

Prevalence, Clinical Characteristics, and Risk Factors of Food Regurgitation in Infants Younger than 18 Months: A Population-Based Cross-Sectional Study in Tehran, Iran

Parichehr Tootoonchi*

Associate professor of pediatrics. Department of Pediatrics. Faculty of Medicine, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

***Corresponding author:** Parichehr Tootoonchi, Associate professor of pediatrics, Department of Pediatrics, Faculty of Medicine, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

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ABSTRACT

Background: Food Regurgitation (FR) is a physiologic process mostly happening in less than 2- year- old child in which the swallowed liquid or food moves from the stomach back into the mouth. The prevalence of FR is between 40-90% in infancy. This study has been designed to determine the prevalence, clinical manifestations and risk factors of Food regurgitation in less than 18 months infants in south Tehran, capital of Iran.

Materials & Methods: In this descriptive cross-sectional study, 5 health centers have been selected randomly in south Tehran, capital of Iran. From each health center 90 less than 18- month- old infants have been selected conveniently. Each mother has undergone an interview about the infant's characteristics and risk factors by trained personnel. The infant's characteristics included age, sex, the birth weight, gestational age, the maternal age, delivery type, birth order, the age for starting the supplemental food, the prominent milk type consumed in the first 6 months of life, family history of FR in the siblings, sleeping position or feeding position of the infant and existence of FR. Furthermore, in the involved babies the FR characteristics have asked the mothers contained, the daily frequency of FR, the daily time which FR mostly occur, volume and consistency of the food in FR, time of FR in relation to feeding, doing the burping process in the infant by the mother, the infant's age of FR onset or abate, the amount of food regurgitated in each time, and associated disease in the involved infant. The statistical software package SPSS for Windows: version 25 was used for data analyzing and Chi-square (χ^2) test for assessing significant statistical relation between FR and the infants' characteristics considered with the significance level ($p < 0.05$).

Results: The prevalence of FR was 76.5% (344 babies). Most of the cases (54%) were less than 6- month-old. 52% of the cases were males. The percent of cases with FR was higher in the babies with nonspecific sleeping position or feeding position on back and in babies on breast feeding; there was not significant statistical relation between FR and these characteristics. FR was very common among low birth weight or preterm infants (83% & 71% respectively). 100% of the cases with congenital or chronic disorders involved with FR. There was no significant statistical relation between FR and the infants' characteristics. The age of FR onset was mostly during the first week of life (70%) and FR abated mostly after 6 months of age (38%). In the involved infants, FR often happened all day long and mostly 1-2 times a day with low volume.

Conclusion: Though our findings are consistent with other studies' results, the percent of FR was almost high among our infants. Considering that our study results rely on the maternal recall, performing randomized prospective studies with support of Para-clinic tests for confirming the diagnosis are highly recommended for obtaining true prevalence, characteristics and risk factors of FR among the less than 18- month- old babies.

Keywords: Food Regurgitation; Infants; Prevalence; Risk Factor

Abbreviations: FR: Food Regurgitation; ACE: Angiotensin-Converting Enzyme; PPI: Proton Pump Inhibitors

Introduction

Food Regurgitation (FR) or spitting up is a process in which the swallowed liquid or food comes up from stomach into the mouth and mostly is a normal process in healthy infants [1], however, it is a worrisome medical symptom for the caregivers of infants especially if happens recurrently or associated with additional symptoms such as failure to thrive or respiratory manifestations. The clinical diagnosis is usually based on thorough history and physical examination [1-6]. Despite the benign nature of the event, the prevalence of FR has reported between 40- 90% in infancy [4,6]. Generally, FR is a self-limiting condition which decreases with age and resolves in most of the infants by 1 year of age. It is associated with normal thriving; therefore, its treatment is conservative [2-4, 7-9] mostly included re-assuring the parents that the event is a self-limited benign condition which does not need any additional testing or pharmacologic treatment. Nowadays, there is no drug for preventing FR in infants. In case non-physiologic regurgitation happens in infancy which includes infants with regurgitation and vomiting associated with failure to thrive, or respiratory symptoms such as wheezing or coughing, some references recommend Proton Pump Inhibitors (PPI) or H2 blockers administration [2,5].

Although, a long list of drugs cause gastro-esophageal regurgitation such as Tricyclic antidepressants, Calcium channel blockers, Beta blockers, Statins, Angiotensin-Converting Enzyme (ACE) inhibitors, Nitrates, Narcotics, Anticholinergics, Dopamine-like drugs (for Parkinson's disease), Bisphosphonates (for osteoporosis) and analgesics, these categories of drugs not prescribed routinely in infancy. As far as literature reviews are concerned, there was just one hospital- based study has been performed in 2008 in Tehran in a hospital, therefore, this study has been designed to assess the prevalence, clinical manifestations and risk factors of FR in infants to obtain an estimate of the condition in less than 18 months old infants population.

Material and Methods

A descriptive cross-sectional population-based study has been performed in south Tehran, capital of Iran in 450 less than 18-month-old infants to determine the prevalence, clinical manifestations and risk factors of FR by interviewing the mothers by trained personnel based on a structured questionnaire. Sample size was calculated by the following formula

$$z^2 \times P \times (1 - P) / d^2 = 1.96 \times 1.96 \times 0.5 \times 0.5 / 0.05 \times 0.05 = 400$$

First of all, 5 health centers have been selected randomly among 33 health centers in south Tehran. Then, 90 infants attended in each health center to perform health care, growth and development monitoring or vaccination has been selected conveniently. All the less than 18 months old infants who have been attended in each health center have been entered in the study till 90 infants of each center are included. There were no exclusion criteria. Each mother has undergone an interview about the infant's characteristics and risk factors by trained personnel.

The infant's characteristics included age, sex, the birth weight, gestational age, the maternal age, delivery type, the age for starting the supplemental food, the prominent milk type consumed in the first 6 months of life, family history of FR in the siblings, sleeping position in the infant, existence of FR, the daily frequency of FR, the daily time which FR mostly occur, feeding position of the infant, associated symptoms with FR, volume and consistency of the food in FR, time of FR in relation to feeding, doing the burping process in the infant by the mother, the infant's age of FR onset or abate, the amount of food regurgitated in each time, and associated disease in the involved infant. The study protocol was approved by the Ethics Committee of Islamic Azad University of Medical Sciences, Tehran branch, by a simple agreement in Feb 2020. SPSS (version 25) was used for data analysis. To compare the means, a T test was run. To compare categorical data, the Qui square or Fisher exact test was applied. P Value < 0.05 was considered statistically significant.

Results

450 less than 18- month- old infants in this study have been assessed. The prevalence of FR was 76.5% (344 babies). Age range of the involved infants included 186 cases (54%) and 158 cases (46%) in less than 6- month-old and 7-18- month-old respectively. The number of males was more than females (180, 52% versus 164, 48%). Overall, the frequency of FR among low birth weight or premature infants was 83% (10 out of 12 babies) or 71% (5 out of 7 babies) respectively (Table 1). There was no significant statistical relation between FR and infant's age, sex, birth weight or gestational age. Despite, the percent of FR in babies who were feeding with breast milk was more than the babies were feeding with other milks (including formula with or without breast milk) (75% versus 72%), no significant statistical relation was found between FR and type of feeding milk. Furthermore, there was no significant statistical relation between FR and following characteristics of the involved infants: type of delivery, birth order, positive history of FR in the infant's siblings, and the maternal age (Table 1). It is very interesting that the infant's burping has been done in almost all the cases with FR (341 babies, 96%) by the mother and FR has happened in 343 babies (99.7%). However, there was no significant statistical relation between FR and using the burping maneuver by the mothers (Table 2). By the mothers' report, regurgitation has occurred in the infants with semi sitting feeding position or non-specific sleeping position more than the others; however, no significant statistical relation was found between FR and feeding position or sleeping position of the cases (Table 1). Despite just 10 babies out of 450 babies (2.2%) had involved with a congenital or chronic disease (included Down syndrome in 2 cases, ASD in 3 cases, VSD in 1 case, Hirsh prong disease in 1 case, Tetralogy of Fallot in 1 case, and convulsion in 3 cases), all of them (100%) have involved with FR. According to FR characteristics, the age of FR onset was mostly during the first week of life (70%) and FR abated mostly after 6 month of age (38%).

Table 1: The frequency, percent and the p value for statistical significance relation of the infant's characteristics by food regurgitation in the studied infants.

Infant Characteristics	Food Regurgitation					Infant Characteristics	Food Regurgitation					
	Yes		No					Yes		No		
	N	%	N	%				P value	N	%	N	
Age					NS	Delivery type					NS	
<3 months	84	19	32	7		Vaginal	163	36	43	10		
3-6 months	102	23	20	4		Cesarian- section	181	40	63	14		
7-12 months	90	20	36	8								
13-18 months	68	15	18	4								
Sex					NS	Birth order					NS	
Male	180	40	62	14		1	243	53	84	19		
Female	164	36	44	10		=>2	101	23	22	5		
Sleeping position					NS	History of regurgitation in the siblings					NS	
Prone	43	10	15	3		Yes	65	14	18	4		
Supine	80	18	23	5		No	279	62	88	20		
Others	221	50	66	14								
Feeding position					NS	Feeding milk					NS	
Semi sitting	156	35	37	8		Breast milk	313	70	101	22		
Back position	188	41	69	16		Others	31	7	4	1		
Birth weight(gram)					NS	Age of starting supplemental food					NS	
<2500	10	2.5	2	0.5		<6 months	56	13	14	3		
=>2500	334	74	104	23		=> 6 months	138	30	42	10		
						Not yet	150	33	47	11		
Gestational age(weeks)					NS	Maternal age (year)					NS	
<37	5	1	2	0.5		<20	48	11	23	4.5		
=>37	339	75.5	104	23		20-35	288	64	81	18		
						>35	8	2	2	0.5		

Note: N: number, %: percent, NS: no significant

In the involved infants, FR often happened all day long and the average amount of regurgitation was little (less than 1 teaspoon each time) (Table 2). Almost all the cases regurgitated after feeding, the

consistency of food was milk curd (93%) and more than 50% of the infants usually spitted up 1-2 times a day (Table 2).

Table 2: The frequency and percent of the characteristics of food regurgitation in the involved babies.

Characteristics of Food Regurgitation			Characteristics of Food Regurgitation		
	Number	Percent		Number	Percent
Time of food regurgitation during day			The infant's age of Food regurgitation onset		
Morning	74	22	During the first week of life	244	70
Afternoon	46	14	1-4 weeks of life	100	30
Evening	28	8			
All day long	196	54	The average frequency of food regurgitation during the day		
The amount of food regurgitation in each time			1 time	66	19
Little	337	98	2 times	132	39
Moderate	7	2	3-4 times	98	28
Consistency of the food regurgitated			=>5 times	48	14
Milky	23	7	The infant's age at which Food regurgitation abates		
Milk Curd	321	93	<3 months	36	10
Time of regurgitation with regard to feeding			3-6 months	41	12
After Feeding	343	99.7	7-12 months	85	24
During feeding	1	0.3	13-18 months	46	14
Doing Burping in the infant by the mothers			Not yet	136	40
Yes	341	99	Associated disease in the involved infant		
No	3	1	Yes	10	3
			No	334	97

Discussion

In this cross-sectional study, the prevalence of FR was 76.5% in less than 18-month-old babies like the other studies [6,10-12]. More than 50% of the involved babies were less than 6 months old and FR frequency decreased after this age similar to the results of other studies [4,6,10-20]. Furthermore, similar to the results of other articles [6,12], there was no difference between males' or females' cases with regard to FR frequency. Regarding FR times, almost 60% of our babies regurgitated 1-2 times a day, like other studies' reports [6,11,13,14,19,20]. Most of our babies (162 cases, 46%) stopped regurgitation till one year of age according to the mothers' report, such as other reports [3,4,7,9,19,20]. Despite the peak age for FR in this study being in the first month of life, like some of the other research [4,11,14,19,20], other studies mentioned [3,10,13,15,18] the peak age of FR after one month of age. It sounds like the population genetics, feeding practice, the milk type or geographical location of the

babies might explain this discrepancy. Although some articles express that the common etiologies of FR are overfeeding or air swallowed during feeding [2], it sounds the true causes for FR are immature anatomy and motility include short esophagus, low pressure of lower esophageal sphincter, delayed swallow-peristalsis reflexes, and limited gastric accommodation which make FR more frequent in early infancy [18].

As in other articles [6,13-15], no significant statistical relation was found between FR and breastfeeding. Therefore, performing large scale studies with randomized sampling is highly recommended, as more than 90% of the infants in this study have consumed breast milk. Although some of the references reported that prematurity is a risk factor for FR [5,18], as far as we searched the literature, no research has been done to assess the relation between birth weight or gestational age and FR. It is noteworthy that despite no significant statistical relations found in this study, the number of low

birth weight or preterm babies was few in our sample; therefore, the confirmation of these results needs to be evaluated in studies with high numbers of premature or low birth weight babies. In most of our cases (40%), despite consuming supplemental traditional foods, FR still continued, therefore, in contrast to the findings of other authors [2,21-24], consuming these types of foods have not shown significant statistical relation with FR frequency in our study. Moreover, we found that back position for feeding and non-specific position for sleeping was more common in our involved babies with FR, however, none of them has shown significant relation with FR; Moreover, with regard to this subject the findings of other reports are controversial [14, 24, 25]. For assessing the effect of feeding or sleeping position of the babies on FR, performing prospective studies is recommended as confirming the relationship needs a lot of babies in different positions of feeding or sleeping. Besides, though burping maneuver has been performed by most of the cases' mothers (99%), according to our statistical test, it hasn't shown any effect on FR frequency.

It is interesting that the only article which studied burping effect on FR has shown that performing this maneuver has increased the FR frequency [26]. Nevertheless, the method and time as well as frequency of applying burping maneuver by the mothers should be asked in detail in future studies in order to confirm the relation, if there is any. Birth order, delivery type, positive history of FR or maternal age of the cases hasn't shown significant relation with FR. According to our knowledge, none of the above variables has been assessed in the other research to determine their statistical relation with FR. Moreover, unfortunately, as far as our knowledge is concerned, there was no report of the frequency of FR among babies with congenital disorders in the literature; therefore, we were not able to compare this finding with other reports results'.

Conclusion

In this study, the findings are consistent with the results of other studies regarding the prevalence and risk factors of FR. Because of the high prevalence of FR in this study, it sounds clinical diagnosis of the physiologic FR is very important for preventing repeated attendance to pediatrician clinics, performing additional time-consuming diagnostic tests or taking inappropriate pharmacological treatments for a benign self-limited physiologic condition. Nevertheless, the findings are based on the mothers' recall which might be a pitfall of the study. Furthermore, one of our drawbacks was the sampling method because of the limited resources. Moreover, FR in this study hasn't been confirmed by any Para-clinic tests; therefore, the prevalence of FR might be an overestimate figure. Regarding limited access to financial and human resources as well as medical equipments, designing and performing randomized perspective studies and using a valid and reliable questionnaire for collecting data about FR characteristics and risk factors is highly recommended in the future large-scale studies in order to obtain the true prevalence, risk factors and characteristics of FR in less than 18-month-old babies.

Patient Consent for Publication

Written informed consent for interviewing infants' mothers and publication of the babies' data, without any potential identifying information, was provided by the mothers of the infants.

Conflicts of Interest

The author declares no conflict of interest.

References

1. Bora G, Kovacic K (2023) Food regurgitation, In: Nelson Pediatric symptom-based diagnosis. 2nd ed. Elsevier publication 265.
2. Indrio F, Riezzo G, Raimondi F, Francesco Raimondi, Luciano Cavallo (2009) Regurgitation in healthy and non-healthy infants. *Ital J Pediatr* 35: 39.
3. Baird DC, Harker DJ, Karmes AS (2015) Diagnosis and treatment of gastroesophageal reflux in infants and children. *Am Fam Physician* 92(8): 705-717.
4. Antono B, Dotson A (2025) Gastroesophageal reflux in infants and children: Diagnosis and treatment. *Am Fam Physician* 111(1): 62-72.
5. Rosen R, Vandenplas Y, Singendonk M, Cabana M, Carlo D, et al. (2018) Pediatric gastroesophageal reflux clinical practice. *JPGN* 66(3): 516-554.
6. Hegar B, Boediarso A, Firmansyah A, Yvan V (2004) Investigation of regurgitation and other symptoms of gastroesophageal reflux in Indonesian infants. *World J Gastroenterol* 10(12): 1795-1797.
7. Czinn SJ, Blanchard S (2013) Gastroesophageal reflux disease in neonates and infants: when and how to treat. *Paediatr Drugs* 15(1): 19-27.
8. Poddar U (2019) Gastroesophageal reflux disease (GERD) in children. *Paediatr Int Child Health* 39(1): 7-12.
9. Singendonk M, Goudswaard E, Langendam M, Michiel VW, Etten Jamaludin FV, et al. (2019) Prevalence of gastroesophageal reflux disease symptoms in infants and children: A systematic review. *J Pediatr Gastroenterol Nutr* 68(6): 811-817.
10. Nelson SP, Chen EH, Syniar GM, Christoffel KK (1997) Pediatric practice research group. Prevalence of symptoms of gastroesophageal reflux during infancy. A pediatric practice-based survey. *Arch Pediatr Adolesc Med* 151(6): 569-572.
11. Hegar B, Hindra ID, Satari DR, Y Vandenplas (2013) Regurgitation and gastroesophageal reflux disease in six to nine months old Indonesian infants. *Pediatr Gastroenterol Hepatol Nutr* 16(4): 240-247.
12. Campanozzi A, Boccia G, Pensabene L, Panetta F, Marsegli A (2009) Prevalence and natural history of gastroesophageal reflux: pediatric prospective survey. *Pediatrics* 123(3): 779-783.
13. Osatakul S, Sriplung H, Puetpaiboon A, Cha OJ, Chamnongpakdi S (2002) Prevalence and natural course of gastroesophageal reflux symptoms: a 1-year cohort study in Thai infants. *J Pediatr Gastroenterol Nutr* 34(1): 63-67.
14. Miyazawa R, Tomomasa T, Kaneko H, Atsushi Tachibana, Tetsushi Ogawa et al. (2002) Prevalence of gastro-esophageal reflux-related symptoms in Japanese infants. *Pediatr Int* 44(5): 513-6.
15. Hegar B, Dewanti NR, Kadim M, Alatas S, Firmansyah A, et al. (2009) Natural evolution of regurgitation in healthy infants. *Acta Paediatr* 98: 1189-1193.

16. Leung AK, Hon KL (2019) Gastroesophageal reflux in children: an updated review. *Drugs Context* 8: 212591.
17. Van Howe RS, Storms MR (2010) Gastroesophageal reflux symptoms in infants in a rural population: longitudinal data over the first six months. *BMC Pediatr* 10: 7.
18. Pottorff A, Ortigoza EB, Sanghavi R, Alejandro LC (2026) Physiology of gastroesophageal reflux in the neonate. *Semin Perinatol* 50(2): 152130.
19. Curien CM, Jantchou P (2020) Natural history of gastroesophageal reflux in infancy: new data from a prospective cohort. *BMC Pediatr* 20(1): 152.
20. Hegar B, Boediarso A, Firmansyah A, Yvan V (2004) Investigation of regurgitation and other symptoms of gastroesophageal reflux in Indonesian infants. *World J Gastroenterol* 10(12): 1795-1797.
21. Horvath A, Dziechciarz P, Szajewska H (2008) The effect of thickened-feed interventions on gastroesophageal reflux in infants: systematic review and meta-analysis of randomized, controlled trials. *Pediatrics* 122(6): e1268-77.
22. Duncan DR, Larson K, Rosen RL (2019) Clinical aspects of thickeners for pediatric gastroesophageal reflux and oropharyngeal dysphagia. *Curr Gastroenterol Rep* 21(7): 30.
23. Salvatore S, Savino F, Singendonk M, Tabbers M, Benninga MA, et al. (2018) Thickened infant formula: What to know. *Nutrition* 49: 51-56.
24. Rybak A, Pesce M, Thapar N, Osvaldo Borrelli (2017) Gastro-esophageal reflux in children. *Int J Mol Sci* 18(8): 1671.
25. Vandenplas Y, De Schepper J, Verheyden S, T Devreker, J Franckx, et al. (2010) A preliminary report on the efficacy of the multicare ar-bed in 3-week-3-months old infants on regurgitation, associated symptoms and acid reflux. *Arch Dis Child* 95(1): 26-30.
26. Kaur R, Bharti B, Saini SK (2015) A randomized controlled trial of burping for the prevention of colic and regurgitation in healthy infants. *Child Care Health Dev* 41(1): 52-56.

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Parichehr Tootoonchi . Biomed J Sci & Tech Res



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