Journal of Iranian Medical Council, Volume 3, Issue no. 4
http://dx.doi.org/10.18502/jimc.v3i4.5192

Original Article

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The Relationship between the Type of Milk Consumed and the Risk of Kidney Stones in Children Under Two Years of Age

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Abstract

Background: Kidney stones are one of several serious health problems in childhood that cause nutritional and growth disorders, and may finally lead to chronic kidney failure in this group.

Methods: In this analytical study conducted through a case-control design, 30 children under the age of two with kidney stones, and 125 children of the same age and sex without stones were studied. Patient information including personal profile and the results of some necessary tests were extracted from patient records and listed in a checklist. The data was analyzed using SPSS (Version 17.0). Statistical significance was considered when p-value was <0.05.

Results: In terms of duration of breastfeeding, a significant difference was observed between the patients with stones and patients without stones; the duration of breastfeeding was longer in the control group (p=0.003). In addition, the duration of feeding with formula milk and cow milk was longer in the case group (p=0.038 and p=0.012, respectively).

Conclusion: Breastfeeding can serve as a nutritional factor that plays a preventive and protective role against the formation of kidney stones in infants.

Keywords: Animals, Breast feeding, Child, Infant, Kidney stone, Milk

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Received: Jun 12 2020
Accepted: Aug 27 2020

Citation to this article:
Shajari H, Shajari A, Golshan Tafti M, Samaninejad R. The Relationship between the Type of Milk Consumed and the Risk of Kidney Stones in Children Under Two Years of Age. *J Iran Med Counc*. 2020;3(4):205-10.

Introduction

Kidney stones are a serious health problem in children that causes nutritional, cardiovascular and growth disorders, and may finally lead to chronic renal failure in this group (1). The formation of these stones follows a process, which begins with the crystallization of dissolved materials and subsequently the growth and accumulation of crystals (2). These stones are made of different compounds with calcium oxalate being the most frequent type, followed by calcium phosphate (3). The stones are formed when the equilibrium between solutes, stimulants and inhibitors of deposition is disrupted (1). In general, the incidence rate of kidney stones in children is 2 to 3%; however, the incidence, composition, site of formation and clinical characteristics vary from region to region and from time to time. The variation may be due to differences in climate, diet, economic and social factors (4,5). In Iran, the western and northern parts of the country have the highest incidence of kidney stones (6,7).

Breastfeeding is one of the goals of the World Health Organization (WHO) that emphasizes breastfeeding in the early hours after delivery and for at least 6 months postpartum (8). This emphasis is backed by health experts who consider breastfeeding as the best choice for infant nutrition (9). In terms of quality and quantity, the human milk satisfies the growth requirement of infants, provides energy and is easily digested; no other method can replace breastfeeding. More than 400 beneficial substances, including white blood cells and immunoglobulins are found in human milk, which protect the baby from diseases, and cannot be synthesized in laboratories (10). Human milk reduces the incidence of hospitalization due to respiratory diseases and protects the infant from diarrhea caused by enterococci, otitis media, allergies, and type 2 diabetes (11). Given the benefits of breastfeeding, it is believed to be one of the protective factors against the formation of kidney stones in infants. A study in Iran reported that milk consumption acts as a protective factor while the male gender, family history of urolithiasis and increased body mass index are the risk factors for urinary stones (12). A study conducted in Kuwait also found that lithogenic metabolic factors were the most important predisposing factors for stone formation among Kuwaiti children, while diet and environmental factors played an insignificant role (13). Limited studies have been conducted in Iran in the field of urolithiasis, and the effects of different fluids and the fluid intake pattern on the development of kidney stones have not been determined appropriately. Given the increasing incidence of urolithiasis in children, there is a need for further studies in this field. Therefore, an attempt was made to investigate the relationship between the type of the milk consumed and formation of kidney stones in children under two years of age.

Materials and Methods

In this analytical study conducted through case-control design, 30 children under the age of two with kidney stones, and 125 children of the same age and sex with kidney stones were evaluated. Patient information including personal profile and the results of some necessary tests were extracted from patient records and listed in a checklist.

Inclusion criteria

All children under two years of age with kidney stones were included in the study.

Exclusion criteria

Patients over two years or under 2 months old, patients with hereditary renal stones such as cystinuria and hyperoxaluria and patients dissatisfied with their inclusion in the study were excluded from the research.

Ethical considerations

The study protocol was approved by the ethics committee of University of Medical Sciences. Informed consent was received from the parents for participation. The information was kept confidential in accordance with the Helsinki Convention, and was used for research purposes only.

Statistical analysis

Data were analyzed using SPSS statistical software (Version 17.0). T-test and ANOVA were used for making comparisons between the study groups. p-values less than 0.05 were considered statistically significant.

Results

Distribution of gender in the study population

In this study, 155 children under 2 years of age (30

patients with stones and 125 patients without stones) were studied of whom 50.3% (n=78) were male and the rest were females. In terms of gender, the case and control groups had no significant difference (p=0.656) (Table 1).

Evaluation of the duration of breastfeeding, feeding with formula milk and cow milk in the study groups

According to the independent t-test analysis among patients with stones and patients without stones, there was a significant difference in the duration of breastfeeding between the two groups; the duration was longer in the control group (p=0.003). Also, a significant difference was observed between the patients with stones and patients without stones in the duration of feeding with formula milk, which was longer in the case group (p=0.038). Furthermore, the duration of feeding with cow milk was higher in patients with stone (p=0.012) (Table 2).

Mean age of complementary feeding in study groups

From the independent t-test analysis, no significant difference was noted in the mean age of complementary feeding between the patients with stones and patients without stones (Age-fed) (p= 0.688) (Figure 1).

Investigating the combined effect of different types of milk in patients with stones and patients without stones

Using Chi-square test, it was shown that the rate of breastfeeding and feeding with formula milk was significantly higher in the control group (Table 3).

According to independent t-test analysis, the duration of breastfeeding and formula milk feeding in the case and control were not significantly different in B-fed and F-fed groups (p=0.863 and p=0.525) (Table 4).

Based on the analysis with independent t-test, the duration of breastfeeding and cow milk feeding in the case and control groups were not significantly different in B-fed and A-fed groups (p=0.863 and p=0.525) (Table 4).

According to independent t-test analysis, the duration of breastfeeding, formula and cow milk feeding in the case and control groups were not significantly different in the all groups of B-fed, D-fed and A-fed (p=0.583, p=0.102 and p=0.788) (Tables 5 and 6).

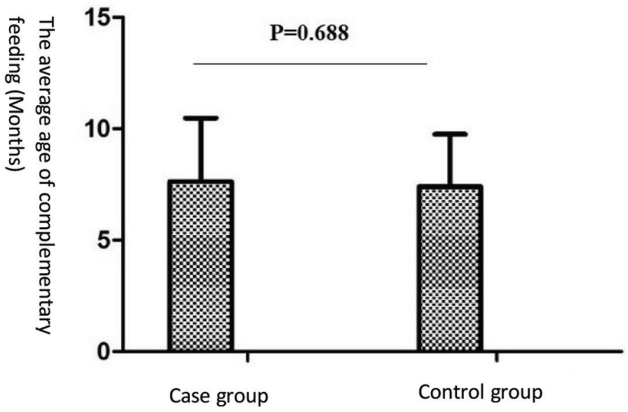

Figure 1. Mean age of complementary feeding in case and control group.

Table 1. Comparison of case and control groups by gender

Variable		Patients with stones	Patients without stones	Total	p-value
Gender	Male	14(46.7%)	64(51.2%)	78(50.3%)	0.656
	Female	16(53.3%)	61(48.8%)	77(49.7%)	

Table 2. Comparison of patients with stones and patients without stones by duration of breastfeeding (B-fed)

Variable		Frequency	Mean ± SD	p-value
Breastfeeding	Case	14	11.14±8.83	0.003
	Control	81	17.38±6.65	
Formula milk feeding	Case	2	24	0.038
	Control	11	14±5.69	
Cow milk feeding	Case	30	2.26±5.72	0.012
	Control	125	0.56±2.42	

Comparison of patients with stones and patients without stones according to the family history of kidney stones

Odds ratio of kidney stones in people with a family history of kidney stones was 8.88, and given the confidence interval of 95% (CI=3.64-21.69) in which 1 is excluded, this relationship was significant and was recognized as one of the strongest risk factors (Table 7).

Discussion

Recently, some studies have suggested that calcium, phosphate, and vitamin D levels may be associated with kidney stone formation, although the results are inconsistent. In a recent meta-analysis, it was concluded that vitamin D receptor polymorphisms could be potential markers for susceptibility to kidney stone formation. However, in a case-control study that evaluated the role of vitamin D in adults with urinary

Table 3. Comparison of the patients with stones and patients without stones according to breastfeeding, formula milk and cow milk feeding

Variable	Case	Control	Total	p-value
Breastfeeding	14(46.7%)	81(64.8%)	95(61.3%)	0.046
Formula milk feeding	2(1.6%)	10(8%)	12(7.7%)	
Breastfeeding and formula milk feeding	8(26.7%)	26(20.8%)	34(21.9%)	
Breastfeeding and cow milk feeding	4(13.3%)	3(2.4%)	7(4.5%)	
Breastfeeding, formula and cow milk feeding	2(6.7%)	2(1.6%)	4(2.6%)	
Cow milk and formula milk feeding	0(0%)	3(2.4%)	3(1.9%)	

Table 4. Comparison of the patients with stones and patients without stones by duration of breastfeeding and formula milk feeding

Variable		Frequency	Mean ± SD	p-value
Breastfeeding and formula milk (B-fed)	Case	8	10.81± 7.94	0.863
	Control	26	11.3±6.77	
Breastfeeding and formula milk (B-fed)	Case	8	13.37±7.26	0.525
	Control	26	11.51±7.10	

Table 5. Comparison of the patients with stones and patients without stones by duration of breastfeeding and animal milk feeding

Variable		Frequency	Mean ± SD	p-value
Breastfeeding and formula milk feeding (B-fed)	Case	3	23.25±1.5	0.173
	Control	4	15.56±9.71	
Breastfeeding and formula milk feeding (A-fed)	Case	3	13.75±8.26	0.735
	Control	4	11.66±6.50	

Table 6. Comparison of case and control groups by duration of breastfeeding, dried and animal milk feeding

Variable		Frequency	Mean ± SD	p-value
Breastfeeding, cow-, formula feeding (B-fed)	Case	2	13±15.55	0.583
	Control	2	5.5±4.94	
Breastfeeding, cow-, formula milk feeding (F-fed)	Case	2	5.5±4.94	0.102
	Control	2	16.5±2.12	
Breastfeeding, cow-, formula milk feeding (A-fed)	Case	2	6.5±7.77	0.788
	Control	2	8.5±4.94	

Table 7. Comparison of case and control groups by family history of kidney stones

Variable		Case	Control	Total	p-value
Family history of kidney stones	Yes	21(70%)	26(20.8%)	47(30.3%)	0.001
	No	9(30%)	99(79.2%)	108(69.7%)	

incontinence, it was found that the major metabolites of vitamin D had no pathophysiological role in the formation of urinary stones. This study aimed to investigate the relationship between the type of infant nutrition (Milk feeding) and development of kidney stones in 155 children under two years of age. The duration of breastfeeding was longer in the patients without stones, the duration of feeding with formula milk was longer in the case group (p=0.038), and the duration of cow milk feeding was longer in the case group. Also, the risk of developing kidney stones in people with a family history of kidney stones was 8.88%. This means that children with a family history of kidney stones are approximately 9 times more likely to develop kidney stones. This relationship was significant and was recognized as one of the strongest risk factors.

In a study examining kidney and urinary tract stones in children with male to female ratio of 1.2, the reported family history of kidney stones was 58% and as a result, the findings of the study indicated that lithogenic metabolic factors were the most important predisposing factors for development of stones in children, while the diet and environmental factors played an insignificant role (13). Again in our study, 70% of children with kidney stones had a family history of kidney stones, which reflects a strong significant relationship and highlights the role of genetics for its development in children. Interestingly, given that among control group members, who were free of kidney stones, the consumption of breast milk was more than the amount in the case group, and the consumption of dried and animal milk in the control group was less than the amount in the case group, it can be concluded that diet plays an effective role in the development of kidney stones in children under two years of age and that breastfeeding can play a preventive role in the development of kidney stone.

The findings of Moghaddas *et al*'s study are consistent with our results which showed that breastfeeding has a preventive and protective role against the development of kidney stones in children under two years of age, and that family history plays a key role in the development of kidney stones. The results of this study, which aimed to investigate the effect of the type and amount of fluid intake on kidney stones, showed that the average consumption of tea, natural fruit juices, beer and the total average of consumed fluids in the case group was higher than those in the control group. Male gender, obesity and family history of urinary stones are the risk factors for developing urinary stones, while milk consumption was considered as a protective factor (12).

Similarly, the results of a recently published study showed that breastfeeding has significant and beneficial effects on the treatment process of renal stones in children, such that the children whose disease progressed slowly, and in whom the size or number of kidney stones decreased, had a longer mean duration of breastfeeding. The infants who received breast milk for the first 6 months of their lives needed less treatment and had less growth retardation. Breastfeeding should be adopted as a medication in children with stones, especially during infancy (13).

Conclusion

In general, it can be said that the results of this study confirm the preventive and protective effects of breastfeeding as a nutritional factor against the development of kidney stones.

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