



Brief report

Earlier appearance of the ossification center of the femoral head in breast-fed versus formula-fed infants

Filippo Narese M.D.^{a,b}, Giuseppe Puccio M.D.^{c,*}, Walter Mazzucco M.D.^d, Alessandro Falzone M.D.^e, Valeria Venturella M.D.^a, Donatella Narese^f, Emilio Capra M.D.^g

^aSezione di Scienze Radiologiche, D.I.BI.M.E.L., Policlinico "P. Giaccone", Palermo, Italy

^bCasa di Cura "Regina Pacis", San Cataldo, Caltanissetta, Italy

^cDipartimento Materno Infantile, Università di Palermo, Palermo, Italy

^dDipartimento delle Scienze per la Promozione della Salute Università di Palermo, Palermo, Italy

^eU.O. di Radiologia, Presidio Ospedaliero "S. Elia", Azienda Sanitaria Provinciale di Caltanissetta, Caltanissetta, Italy

^fFacoltà di Medicina e Chirurgia, Università di Palermo, Palermo, Italy

^gU.O. di Pediatria, Presidio Ospedaliero "S. Elia", Azienda Sanitaria Provinciale di Caltanissetta, Caltanissetta, Italy

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ABSTRACT

Objective: The aim of this study was to evaluate possible differences in the rate of appearance of the femoral head ossification center (FHOC) in infants according to the type of feeding (exclusive breast-feeding, formula, mixed feeding).

Methods: A retrospective study was conducted in a population of 285 healthy infants who consecutively underwent echographic evaluation of the hip as a screening for hip dysplasia from April 1 through October 31, 2008. For each infant, type of feeding, sex, gestational age, weight at birth, and age at the time of echographic examination were recorded. Data analysis was performed in the entire sample population and in a subpopulation of 143 infants after exclusion of preterm or low-birth-weight infants and those who underwent echographic examination outside the scheduled age range. Data were analyzed by chi-square test, Kruskal–Wallis test, and multiple logistic regression analysis.

Results: An FHOC was present in 48.3% of breast-fed infants, 25.7% of formula-fed infants, and 28% of the mixed feeding group ($P = 0.001$). In multiple logistic regression analysis, the best regression model included the following variables: age at test ($P = 2.23 \times 10^{-7}$), gestational age ($P = 0.0017$), and exclusive breast-feeding ($P = 0.0003$). Similar results were obtained in the selected subpopulation of 143 infants (FHOC in 54.2% of breast-fed group, 28.2% of formula-fed group, and 33.3% of mixed-feeding group, $P = 0.01$).

Conclusion: Exclusive breast-feeding may be associated to an earlier appearance of FHOC in a population of normal infants compared with formula feeding.

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Introduction

Breast milk is considered the gold standard in infant feeding: it is species-specific and it is believed to ensure ideal nutritional support to newborns and infants in the first months of life. Although artificial formulas have been improved to be more similar to breast milk, it is generally assumed that breast-feeding has many known and unknown advantages compared with formula-feeding [1].

Appearance of the femoral head ossification center (FHOC) is an important landmark in the development of the hip in the first months of life [2]. A delay in its appearance is an indication of congenital hip dysplasia, but it can also occur when a pathologic condition involving bone growth or mineralization, such as hypothyroidism, is present [3].

The presence of FHOC is routinely assessed in echographic screening for hip dysplasia [4]. An appropriate timing for this echographic examination can be set at about 3 mo of age according to the observation that the FHOC can be seen on x-ray starting at 3 to 4 mo of age, although it usually can be identified sooner echographically.

* Corresponding author. Tel.: +39-339-268-1047; fax: +39-091-655-3631.
E-mail address: gipuccio@gmail.com (G. Puccio).

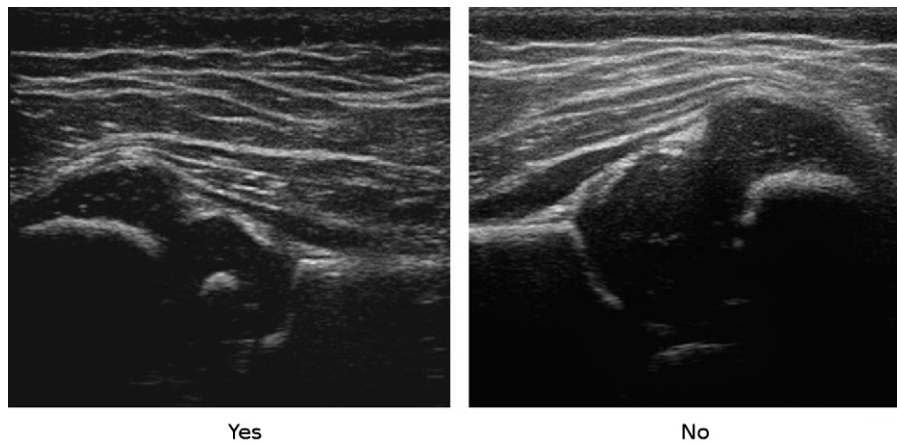


Fig. 1. Echographic evaluation of the femoral head ossification center. (Left) The femoral head ossification center was considered present if a hyperechogenic image with evidence of a posterior shadow cone in the context of the cartilaginous femoral head was detected. (Right) Absent femoral head ossification center.

The aim of this study was to evaluate if data gathered at the time of a routine echographic screening for hip dysplasia in infants show any differences in the rate of appearance of the FHOC according to the type of feeding received in the first months of life (exclusive breast-feeding versus formula or mixed feeding).

Materials and methods

This retrospective, unblinded study was conducted in a population of 285 healthy infants who consecutively underwent an echographic evaluation of the hip as a systematic screening for hip dysplasia, from April 1 through October 10, 2008, at the pediatric operative unit of the Azienda Ospedaliera S. Elia in Caltanissetta, Italy. The sample consisted of infants with no specific risk factors for hip dysplasia. The echographic examination is usually scheduled at 11 to 15 wk of age, but the actual age range was 5 to 21 wk (mean 12.39 wk, median 13 wk).

The examination was performed by a well-trained ultrasonographer and a pediatrician. For each infant, type of feeding and other variables, including type of feeding, sex, gestational age at birth in weeks (GA), weight at birth in grams (BW), and age at the time of echographic examination in weeks (AE), were recorded.

Type of feeding was categorized as exclusive breast-feeding (infants who had been receiving exclusively breast milk since birth), exclusive formula (infants who had had been receiving exclusively formula, except for possible attempts at breast-feeding during the first week of life) or mixed (all other infants).

Data analysis was performed in the entire sample population or, to avoid possible bias, in a subpopulation of 143 infants after exclusion of preterm or low-birth-weight infants and those who underwent the echographic examination outside the scheduled age range.

Statistical methods

Distributions of variables in different groups were analyzed by non-parametric methods: Kruskal–Wallis test for continuous variables and

chi-square test for independence for categorical variables. To further analyze the relation between the type of feeding and FHOC, a logistic multiple regression analysis was performed. All statistical analyses were performed using the free open-source software R 2.9.0 [5].

Results

In none of the 285 screened infants was hip dysplasia or any other pathologic condition involving bone mineralization documented. The presence of FHOC was demonstrated by a hyper-echogenic image with evidence of a posterior shadow cone in the context of the cartilaginous femoral head (Fig. 1) [6]. Table 1 presents the population characteristics (sex, GA, and BW) according to the type of feeding.

More than half of participating subjects were fed exclusively with formula (51.9%). The sample population showed a good homogeneity for sex distribution ($P = 0.33$). GA was slightly older in the breast-fed group ($P = 0.055$), and BW was slightly but significantly greater in the breast-fed group ($P = 0.005$). AE was not significantly different among the three groups ($P = 0.37$).

The FHOC was present in 48.3% of the breast-fed group (95% confidence interval [CI] 38.1–58.6), 25.7% of the formula-fed group (95% CI 19.3–33.3), and 28% of the mixed group (95% CI 17.5–41.7). This difference was statistically significant ($P = 0.001$, chi-square test).

Unfortunately, the three groups were not comparable for many important parameters, which can potentially affect the presence of FHOC at the time of examination, particularly BW and GA. Moreover, the time of examination, although not significantly different among the three groups, can greatly

Table 1
Population characteristics according to type of feeding

| Type of feeding | n (%) | Sex (%) | | GA (wk) | | | BW (g) | | |
|-----------------|------------|-------------|-------------|---------|------|--------|-----------|------|--------|
| | | Female | Male | Range | Mean | Median | Range | Mean | Median |
| BF | 87 (30.5) | 47 (54%) | 40 (46%) | 35–42 | 39.3 | 40 | 1980–4350 | 3286 | 3300 |
| Fa | 148 (51.9) | 67 (45.3%) | 81 (54.7%) | 29–42 | 38.7 | 39 | 1180–4850 | 3091 | 3050 |
| Mx | 50 (17.6) | 27 (54%) | 23 (46%) | 35–42 | 38.7 | 39 | 2200–4500 | 3095 | 3000 |
| Total | 285 | 141 (49.5%) | 144 (50.5%) | 29–42 | 38.8 | 39 | 1180–4850 | 3151 | 3150 |

BF, breast-fed; BW, birth weight; Fa, formula-fed; GA, gestational age; Mx, mixed feeding Distribution of the main variables in the different feeding groups

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