



Breastfeeding As a Protective Factor for Childhood Obesity

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Abstract

Background: Numerous studies indicate that weight gain during early childhood is strongly associated with obesity later in life, as well as with adult morbidity. There is increasing evidence suggesting that breastfeeding provides protection against the development of overweight and obesity in young children and adolescents.

Objectives: The aim of this study was to determine whether breastfeeding and its duration are related to obesity in children, assessed through anthropometric parameters: Body Mass Index (BMI), head circumference, upper arm circumference, skinfold thickness, and chest circumference, in children aged 0 to 5 years in Montenegro.

Methods: A cross-sectional study was conducted on a representative sample of 7,811 children aged 0 to 5 years, of both genders. Data collection involved anthropometric measurements, including height, head circumference, upper arm circumference, chest circumference, skinfold thickness, and body weight. These measurements were recorded in standardized protocols alongside a questionnaire designed for this specific research, which included questions on breastfeeding status, duration, and any chronic disease diagnoses. The questionnaire was completed by parents or guardians. The study was conducted in pediatric counseling clinics in primary healthcare centers, preschool institutions, and maternity departments in Montenegro. Correlation analyses and linear regression analyses were conducted to examine the association between breastfeeding and standardized anthropometric parameters. In the regression analyses, breastfeeding was treated as a dichotomous variable (breastfeeding status), a continuous variable (duration in months), and a categorical variable, in order to assess the consistency of the observed effects. The regression models were first analyzed without adjustment (univariate models) and subsequently adjusted for sex and age as potential confounding variables, as well as for their combined effect.

Results: Among the total sample, breastfed children (76.7%) had significantly lower mean values for head circumference, upper arm circumference, and chest circumference compared to non-breastfed children (23.3%) ($P < 0.00$). Gender-based analysis yielded similar results. The average values of anthropometric parameters in non-breastfed children were lower than in children breastfed for 0 - 6 months but higher than in children breastfed for more than 6 months. Regression analysis demonstrated a significant influence of breastfeeding and breastfeeding duration on anthropometric parameters. Breastfeeding status had the greatest effect on head circumference (0.070), upper arm circumference (0.067), and chest circumference (0.044), while breastfeeding duration significantly impacted BMI (0.125), body weight (0.121), head circumference (0.103), height (0.099), and chest circumference (0.048).

Conclusions: The results indicate that breastfeeding is a significant predictor of obesity in later life in both genders.

Keywords: Breast Feeding, Childhood Obesity, Anthropometric Parameters, Feeding Behavior, Risk Factors, Preschool Children

1. Background

Excessive body weight and childhood obesity have been recognized as global public health concerns for decades. The prevalence of childhood overweight is

increasing worldwide (1). WHO estimates indicate that in 2019, 38.2 million children under the age of five were overweight or obese (2). If these trends persist, the prevalence of overweight among children under five is projected to rise from 7% in 2012 to 11% by 2025 (2).

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Early childhood weight gain is strongly associated with obesity in later life and increased morbidity. Studies have demonstrated links between early metabolic disorders and later cardiovascular diseases (3, 4), as well as an increased risk of metabolic complications such as type 2 diabetes mellitus and associated comorbidities (5). Furthermore, recent evidence indicates that metabolic alterations in obese children, including elevated insulin and uric acid levels, may contribute to the early development of hypertension and other cardiovascular risk factors (6), in addition to psychological distress resulting from peer and family stigmatization (7). Identifying nutritional disorders early is crucial, as the first five years of life represent a critical window for obesity prevention (8-11). Preventive measures are far more effective and economically justified than obesity treatment (9). In this context, recent research highlights the importance of community-based strategies and the assessment of community readiness as key prerequisites for the successful implementation of childhood obesity prevention programs (12).

Research suggests that breastfeeding provides protection against overweight in children and adolescents. Infants on a natural diet exhibit lower weight gain in the first six months than formula-fed infants, which lowers the risk of future obesity (3). Breastfeeding has been proposed as a preventive intervention against childhood obesity (9). Human milk contains hormones, neuropeptides, and growth factors that influence growth, development, and self-regulation of food intake (11). Additionally, it is easily digestible and meets all infant nutritional needs, delaying the introduction of solid foods and reducing obesity risk (10, 13).

2. Objectives

This study aims to determine whether breastfeeding and its duration are related to childhood obesity by analyzing anthropometric parameters [Body Mass Index (BMI), chest circumference, upper arm circumference, skinfold thickness, and head circumference] in children aged 0 - 5 years in Montenegro.

3. Methods

A cross-sectional study was conducted on a representative sample of 7.811 children aged 0 - 59

months, accounting for approximately 18% of Montenegro's total child population in this age group. The sample was defined based on the number of children under five in all Montenegrin municipalities.

Ethical approval was obtained in accordance with the Declaration of Helsinki, and written parental consent was secured. Anthropometric data (height - TV, head circumference - OG, upper arm circumference - ON, chest circumference - OGK, skinfold thickness - DKN, and body weight - TM) were collected following WHO recommendations. Data were recorded in standardized protocols and complemented by a questionnaire on breastfeeding status, duration, and chronic disease diagnoses. Parents or guardians completed the questionnaire.

The study was conducted in pediatric counseling clinics in all primary healthcare centers, preschool institutions, and maternity departments in Montenegro. Doctors and trained interviewers conducted the measurements. Skinfold thickness was measured using a John Bull caliper.

Descriptive statistics were presented as counts and percentages for categorical variables, and as means with standard deviations for continuous variables. To assess the relationships between variables, Pearson's and Spearman's correlation coefficients were calculated, depending on the data distribution and scale. Linear regression analysis was performed to examine the influence of breastfeeding status and breastfeeding duration on standardized anthropometric indicators, including BMI, head circumference, upper arm circumference, chest circumference, and skinfold thickness.

Pearson's and Spearman's correlations were used to assess variable relationships. Linear regression analysis was applied to assess the influence of breastfeeding and breastfeeding duration on standardized anthropometric variables. Data were analyzed using SPSS 29.0.

All statistical analyses were conducted using SPSS Statistics version 29.0 (IBM Corp., Released 2023. IBM SPSS Statistics for Windows, Version 29.0. Armonk, NY: IBM Corp.) and R version 3.4.2 (R Core Team, 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria).

Table 1. Distribution of Children Regarding Gender, Age, and Anthropometric Values^a

Variables	Total	TM (kg)	TV (cm)	BMI (kg/m ²)	HC (cm)	UAC (cm)	ST (mm)	CC (cm)
Gender								
Male	4001 (51.2)	12.5 ± 5.6	84.8 ± 19.8	16.8 ± 2.3	46.8 ± 5.1	14.9 ± 4.5	10.1 ± 5.4	51.5 ± 5.8
Female	3810 (48.8)	11.9 ± 5.5	83.0 ± 20.3	16.5 ± 2.2	45.7 ± 5.1	14.8 ± 4.5	9.9 ± 5.6	50.0 ± 5.9
Age group (mo)								
0 - 6	2116 (27.1)	6.3 ± 1.6	61.1 ± 5.8	16.5 ± 2.2	40.1 ± 2.9	12.1 ± 4.5	8.5 ± 6.2	40.9 ± 3.8
6.1 - 12	1374 (17.6)	9.1 ± 1.5	71.9 ± 4.8	17.6 ± 2.1	44.7 ± 2.6	13.4 ± 5.3	12.1 ± 6.5	45.6 ± 4.1
12.1 - 24	1072 (13.7)	11.8 ± 2.0	82.8 ± 6.4	17.2 ± 2.3	47.4 ± 2.8	14.3 ± 5.2	10.7 ± 5.8	49.3 ± 3.4
24.1 - 36	982 (12.6)	14.7 ± 2.4	95.1 ± 8.5	16.3 ± 2.1	49.3 ± 2.6	16.5 ± 2.2	8.9 ± 3.0	51.1 ± 3.2
36.1 - 48	1054 (13.5)	17.1 ± 2.9	103.5 ± 7.3	15.9 ± 1.9	50.5 ± 2.4	17.0 ± 2.3	9.8 ± 4.3	53.0 ± 3.4
48.1 - 60	1213 (15.5)	20.2 ± 3.7	112.3 ± 7.3	16.0 ± 2.3	51.6 ± 2.3	17.7 ± 2.1	10.4 ± 5.6	55.5 ± 3.5

Abbreviations: TM, body weight; TV, height; BMI, Body Mass Index; HC, head circumference; UAC, upper arm circumference; ST, skinfold thickness; CC, chest circumference.

^a Values are as expressed as No. (%) or mean ± SD.

Available at: <https://www.R-project.org/>). A P-value of less than 0.05 was considered statistically significant.

4. Result

The study included a total of 7,811 children of both genders, aged 0 to 60 months. The distribution of children by gender and age, as well as the measured anthropometric parameters, is presented in Table 1. The number of children is similar between genders, with the majority belonging to the infant age group. Anthropometric parameters are comparable across genders but, as expected, show higher values in older children.

The standardized anthropometric values between breastfeeding groups are presented in Table 2. In the total sample, children who were breastfed had significantly lower head circumference, upper arm circumference, and chest circumference mean z-scores compared to children who were not breastfed. A gender-stratified analysis yielded similar results.

The correlation between breastfeeding duration and standardized anthropometric parameter values is presented in Table 3. The average values for children who were not breastfed are lower compared to those who were breastfed for 0–6 months but higher than those who were breastfed for more than 6 months. Most parameters show an initial increase as the breastfeeding category rises, followed by a significant decrease. Spearman rank correlation analysis was conducted twice, with and without the "no breastfeeding" category. As shown in the table, correlation coefficients have a

negative sign, with significantly higher values in the analysis excluding the "no breastfeeding" category.

The correlation analysis between breastfeeding duration (in months) and standardized anthropometric parameters demonstrates a significant negative correlation (Figure 1).

The regression analysis of standardized anthropometric parameters in relation to breastfeeding duration demonstrated a significant impact of breastfeeding on anthropometric outcomes. The analysis was conducted using independent variables alone and with adjustments for gender, age, and their combined effect. The models consistently indicated a negative correlation between breastfeeding duration and standardized anthropometric parameters, with minimal or statistically insignificant changes in regression coefficients. All analyses were performed using breastfeeding status (Yes/No) and were repeated with breastfeeding duration as both a continuous variable (in months) and a categorical variable (Table 4).

5. Discussion

Obesity has remained a major global public health concern for decades. According to the World Health Organization (WHO), the prevalence of overweight children under the age of five has increased dramatically, reaching 41 million worldwide in 2016 (14).

Childhood obesity is associated with an increased risk of developing diabetes and hypertension and contributes to obesity in adulthood, thereby elevating

Table 2. Standardized Values (z Values) of Anthropometric Parameters Between Breastfeeding Groups^a

Breastfeeding	Yes	No	P-Value
Total			
TM (kg)	0.20 ± 0.99	0.25 ± 1.11	0.088
TV (cm)	0.18 ± 1.02	0.21 ± 1.02	0.357
HC (cm)	0.17 ± 1.02	0.33 ± 0.98	< 0.001
UAC (cm)	-0.03 ± 1.01	0.12 ± 0.93	< 0.001
ST (mm)	0.02 ± 1.04	-0.04 ± 0.86	0.135
CC (cm)	-0.03 ± 0.98	0.07 ± 1.00	0.007
BMI (kg/m ²)	0.19 ± 0.98	0.21 ± 0.96	0.451
Male			
TM (kg)	0.20 ± 0.99	0.25 ± 1.08	0.225
TV (cm)	0.18 ± 1.01	0.21 ± 1.01	0.345
HC (cm)	0.16 ± 1.02	0.33 ± 0.97	< 0.001
UAC (cm)	-0.03 ± 1.01	0.08 ± 0.95	0.005
ST (mm)	0.01 ± 1.04	-0.02 ± 0.88	0.635
CC (cm)	-0.03 ± 0.99	0.05 ± 0.95	0.134
BMI (kg/m ²)	0.19 ± 0.99	0.19 ± 0.94	0.996
Female			
TM (kg)	0.21 ± 1.00	0.26 ± 1.14	0.209
TV (cm)	0.19 ± 1.03	0.20 ± 1.04	0.722
HC (cm)	0.17 ± 1.02	0.34 ± 0.99	< 0.001
UAC (cm)	-0.05 ± 1.02	0.15 ± 0.91	< 0.001
ST (mm)	0.02 ± 1.04	-0.06 ± 0.84	0.099
CC (cm)	-0.03 ± 0.97	0.09 ± 1.05	0.020
BMI (kg/m ²)	0.18 ± 0.97	0.23 ± 0.97	0.274

Abbreviations: TM, body weight; TV, height; HC, head circumference; UAC, upper arm circumference; ST, skinfold thickness; CC, chest circumference; BMI, Body Mass Index.

^a Values are as expressed as mean ± SD.

the risk of premature mortality, chronic non-communicable diseases, and disabilities (9, 15).

A WHO analysis and other studies, including Ogden et al. and a large Chinese cohort, consistently showed that breastfeeding, particularly of longer duration or exclusive up to 5 - 6 months, is associated with a lower risk of childhood overweight and obesity (16-18).

A study in Montenegro examined this relationship by analyzing anthropometric parameters in a representative sample of children aged 0 - 59 months. Breastfed children had significantly smaller head, upper arm, and chest circumferences than non-breastfed peers, suggesting a protective effect of breastfeeding against early childhood overweight.

Gillman et al. found that exclusive or predominant breastfeeding during the first six months significantly reduced the risk of overweight, with longer

breastfeeding (> 7 months) offering more protection than shorter duration (≤ 3 months) (19).

Consistent with these findings, the Montenegrin study showed that anthropometric values were highest in non-breastfed children, lower in those breastfed 0 - 6 months, and lowest in children breastfed over six months. Strongest correlations, especially for head, upper arm, and chest circumference, were observed in the non-breastfed group.

Similar protective effects of longer breastfeeding were confirmed in Germany, Brazil, and a multicenter European study, which also identified gestational weight gain as a key risk factor for childhood obesity (20-22).

Regression analysis from the Montenegro study showed a consistent negative association between breastfeeding duration and standardized anthropometric parameters. Adjustments for gender and age had minimal effect on the results. Prolonged

Table 3. Correlation of Anthropometric Parameters with Breastfeeding Duration by Gender ^a

Gender and Parameter	No Breastfeeding	0-3 (mo)	3.1-6 (mo)	6.1-9 (mo)	9.1-12 (mo)	>12 (mo)	Correlation (Rho) All	Correlation (Rho) Without No Breastfeeding	P-Value
Male									
TM	0.25 ± 1.08	0.34 ± 0.98	0.45 ± 1.15	-0.06 ± 0.88	0.00 ± 0.85	-0.05 ± 0.90	-0.120 ^b	-0.195 ^b	< 0.001
TV	0.21 ± 1.01	0.24 ± 0.95	0.42 ± 1.18	0.00 ± 1.00	0.03 ± 0.90	0.00 ± 1.00	-0.077	-0.127 ^b	< 0.001
HC	0.33 ± 0.97	0.22 ± 0.96	0.44 ± 1.03	-0.05 ± 0.83	0.03 ± 1.07	0.00 ± 1.11	-0.111 ^b	-0.105 ^b	< 0.001
UAC	0.08 ± 0.95	-0.14 ± 1.10	0.06 ± 1.00	0.11 ± 1.00	0.11 ± 0.81	-0.08 ± 0.95	-0.046 ^b	-0.029	0.155
ST	-0.02 ± 0.88	0.01 ± 0.96	0.02 ± 0.85	0.11 ± 0.89	-0.02 ± 1.23	-0.02 ± 1.18	-0.026	-0.093 ^b	< 0.001
CC	0.05 ± 0.95	-0.03 ± 1.09	0.09 ± 0.95	-0.05 ± 1.07	-0.08 ± 0.97	-0.06 ± 0.89	-0.056 ^b	-0.041	0.132
BMI	0.19 ± 0.94	0.37 ± 0.87	0.34 ± 1.10	-0.05 ± 0.97	0.00 ± 0.94	-0.06 ± 1.08	-0.131 ^b	-0.233 ^b	< 0.001
Female									
TM	0.26 ± 1.14	0.30 ± 0.93	0.45 ± 1.09	-0.08 ± 0.92	0.18 ± 0.99	-0.13 ± 0.93	-0.105 ^b	-0.165 ^b	< 0.001
TV	0.20 ± 1.04	0.20 ± 0.93	0.46 ± 1.15	-0.05 ± 1.05	0.23 ± 1.02	-0.11 ± 0.96	-0.060 ^b	-0.094 ^b	< 0.001
HC	0.34 ± 0.99	0.22 ± 0.97	0.41 ± 1.05	-0.09 ± 0.94	0.11 ± 1.02	-0.05 ± 1.06	-0.113 ^b	-0.097 ^b	< 0.001
UAC	0.15 ± 0.91	-0.13 ± 1.14	-0.04 ± 1.06	0.00 ± 0.95	0.21 ± 0.75	-0.13 ± 0.88	-0.055 ^b	0.003	0.872
ST	-0.06 ± 0.84	-0.07 ± 0.96	0.18 ± 1.40	0.10 ± 0.91	-0.03 ± 0.90	0.01 ± 0.86	0.040	-0.006	0.833
CC	0.09 ± 1.05	-0.10 ± 0.93	0.17 ± 1.02	0.01 ± 0.99	-0.06 ± 1.11	-0.11 ± 0.82	-0.044	-0.006	0.817
BMI	0.23 ± 0.97	0.35 ± 0.88	0.32 ± 1.09	-0.02 ± 1.03	-0.02 ± 0.92	-0.05 ± 0.89	-0.131 ^b	-0.215 ^b	< 0.001
Total									
TM	0.25 ± 1.11	0.32 ± 0.96	0.45 ± 1.12	-0.07 ± 0.9	0.09 ± 0.92	-0.09 ± 0.92	-0.113 ^b	-0.181 ^b	< 0.001
TV	0.21 ± 1.02	0.22 ± 0.94	0.44 ± 1.16	-0.03 ± 1.03	0.13 ± 0.96	-0.05 ± 0.98	-0.069 ^b	-0.111 ^b	< 0.001
HC	0.33 ± 0.98	0.22 ± 0.97	0.42 ± 1.04	-0.07 ± 0.89	0.07 ± 1.04	-0.02 ± 1.08	-0.112 ^b	-0.101 ^b	< 0.001
UAC	0.12 ± 0.93	-0.13 ± 1.12	0.00 ± 1.04	0.06 ± 0.98	0.16 ± 0.79	-0.10 ± 0.92	-0.052 ^b	-0.015	0.316
ST	-0.04 ± 0.86	-0.03 ± 0.96	0.11 ± 1.19	0.11 ± 0.90	-0.03 ± 1.09	0.00 ± 1.04	0.006	-0.049 ^b	0.010
CC	0.07 ± 1.00	-0.07 ± 1.01	0.13 ± 0.99	-0.02 ± 1.03	-0.07 ± 1.04	-0.08 ± 0.86	-0.051 ^b	-0.024	0.205
BMI	0.21 ± 0.96	0.36 ± 0.87	0.33 ± 1.09	-0.04 ± 1.00	-0.01 ± 0.93	-0.05 ± 0.99	-0.131	-0.224 ^b	< 0.001

Abbreviations: TM, body weight; TV, height; HC, head circumference; UAC, upper arm circumference; ST, skinfold thickness; CC, chest circumference; BMI, Body Mass Index.

^a Values are as expressed as mean ± SD.

^b Statistically significant (P < 0.05).

breastfeeding was linked to reduced values of body mass, BMI, height, head circumference, upper arm circumference, and chest circumference, across both gender and age categories.

5.1. Conclusions

The findings of this study suggest that breastfeeding plays a crucial role in predicting obesity risk later in life for both genders. A longer duration of breastfeeding is associated with lower anthropometric parameter values, with children breastfed for more than six months exhibiting lower values compared to those breastfed for three months or less. The lowest values

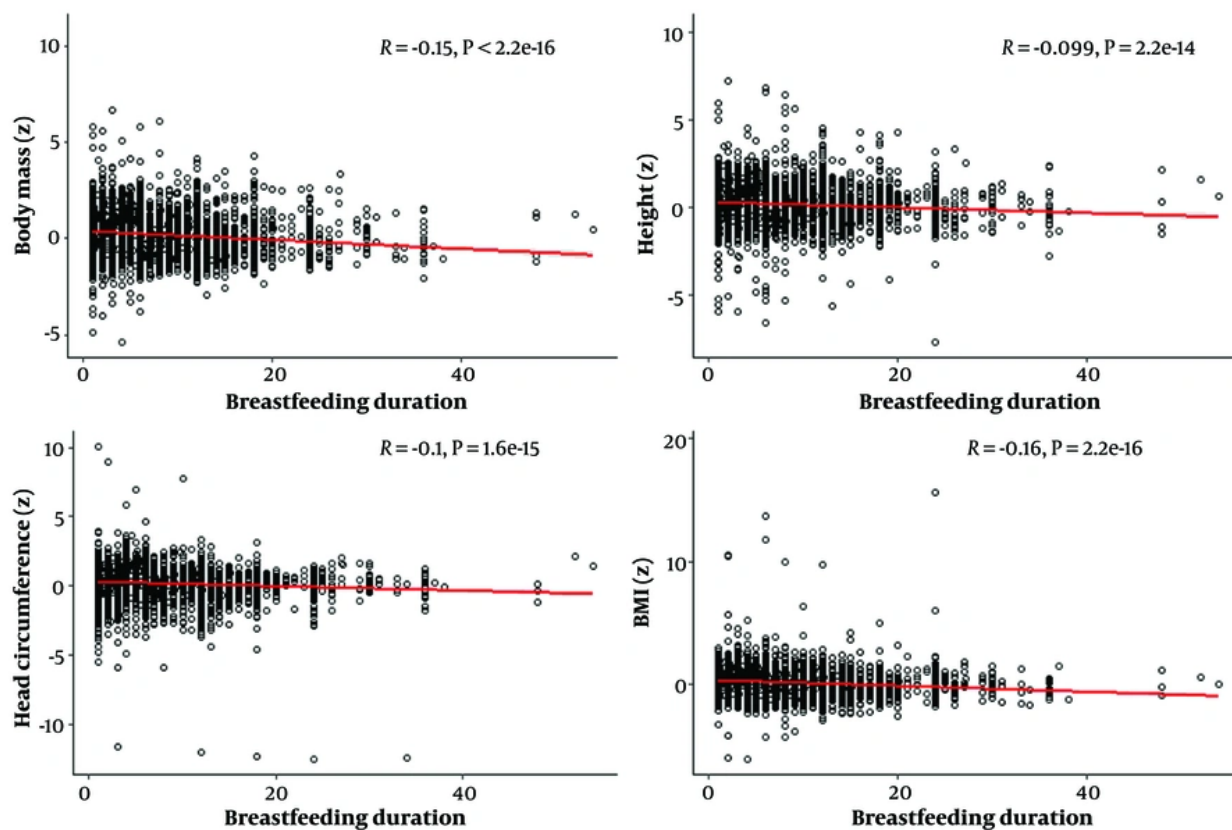


Figure 1. Correlation between breastfeeding duration and standardized anthropometric parameters

were observed in children who were not breastfed at all. These results further emphasize the protective role of prolonged breastfeeding in childhood growth and development.

Footnotes

AI Use Disclosure: The authors declare that no generative AI tools were used in the creation of this article.

Authors' Contribution: Study concept and design: S. C.; Data collection: S. C., M. K., and V. R.; Analysis and interpretation of data: S. C., A. L. J., and E. K.; Drafting of the manuscript: S. C.; Critical revision of the manuscript for important intellectual content: A. L. J., M. K., and E. K.; Final approval of the manuscript: S. C., A. L. J., E. K., M. K., and V. R.

Conflict of Interests Statement: The authors declare no conflict of interests.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after publication. The data are not publicly available due to ethical restrictions and the need to protect the privacy and confidentiality of research participants, in accordance with institutional and national data protection guidelines.

Ethical Approval: The study was approved by the Ethics Committee of the Institute of Public Health of Montenegro, as well as the Ethics Committee of the Faculty of Medicine, University of Montenegro (Number: 744/2).

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Table 4. Regression Models of Standardized Anthropometric Variables and Breastfeeding Status (Yes/No) and Duration

Outcome Variables and Breastfeeding Variables	Crude B (Standardized β)	P-Value	Adjusted for Gender B (Standardized β)	P-Value	Adjusted for Gender and Age B (Standardized β)	P-Value
TM						
Breastfeeding (yes/no)	-0.049 (-0.020)	0.071	-0.050 (-0.021)	0.070	-0.059 (-0.024) ^a	0.031
Breastfeeding duration (mo)	-0.019 (-0.121) ^a	< 0.001	-0.019 (-0.121) ^a	< 0.001	-0.015 (-0.094) ^a	< 0.001
Breastfeeding duration (categorical)	-0.074 (-0.074) ^a	< 0.001	-0.074 (-0.122) ^a	< 0.001	-0.060 (-0.099) ^a	< 0.001
BMI						
Breastfeeding (yes/no)	-0.020 (-0.009)	0.451	-0.020 (-0.009)	0.449	-0.036 (-0.016)	0.158
Breastfeeding duration (mo)	-0.019 (-0.125) ^a	< 0.001	-0.019 (-0.125) ^a	< 0.001	-0.010 (-0.064) ^a	< 0.001
Breastfeeding duration (categorical)	-0.073 (-0.127) ^a	< 0.001	-0.073 (-0.127) ^a	< 0.001	-0.044 (-0.076) ^a	< 0.001
TV						
Breastfeeding (yes/no)	0.025 (0.010)	0.357	0.025 (0.010)	0.355	0.029 (0.012)	0.282
Breastfeeding duration (mo)	-0.016 (-0.099) ^a	< 0.001	-0.016 (-0.099) ^a	< 0.001	-0.015 (-0.095) ^a	< 0.001
Breastfeeding duration (categorical)	-0.048 (-0.079) ^a	< 0.001	-0.048 (-0.079) ^a	< 0.001	-0.042 (-0.070) ^a	< 0.001
HC						
Breastfeeding (yes/no)	0.168 (0.070) ^a	< 0.001	0.168 (0.070) ^a	< 0.001	0.180 (0.075) ^a	< 0.001
Breastfeeding duration (mo)	-0.016 (-0.103) ^a	< 0.001	-0.016 (-0.103) ^a	< 0.001	-0.008 (-0.053) ^a	< 0.001
Breastfeeding duration (categorical)	-0.071 (-0.119) ^a	< 0.001	-0.071 (-0.119) ^a	< 0.001	-0.052 (-0.088) ^a	< 0.001
UAC						
Breastfeeding (yes/no)	0.152 (0.067) ^a	< 0.001	0.152 (0.067) ^a	< 0.001	0.150 (0.066) ^a	< 0.001
Breastfeeding duration (mo)	0.005 (0.031) ^a	0.033	0.005 (0.031) ^a	0.034	0.002 (0.012)	0.451
Breastfeeding duration (categorical)	-0.007 (-0.011) ^a	0.368	-0.007 (-0.011) ^a	0.368	-0.012 (-0.021)	0.107
ST						
Breastfeeding (yes/no)	-0.052 (-0.022)	0.175	-0.052 (-0.022)	0.175	-0.053 (-0.023)	0.170
Breastfeeding duration (mo)	-0.001 (-0.004)	0.713	-0.001 (-0.004)	< 0.001	-0.003 (-0.018)	0.338
Breastfeeding duration (categorical)	0.007 (0.013)	0.420	0.007 (0.013)	0.420	0.007 (0.013)	0.434
CC						
Breastfeeding (yes/no)	0.096 (0.044) ^a	0.007	0.096 (0.044) ^a	0.007	0.104 (0.047) ^a	0.004
Breastfeeding duration (mo)	-0.002 (-0.014)	0.455	-0.002 (-0.014)	0.455	-0.005 (-0.039) ^a	0.259
Breastfeeding duration (categorical)	-0.025 (-0.048) ^a	0.003	-0.025 (-0.048) ^a	0.003	-0.033 (-0.063) ^a	< 0.001

Abbreviations: TM, body weight; TV, height; HC, head circumference; UAC, upper arm circumference; ST, skinfold thickness; CC, chest circumference; BMI, Body Mass Index.

^a Statistically significant ($P < 0.05$).

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Informed Consent: Ethical approval was obtained in accordance with the Declaration of Helsinki, and

written parental consent was secured.

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