Breastfeeding and Obesity among Kuwaiti Preschool Children

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Key Words

Breastfeeding • Obesity • Kuwait • Preschool children

Abstract

Objectives: To determine if breastfeeding and its duration are associated with a reduced risk of obesity among Kuwaiti preschool children. **Subjects and Methods:** The sample consisted of 2,291 (1,092 males and 1,199 females) preschool children (3–6 years of age) and their mothers. The data were collected from September 2003 to June 2004. Height and weight measurements were used for defining weight status while other data were collected by questionnaire. **Results:** There was no significant association of breastfeeding or its duration with either overweight or obesity among preschool children after adjusting for effects of the confounders. The child's gender, age and birth weight were the significant factors influencing current weight. Girls were at 32% higher risk of becoming obese than boys. Children aged 4–5 years were at nearly 3 times higher risk of overweight and obesity than children of less than 4 years. Children with higher birth weight (≥ 4 kg) had double the risk of obesity than those of normal birth weight (≥ 2.5 to < 4.0 kg). Maternal obesity was a strong predictor of obesity in the children. A child with an obese mother had nearly 2 times higher risk of being overweight (BMI between the 85th the 95th percentiles) and 3 times of being obese (BMI ≥ 95 th percentile) compared to a

child born to a mother with a normal body weight. **Conclusion:** Breastfeeding and its duration are not associated with obesity status. However, there is a positive association between child and maternal obesity.

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Introduction

The prevalence of overweight among children is increasing rapidly worldwide [1, 2]. In Kuwait, obesity is considered to be the most frequent nutritional disorder among preschool children [3]. Many studies showed that overweight children are at increased risk of becoming overweight adults [4, 5] and, therefore, they are at an increased risk of developing elevated blood pressure, cholesterol and triglycerides, and type II diabetes [6, 7]. So preventing overweight is mandatory for the long-term prevention of chronic diseases [8].

Since therapeutic interventions for weight loss in obese children are costly and their long-term success is less than satisfactory [9], finding a simple strategy without side effects is in great demand. With the suggestion that nutrition in early life could influence the risk of subsequent obesity [10], breastfeeding might be a powerful strategy for fighting childhood obesity. However, its effect is still uncertain. Many studies have been conducted,

but most have shown mixed effects of breastfeeding on child weight status depending on the degree to which confounders were controlled. Some studies showed that breastfeeding [11, 12] and longer duration of breastfeeding [13–15] might protect against obesity in later life. Other studies found no significant association between breastfeeding and children's mean adiposity [16] and overweight [17–19]. Moreover, Agras et al. [20] found that the mean BMI was higher for children who were breastfed for more than 5 months' duration.

The present study was undertaken because the declining breastfeeding practices in Kuwait and the concurrent increasing obesity among children have not been investigated to date. The objective was to determine if breastfeeding and its duration are associated with a reduced risk of obesity among Kuwaiti preschool children.

Methods

Design and Sample

The sample was taken from the ongoing Kuwait Nutrition Surveillance System (KNSS) of the Ministry of Health. The KNSS was started with World Health Organization's assistance in 1995 and advised by the Center for Disease Control and Prevention (CDC). The KNSS is intended to provide the collected data to the policymakers of the Ministry of Health and to the World Health Organization officials.

It is designed as a sentinel sample of the Kuwaiti population. The KNSS is based on an estimated sample size for each population group recommended by the CDC experts and reflects the nutritional status of the population and monitors trends.

Eight trained personnel collected data annually at 1 or 2 selected health clinics and 1 or 2 schools which serve Kuwaitis from all governorates. Pupils and their mothers were selected during scheduled school meetings. All children who attended an immunization clinic and their mothers were included in the study. Mothers who could not attend these occasions were called separately. All mothers were asked to answer the questionnaire.

Anthropometric indices were recorded, and blood hemoglobin, plasma cholesterol and glucose levels were determined on samples collected by finger prick after obtaining verbal permission.

The data were collected from September 2003 to June 2004. Of the total number of 2,359 Kuwaiti preschool children, 68 were excluded and the remaining 2,291 (3–6 years of age, 1,092 males and 1,199 females) and their mothers participated in the study. Among the excluded 68 there were children with very low birth weight (<1,500 g, $n = 31$) as they were not sufficiently mature to initiate breastfeeding, children aged <3 years ($n = 6$) or 7 years ($n = 1$), children whose mother was pregnant at the time of data collection ($n = 10$) and those with incomplete information ($n = 20$).

Anthropometric Measurements

The technicians measured the children's and their mother's height without shoes to the nearest 0.1 cm and weight without shoes and in light clothing to the nearest 0.1 kg using SECA model 220 electronic balances. The weight status for children was defined using BMI for age and gender percentiles from the revised growth charts of the CDC [21]. The BMI for age was chosen because it is a worldwide accepted standard for screening overweight and obesity in children and in early childhood it is correlated with fatness.

Children with a BMI between the 85th and 95th percentiles were considered as overweight and those with a BMI ≥ 95 th percentile as obese. The BMIs (weight in kilograms/height in meters squared) of the mothers were classified as underweight (<18.5), normal weight (18.5 to <25), overweight (25.0 to <30) and obese (≥ 30.0).

Demographic and Maternal Characteristics

From the KNSS questionnaire, mothers' educational levels, maternal age at childbirth, education (primary or below secondary, diploma, undergraduate degree and above) and working status (working or not working) were taken.

Demographic and Child Characteristics

The child's age was taken from the civil identity card. Gender, gestational age (preterm <37 weeks, full term ≥ 37 weeks) and birth weight (low <2.5 kg, normal 2.5 to <4.0 kg, high ≥ 4.0 kg) were obtained from the KNSS questionnaire. A random sample of 100 cases was validated for their reported birth weight and gestational age against birth records to ensure the accuracy.

Infant Feeding

Data for past breastfeeding practices were obtained from the KNSS questionnaire. Questions on breastfeeding practices included whether the child was ever breastfed, at which age the child completely stopped being breastfed, when infant formula was started, and the age at which the child was introduced to solid foods. Children were classified as never breastfed, or fully breastfed (breast milk with water and water-based drinks). The duration of breastfeeding was categorized as never (0 months), <2 months, 2 to <4 months, 4 to <6, and ≥ 6 months for analysis. Infants who were partially breastfed (breast and formula fed) were not included in the study.

Data Analysis

The collected data were analyzed using Statistical Package for Social Sciences, v. 13.0 (SPSS Inc., Chicago, Ill., USA). Five percent was used as the threshold for statistical significance. The χ^2 test was applied to assess the association between two categorical variables. The multinomial logistic regression analysis was used to estimate the risk of different factors in overweight and obese children after controlling for confounding factors such as weight status of the child (overweight and obesity with reference to normal weight) as the dependent variable and the child's gender, age, birth weight, gestational age, duration of breastfeeding and age of introduction of solid foods, and the mother's age, educational level, working status and BMI status as independent variables. The adjusted odds ratios (AORs) and 95% confidence interval (CI) for associated factors were reported.

Results

Characteristics of the Sample

The characteristics of the studied children are given in table 1. The mean age of the children was 4.37 years (SD = 0.80); 37.1% were aged less than 4 years, 35% 4 years and 27.9% were aged more than 5 years. 81.2% had a gestational age of greater than or equal to 38 weeks. The male-to-female ratio was 1:1.1. With regard to breastfeeding, 15.4% were never breastfed, 40% were fed for less than 2 months, 19.5% were breastfed for 2–3 months, 7.4% were breastfed for 4–5 months, and 17.7% for 6 months or more. Some 28.7% of the children were introduced to solid foods at the age of 2–3 months and 51.6% at the age of 4–5 months. The mean age of the mothers at their child's birth was 29.3 years (SD = 6.07), a majority (75.9%) being between 19 and 34 years, 22.6% aged more than or equal to 35 years and 1.5% less than 19 years. The mothers' BMI showed that 37.5% were overweight (BMI 25 to <30) and 41% were obese (BMI $\geq$ 30). 58.6% of the mothers were educated above secondary level and 59.2% were working.

BMI and Childhood Weight Status

According to the CDC BMI for sex- and age-specific percentiles, 184 (8%) of Kuwaiti preschool children in the studied age groups were classified as overweight and 277 (12.1%) as obese (table 2). In the different age groups, 55 (6.5%) of those aged <4 years, 124 (15.5%) of 4 to <5 years of age and 98 (15.3%) of $\geq$ 5 years were obese; 36 (4.2%) of <4 years of age, 85 (10.7%) of 4 to <5 years and 62 (9.7%) of $\geq$ 5 years were overweight. The above associations between age categories and weight status were highly significant ($p < 0.001$).

The birth weight of the child was significantly associated with weight status; 43 (21.8%) of obese children had a birth weight $\geq$ 4 kg, while 212 (11.2%) of them had a normal birth weight ($\geq$ 2.5 to <4.0 kg; $p < 0.001$).

The child's gender, gestational age and duration of breastfeeding were not significantly associated with the weight status. The maternal factors significantly associated with the weight status of the children were age of the mother at the child's birth ($p = 0.045$) and the mother's BMI status ($p < 0.001$). The prevalence of obesity was greater among children whose mothers were aged $\geq$ 35 years at childbirth compared to those whose mothers were 19–34 years of age at the time.

Associated Risk Factors for Overweight

Table 3 shows the factors associated with overweight and obesity among Kuwaiti preschool children after ad-

Table 1. Sociodemographic characteristics of Kuwaiti children who took part in the study

	Number	%
Gender of child		
Male	1,092	47.7
Female	1,199	52.3
Age of child (years)		
<4	850	37.1
4–<5	801	35.0
$\geq$ 5	640	27.9
Mean $\pm$ SD	4.37 $\pm$ 0.80	
Gestational age (weeks)		
<37	431	18.8
$\geq$ 38	1,860	81.2
Birth weight (kg)		
Low (<2.500)	198	8.6
Normal (2.500–3.999)	1,896	82.8
High ($\geq$ 4.000)	197	8.6
Duration of breastfeeding (months)		
Not breastfed	352	15.4
<2	916	40.0
2–<4	447	19.5
4–<6	170	7.4
$\geq$ 6	406	17.7
Age of introduction of solid foods (months)		
<2	65	2.8
2–<4	657	28.7
4–<6	1,182	51.6
$\geq$ 6	387	16.9
Age of mother at childbirth (years)		
<19	34	1.5
19–<35	1,739	75.9
$\geq$ 35	518	22.6
Mean $\pm$ SD	29.30 $\pm$ 6.07	
Mother's BMI		
Underweight (<18.5)	23	1.0
Normal (18.5–24.99)	469	20.5
Overweight (25–29.99)	859	37.5
Obese ($\geq$ 30)	940	41.0
Education level of mother		
Primary or below	100	4.4
Intermediate or secondary	849	37.1
Diploma	604	26.4
University and above	738	32.2
Working status of mother		
Not working	935	40.8
Working	1,356	59.2

justing for effects of the other variables using the multinomial logistic regression model with weight status of the child (overweight and obesity with reference to normal weight) as the dependent variable and child's gender, age, birth weight, gestational age, duration of breastfeeding and age of introduction of solid foods, age of mother at

Table 2. Characteristics of the studied children and their mothers according to children's BMI category

	Child's BMI category			p value ¹
	normal	overweight	obesity	
Child's gender				0.28
Male	887 (81.2)	84 (7.7)	121 (11.1)	
Female	943 (78.6)	100 (8.3)	156 (13.0)	
Child's age (years)				<0.00
<4	759 (89.3)	36 (4.2)	55 (6.5)	
4-<5	591 (73.8)	86 (10.7)	124 (15.5)	
≥5	480 (75.0)	62 (9.7)	98 (15.3)	
Gestational age (weeks)				0.32
<37	350 (81.2)	27 (6.3)	54 (12.5)	
≥37	1,480 (79.6)	157 (8.4)	223 (12.0)	
Birth weight (kg)				<0.00
<2.500	165 (83.3)	11 (5.6)	22 (11.1)	
2.500–3.999	1,525 (80.4)	159 (8.4)	212 (11.2)	
≥4.000	140 (71.1)	14 (7.1)	43 (21.8)	
Duration of breastfeeding (months)				0.66
Not breastfed	286 (81.3)	29 (8.2)	37 (10.5)	
<2	741 (80.9)	72 (7.9)	103 (11.2)	
2-<4	360 (80.6)	31 (6.9)	56 (12.5)	
4-<6	128 (75.3)	16 (9.4)	26 (15.3)	
≥6	315 (77.6)	36 (8.9)	55 (11.5)	
Age of introduction of solid foods (months)				0.01
<2	41 (63.1)	10 (15.4)	14 (21.5)	
2-<4	528 (80.3)	51 (7.8)	78 (11.9)	
4-<6	966 (81.7)	85 (7.2)	131 (11.1)	
≥6	295 (76.2)	38 (9.8)	54 (14.0)	
Age of mother at childbirth (years)				0.05
<19	29 (85.3)	4 (11.8)	1 (2.9)	
19–<35	1,390 (79.9)	149 (8.6)	200 (11.5)	
≥35	411 (79.3)	31 (6.0)	76 (14.7)	
Mother's BMI status				<0.00
Underweight (<18.5)	21 (91.3)	1 (4.3)	1 (4.3)	
Normal (18.5–24.9)	405 (86.3)	28 (6.0)	36 (7.7)	
Overweight (25.0–29.9)	702 (82.0)	69 (8.0)	86 (10.0)	
Obese (≥30)	700 (74.5)	86 (9.1)	154 (16.4)	
Education level of mother				0.50
Primary or below	82 (82.0)	8 (8.0)	10 (10.0)	
Intermediate or secondary	693 (81.6)	65 (7.7)	91 (10.7)	
Diploma	484 (80.0)	47 (7.8)	73 (12.2)	
University and above	571 (77.3)	64 (8.7)	103 (14.0)	
Mother's working status				0.08
Not working	764 (81.7)	75 (8.0)	96 (10.3)	
Working	1,066 (78.6)	109 (8.0)	181 (13.4)	

Figures in parentheses are percentages. ¹ By χ^2 test.

childbirth, mother's educational level, working and BMI status as independent variables. The child's gender, age, birth weight, age of introduction solid foods and the mother's BMI status were the significant factors selected by the multinomial logistic regression analysis. A female child was found to be at 1.32 times higher risk of becom-

ing obese than a male child (AOR = 1.32, 95% CI = 1.01–1.72, $p = 0.039$). A child at the age of 4 to <5 years was at 2.82 times higher risk of becoming obese (AOR = 2.82, 95% CI = 2.00–3.98, $p < 0.001$) and 3 times higher risk of becoming overweight (AOR = 3.00, 95% CI = 1.99–4.51, $p < 0.001$) than a child of <4 years. A child at the age of

Table 3. Multinomial logistic regression analysis of factors associated with overweight

	Overweight (BMI 85th–94th percentile)		Obesity (BMI ≥95th percentile)	
	AOR	p value	AOR	p value
Child's gender, male (reference group)				
Female	1.18 (0.87–1.62)	0.287	1.32 (1.01–1.72)	0.04
Child's age (years), <4 (reference group)				
4–<5	3.00 (1.99–4.51)	<0.001	2.82 (2.00–3.98)	<0.00
≥5	2.53 (1.64–3.91)	<0.001	2.63 (1.84–3.77)	<0.00
Gestational age (weeks), <37 (reference group)				
≥37	1.38 (0.90–2.14)	0.143	1.03 (0.73–1.43)	0.89
Birth weight (kg), 2.500–3.999 (reference group)				
≥4.000	0.95 (0.53–1.71)	0.870	2.06 (1.40–3.03)	<0.00
<2.500	0.68 (0.36–1.30)	0.243	0.99 (0.61–1.62)	0.97
Duration of breastfeeding (months), not breastfed (reference group)				
<2	0.98 (0.61–1.56)	0.922	1.25 (0.82–1.89)	0.30
2–<4	0.83 (0.48–1.43)	0.505	1.23 (0.78–1.95)	0.38
4–<6	1.13 (0.58–2.18)	0.724	1.48 (0.84–2.61)	0.17
≥6	1.09 (0.64–1.86)	0.754	1.39 (0.87–2.22)	0.17
Age of introduction of solid foods (months), 4–<6 (reference group)				
<2	2.46 (1.16–5.18)	0.018	2.39 (1.23–4.63)	0.01
2–<4	1.13 (0.78–1.64)	0.524	1.08 (0.79–1.47)	0.64
≥6	1.39 (0.91–2.12)	0.125	1.24 (0.86–1.79)	0.24
Age of mother at childbirth (years), 19–<35 (reference group)				
≥35	0.68 (0.45–1.03)	0.068	1.26 (0.93–1.71)	0.14
<19	1.25 (0.42–3.71)	0.694	0.27 (0.04–2.07)	0.20
Mother's BMI status, normal (18.5–24.9) (reference group)				
Overweight (25.0–29.9)	1.50 (0.94–2.39)	0.087	1.43 (0.94–2.17)	0.09
Obese (≥30)	1.94 (1.22–3.07)	0.005	2.63 (1.76–3.93)	<0.00
Underweight (<18.5)	0.85 (0.11–6.72)	0.880	0.64 (0.07–4.68)	0.67
Education level of mother, primary or below (reference group)				
Intermediate or secondary	1.02 (0.64–3.52)	0.970	1.29 (0.63–2.65)	0.49
Diploma	1.20 (0.51–2.82)	0.680	1.37 (0.64–2.96)	0.42
University and above	1.49 (0.46–2.25)	0.358	1.82 (0.85–3.92)	0.12
Mother's working status, not working (reference group)				
Working	0.89 (0.60–1.33)	0.581	1.29 (0.92–1.81)	0.14

The comparison is with children of normal BMI (<85th percentile). Figures in parentheses indicate 95% CI.

≥5 years was at 2.63 times higher risk of becoming obese (AOR = 2.63, 95% CI = 1.84–3.77, $p < 0.001$) and 2.53 times higher risk of becoming overweight (AOR = 2.53, 95% CI = 1.64–3.91, $p < 0.001$) than a child of <4 years. A child with a birth weight of ≥4 kg was at 2.06 times higher risk of becoming obese than a child who had a birth weight of 2.5 to <4.0 kg (AOR = 2.06, 95% CI = 1.40–3.03, $p < 0.001$). A child to whom solid foods were introduced at the age of <2 months was at 2.39 times higher risk of becoming overweight (AOR = 2.39, 95% CI = 1.23–4.63, $p = 0.010$) and 2.46 times higher risk of becoming obese (AOR = 2.46, 95% CI = 1.16–5.18, $p = 0.018$) than a child to whom solid foods were introduced at the age of 4–6 months. A child whose mother was obese, was at 2.63

times higher risk of becoming obese (AOR = 2.63, 95% CI = 1.76–3.93, $p < 0.001$) and 1.94 times higher risk of becoming overweight (AOR = 1.94, 95% CI = 1.22–3.07, $p = 0.005$) than a child whose mother had normal weight. The duration of breastfeeding was not found to be a significant factor associated with the BMI status of pre-school children.

Discussion

Our findings reveal that neither breastfeeding nor duration of breastfeeding was associated with childhood obesity at 3–6 years of age when potential con-

founders were controlled for. In contrast to our results, Burdette et al. [22] showed that children breastfed for a longer duration and those who were breastfed without concurrent formula feeding did not have a significantly lower fat mass than did those children who were never breastfed.

A recent study [23] reported that the duration and exclusivity of breastfeeding did not reduce the measures of adiposity at the age 6.5 years. The authors previously reported that any positive effect might be the result of uncontrolled confounding and selection bias.

A review of published and unpublished observational evidence concluded that breastfeeding was inversely associated with obesity at different age groups using data that were not adjusted for confounders [14, 24]. Owen et al. [25] in their meta-analysis highlighted the effect of maternal factors such as BMI, socioeconomic status and smoking on exaggerating the association between breastfeeding and obesity. Adjusting these confounders markedly attenuated the effect of breastfeeding on reducing the risk of obesity.

Our findings are less likely to be attributable to reverse causality as we included a large sample in which measurements of height and weight were taken. The large sample size made it possible to adjust for important confounding factors such as birth weight, maternal weight, and maternal education.

Our negative results could be explained by other factors that have a stronger effect on body weight than breastfeeding. Kuwait has been undergoing social changes that increase food consumption and sedentary lifestyle. These may contribute to increased body weight among children. However, this explanation needs to be backed up by evaluation of activity and dietary intake of the children.

A recent study by Scholtens et al. [26] that tracked 2,347 children, who participated in a longitudinal study from birth, showed that the effect of breastfeeding on reducing the risk of obesity in later years is achieved in the first year of life. Current dietary and lifestyle factors are more responsible for reducing the risk of overweight at 7 years of age.

Limitations of this study were the dependence on retrospective maternal recall of breastfeeding practices in the previous 4–6 years. The recall period in our study was short compared to that of many reports where they have shown close agreement between long-term recall and postnatal records [16].

The study by Agras and Mascola [27] confirmed that parental overweight is the most potent risk factor for

childhood overweight. There is evidence that targeting parental behaviors may be more effective than interventions directed solely towards children.

We also found that maternal BMI was a strong predictor of child BMI status. Children of obese mothers are 1.94 times more overweight and 2.63 times more obese than the children of normal-weight mothers. This is in agreement with other studies showing that maternal BMI was a strong predictor of obesity [16–19, 28, 29].

Birth weight is another strong predictor of a child's BMI. We found that a high birth weight (≥ 4.0 kg) was positively associated with an increased risk of obesity (≥ 95 th percentile). Hediger et al. [17] reported a positive effect of high birth weight on child's BMI that diminished when maternal BMI was controlled.

Age was the strongest predictor of obesity. The prevalence of obesity was found to peak at 4 years. Whitaker et al. [30] reported that early adiposity rebound before the age of 5.5 years was associated with an increased risk of adult obesity which is found to be true for Kuwaiti children.

Gender was also found to be a predictor of obesity. Females are at an increased risk of obesity compared to males. This is consistent with the finding of Mei et al. [31] that obesity was higher among females than males which first appeared as early as the preschool years and persisted into adulthood. Reduced physical activity of Kuwaiti girls may explain the greater prevalence of overweight.

Conclusion

Our results suggest that breastfeeding and its duration are not associated with the obesity status of Kuwaiti preschool children (3–6 years of age). Therefore, while breastfeeding is still recommended, it may not be as effective as moderation of other childhood features such as dietary habits and physical activity in protecting children from becoming obese. As there is a positive association between childhood and maternal obesity, interventions targeted at the family rather than just the child may be more effective.

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