

Effect of Breastfeeding Practices and Maternal Nutrition on Baby's Weight Gain During First 6 Months

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Received: 20 February 2016 / Accepted: 30 May 2016 / Published online: 18 June 2016
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About the Author



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Abstract

Objective To study cross-sectionally, effect of early feeding practices and maternal nutrition, with special reference to traditional food supplements (TFSs), on baby's weight gain during first 6 months.

Methods Design: Cross-sectional observational study design. Settings: Urban tertiary healthcare centre, India. Participants: One hundred and fifteen primiparous mother–infant pairs within 6 months of delivery. Outcome

measures: We studied the subjects for anthropometry, feeding practices and nutrient intakes after delivery, and their baby's weights were measured, and WAZ scores from WHO Anthro software and weight gain from birth were calculated.

Results Eighty per cent women from partial breastfeeding (PBF) group were either overweight or obese, while 33 % of exclusively breastfeeding (EBF) group were normal weight. To further explore relationship between TFS intakes and babies' feeding status, study population were divided into four groups based on consumption of TFS and feeding practices. General linear univariate model analysis adjusted with pre-pregnancy BMI, gestational weight gain, infant age and birth weight showed highest weight gain (3.8 ± 0.3 kg) for TFS + PBF group, than other groups such as TFS + EBF group (2.9 ± 0.3 kg, $p = 0.043$) and NTS + EBF (2.7 ± 0.3 kg, $p = 0.017$), though NTS + PBF group also had lower weight gain, but this difference was not significant (3.4 ± 0.3 kg, $p = 0.489$).

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Conclusion Higher baby's weight gain was seen among partially breastfed babies. Rather than TFS, type of feeding affected baby weight gain to a greater extent which may increase baby's risk of obesity in future.

Keywords Partial breastfeeding · Traditional food supplements · Obesity · Weaning · Infant · Weight gain

Introduction

According to the World Health Organization, all infants must be exclusively breastfed for the first 6 months of life [1]. Benefits of breastfeeding are immunological, psychological and developmental. Further, during the first year of life, breastfed infants show a different growth pattern than formula fed or mixed fed infants [2]. Breastfed infants have also been found to be leaner and lighter [3]. Reports also suggest that the duration of breastfeeding is inversely related to the risk of increased weight gain in babies [4]. Early weaning is known to increase baby's weight rapidly, which may result in increased risk of obesity in later years. In a study performed in southern Germany, it was found that at the time of school entry, among children who were exclusively breastfed till 5 months, there was 35 % reduction in obesity [5]. In another study, authors reported that rapid infant weight gain was associated with increased risk of being overweight at 4 years of age [6]. Thus, type of feeding, breast, top or mixed, has significant effects on a baby's weight.

Indian mothers consume traditional food supplements (TFSs) which are rich in fats, along with their habitual diet during the initial post-partum period. It is believed that these traditional supplements are beneficial for the health of the baby and mother [7]. However, to the best of our knowledge, effect of feeding practices; i.e. exclusive versus partial breastfeeding (PBF) along with the consumption of TFSs by mothers on infant weight gain has not been investigated so far.

Thus, our objective was to study cross-sectionally, the association of early feeding practices and maternal nutrition, with special reference to TFSs, on baby's weight gain during first 6 months.

Materials and Methods

Selection of Participants

A cross-sectional study was conducted in urban middle class lactating mothers attending a multi-specialty hospital, in Pune city, India, during July 2010–April 2012. All

lactating mothers (and their infants) coming for vaccination of infants were asked about their willingness to participate in the study. Exclusion criteria were: mothers having infants who were more than 6 months of age, mothers of twin children and mothers with intra uterine growth retardation (IUGR) or small for gestational age (SGA) infants after confirmation from paediatrician/gynaecologist [8]. Further, to assess the effect of feeding practices on infant weight gain, which usually gets established after 11 days of delivery [9], infants below 11 days of age and above 181 days of age were excluded from the study. Among those who fulfilled the selection criteria, 115 mothers (mean age 28.6 ± 3.3 years) were randomly recruited for this study. The research protocol was approved by the institutional ethics committee and all participants gave written informed consent.

Anthropometry

Weight was measured on the date of enrolment (DOE) in light clothes, without shoes, using an electronic digital scale (Salter, India) to the nearest 0.1 kg. Pre-pregnancy weight recorded by the gynaecologist around 1 month before pregnancy was obtained from medical records. Gestational weight gain was computed using pre-delivery weight from records over pre-pregnancy weight. Mother's post-partum retention (PPWR) in weight till the date of enrolment over pre-pregnancy weight was computed. Standing height was measured using a stadiometer (Leicester Height Meter, Child Growth Foundation, UK, range 60–207 cm) to the accuracy of 1 mm. Body mass index (BMI) was calculated as weight in kg/height in m^2 . Asian cut-offs for BMI [10] were used for classifying women into normal, overweight and obese categories. Waist circumference (circumference between the lowest rib and the iliac crest at the end of gentle expiration) was measured using a non-stretchable tape to the nearest 1 mm.

Infants' birth weight was obtained from hospital records. Infants' weight on the enrolment day of the mother was measured on an electronic digital scale (Diligent Scale, Deluxe, Corona Systems, 0.001 g). Increase in weight of infants till the date of enrolment over birth weight was calculated. Weight for age Z scores (WAZ) were calculated using WHO—Anthro software.

Socio-Demographic Information and Lactation History

A structured and pre-tested questionnaire (intra class correlation coefficient = 0.75, $p = 0.001$) was administered to collect information on socio-demographic factors such as age, education and occupational status [11]. Details of delivery, information on history of lactation regarding

whether baby was breastfed exclusively or partially [12], were recorded. Exclusive breastfeeding (EBF) was defined when the infant received breast milk only and no other solids or liquids with the exception of vitamins, minerals, medicines or oral rehydration solution [12]; PBF was defined when the infant received breast milk in addition to complementary foods; and *complementary foods* included milk, infant formula, gruel or semi-solid foods given in addition to breast milk [12].

Dietary Assessment

Dietary intakes were assessed by 24-h recall on three non-consecutive days, including a Sunday. Mothers were asked about the intake of food items including intake of traditional food consumed during post-partum period using standard cups and spoons by a trained investigator through face-to-face interview. Daily dietary intakes of nutrients by mothers were calculated using C-Diet version 2.0 [13] based on Indian cooked foods database [14] and the nutritive value tables of raw foods [15].

Statistical Analysis

Data were analysed using SPSS software for Windows (version 11.0, 2001, SPSS Inc., Chicago, IL, USA). Mothers were post-classified into two groups based on feeding practices and TFS intakes. Differences in anthropometry and nutrient intakes were assessed with Student's *t* test. Generalized linear model was used to test the differences in means of two groups infants' weight gain after adjusting for infant's age and birth weight.

Results

Sixty-two per cent mothers breastfed their infants exclusively, while 38 % mothers started complimentary feeding along with breastfeeding before 6 month of infant age. Complimentary food consisted of cow milk/formula feeds/dal–rice water. Both EBF and PBF mothers were similar in age, height, weight and pre-pregnancy BMI ($p > 0.1$) (Table 1). PBF mothers showed higher BMI on date of enrolment. ($p = 0.041$). Thirty-three per cent of mothers from EBF group had a normal BMI on the date of enrolment, whereas only 20 % mothers from the PBF group had a normal BMI. Of the remaining PBF mothers, 37 % were OW and 43 % were obese. In the mothers who exclusively breastfed their babies, 23 % mothers were obese. Mother's pre-pregnancy BMI was positively correlated with baby's birth weight ($r = 0.229$, $p = 0.016$).

Nutrient intakes of exclusively breastfeeding mothers and PBF mothers were similar in calories (2317 ± 611 vs

Table 1 Demographic and anthropometric characteristics of EBF and PBF groups

| Parameters | EBF group (Mean \pm SD) <i>n</i> = 71 | PBF group (Mean \pm SD) <i>n</i> = 44 | <i>p</i> |
|--|---|---|----------|
| Mother's age (years) | 28.6 \pm 3.5 | 29.5 \pm 3.0 | 0.172 |
| Height (cm) | 157 \pm 5.0 | 156 \pm 5.2 | 0.101 |
| Pre-pregnancy BMI (kg/m ²) | 23.2 \pm 3.5 | 24.1 \pm 4.1 | 0.210 |
| Mother weight (kg) | 63 \pm 10 | 66 \pm 12 | 0.238 |
| Mother waist (cm) | 94 \pm 8 | 98 \pm 12 | 0.141 |
| Mother BMI (kg/m ²) | 25.2 \pm 3.7 | 27 \pm 5.0* | 0.041 |
| Baby birth weight (kg) | 3.0 \pm 0.4 | 3.0 \pm 0.4 | 0.481 |
| Baby birth length (cm) | 50 \pm 1.0 | 50 \pm 2.6 | 0.936 |
| Baby WAZ scores on DOE | -1.1 \pm 1.3 | -0.76 \pm 1.5 | 0.229 |

BMI body mass index, DOE date of enrolment

* $p < 0.05$

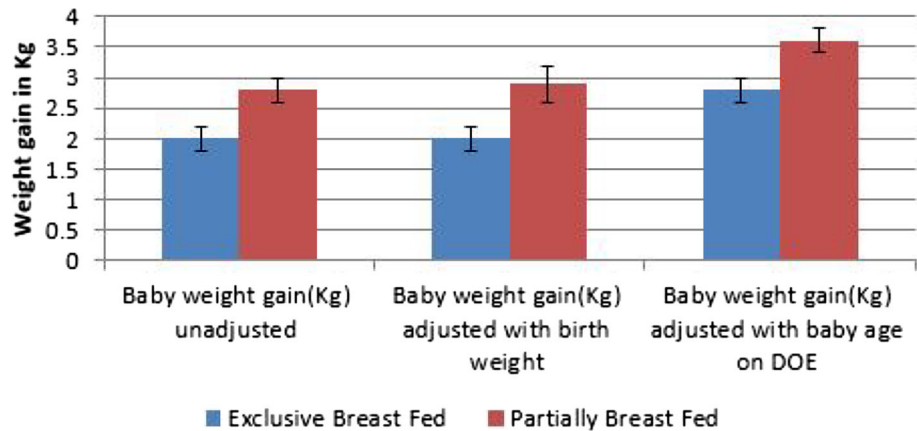
2122 ± 431 kcal/day), proteins (53 ± 14 vs 48 ± 12 g) and dietary fat (92 ± 39 g vs 85 ± 24 g) ($p > 0.05$ for all). However, most mothers from both groups consumed an inadequate amount of nutrients (energy 75 % below RDA, protein- 99 % below RDA) except for fat intake. Sixty-five per cent of mothers consumed TFSs during initial (mean 45 days) post-partum period. These TFSs consisted of dry fruits, simple sugars and clarified butter [7]. Maternal nutrient intakes did not show any association with baby's weight gain in either group.

Mean age of PBF babies was 110 ± 58 days indicating the initiation of top feeding at much earlier age (before 4 months) than recommended by WHO (after 6 months). WAZ scores for babies on the date of enrolment were lower in EBF group (-1.11 ± 1.25) than in the PBF group (-0.76 ± 1.5) ($p > 0.1$). Unadjusted weight gain among PBF (3.0 ± 0.18 kg) was higher than EBF babies (2.0 ± 0.15 kg) ($p = 0.018$).

As seen in Fig. 1, weight gain in PBF babies was significantly higher than EBF babies after adjusting for babies birth weight ($p = 0.015$) or age in days ($p = 0.016$).

To further explore relationship between TFS and babies' feeding status, mothers and their babies were divided into four groups, those who consumed TFS and type of feeding (TFS + PBF, TFS + EBF) and those who did not consume supplements and type of feeding (NTS + PBF and NTS + EBF). In babies who were partially breastfed, there were no significant differences in their weight between mothers who had TFS and did not ($p > 0.05$). Similarly, in babies who were exclusively breastfed, there was no difference in the baby weight in mothers who did and did not consume TFS ($p > 0.05$). These results indicate that the type of feeding had a significant effect on baby weight than mother's consumption of TFS or otherwise. Further, general linear univariate model analysis adjusted with pre-

Fig. 1 Weight gain in EBF and PBF babies



pregnancy BMI, gestational weight gain, infant age and birth weight showed highest weight gain (3.8 ± 0.3 kg) for TFS + PBF group, than other groups such as TFS + EBF group (2.9 ± 0.3 kg, $p = 0.043$) and NTS + EBF (2.7 ± 0.3 kg, $p = 0.017$), though the NTS + PBF group also had lower weight gain, but this difference was not significant (3.4 ± 0.3 kg, $p = 0.489$).

Discussion

Higher weight gain in partially breastfed babies is a matter of concern and has also been reported by others [16, 17]. Obesity in children is on the rise the world over, including in urban areas of developing countries such as India [18]. As per WHO growth standards, infants with BMI Z score above +1 are considered as overweight and +2 considered as obese. Therefore, infants with a BMI of less than +1 are considered within safe limits for weight gain [19–21]. Our and other studies indicate that partial breastfeeding is associated with increased weight gain; this could be a starting point for obesity in children. Thus, encouraging mothers to exclusively breastfeed infants for the first 6 months may be an important step in the prevention of childhood obesity.

Together with being critical for the baby, EBF is also associated with weight loss or lower BMI in mothers [22]. We have earlier reported that the consumption of TFS along with PBF during lactation is an important factor responsible for higher weight retention in mothers' post-partum [7]. Recent studies report that high post-partum weight gain in mothers is a predictor of future cardio metabolic risk [23]. Further, though supplements in various forms are consumed by mothers in many cultures during lactation [24, 25], very few studies have looked at the effect of these supplements on babies weight gain. We found that rather than the supplements, type of feeding affected baby weight gain to a greater extent.

The strength of our study is that, though many women in the world over consume some supplements during lactation, few studies have looked at the relationship between the consumption of these supplements and baby weight gain. We have also assessed this weight gain after appropriate adjustments. One of our limitations is that we have collected maternal dietary intake on date of enrolment; hence, we could not correlate nutrient intakes with baby's weight gain through 6 months. Thus, a longitudinal study would help to confirm our results of association of PBF with higher BMI in the mother and greater weight gain in the infant.

Conclusion

We found that exclusively breastfed babies had lower weight gain and their mothers were less likely to be overweight than mothers who partially breastfed their babies; our results thus underline WHO recommendations for exclusive breastfeeding of infants till 6 months of age. Higher weight gain in partially breastfed babies may put them at the risk of obesity in future; further longitudinal studies are required for confirming these results.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Informed Consent Research protocol was approved by the institutional ethics committee and all participants gave written informed consent.

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