



Abstract

Breastfeeding Duration and Bone Mineral Density in Childhood: A Prospective Study within GUSTO Cohort [†]

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Nutrition contributes to bone mineral density (BMD) and plays a role in bone growth during infancy and childhood. However, the published relationships between breastfeeding exposure and BMD in infancy, childhood and adult life are not consistent. This cross-sectional study examined relationships of both breastfeeding duration and time of solid food introduction, with BMD in young Asian children from the Growing up in Singapore Towards healthy Outcomes (GUSTO) cohort.

Six-year-old children that were born healthy at term with available dual-energy X-ray absorptiometry (DXA) lumbar spine (LS) scans and data on the duration of any breastfeeding were included in the analysis ($n = 207$; 103 boys, 104 girls; 110 Chinese, 34 Indian and 63 Malay). LS bone mineral apparent density (BMAD), i.e., volumetric BMD, was estimated according to the published equation based on bone mineral content (BMC) and bone area from L2 to L4 ($BMC/A_p^{3/2}$) [1]. Outcomes in univariable and multivariable linear regression models included areal BMD_{LS} ($aBMD_{LS}$) and $BMAD_{LS}$ (to take account of bone size in growing children), and the standard deviation scores $Z_{LS-BMAD}$ and $Z_{LS-aBMD}$.

Covariates adjusted for were maternal ethnicity, pre-pregnancy BMI, child's sex and both, child weight, and physical activity at 6 years of age.

Only 11 children were not breastfed, with the rest breastfed on average for 7.6 ± 11.5 (0.0–54.8) months. At 6 years of age, no significant difference in BMD_{LS} was detected by maternal ethnicity. Boys had lower BMD_{LS} compared to girls ($aBMD_{LS}$: -0.025 (95% CI: $-0.040, -0.010$; $p = 0.002$) g/cm^2 ; $Z_{LS-aBMD}$: -0.436 (95% CI: $-0.704, -0.168$; $p = 0.002$) g/cm^2 ; $BMAD_{LS}$: -0.008 (95% CI: $-0.011, -0.005$; $p < 0.0001$) g/cm^3 ; $Z_{LS-BMAD}$: -0.621 (95% CI: $-0.882, -0.360$; $p < 0.0001$) g/cm^3). In the univariable model, children with longer breastfeeding duration had significantly lower $aBMD_{LS}$, but not $BMAD_{LS}$ ($aBMD_{LS}$: -0.0007 (95% CI: $-0.001, -1.575$; $p = 0.045$) g/cm^2 ; $Z_{LS-aBMD}$: -0.012 (95% CI: $-0.024, -0.0003$; $p = 0.045$) g/cm^2). In the analysis stratified by sex, the association with breastfeeding duration was significant only for girls and only for $aBMD_{LS}$ ($aBMD_{LS}$: -0.001 (95% CI: $-0.002, -0.0001$; $p = 0.037$) g/cm^2 ; $Z_{LS-aBMD}$: -0.018 (95% CI: $-0.035, -0.001$; $p = 0.037$) g/cm^2). Adjusting for covariates resulted in no significant relationships with breastfeeding duration.

The average time of solid food introduction was reported as 5.5 ± 1.2 months (3.0–10.0; $n = 188$; 93 boys, 95 girls). No significant relationship with time of solid food introduction was found in the entire group in both the univariable and adjusted models. However, in stratified analysis, boys with later solid food introduction had lower BMD_{LS} ($aBMD_{LS}$: -0.009 (95% CI: $-0.018, -0.0006$; $p = 0.037$) g/cm^2 ; $Z_{LS-aBMD}$: -0.166 (95% CI: $-0.321, -0.010$; $p = 0.037$) g/cm^2 ; $BMAD_{LS}$: -0.003 (95% CI: $-0.005, -0.0006$; $p = 0.011$) g/cm^3 ; $Z_{LS-BMAD}$: -0.205 (95% CI: $-0.360, -0.050$; $p = 0.010$) g/cm^3). These relationships persisted when adjusting for covariates.

Breastfeeding duration and time of solid food introduction may have a long-term impact on bone mineralization in young children. However, a more precise quantitative approach when measuring breastfeeding exposure, such as 24 h infant milk intake and intake of milk components, would be prudent. Understanding the factors influencing bone remodeling during these periods of rapid skeletal growth is important for determining effective interventions to enhance bone development in vulnerable infants and children.

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Informed Consent Statement: Written informed consent was obtained from all subjects involved in this study. The children filled out an assent form to document their understanding of and participation in the study, while their parents gave written informed consent.

Data Availability Statement: Restrictions apply to the availability of some, or all, data generated or analyzed during this study. The corresponding author will, upon request, detail the restrictions and any conditions under which access to some data may be provided.

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