

ORIGINAL ARTICLE

Does maternal diet affect infantile colic?

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Abstract

Objective: The aim of this study was to investigate the effect of maternal diet on infantile colic without any interventions or food restrictions.

Methods: Thirty colicky and 29 non-colicky infants were included in this prospective study. Mother's diet and baby crying time were recorded for 1 week by mothers; nutritionist classified contents of mother's diet and compared the diet of mother in colicky and non-colicky infants.

Results: It was found that mothers of non-colicky infants consumed significantly more grapes and lemons than mothers of colicky infants ($p=0.044$). The crying time was moderately negatively correlated with the percentage of protein in the maternal diet ($R=-0.45$, $p=0.01$) and the presence of potatoes in the maternal diet ($R=-0.38$, $p=0.034$) and positively correlated with the maternal consumption of walnut ($R=0.38$, $p=0.034$), banana ($R=0.44$, $p=0.01$).

Conclusions: Removing bananas from the maternal diet may reduce colic. The consumption of a protein-rich maternal diet, grapes, lemons and potatoes by breastfeeding mothers may protect infants from colic.

Keywords

Crying time, infantile colic, maternal nutrition

History

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Introduction

Infantile colic (IC) is a very common problem of early infancy characterized by paroxysmal episodes of uncontrolled crying, fussing and irritability. The Rome III criteria define it as episodes lasting for at least 3 h per day, occurring at least 3 days per week for at least 1 week in otherwise healthy infants in the first 3 months of life [1]. IC is the reason for 17–30% of all pediatric visits to clinicians during the first 3 months of life and it affects up to 28% of infants [2,3]. Many patients with colic episodes attend hospitals from 5 p.m. to 9 a.m. Colic is frequently associated with secondary feeding difficulties and negatively affects family interactions [4].

Although many hypotheses have been proposed, there is no consensus about the etiology of IC, although it is likely multifactorial. Suggested etiological hypotheses include intolerance of various nutrients, gastro-esophageal reflux, altered gastrointestinal function, transient low lactase activity, intestinal microflora imbalance and cow's milk protein allergy [5].

The role of maternal diet in IC is controversial. In a crossover trial, removing cow's milk from the diet of

breastfeeding mothers did not reduce colic [6]. Some studies have shown that the exclusion of some allergenic or dairy foods from the maternal diet reduces symptoms of IC [7]. A protein-rich diet has been reported to cause IC [4]. In this study, we examined the effect of the mother's diet in IC without any interventions or food restrictions.

Methods

This prospective study enrolled 59 breastfed infants (30 colicky infants and 29 infants without colic) between January and December 2014. After approved by the Local Ethics Committee, we investigated the effect of maternal nutrition on the colicky infants. Patients with a diagnosis of IC according to the Rome III criteria who were <3 months of age and had been brought to the pediatric outpatient clinic because of crying or restlessness were included in the study. Infants who were premature or had gastro-esophageal reflux, urinary tract infection, food intolerance, or neurological, cardiac, or pulmonary problems were excluded from the study.

The mothers of all infants recorded the contents of their diets each day for 1 week without any interventions or other restrictions. The mothers also completed crying and restlessness charts for 1 week, and the results were scored by the study nurse.

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The contents of the mother's diet were classified by a nutritionist using the nutrition information program (Ebispro, Stuttgart, Germany; Turkish version: BeBiS, version 7.2) as protein, carbohydrate, fat, minerals and vitamins. Data source of this software was 97% Bundeslebensmittelschlüssel (BLS) version II.3 and 3% United States National Nutrient Database for Standard Reference (USDA SR 19). Daily consumption of each food group, micro and macro nutrients were assessed using the same software. Statistical analyses were performed separately for different 72 foods in seven food groups (meat products, dairy products, vegetables and fruits, cereals, legumes, fat and sugars). We investigated whether there was a relationship between the mothers' nutrient intake and the duration of crying in patients with IC. The diets of the mothers with and without colicky infants were also compared. All infants underwent a detailed physical examination by a pediatrician.

Statistical analyses

Statistical analyses were carried out using SPSS 16 for Windows (SPSS Inc., Chicago, IL). Compliance of data with the normal distribution was evaluated using the Kolmogorov–Smirnov test. Normally distributed continuous data were compared using the Student *t*-test. Categorical data were compared using the χ^2 test. Linear relationships between continuous variables were examined using Pearson's correlation analysis.

Results

The study enrolled 30 colicky infants and 29 non-colicky infants. For the infants with IC, the median time to the onset of complaints was 32.5 [interquartile range (IQR) 30–61.2] days, and the median maternal age was 30 (IQR 25–40) years. For the infants without colic, the median age was 32 (IQR 30–68) days and the median maternal age was 29 (IQR 25–39) years. Whereas 60% (18/30) of the colicky infants were girls and 40% (12/30) were boys, 45% (13/29) of the non-colicky infants were girls and 55% (19/29) were boys. There were no significant differences in demographic data between the groups. In the colicky infants, the median daily crying time was 240 (IQR 180–360) min.

We compared the consumption of meat products, dairy products, vegetables and fruits, cereals, legumes, fat, and sugars by the mothers of colicky and non-colicky infants. The mothers of non-colicky infants ate significantly more grapes (48% without colic, 20% with colic, $p=0.044$) and lemons (48% without colic, 20% with colic, $p=0.044$). There were no other significant differences in the maternal consumption of other food groups.

In the colicky infants, the crying time was moderately negatively correlated with the percentage of protein in the maternal diet ($R=-0.45$, $p=0.01$) and the presence of potatoes in the maternal diet ($R=-0.38$, $p=0.034$) and positively correlated with the maternal consumption of walnut ($R=0.38$, $p=0.034$), banana ($R=0.44$, $p=0.01$), docosahexaenoic acid (DHEA; $R=0.44$, $p=0.013$), arachidonic acid ($R=0.45$, $p=0.011$) and eicosapentaenoic acid (EPA; $R=0.45$, $p=0.012$) (Table 1).

Discussion

Variation in the nutrient content of breast milk is the result of changes in breast metabolism, placenta metabolism and the diet of pregnant women [8]. A comprehensive study reported that the duration of crying was reduced significantly in colicky infants with mothers on low-allergen diets that excluded cow's milk, eggs, peanuts, tree nuts, wheat, soy and fish [9], whereas another study reported that excluding dairy products, fish and eggs from the maternal diet did not reduce the symptoms in colicky infants [10]. A study that analyzed milk composition in breastfeeding mothers of colicky and non-colicky infants found no differences using protein electrophoresis or chromatographic lipid analysis, and the carbohydrate content was similar in both groups [11]. The maternal consumption of milk and dairy products were also similar between colicky and non-colicky infants in our study. One study reported that a protein-rich diet was one factor causing IC [4]. Conversely, we found a moderate negative correlation between a protein-rich maternal diet and crying time in colicky infants.

This study found that basic food groups in the maternal diet did not differ between colicky and non-colicky breastfeeding infants, including meat products, dairy products, vegetables and fruits, cereals, legumes, oils and sugars. Only grapes and lemons in the maternal diet were associated with decreased colic. There is not any study or information about maternal lemon consumption in IC in the literature.

A cross-sectional study reported that the maternal consumption of cruciferous vegetables, cow's milk and onions was associated with increased colic, while the consumption of chocolate and garlic had no effect [12]. Two different studies evaluated the effects of carbohydrate malabsorption on the symptoms of IC. The first study found that the consumption of apple juice increased symptoms in colicky infants more than the consumption of white grape juice due to poorly absorbed carbohydrates in apple juice [13]. The second study compared white grape juice with pear juice (equivalent to apple juice) and reported no difference in crying time in healthy infants [14]. Perhaps the reason for the absence of differences between the two fruit juices in the second study was that it enrolled non-colicky infants. In our study, we found that the maternal consumption of grapes and lemon was associated with decreased colic.

Starch can be divided into rapidly digestible, slowly digestible and resistant starch fractions. Resistant starch is

Table 1. The relationship between crying time of colicky infants and their maternal diet.

Nutrients	Crying time (min) mean \pm SD	Statistical analyses
Protein	205.45 \pm 30.77	$p=0.01$, $R=-0.45$
Potatoes	275.65 \pm 90.59	$p=0.034$, $R=-0.38$
Bananas	286.32 \pm 89.39	$p=0.01$, $R=0.44$
Walnuts	287 \pm 91.31	$p=0.034$, $R=0.38$
Eicosapentaenoic acid	315 \pm 105.15	$p=0.012$, $R=0.45$
DHEA	360 \pm 97.98	$p=0.013$, $R=0.44$
Arachidonic acid	360 \pm 97.98	$p=0.011$, $R=0.45$

SD, standard deviation.

classified as fiber, and native raw banana starch appears to be very resistant to hydrolysis, as up to 78% of ingested α -glucans from raw banana starch escaped digestion in the small intestine [15]. Potatoes contain resistant starch also, but the high resistance to enzymatic digestion of raw potato starch is completely lost on gelatinization. The digestibility in the gut is likely to be dependent on the proportion of gelatinized granules after cooking [16]. We found a moderate negative correlation between the maternal consumption of potatoes and the crying time of the colicky infants and a positive correlation with the consumption of banana. In our society that mothers consumed raw banana, on the other hand cooking the potatoes can explain these results.

According to our results, removing bananas from the maternal diet may reduce colic. In addition, the consumption of a protein-rich maternal diet, grapes, lemons and potatoes by breastfeeding mothers may protect infants from colic. Other nutrients such as cow's milk, dairy products and legumes were not associated with colic symptoms. The meaning of the positive correlations between crying time and maternal DHEA, EPA and walnut consumption in infantile colic is not clear.

As dietary therapies are low-risk interventions, these could be offered as an option to mothers who wish to try dietary manipulation in an attempt to alleviate colic symptoms. However, expert nutritional guidance should be sought, as very restricted maternal diets have the potential to be nutritionally inadequate [17].

This study was based on the hypothesis that the composition of the maternal diet affects the content of breast milk. A prospective study should examine the effect of removing various foods from the diets of breast-feeding mothers on the colic symptoms of their infants.

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Declaration of interest

The authors report no conflicts of interest.

References

1. Hyman PE, Milla PJ, Benninga MA, et al. Childhood functional gastrointestinal disorders: neonate/toddler. *Gastroenterology* 2006; 130:1519–26.
2. Lucassen PL, Assendelft WJ, van Eijk JT, et al. Systematic review of the occurrence of infantile colic in the community. *Arch Dis Child* 2001;84:398–403.
3. Clifford TJ, Campbell MK, Speechley KN, Gorodzinsky F. Infant colic: empirical evidence of the absence of an association with source of early infant nutrition. *Arch Pediatr Adolesc Med* 2002; 156:1123–8.
4. Mhaske S, Mhaske S, Badrinarayan S, et al. Role of protein rich maternal diet in infantile colic. *J Indian Med Assoc* 2012;110: 317–8.
5. Vandenplas Y, Gutierrez-Castrellon P, Velasco-Benitez C, et al. Practical algorithms for managing common gastrointestinal symptoms in infants. *Nutrition* 2013;29:184–94.
6. Evans RW, Fergusson DM, Allardyce RA, Taylor B. Maternal diet and infantile colic in breast-fed infants. *Lancet* 1981;1:1340–2.
7. Hill DJ, Hudson IL, Sheffield LJ, et al. A low allergen diet is a significant intervention in infantile colic: results of a community-based study. *J Allergy Clin Immunol* 1995;96:886–92.
8. Bobiński R, Mikulska M, Mojska H, et al. Pregnant women's diet composition and transitional milk fatty acids: factor analysis. *Ginekol Pol* 2015;86:113–18.
9. Hill DJ, Roy N, Heine RG, et al. Effect of a low-allergen maternal diet on colic among breastfed infants: a randomized, controlled trial. *Pediatrics* 2005;116:e709–15.
10. Oggero R, Garbo G, Savino F, Mostert M. Dietary modifications versus dicyclomine hydrochloride in the treatment of severe infantile colics. *Acta Paediatr* 1994;83:222–5.
11. Carranza-Lira S, Uribe-Medina A, Ogando-Suárez M. The effect of milk products consumption in mothers during breastfeeding. *Rev Med Inst Mex Seguro Soc* 2010;48:597–602.
12. Lust KD, Brown JE, Thomas W. Maternal intake of cruciferous vegetables and other foods and colic symptoms in exclusively breast-fed infants. *J Am Diet Assoc* 1996;96:46–8.
13. Duro D, Rising R, Cedillo M, Lifshitz F. Association between infantile colic and carbohydrate malabsorption from fruit juices in infancy. *Pediatrics* 2002;109:797–805.
14. Cole CR, Rising R, Lifshitz F. Consequences of incomplete carbohydrate absorption from fruit juice consumption in infants. *Arch Pediatr Adolesc Med* 1999;153:1098–102.
15. Zhang P, Hamaker BR. Banana starch structure and digestibility. *Carbohydr Polym* 2012;87:1552–8.
16. Noda T, Takigawa S, Matsuura-Endo C, et al. Factors affecting the digestibility of raw and gelatinized potato starches. *Food Chem* 2008;110:465–70.
17. Iacovou M, Ralston RA, Muir J, et al. Dietary management of infantile colic: a systematic review. *Matern Child Health J* 2012;16: 1319–31.