			
	Mean	SD	No ($n=270$)		Yes ($n=197$)		No ($n=375$)		Yes ($n=132$)	
Monitoring†	3.8	1.1	3.8	1.2	3.8	1.1	3.9	1.2	3.7	1.1
Modelling‡	2.9	1.1	2.9	1.1	2.9	1.1	3.0	1.0	3.4**,	1.0
Pressuring to Eat†	3.0	1.0	3.2**,§	1.0	2.9	0.9	3.2***,	1.0	2.7	0.9
Regulation†	2.4	0.9	2.4	0.9	2.4	0.9	2.4	1.0	2.4	0.9
Food Restriction (easy access to unhealthy foods)†	3.5	1.6	3.6*,§	1.6	3.3	1.6	3.5	1.6	3.5	1.5
Child Control†	2.8	0.9	2.9	0.9	2.8	0.9	2.8	0.9	3.0	0.9

* $P < 0.05$, ** $P < 0.001$, *** $P < 0.0001$.

†5 = always; the higher the score, the greater use of monitoring, pressuring to eat, regulation, easy access to unhealthy food and child control.

‡5 = never; the higher the score, the less use of modelling.

§Mean value was significantly different by child's excess weight concern.

||Mean value was significantly different by child's overweight/obesity perception.

whereas the odds of child control were >1 even if the mother perceived her child as overweight/obese (OR = 1.7; 95% CI 1.1, 2.7). The sociodemographic factor that was related to the highest number of feeding practices was education: a higher education was associated with more pressuring to eat, less regulation and less easy access to unhealthy foods; or monitoring was less absent (Table 4).

Discussion

The present study contributes to knowledge on the magnitude of feeding practices and factors distinguishing utilization in a population predominantly characterized as young; with a partner; with a first or second child of pre-school age; with an elementary, secondary or college education; and with residence in an urban region with high levels of childhood obesity. More than three of every ten pre-schoolers were overweight or obese, a figure far above the Mexican national mean of one in every ten children under 5 years⁽³⁾. Both statistics are based on equivalent WHO BMI-for-age and sex criteria to define overweight/obesity. Discrepancies between the prevalence rates in north-eastern Mexico and national estimates of childhood obesity have been explained by economic development: there is a higher prevalence of overweight and obesity in areas of greater development, for example northern Mexico and the Mexico City region; there is a lower prevalence in areas of less development, for example the central and southern regions. As early as 1999, the National Health and Nutrition Survey uncovered a growing disparity in food and nutrient intakes between regions of the country. In 2012, that survey revealed greater intakes of added sugars and saturated fat by children aged 1–4 years from the north *v.* centre and

south; urban *v.* rural; and high *v.* medium/low socioeconomic status ($P < 0.05$)⁽⁴³⁾.

The mean scores on feeding practices were estimated. The Pressuring to Eat mean score was 3.0, which was lower than that reported in Chile (≥ 3.6)⁽²¹⁾, but higher than that reported in Spanish-speaking Hispanics in the USA⁽²⁰⁾, the UK⁽¹⁵⁾ and Australia⁽¹⁶⁾, all of which were ≤ 2.7 . In these countries, a scale very similar in content to ours had been employed. Differences were also observed in monitoring and child control. For Monitoring, the mean Mexican score was lower than that of Australia and the USA (Hispanics); and for Child Control, higher than that of France^(16,18,19). In these countries, a scale very similar in content to ours had also been employed. These results support previous suggestions that feeding practices vary by sociocultural background^(18,22). In terms of percentages, not modelling ranked first in frequency; more than six of every ten mothers did not use modelling strategies and consumption of sweetened beverages, candy or snacks in front of the child was a common practice. Regrettably, the multivariate analysis showed that neither concern nor perception of overweight/obesity was associated with modelling, like Lauzon-Guillain *et al.*⁽¹⁸⁾, who did not find an association either. Maternal feeding practices provide an opportunity to model good eating habits. A good eating behaviour by mothers relates to children's higher intake of healthy foods and lower consumption of sweet snacks and fast foods^(44,45). The importance of teaching by example needs to be reinforced.

Pressuring to eat was a frequent feeding practice; more than five of every ten mothers used it. 'The child should eat all the food on the plate' was the most commonly reported individual maternal feeding practice. The mothers' perception of their child as overweight/obese was associated with lower odds of pressuring to eat, suggesting that the mothers were indeed responding accordingly. However, four to five

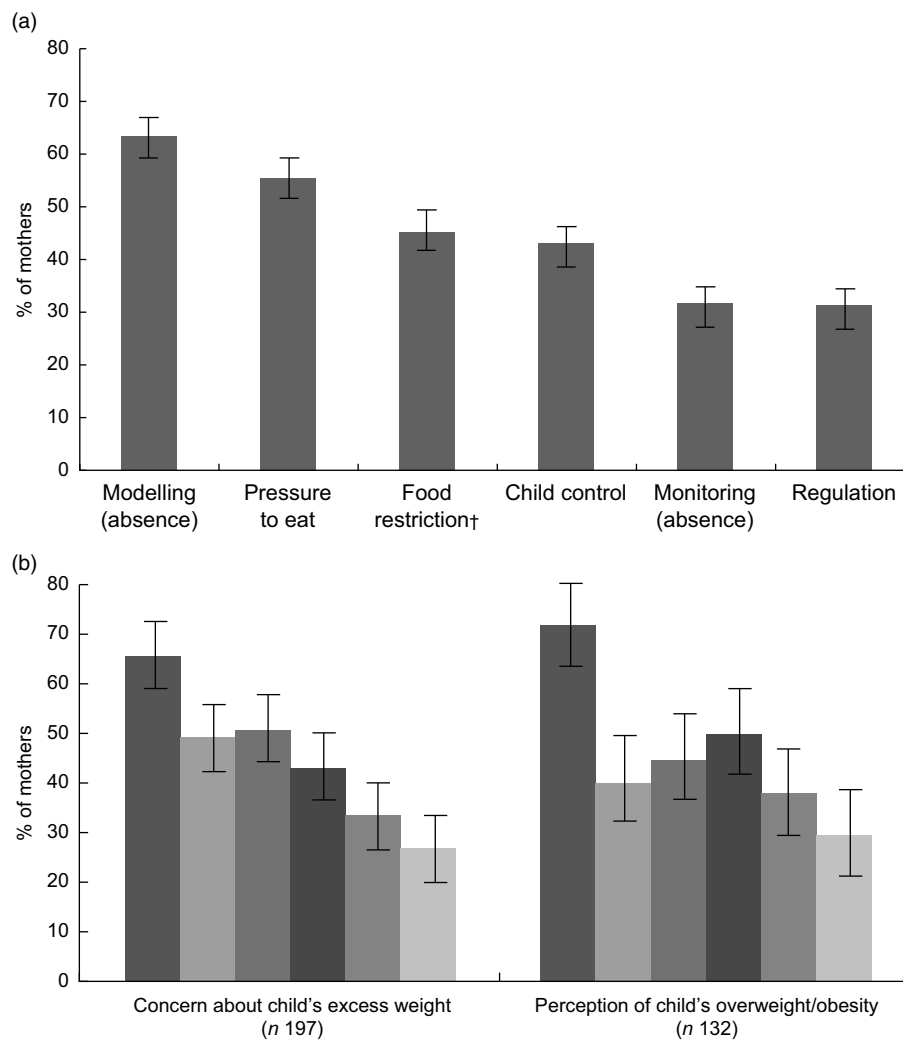


Fig. 2 Maternal feeding practices prevalence, with their 95 % CI represented by vertical bars, (a) overall and (b) according to mother's concern about excess weight and mother's perception of child's overweight/obesity (■, modelling (absence); ■, pressure to eat; ■, food restriction†; ■, child control; ■, monitoring (absence); ■, regulation), among mothers aged ≥ 18 years who were in charge of feeding a singleton child aged 2–6 years ($n=507$), north-eastern Mexico, August–December 2016. †Easy access to unhealthy foods

of every ten mothers pressured their child to eat despite concern about their child's excess weight and having a perception of the child as overweight/obese. This maternal feeding practice could be explained by two factors: the sociocultural significance of food in Mexico and the lack of distinction between pressuring to eat healthy and unhealthy foods. Future research must consider the quality of the diet in this context while acknowledging that pressuring to eat is problematic as a practice, irrespective of the type of food that the child is being pressured to eat. Regarding food restriction, about four to five of every ten mothers allowed easy access to unhealthy foods. Restriction involves a type of limit to access palatable and usually unhealthy foods. Some parents tend to use restrictive feeding practices such as withholding high-fat/high-sugar foods, especially when concern about child's excess weight or a perception of overweight/obesity exists⁽⁴⁶⁾. However, in the present study, the odds of easy access to unhealthy foods were higher despite concern

about the child's excess weight. Controlling the availability of foods is a vital aspect of healthy eating, but caution is needed because when children are exposed to restricted items, they could be more likely to choose these foods and consume them in excess⁽¹³⁾. Another practice, child control, was permitted by more than four of every ten participants, even if concern or overweight/obesity perception was present. Moreover, the odds of child control were higher despite overweight/obesity perception. Giving children control over the foods they select and consume has been associated with a greater intake of sweet snacks and fast foods⁽⁴⁴⁾. Hence, it is important to raise awareness on the negative consequences of this feeding practice. Regulation and not monitoring were the least common maternal feeding practices, and they were not associated with concern or overweight/obesity perception.

Some sociodemographic variables characterized maternal feeding practices, but the associations varied across practices. Health programmes should consider the

Table 4 Multivariate logistic regression analysis for maternal feeding practices† among mothers aged ≥18 years who were in charge of feeding a singleton child aged 2–6 years (*n*507), north-eastern Mexico, August–December 2016

	Moderate-to-high use of maternal feeding practice (score ≥ 3)											
	Monitoring‡ (absence)		Modelling (absence)		Pressuring to Eat		Regulation		Food Restriction (easy access to unhealthy foods)		Child Control	
	AOR	95 % CI	AOR	95 % CI	AOR	95 % CI	AOR	95 % CI	AOR	95 % CI	AOR	95 % CI
Child's excess weight concern	1.1	0.7, 1.7	1.1	0.7, 1.6	0.7	0.5, 1.1	0.8	0.5, 1.3	1.5*	1.1, 2.3	0.9	0.6, 1.4
Child's overweight/obesity perception	1.5	0.9, 2.4	1.4	0.9, 2.3	0.6**	0.4, 0.9	0.7	0.4, 1.3	0.9	0.5, 1.4	1.7*	1.1, 2.7
Mother's overweight/obesity	1.1	0.9, 1.5	1.2	1.0, 1.6	1.0	0.8, 1.3	1.2	0.9, 1.6	1.3*	1.1, 1.8	1.3*	1.0, 1.7
Mother's education (college/university)	0.5***	0.4, 0.7	0.8	0.6, 1.0	1.5**	1.2, 2.0	0.7*	0.5, 0.9	0.7*	0.6, 0.96	0.9	0.7, 1.2
Mother's age (years)	1.0	1.0, 1.1	0.95*	0.91, 1.0	0.94**	0.89, 0.98	0.91***	0.87, 0.96	1.0	0.9, 1.0	1.0	0.9, 1.0
Birth order (≥3rd)	0.8	0.6, 1.2	1.4*	1.0, 2.0	1.4*	1.0, 2.0	1.3	0.9, 1.8	1.3	0.9, 1.8	1.1	0.8, 1.5
Child's sex (male)	1.7*	1.1, 2.5	1.0	0.7, 1.5	0.7	0.5, 1.0	0.7	0.5, 1.1	1.5	1.0, 2.2	1.7**	1.1, 2.4
Child's age (years)	1.0	0.9, 1.2	1.2*	1.1, 1.5	1.1	0.9, 1.3	1.2*	1.01, 1.5	1.7***	1.4, 2.0	0.9	0.7, 1.0
Food responsiveness (5 = always)	0.8	0.7, 1.0	1.2	1.0, 1.4	0.8***	0.6, 0.9	1.2	0.9, 1.4	1.0	0.8, 1.2	0.8*	0.7, 0.9

AOR, adjusted odds ratio, considering all variables exposed in the model.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

†Six separate multivariate logistic regression models were run; the maternal feeding practice being examined was the dependent variable, whereas the independent variables were mother's and child's characteristics.

‡Monitoring scores were reversed previous dichotomization, so that the moderate-to-high use category for all practices denoted a less-than-optimal practice.

mother's education, given its association with four of the six feeding practices examined (educated mothers used more pressuring to eat, less regulation and less easy access to unhealthy foods; or monitoring was less absent). Kröller and Warschburger⁽⁴⁷⁾ found that the higher the mother's education, the greater the monitoring; and Musher-Eizenman *et al.*⁽⁴⁸⁾ found that the higher the mother's education, the less the regulation. The finding of higher educational levels associated with greater pressuring to eat differs from other studies that did not report such an association^(22,49). High parental education has been related to health consciousness in food choices^(50,51) and this observed association could be connected to pressure to eat healthy foods. According to Hinnig *et al.*⁽⁵²⁾, children with highly educated parents who lived in highly developed countries tended to have a healthier diet, but the association was not clear in medium and less-developed countries. More research is needed to clarify the link between education, pressure to eat and the quality of the diet.

Another associated sociodemographic variable was the mother's overweight/obesity status that was associated with higher odds of easy access to unhealthy foods and letting the child control her/his eating. Santos *et al.*⁽²¹⁾ reported greater use of restriction (CFQ subscale) by heavier mothers, but only in girls; and Haycraft *et al.*⁽⁵³⁾ reported greater use of child control by obese mothers. An older maternal age was associated with less absence of modelling, less pressuring to eat and less regulation,

whereas an older child age was associated with greater absence of modelling, greater regulation and greater easy access to unhealthy foods. Additionally, children's male sex was associated with greater child control and less use of monitoring. In other words, there was less child control and greater use of monitoring with daughters. Latino mothers (Mexican-American) engage in more restraining behaviours with their daughters than with their sons. A cultural awareness of standards for female physical attractiveness might influence parents' feeding practices⁽⁵⁴⁾. In other countries, such as Poland, parents use the regulation feeding practice less often in 5-year-old girls than in boys regardless of weight status⁽⁵⁵⁾. Other authors have not found maternal feeding practice differences based on the child's sex^(22,46,47). Finally, higher birth order was associated with greater absence of modelling and greater use of pressuring to eat. Parents might struggle to persuade one child to eat enough, whereas for a sibling, they struggle to stop him or her from eating too much⁽⁵⁶⁾. Farrow *et al.*⁽⁵⁷⁾ provided evidence that the parent-child relationships involving food can vary within families; parents use more pressure to eat with siblings who are slower to eat, are fussier and are less responsive to food. It is also plausible that parental attention towards each child during mealtime situations decreases with an increasing number of children and the presence of siblings might be protective against the development of picky eating⁽⁵⁸⁾. More research is needed to clarify this particular finding.

Limitations of the study

The present study had some limitations. The sample size was large and the participating mothers displayed a wide range of education. However, all lived in an urban location and thus the present results cannot be generalized to rural settings. In the future, there is also a need to study other parental characteristics that were not considered here such as mother's own eating habits, which have been found to influence feeding practices (e.g. restrained, uncontrolled and emotional eating)⁽¹⁸⁾. The present investigation did not consider primary caregivers other than mothers. However, statistics from the 2017 National Survey of Employment and Social Security showed that 72.6% of Mexican mothers or 72.0% of mothers with children aged ≤ 6 years from the north-east of Mexico take care of their children because they do not work; less than 5% use a day-care centre; and the rest (23%) receive help from a grandmother, their husband or a friend to care for the child while they work⁽⁵⁹⁾. Therefore, the generalizability of our results to a wider population of mothers of pre-school children is plausible.

Conclusions

The present study revealed that the most frequently used practices were pressuring to eat and child control; the most frequently absent practices were modelling and food restriction. All of them prevailed despite concern about the child's excess weight or a perception of the child as overweight/obese. Therefore, these maternal feeding practices need to be improved and there is need to focus on mother's concern about the child's excess weight and mother's perception of the child as overweight/obese. It is essential to determine what factors make mothers use less healthy feeding practices to optimize intervention planning, principally in this region with high child obesity rates. The sociodemographic factor that differentiated the highest number of feeding practices was education. Other factors were associated with certain maternal feeding practices, but the associations varied across practices. Feeding practices are potentially modifiable in favour of maintaining a healthy weight, and an understanding of feeding practices is fundamental to child health because it is the ideal growth stage for interventions aimed at healthy eating.

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