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Anemia and associated factors among Kuwaiti preschool children and their mothers

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KEYWORDS

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Abstract *Background:* Anemia is a major nutritional health problem throughout the world. *Objectives:* To determine the prevalence and the factors associated with anemia among Kuwaiti children aged 4–5 years.

Design: A sample of 578 Kuwaiti preschool children (4–5 years of age) and their mothers were selected from ongoing Kuwait Nutrition Surveillance System from September 2003 to June 2004. Mothers participated in an interview where demographic; health and nutrition information was collected. Anthropometrical data and blood sample were also collected for children and mothers; anemia was defined as hemoglobin < 11 g/dl for children and < 12 g/dl for mothers.

Results: The risk of having anemia was 1.8 times more in children aged 5 years than in children aged 4 years; a moderately/severely stunted child was 2.3 times prone to be anemic than a normal child; a moderately/severely overweight child was less likely to be anemic; a child who was breastfed for less than one month was 2.8 times more at risk of being anemic than a child who was breastfed for more than 6 months; a child who was given cereals as a weaning food was 3.5 times of becoming anemic than a child given meat and egg as a weaning food. Children of mothers whose age was < 30 years, and children of anemic mothers were more likely to become anemic.

Conclusions: Anemia remains a common health problem for Kuwaiti preschool children and further studies are needed to focus on etiologies and interventions.

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1. Introduction

Anemia is a major nutritional problem throughout the world and it affects 1.62 billion people worldwide. Preschool children are affected most, with a prevalence of 47.4%.¹

The most prevalent form of anemia worldwide is iron deficiency, and it particularly affects women in reproductive periods and children less than 5 years. It may lead to serious health problems, such as poor cognitive and motor development and behavioral problems in children.

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Kuwait is a small wealthy country with an area of 17,818 km.² The discovery of oil in 1940s changed the living standards of Kuwait citizens dramatically with high standard of living, which includes free medical care, education, and other amenities together with increased income. As a result, food habits have changed from traditional to western foods with high energy density meals replacing carbohydrate based staples.²

Over the last few decades, there have been a number of studies indicating that anemia is a significant public health problem in the State of Kuwait. Most of these studies have been performed on adult women or children. Surveys suggest that iron deficiency is the most likely cause of anemia in Kuwait.³⁻⁵ Overall, various studies have estimated the prevalence of anemia to be between 25 and 37% among young adult women.⁶ The prevalence of anemia among preschool-age children in Kuwait remains relatively high.

The identification of children who are at risk is vital. Determination of the related factors between mothers and children is needed for the development of successful education intervention programs. Only two studies have previously been conducted in Kuwait studying anemia and associated factors; the first was conducted in 1996 and covered the nutritional status of preschool children in general including anemia.⁷ The second study was conducted only in one district of Kuwait on children aged 2–10 years.⁸

Therefore, the present study had the aims of estimating the prevalence of anemia and identifying the associated factors among Kuwaiti children aged 4–5 years.

2. Material and methods

The State of Kuwait is running a nation-wide Kuwait Nutrition Surveillance System with consultation provided by the World Health Organization [WHO] and Center for Disease Control and Prevention since 2001. It is designed as a sentinel sample of the Kuwaiti population and based on the estimated sample size for each population group from birth to beyond 60 years and reflects the nutritional status of the population and monitors the trends.

A sample of 578 Kuwaiti pre-school children (4–5 years of age) and their mothers were selected from the ongoing Kuwait Nutrition Surveillance System. The recruitment period was from September 2003 to June 2004. The subject information was collected from the kindergarten schools. Qualified dietitians obtained oral consent from the mothers.

Anthropometrical, biochemical and dietary information was collected for the study during the 9 month period.

Biochemical kits were used to test hemoglobin using Hemo-Cue by finger prick. WHO standard cut off point was used to identify anemia.⁹ Children less than 5 years with hemoglobin (Hb) values of < 11.0 g/dl were considered anemic. Similarly mothers with hemoglobin less than 12 g/dl were considered anemic.

Heights were measured 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 (SECA, Medical Scales and Measuring Systems, Hamburg, Germany). Body Mass Index [BMI] for age was used to measure overweight and obesity among children. BMI for age was reported, rather than weight by age, as the worldwide accepted standard

for screening overweight and obesity in children. Children with Body Mass Index [BMI] ≥ 2 SD were considered overweight and ≥ 3 SD as obese.¹⁰

The BMI (weight in kg/(height in meter)²) of mothers was classified according to the WHO classification, underweight (BMI < 18.5) normal (BMI ≥ 18.5 to ≤ 25), overweight (BMI ≥ 25 to ≤ 30) and obese (BMI ≥ 30).¹¹

A questionnaire was developed and validated.

Data such as birth weights, past breastfeeding practices, duration of breastfeeding, time of starting infant formula, time of starting weaning food, type of weaning food, child's eating habits, (whether the child ate regularly and the frequency of eating with the family) child's chronic illness were collected using questionnaire.

Also the mother's age, education, and occupation information were collected from the questionnaire.

Subjects excluded from the study were very low birth weight (< 1500 g, $n = 31$), children's age < 4 and > 5, pregnant mothers ($n = 10$) and incomplete questionnaire ($n = 20$).

2.1. Statistical methods

Statistical analyses were carried out using Statistical Package for Social Sciences, v.19.0 (SPSS Inc., Chicago, USA). The level of statistical significance was set at 0.05. The chi-square test or Fisher's exact test was used to assess the association between two qualitative variables wherever appropriate. Pearson's correlation was used to test the significant association between two quantitative variables. Natural logarithms of the variables child's weight and mother's weight were used in the analysis to make their distributions nearly normal. Multiple logistic regressions were used to estimate the risk of different factors on the prevalence of anemia (0 for absent and 1 for present) after controlling/confounding between them. The adjusted odds ratios and their 95% CI for significantly associated factors were reported.

3. Results

3.1. Prevalence of anemia among the study population

The studied sample consisted of a total of 578 children (306 girls and 272 boys) aged 4–5 years. A higher proportion (64.7%) of the children was of 4 years age. The overall prevalence of anemia (hemoglobin < 11 g/dl for age 4 & < 11.5 for age 5) among the studied children was 23.0% (95% CI = 19.6–26.7). The mean Hb concentration was 11.98 (SD = 1.22) ranging from 7.4 to 15.0. **Table 1** shows the Hb distribution for the study population. Overall 11.4% of children had their Hb concentration between 10 and 10.9 g/dl, 4.9% between 7 and 9.9 g/dl (12.9% and 7.0% for boys; 12.1% and 5.9% for girls), and none of them below 7 g/dl.

3.2. Associated factors for anemia among the study population

Table 1 shows the prevalence of anemia among the studied children according to child and mother characteristics. The child characteristics that were statistically associated with anemia were: child's age; Z-score for height-to-age; duration of

Table 1 Prevalence of anemia among Kuwaiti children according to child and other characteristics ($n = 578$).

	Number	Anemia	<i>p</i> -Value
<i>Child's age (years)</i>			0.038 ^a
4	374 (64.7)	76 (20.3)	
5	204 (35.3)	57 (27.9)	
<i>Gender</i>			0.499 ^a
Boys	272 (47.1)	66 (24.3)	
Girls	306 (52.9)	67 (21.9)	
<i>Birth weight (kg)</i>			0.633 ^b
<2.5	48 (8.3)	11 (22.9)	
2.5–4.0	505 (87.4)	118 (23.4)	
>4.0	25 (4.3)	4 (16.0)	
<i>Height z score</i>			0.005 ^b
Normal (z score ≥ -1.0)	403 (69.7)	86 (21.3)	
Mildly stunted (z score < -1.0 & ≥ -2.0)	105 (18.2)	18 (17.1)	
Moderately/severely stunted (z score < -2.0)	70 (12.1)	29 (41.4)	
<i>Weight z score</i>			0.085 ^b
Normal (z score ≤ 1.0)	443 (76.6)	106 (23.9)	
Mildly overweight (z score > 1.0 & ≤ 2.0)	83 (14.4)	22 (26.5)	
Moderately/severely overweight (z score > 2.0)	52 (9.0)	5 (9.6)	
<i>Duration of breast feeding (months)</i>			0.008 ^b
<1	71 (12.3)	24 (33.8)	
1–2	178 (30.8)	46 (25.8)	
3–5	170 (29.4)	35 (20.6)	
≥ 6	159 (27.5)	29 (18.2)	
<i>Started infant formula (month)</i>			0.485 ^b
<1	156 (27.1)	40 (25.6)	
1–3	205 (35.6)	45 (22.0)	
>3	215 (37.3)	48 (22.3)	
<i>Infant formula iron fortified</i>			0.350 ^a
Yes	489 (88.3)	110 (22.5)	
No	65 (11.7)	18 (27.7)	
<i>Started weaning food (month)</i>			0.485 ^b
<2	32 (5.5)	6 (18.8)	
2–3	165 (28.5)	40 (24.2)	
4–5	258 (44.6)	67 (26.0)	
≥ 6	123 (21.4)	20 (16.3)	
<i>Type of weaning food</i>			0.010 ^a
Cereals	154 (17.3)	45 (29.2)	
Fruits and vegetables	213 (36.8)	52 (24.4)	
Cereals, fruits and vegetables	107 (18.5)	24 (22.4)	
Family food/meat/egg	104 (19.4)	12 (11.5)	
<i>Number of children</i>			0.238 ^b
<3	100 (17.3)	18 (18.0)	
3–5	366 (63.3)	87 (23.8)	
≥ 6	112 (19.4)	28 (25.0)	
<i>Child eat meals regularly</i>			0.350 ^a
Yes	391 (68.1)	87 (22.3)	
No	183 (31.9)	44 (24.0)	
<i>Frequency of child eating with family</i>			0.180 ^a
Always	351 (60.9)	87 (24.8)	
Twice a day	125 (21.7)	28 (18.4)	
Once a day	63 (10.9)	10 (15.9)	
Sometimes	37 (6.4)	11 (29.7)	
<i>Child suffering from illness</i>			0.314 ^a
Yes	102 (17.8)	27 (26.5)	
No	471 (82.2)	103 (21.9)	
<i>Age of mother (years)</i>			0.089 ^b
<30	144 (24.9)	42 (29.2)	
30–39	328 (56.7)	69 (21.0)	
≥ 40	106 (18.4)	22 (20.8)	
<i>Mother's level of education</i>			0.517 ^b
Secondary or below	248 (43.0)	54 (21.8)	
Diploma	154 (26.6)	36 (23.4)	

Table 1 (continued).

University and above	176 (30.4)	43 (24.4)	0.951 ^a
Mother's working status			
Not working	229 (39.6)	53 (23.1)	0.008 ^a
Working	349 (60.4)	80 (22.9)	
Mother's Hb level			
≥ 12	357 (61.8)	69 (19.3)	
< 12	221 (38.2)	64 (29.0)	

Numbers may not add up to the total due to missing data.

^a *p*-Values are generated by chi-square test.

^b *p*-Values are generated by chi-square test for linear trend.

breast feeding; type of weaning food; and mother's Hb concentration.

The prevalence of anemia was significantly high among children aged 5 years, moderately/severely stunted (*z* score of height for age ≤ 2.0) children, children who had lesser duration of breast feeding, and children who had cereals alone or combination of cereals, fruits and vegetables as their weaning food. Also anemia was significantly more prevalent among children of anemic mothers.

Significantly positive correlations were observed between child's hemoglobin concentrations and child's height, weight, mother's age and hemoglobin (Table 2). The correlations were not strong, however the highest among them was the one between hemoglobin concentrations of child and mother ($r = 0.123$, $P = 0.003$). Mother's height, weight and child's birth weight were not significantly correlated with the child's hemoglobin concentrations.

Table 3 shows risk factors associated with the presence of anemia among the studied sample by multivariate logistic regression analysis. Child's age, height, weight, duration of breast feeding, type of weaning food, mother's age, and Hb concentration were significantly independent factors associated with the prevalence of anemia after confounding for other variables. The risk for a child aged 5 years to have anemia was 1.8 times than a child aged 4 years; a moderately/severely stunted child (height for age *z* score ≤ 2.0) was 2.3 times prone to be anemic than a normal child; a moderately/severely overweight child (*z* score > 2.0) was less likely to be anemic; a child

breastfed only for < 1 month was 2.8 times at risk of becoming anemic than a child breast fed for ≥ 6 months; a child who had cereals as the type of weaning food has 3.5 times chance to become anemic than a child who had family food/meat and egg as weaning food. Children of mothers whose age was < 30 years, and mothers who had their hemoglobin level < 12 were more likely to become anemic.

4. Discussion

The present study showed that the overall prevalence rate of anemia among Kuwaiti preschool children (4–5 year) was 23% between 2003 and 2004. This rate is twice that of industrialized countries such as Austria 10.5%, Belgium 8.7%.¹ However, it is still markedly lower than prevalence data reported by South Asian countries such as India 74.3%, Bangladesh 47% and Pakistan 50.9%.¹

In Kuwait the prevalence is lower than that reported by previous study which illustrated high prevalence of anemia among preschool Kuwaiti children: 46.9% in 1979¹² and 29.3% in 1996⁷ which is noteworthy. This probably reflects an improvement in dietary quality maybe due to the fortification of flour with thiamin, riboflavin, niacin, iron and folic acid since 2001 and also a potentially improved consumption of iron rich foods such as red meat, eggs and dark green leafy vegetables. One of the limitations of the present study is that dietary intake data were not collected.

The prevalence of anemia among preschool children differs according to the socio-demographic characteristics recorded. The data showed a statistically significant difference of some variables as discussed later, but not for others such as infection and maternal education.

The distribution of anemia by age group showed that 27.9% were aged 5 years which is statistically higher than the 20.3% aged 4 years. There was no significant sex difference observed in the prevalence rate of anemia.

As anemia and malnutrition usually share common causes, it is expected that multiple nutrition problems will co-occur in the same individual. Anthropometric measurement is considered to be a simple, non invasive and reliable technique to measure the nutritional status. Our data showed that stunted children are more predisposed to anemia than children with normal height suggesting a relationship between chronic malnutrition and anemia. These results were consistent with findings from other studies that showed a positive association between height for age and concentration of hemoglobin.^{13,14}

Table 2 Correlation of quantitative variables with hemoglobin concentrations of 578 Kuwaiti children.

	Hemoglobin	
	<i>r</i>	<i>p</i> -Value
Child's height (cm)	0.086	0.039
Child's weight (kg)	0.094	0.023
Child's birth weight (kg)	-0.027	0.511
Mother's age (years)	0.085	0.042
Mother's height (cm)	0.072	0.086
Mother's weight (kg)	0.026	0.526
Mother's hemoglobin (mg/dL)	0.123	0.003

r = Pearson correlation coefficient.

Natural logarithms of the variables child's weight and mother's weight are used because of their skewness.

Table 3 Significant factors associated with anemia by multiple logistic regression analysis ($n = 578$).

Variable	Adjusted odds ratio	95% CI	p-Value
<i>Child's age (years)</i>			
4 (reference)	1.00		
5	1.81	1.15–2.84	0.011
<i>Height z score</i>			
Normal (z score ≥ -1.0)	1.00		
Mildly stunted (z score < -1.0 & ≥ -2.0)	0.74	0.39–1.44	0.378
Moderately/severely stunted (z score < -2.0)	2.35	1.23–4.50	0.010
<i>Weight z score</i>			
Normal (z score ≤ 1.0) (reference)	1.00		
Mildly overweight (z score > 1.0 & ≤ 2.0)	1.51	0.80–2.85	0.208
Moderately/severely overweight (z score > 2.0)	0.33	0.11–0.94	0.038
<i>Duration of breast feeding (month)</i>			
< 1	2.83	1.16–6.89	0.022
1–2	1.35	0.69–2.66	0.387
3–5	0.92	0.49–1.73	0.796
≥ 6	1.00		
<i>Type of weaning food</i>			
Cereals	3.51	1.56–7.89	0.002
Cereals, fruits and vegetables	2.68	1.27–5.65	0.010
Family food/meat/egg	1.00		
<i>Age of mother (years)</i>			
< 30	2.42	1.08–5.40	0.031
30–39	1.13	0.54–2.37	0.744
≥ 40	1.00		
<i>Mother's Hb level</i>			
≥ 12	1.00		
< 12	1.59	1.02–2.47	0.041

CI = Confidence interval for odds ratio.

Adjusted for child characteristics: gender, month at which infant formula started, infant formula iron fortified, month at which weaning food started, number of children, child eat meals regularly, frequency of child eating with family, child suffering from illness; and mother characteristics: level of education, working status, height, weight.

At the same time our data showed a negative association between anemia and children's BMI, which is inconsistent with findings from another study that showed a positive relation between overweight and anemia.¹³

Our data showed a significant positive association between breast feeding and anemia after adjusting for confounding factors. This finding supports the finding from Timor-Leste and Brazil where breast feeding, practices for more than 6 months were significantly associated with the high level of hemoglobin concentration.¹⁵

Types of weaning food are another associated factor. A child who had cereal alone or combined with fruits and vegetables as weaning food has 3.5 chance to be anemic than a child who had meat as a weaning food¹⁶ as it contains 40% of highly absorbable heme-iron.¹⁷ Based on the concept that child's health reflects the situation of his family, it is highly theoretically possible that a child would present anemia if any member of his family especially the mother were anemic. Such association was found in our study. Maternal anemia had a greater correlation with child anemia which corroborates with findings in other studies.^{15,18}

In the multiple logistic regression analysis and after adjusting for other factors, mother's age and number of children were significantly associated with child's anemia. Child of mother aged less than 30 years was more prone to anemia than children of older mothers. This association has also been found

in other studies which could correlate with mother's experience and child care quality.^{15,18}

A large family size and number of children per family, when more than 3, were positively associated with anemia, which is consistent with the Kuwait nutritional status survey study⁷ where anemia is positively associated with birth order and Amazonian study where high maternal parity (more than 2 pregnancies) is positively associated with anemia.¹⁹ In developing countries this could be related to poor access to antenatal care and maternal nutrition.²⁰ In Kuwait we have a good antenatal care system available to all pregnant women so this relation most probably reflects the quality of child care. The effect of child illness and mother's education are known determinant factors on child's health,^{7,14,16,18,21} however in our study both were not related to anemia. This could be because other factors were more effective than them. At the same time most of the mothers in our study had more than 12 years of schooling and most of the children in our sample had no history of chronic illness which could be related to the good child health care system in our clinic.

Certain limitations with the study should be noted. Hemoglobin concentration has been used as a proxy indicator of iron deficiency and serum ferritin has not been used. Dietary intake is another important factor but these data were not collected and hence causation and effect cannot be linked. The strength of our study is that our data have been collected from a

surveillance system which has been monitored by consultation from the World Health Organization.

5. Conclusion

The overall prevalence of anemia among our sample was 23%. The study indicates that in Kuwait the risk of anemia in 4–5 year old children is affected by age, height for age, weight for age, family size and maternal age and anemia. Strategies to control anemia based on iron supplementation alone are likely to have a limited effect. The current study provided information directing the focus of any intervention to address the other complex factors by ensuring dietary adequacy. Nutritional interventions should be used only as a short term solution. Sustainability of such programs needs to be considered and serious consideration given to underpinning complex issues such as maternal education and family size. Consideration should be given to the creation of child care health centers in all districts where mothers and maids can obtain support and training in providing a healthy diet for all members of the family, appropriate child care and budgeting and household management. An immediate report of this study's Screening Survey is recommended, to establish if the prevalence and factors have changed since almost 10 years ago. In the future in Kuwait with continued focus on iron deficiency anemia, it is hoped the prevalence will further reduce to less than half the prevalence reported in this paper.

Conflict of interest

No authors declare a conflict of interest.

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