

Relationship between bottle feeding in supine position in infants and the presence of asthma among preschoolers

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Abstract

Background Asthma is a common chronic respiratory disease. The risk factors of asthma are allergic factors, familial atopy, race, gender, and smoking during pregnancy. Other risk factors are gastroesophageal reflux and micro-aspiration which cause bronchospasm and bronchial hyperreactivity due to repeated airway irritation.

Objective To determine the association between bottle feeding given in supine position before sleep time in the first year of life with asthma in 4 to 7 years old.

Methods A case control study was conducted on pediatric patients from Sardjito Hospital and Muhammadiyah kindergarten, Yogyakarta. Two structured questionnaires were used; the first identified the case group (asthma) and control group (non-asthma), whereas the second one identified whether the subjects had bottle feeding in supine position in the first year of life or not.

Results 122 subjects were studied, 62 subjects in asthma group and 60 in control group. In asthma group, feeding in supine position before sleep time in the first year had OR of 2.45 (95% CI 1.21 to 6.93), whereas regurgitation when bottle-feeding in supine position had OR of 4.53 (95% CI 1.54 to 13.16). Sudden cry when bottle-feeding in supine position had OR of 5.02 (95% CI 1.69 to 15.71). Asthma in the family increased risk of asthma [OR 3.12 (95% CI 1.16 to 6.50)] and atopic family has OR 3.25 (95% CI 1.01 to 6.27).

Conclusion Bottle feeding in supine position before sleep time during first year of life is associated with occurrence of asthma in preschool children. [Paediatr Indones. 2009;49:182-5].

Keywords: asthma, micro-aspiration, bottle feeding, supine position, preschool

The habit of bottle feeding in supine position before sleeping time in the first year of life has been obviously seen in the community and is predicted to be associated with the occurrence of asthma in preschoolers.¹ Asthma is defined as repeated wheezing or persistent coughs with the following characteristics: it occurs periodically, nocturnal, or after physical activities, and has family history of asthma or other atopic diseases.² Many studies on the risk factors of asthma were reported; one of the risk factors has been gastroesophageal reflux (GER).^{3,4} Data from National Center for Health Statistic (NCHS) showed that the prevalence of asthma in the United States increased to about 75% and mostly occur in children over five years old. However, in Indonesia, the prevalence of asthma in children at the age of 6-12 years old from the total population is 4.8%. Meanwhile, the prevalence of GER related to asthma is estimated to be about 34-89%.⁵

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Previous study¹ shows that the risk of repeated wheezing and asthma in children at the age of five had significantly increased as reports regarding bottle feeding in supine position in bed or baby box before sleep time in the first year of life also increased. Children of 1 to 5 years old who were bottle-fed in supine position before sleep time, had risk of wheezing 1.5 times higher than those who were not. Bottle feeding given in supine position can cause micro-aspiration and GER, thus causing respiratory irritation leading to bronchospasm and wheezing. We aimed to find out the correlation between the administration of bottle feeding in supine position before sleeping time in the first year of life with the presence of asthma in preschoolers (4 to 7 years old).

Methods

A case-control study was conducted on patients who were registered in Pediatric Respiratory Division, Emergency Unit of Sardjito Hospital and Muhammadiyah Kindergarten in Yogyakarta. The first step was to identify the asthma group, and then retrospectively searched the history of supine bottle feeding in the first year of life. A validated questionnaire was used to determine asthma and non-asthma group. The inclusion criteria for case group were children of preschool age (4 to 7 years old) whose parents signed informed consents, stated that their child had been diagnosed or had asthma, and agreed to fill in the questionnaires. The exclusion criteria were children with any of these conditions: anatomic disorders that influence the respiratory function, respiratory airway disorders, and did not get bottle milk until one year old. In the control group, there were non-asthmatic children of preschool age (4 to 7 years old) who were registered in the Pediatric Respiratory or Emergency Unit of Sardjito Hospital whose parents signed informed consents and willing to fill in the questionnaires. The exclusion criteria for the control group was children who did not use bottle milk until one year old.

The sample size was calculated using hypothesis test pattern on two population with $\alpha = 0.05$ and power of 80%. The subjects of case group were 62 and control group were 60. Analysis was done by calculating odds ratio with its confidence interval.

P value of less than 0.05 was considered statistically significant. Multivariate analysis was performed using logistic regression analysis.

Results

One hundred and twenty-two subjects were eligible for the study; 62 subjects of case group and 60 subjects of control group. Sixty-five out of 122 subjects were male, and 59 subjects (48 %) were five years old. Basic characteristics of the subjects are shown in **Table 1**. The data concerning the bottle feeding in supine position was found in 68 children (55.7%).

Table 1. Basic characteristics of the subjects

Characteristic	Case n=62	Control n=60
Sex		
male (%)	28 (45)	37 (62)
female (%)	34 (55)	23 (38)
Age		
≤ 5 years (%)	34 (55)	31 (52)
> 5 years (%)	28 (45)	29 (48)
mean (SD)	5.44 (SD 0.77)	5.5 (SD 0.62)
Smoking mother during pregnancy		
yes (%)	4 (7)	3 (5)
no (%)	58 (93)	57 (95)
Low birth weight		
yes (%)	11 (18)	8 (13)
no (%)	51 (82)	52 (87)
House was surrounding by smoke		
yes (%)	12 (20)	10 (17)
no (%)	50 (80)	50 (83)
Allergic family		
yes (%)	43 (69)	16 (27)
no (%)	19 (31)	44 (73)
Asthma family		
yes (%)	54 (87)	25 (32)
no (%)	8 (13)	35 (58)
Bottled feeding in supine position		
- yes (%)	40 (64)	28 (47)
- no (%)	22 (36)	32 (53)

Bottle feeding in supine position in the first year of life significantly increased risk of asthma [multivariate OR 2.20 (95% CI 1.21 to 6.93)]. Subjects with family history of allergy had 3.25 times risk of getting asthma compared to those without family history of allergy [multivariate OR 3.25 (95% CI 1.01 to 6.27)]. Family history of asthma was the risk factors of asthma [multivariate OR 3.12 (95% CI 1.16 to 6.50)] (**Table 2**).

Table 2. Risk factors of asthma

Variables	Univariate OR (95 % CI)	Multivariate OR (95% CI)
Bottle feeding in supine position		
no	1	1
yes	2.2 (1.06 to 4.57)	2.45 (1.21 to 6.93)
History of allergy in family		
no	1	1
yes	3.16 (1.14 to 8.73)	3.25 (1.01 to 6.27)
History if asthma in family		
no	1	1
yes	3.0 (1.07 to 8.40)	3.12 (1.16 to 6.50)

Bottle feeding in supine position up to three times a day occurred in 35 subjects (51%), whereas more than three times a day occurred in 33 subjects (49%). Bottle feeding up to 15 times a month occurred in 16 subjects (24%), while more than 15 times a month occurred in 52 subjects (76%).

Regurgitation was found in 60% subjects who had bottle-feeding in supine position. Subjects who had bottle-feeding in supine position and had regurgitation would eventually have an increased risk of getting asthma [multivariate OR 4.53 (95% CI 1.53 to 13.16)]. Sudden cry in supine position was found in 40% subjects who had bottle-feeding. Subjects who experienced sudden cry had risk of asthma five times higher compared to those who did not [multivariate OR 5.02 (95%CI 1.69 to 15.71)] (Table 3).

Table 3. Risk factors of asthma in subjects who were bottle-fed in supine position

Variables	Univariate OR (95% CI)	Multivariate OR (95% CI)
Subjects who had regurgitation		
no	1	1
yes	4.63(1.63 to 13.15)	4.53(1.53 to 13.16)
Subjects with sudden cry		
no	1	1
yes	5.62(1.78 to 17.76)	5.02(1.69 to 15.71)

Discussion

Basic mechanism of risk factor of asthma in this study was gastroesophageal reflux (GER) is which

defined as a reflux of flunk in respiratory system which can create a serious problem of asthma in children and becomes one of the causes of nocturnal asthma. Distal esophageal dysfunction causes regurgitation, a condition of effortless moving of flunk from gastric to the esophagus and mouth.⁵ Three mechanisms in which GER can cause asthma are: vagal reflex, high reactivity of bronchus and micro-aspiration of flunk acid as the result of bronchoconstriction. Bronchoconstriction which is caused by GER is stimulated by vagal reflex after gastric distension or after acid infusion from esophagus. Bronchoconstriction enables the occurrence of acid micro-aspiration from gastric to trachea.⁶ The presence of GER and micro-aspiration in the beginning of children’s life may cause chronic inflammation of respiratory system, repeatedly bronchoconstriction and respiratory remodeling.³

Similar to the prevalence data which states that asthma often happens to children at age of 5 to 6 years old, in this research, asthma mostly occurred in children at 5 years old. Out of all subjects, 59 (48%) children showed clinical asthma at 5 years of age, whereas 48 (36%) children at 6 years of age, 6 (5 %) children at 4 years old, and 11 (9%) children showed clinical asthma at 7 years old. Berhman (1992) stated that 80-90 % of first asthma case was found in under-five year old children. Based on CDC data in 1998, the prevalence of asthma in 7 year old children was about 11-20%.

The risk factors of asthma in this study were in accordance with the explanation that genetic factor is one of the risk factor of asthma, which is shown by excessive concentrations of IgE. This case is often found in a family related to the genetic inheritance, an autosomal transmission of atopy.⁷ Asthma is a “complex genetic disorder” which is influenced by many genetic factors; therefore it does not follow the model of Mendelian inheritance. The ADAM-33 (a disintegrin and metalloprotease -33) gen was recently found in 2002 and related to the hyperactivity of bronchus and airway remodeling.⁸

In this study, the administration of bottle feeding in supine position has a big contribution to asthma in children with OR 2.45 (95% CI 1.21 to 6.93). However, the risk of asthma caused by bottle feeding is not influenced by the frequency of bottle feeding daily or monthly (dose response). Generally, the

administration of bottle feeding in supine position increases the risk of asthma in children at the age of 4 to 7 years old. Moreover, the risk of asthma in children who were bottle-fed in supine position was 2.5 times higher than that in children who were not.

Regurgitation during bottle feeding in supine position was 4.5 times higher in causing asthma with OR 4.53 (95% CI 1.53 to 13.16). Regurgitation which usually occurs at the age of 12 to 18 months old is a manifestation of GER as a result of reflux from gastric to esophagus. In children under 12 to 18 month of age, the lower esophageal sphincter (LES) does not work maximally. Therefore, all food and milk in the flunk can easily turn back to esophagus (reflux) and continue to mouth. The function of LES will become better along the increasing of age. In children at the age of more than 18 month, the function of LES usually works maximally, and the symptoms of GER will disappear.⁹⁻¹⁰

Sudden cry in children during bottle-feeding in supine position increased risk of asthma 5.02 times. The clinical manifestations of GER in most children were heartburn 77%, regurgitation 55% and difficulty of swallowing 24%. The symptom of sudden cry in children is the manifestation of heartburn as a result of high acid contain of flunk secretion that causes the burning feeling on the soft net of esophagus behind the sternum.¹¹

The final result of this study showed that supine bottle feeding in children during the first year of life was predicted to be associated with the occurrence of asthma in children. It was caused by bronchospasm which is due to repeated irritation on respiratory system as the result of GER and micro-aspiration during bottle feeding in supine position. Eventhough the micro-aspiration was not always the mechanism of GER, its role in asthma case is important to be considered.

This study used questionnaires which should be filled by the parents, which may produce a recall bias. To decrease the bias information in this research, the questionnaires contained understandable, short and simple questions, so that the respondents could understand the questions and answer them correctly. In conclusion, bottle feeding in supine position before

sleep time in the first year of life is predicted to be associated with the occurrence of asthma among preschoolers (4 to 7 years old).

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