

**A REVIEW:
THE RISK OF IRON DEFICIENCY WITHIN INFANTS WHO ARE EXCLUSIVELY BREAST FED
FOR THE FIRST SIX MONTHS: CASES IN DEVELOPED COUNTRIES**

Rifana Cholidah

Faculty of Medicine, Mataram University

Abstract

This review aims to discuss about the risk of iron deficiency within infants who are exclusively breast fed for the first six months after birth, especially in developed countries. It is well documented that iron deficiency is one of the most common nutritional disease among babies and young children. This commonly occurs during an increased need of iron supply particularly in the first period of life. The WHO and many health authorities recommend to exclusively breast fed babies for the first six months of their life for the best achievement on growth, health and development, and no adverse outcome on growth have been reported for breastfeeding babies exclusively for six months. However, a lower level of iron has been identified in some developing country settings. There have been few studies specifically to examine the relationship between infants who are exclusively breast fed for the first six months after birth and the prevalence of iron deficiency in developed countries. Based on the evidence, there are several factors may affect iron stores depletion of babies and toddlers such as dietary intake, socioeconomic, low iron concentration of weaning foods, cow's milk consumption and prolonged duration of breastfeeding. Most studies that have been carried out have concluded that there is little risk of iron deficiency and iron deficiency anaemia in infants who are exclusively breast fed for the first six months after birth. It seems that only infants with unusual low iron stores at birth are at risk of deficiency if breast fed exclusively for six months.

Introduction

Iron deficiency (ID) is the most common nutritional disorder among infants and young children in both developed and developing country, particularly in the period of rapid growth during the first year of life, due to a high demand for iron supply for the synthesis of blood, muscle, and other tissues. In addition, Iron deficiency is a common contributor to many cases in anaemia, although some other factors may result in anaemia. Oti-Boateng et al (1998) shows that an estimated more than 25% infants and young children aged 6-24 months in developing countries and around 3% infants in industrialised countries have iron deficiency anaemia (IDA) ^{1,2,4,10,11}.

Recommendations about breast feeding

The WHO has recommended for mothers to exclusively breastfeed infants for the first six months of their life for the best optimum growth, development and health. Further, the latest WHO systemic review's findings advise to breastfeed infants exclusively for six months with only breast milk, without other complementary foods or liquids. This has numerous benefits compared to the 3-4 months exclusive breastfeeding followed by mixed breast feeding. No detrimental outcomes on growth have been reported for breastfeeding babies exclusively for six month. However, a lower level of iron has been identified in some developing country settings ¹⁶.

Many health authorities suggest to exclusively breastfeed infants for 4-6 months,

a consideration to prevent the progress of iron deficiency anaemia in healthy full-term infants ⁴.

Prevalence of iron deficiency in breast fed babies

In some western countries, researchers identified that prolonged breastfed infants and infants who have early introduction or high consumption of cow's milk have a higher risk of iron deficiency among babies and young children in countries such as Australia, Canada and the United Kingdom. Grant et al (2007) notes that iron deficiency have been identified to be prevalent in New Zealand young children and it varies with ethnicity, however, not with social deprivation ⁴.

Vendt (2008) carried out a study to investigate the prevalence of iron deficiency and iron deficiency anaemia in infants aged 9-12 months in Estonia. In the first study of three series of research experiments, there were 171 babies involved in this epidemiological study, thirty six infants (21%) were exclusively breast-fed until six months. Researcher used the iron deficiency criteria with infants who had serum ferritin <12 µg/L and mean corpuscular volume (MCV) < 74fL, and iron deficiency anaemia criteria with serum ferritin <12 µg/L, MCV < 74fL and haemoglobin (Hb) <105 g/L. The author found that infants who were exclusively breast-fed up to six months had lower mean of haemoglobin (113 g/L) and serum ferritin (19 µg/L) compared to those exclusively breast-fed until three months who had Hb 117 g/L and serum ferritin 28 µg/L. In spite of having lower concentration of haemoglobin and serum ferritin, none of the infants exclusively breast-fed up to 6 months were

identified as iron deficiency and iron deficiency anaemia ¹⁴.

A similar finding was demonstrated by Duncan et al (1985) who conducted a study in Arizona, USA, examining iron status on infants who were exclusively breast-fed from birth up to the first six months of life. From this study, among thirty three healthy full-term babies who were exclusively breast fed, without any supplemental formula, solid foods, vitamins, and minerals, none developed iron deficiency anaemia though two of 33 infants (7%) indicated iron stores depletion by the indicator of low serum ferritin levels. This data demonstrated that babies exclusively breast fed for the first six months of life are not at increased risk of the iron deficiency anaemia or iron depletion during that time ⁵.

Another study about iron deficiency in exclusively breast-fed infants was carried out by Siimes et al (1984) in Helsinki, Finland. Thirty-six young children who were exclusively breast fed, were studied for nine months. The author used the control group of thirty-two babies who were fully weaned earlier to 3 ½ months. The exclusively breast fed babies received no iron supplementation, while the control group received iron supplementation in formula and wheat cereal ¹².

The data showed that most of infants breast fed exclusively were able to preserve their iron stores at similar levels to that of control infants receiving iron supplements. Also, breast fed infants had a higher mean concentration of haemoglobin compared to control babies at age four and six months. None of the exclusively breast fed infants

had anaemia or iron deficiency prior to age six months ¹².

In the study of iron status and iron intake in Adelaide, Australia by Oti-Boateng et al (1998) involving 234 babies and toddlers aged 6 to 24 months, thirty four per cent of babies were exclusively breast fed until six months. Some of the findings, iron sufficiency (IS) was more frequent in infants who were breast-fed for ≤ 4 months compared to babies breast-fed more than 4 months, also Asian infants had a higher iron sufficiency (72%) than Caucasian babies (69%), but this difference of iron sufficiency between these two different ethnic groups was not significant statistically ¹¹.

Factors associated with iron deficiency in breast fed babies

Grant et al (2003) points out that several factors such as dietary intake, socio-economic and demographic factor have been associated with iron deficiency in young urban children living in developed countries. Further, the relationship between these aspects and iron deficiency differs between countries and between several population groups in the same country. Some published studies from the United Kingdom and Australia highlight the relationship of iron deficiency and the consumption of cow's milk, lower intake of red meat and the use of weaning foods low in iron among infants in those countries ^{7,9,10}.

Several factors may affect the iron stores of newborn, including maternal iron status before and during pregnancy, the amount of blood transferred from placenta to foetus after giving birth before the umbilical cord is

clamped, and gestational age as preterm babies have a lower iron stores ^{1,4}.

Bioavailable iron is present in breast milk, and the healthy, term infants with normal birth weight have sufficient iron stores to maintain their growth requirement during the first six months of life, and after this age the needs of total body iron is higher ^{1,2,4}.

The WHO (2001) identifies that based on the evidence from the study in Honduras which indicated the poorer iron status in infants exclusively breast fed for 6 months than 4 months followed by partial breastfeeding to 6 months, due to the evidence come from the populations in which maternal iron status and infant endogenous stores are not optimal ¹⁵.

Oti-Boateng et al (1998) identified that cow's milk consumption, age and duration of breastfeeding showed a significant effect on iron stores depletion. This finding is in line with evidence in the United Kingdom which was demonstrated by Mills (1990). However, authors have not described in more detail whether babies who are breast fed exclusively up to six months were in the risk of iron deficiency or had significant iron depletion. Both studies indicated that several factors may affect iron deficiency and iron status among infants and toddlers including ethnic group, age of the infants, duration of breast feeding and the consumption of cow's milk ^{9,11}.

Iron status of babies and young children in developed countries remain a concern. However, iron deficiency anaemia, which has long-term impact on delayed psychomotor and cognitive function, was relatively rare ¹¹.

A study was carried out by Innis et al (1997) in Vancouver, Canada. The authors

examined the prevalence of iron deficiency anaemia and depleted iron stores among 434 of healthy babies aged 9 months in Vancouver in relation with their feeding practice and family background. Researcher collected the information of infant feeding practices using qualitatively dietary questionnaire which assessed by a nutritionist⁸.

The data shows that iron deficiency anaemia was more common among babies who were breast fed for more than 3 months than those breast fed < 3 months⁸.

The prevalence of iron deficiency anaemia among healthy, nine-month-old babies in this study was around 15 %. Interestingly, the prevalence of iron deficiency anaemia was higher in babies from middle class family as well as in Caucasian than Oriental or Asian babies. Also, the infants identified at a higher risk when those infants were breast fed at the time of study as it has been known that infants accept a sufficient iron from breast milk for the first four to six months after birth and this study was carried while the babies aged nine months old⁸.

Breastfed infants over 6 month are in higher risk of iron deficiency unless adequate additional sources of dietary iron are given⁸.

Soh et al (2004) carried out the study in South Island, New Zealand. The author found that the presence of suboptimal iron status was around 29% among young New Zealand children and babies. Infants and children with marginal iron status are at increased risk of developing severe iron deficiency if exposed to a physiological

challenge. However, the case of severe iron deficiency is rare¹³.

In the study by Grant et al (2007) in Auckland, New Zealand, 324 infants aged 6 to 23 months were observed. Researchers examined the prevalence of iron deficiency in young children in Auckland, and also identified factors which associated with iron deficiency. Participants were mainly breastfed (87%). Around 78% babies started solid foods before age 6 months, with 68 babies (20%) began in the first 3 months. In other word, it was only around 20% infants in this study who were exclusively breast fed up to six months after birth⁶.

The prevalence of iron deficiency in this study was 14%. The author found that receiving breast milk after age 6 months was associated with a greater risk of iron deficiency than children who have stopped breastfeeding at a younger age. However, authors have not clearly assessed the prevalence of iron deficiency anaemia among exclusively breast fed babies for the first six months after birth. It was identified that the major risk factors for iron deficiency were nutritional. Milk feeding was the greatest determinant with all three main variations; breast, infant formula and cow's milk being related with the risk of iron deficiency⁶.

Conclusion

In conclusion, there have been few studies specifically to investigate the relationship between infants who are exclusively breast fed for the first six months after birth and the prevalence of iron deficiency in developed countries.

Most studies that have been carried out have concluded that there is little risk of iron

deficiency and iron deficiency anaemia in infants who are exclusively breast fed for first six months of life. It seems that only infants with unusually low iron stores at birth are at risk of deficiency if breast fed exclusively for six months.

There are some circumstances which increase the risk of low iron stores and these are: maternal iron status before and during pregnancy, prematurity and loss of excessive blood in cutting the cord at birth. For this reason some researchers have suggested that iron supplementation at birth may be of

benefit to babies with low iron stores. For example, Dewey et al (2002) suggests that routine iron supplementation of breast fed babies may bring benefits to infants with low haemoglobin concentration, but may cause the risks for infants with normal haemoglobin³.

The finding that there is low risk of iron deficiency in this group of infants is in line with World Health Organisation recommendations to breast feed exclusively for the first six months of life.

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