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Original Article (Pages: 3299-3313)

Is Duration of Breastfeeding Associated with Anthropometric Measures in Children and Adolescents? the Weight Disorders Survey of the CASPIAN- IV Study

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Abstract

***Background*:** The association of duration of breastfeeding (BF) with weight disorders remains controversial. This study aimed to evaluate the association of BF with anthropometric measures and weight disorders in Iranian children and adolescents. ***Materials and Methods*:** Using multistage random cluster sampling method, a representative sample of 25,000 school students were selected from urban and rural areas of 30 provinces of Iran (2011-2012). Through a validated questionnaire, data was recorded for every participant. Anthropometricand measures and duration of BF were measured under international standard protocols by using calibrated instruments.

***Results*:** Overall, 23,043 students completed the survey (participation rate: 92.17%). They consisted of 50.8% boys, 73.4% urban residents, with a mean age of 12.55 ± 3.31 years. Significant association was found between BF duration and overweight (P<0.05). In multivariate model, longer duration of BF (BF ≥ 6 months versus < 6 months), was associated with lower risk of becoming overweight [odds ratio(OR):0.86(0.74,0.99)]. There was no significant association between duration of BF with body mass index(BMI), waist circumference, hip circumference, neck circumference, wrist circumference, generalized obesity and abdominal obesity. ***Conclusion*:** Although the longer duration of BF is associated with lower risk of becoming overweight, does not seem to be associated with anthropometric measures in childhood and adolescence. To confirm the results of the present study, more longitudinal studies in Iranian children and adolescents are warranted.

***Key Words*:** Adolescent, Children, Injuries, Socioeconomic status, Iran.

*Please cite this article as: Roya Kelishadi, Fatemeh Rezaei, Shirin Djalalinia, Mojgan Asadi, Sareh Miranzadeh, Mohammad Esmaeil Motlagh, et al. Is Duration of Breastfeeding Associated with Anthropometric Measures in Children and Adolescents? the Weight Disorders Survey of the CASPIAN- IV Study. Int J Pediatr 2016; 4(8): 3299- 3313.

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Received date Mar 10, 2016; Accepted date: Jun 22, 2016

1- INTRODUCTION

In the past decade, overweight and obesity in children has become a major public health problem in both developed and developing countries (1-2). The main determinants of childhood obesity are genetic factors, individual behaviors (such as exercise, time sleeping and watching TV), eating habits and interactions between them (3-6). Other factors that affect childhood obesity include: a family history of obesity, financial and family education, baby food patterns, sleep duration, physical activity level and birth weight (7-8).

In recent years, much attention on primary prevention of chronic non-communicable diseases and their risk factors are concentrated. Breastfeeding (BF) as a protective factor against non-communicable diseases has been considered (8). Some epidemiological and biological study long-term effects of BF on chronic diseases have recorded (9). The health benefits of BF compare with formula feeding is well known, including the protection of respiratory disease and diarrhea, optimal growth, and long-term effects, such as higher IQ, less cardiovascular risk factors and obesity rates less in later childhood (10). The effect of BF is independent of dietary patterns and physical activity in adulthood (11). Evidence shows that BF is protective role against obesity, high blood pressure, blood lipids, and type II diabetes in adults. In addition to short-term interests, encouraging BF can have long-term beneficial health effects at the individual and society (12).

Many studies have been done on the impact of BF on obesity; some studies have shown that BF may have a protective effect against obesity (13-14); while other studies did not find an association between BF and obesity (16-17). As well as in some studies, a chronological relationship between BF duration and obesity has been shown (18-19). Thus, the prevention of obesity, measures to identify and target risk factors in the development of obesity early is essential. Many studies were done about a relationship between BF and childhood obesity. In some studies, were shown that BF has effect on obesity and some of them were shown no relationship between BF and obesity. So, according to there is not study at the national level on BF impact on obesity and weight disorders in Iranian children and young adults. The present study is done to determine the association between BF and obesity and weight disorders in Iranian children and adolescents.

2- MATERIALS AND METHODS

2-1. Methods

Data from 23,000 Iranian children and adolescents gathered through a national survey on weight disorders conducted in 2011–2012 (20) as a complementary of a national school-based surveillance program entitled Childhood and Adolescence Surveillance and PreventIon of Adult Non-communicable disease (CASPIAN-IV survey) were used in the present study.

During the 2011-2012, 23,000 students, aged 6-18 years, were randomly selected from elementary, middle, and high schools of rural and urban areas of 30 provinces of Iran. The details of procedures and protocol of this investigation were published previously (20). Briefly, in these surveys the study population consisted of 23,000 school students, aged 6-18 years. They were selected by multistage, cluster sampling method from urban and rural areas of different cities in 30 provinces of the country (83 clusters of 10 students in each province). Stratification was performed in each province according to the residence area (urban/rural) and school grade (elementary/intermediate/high

school). The sampling was proportional to size with equal sex ratio; i.e., equal number of boys and girls were selected from each province and the ratios in urban and rural areas were proportionate to the population of urban and rural students. In this way, the number of samples in rural/urban are as and in each school grade was divided proportionally to the population of students in each grade. Clusters sampling with equal clusters was used in each province to reach the necessary sample size. Clusters were determined at the level of schools, including 10 sample units (students and their parents) in each cluster. Sampling frame was list of student in each province, which was stratified by sex, living area and grade and was obtained from information bank of ministry of education. In each province, schools were ordered by type ad name of school and number of students was added cumulatively in each province. After determining clusters in each province, in each cluster 10 students were selected consecutively.

A total of 83 clusters of 10 subjects in each of the provinces and a total of 23,000 students were selected. Having Iranian nationality (Iranian identification identity card) was only inclusion criteria of study. Exclusion criteria in these surveys included having a chronic disease, history of chronic medication consumption, and being on a special diet. Trained health experts followed all processes of examinations and inquiry with calibrated instruments. Information was recorded in the checklists and validated questionnaires for all participants (21). To assess the highest level of quality of data, all levels of quality assurance were closely supervised and monitored by Data and Safety Monitoring Board (DSMB) of the project (21-23).

2-2. Definition of Terms

2-2-1. Breast feeding

In this study, breast-feeding (BF) refers to BF that includes the whole month that participants were breastfed. In analysis, BF duration (month) was considered in four different classifications as following:

1: BF duration as continuous variable (month),
2: BF duration ≤ 6 months versus > 6 months (as binary variable),
3: BF duration ≤ 8 months versus >8 months (as binary variable),
4: BF duration ≤ 12 months versus >12 months (as binary variable).

2-2-2. Weight disorders

Abdominal obesity was defined as WC ≥ 90^{th} percentile value for age and gender. The World Health Organization (WHO) standard curves were used to define underweight, overweight, and obesity. Underweight were defined as BMI less than 5^{th}. Overweight subjects were classified as BMI between 85th and 95th percentiles, and obesity was considered as BMI greater than the 95th centile for age and gender. (24, 25) .

2-2-3. Socioeconomic status (SES)

The method and variables, which was used for calculating SES was approved previously in the Progress in the International Reading Literacy Study (PIRLS)(26); using principle component analysis (PCA) method variables including parental education and occupation, possessing private car, type of home (rented/private), school type (public/private), and having personal computer in home were summarized in one main component. This main component was categorized into quintile. The first quintile was defined as a low SES, and fifth as a high.

2-2-4. Physical activity (PA)

To assessment the leisure time physical activity (PA) the information of past week was collected. Participants reported the weekly frequency of their leisure time PA outside the school. Using physical activity questionnaire for adolescents (PAQ-A) instrument PA categorized as ; low PA level, that included those who scored between 1 to 1.9 on the PAQ-A instrument and high PA level that included participants with estimated scores between 2-5 PAQ-A.The validity and reliability of questioner, were approved

through a comprehensive national study (21, 27).

2-2-5. Screen time

The screen time behavior of was assessed through the questionnaire that asked the students to report the average number of hours per day that they spent for watching TV/VCDs, personal computer (PC), or electronic games (EG) in week days and weekends. Total cumulative spent time for screen time was estimated. For the analysis of correlates of screen time, according to the international screen time recommendations, screen time categorized into two groups of less than 2 hours per day (low) , and 2 hours per day or more (high) (28, 29).

2-2-6. Physical Measurements

A team of trained health care experts recorded information based on standard approved checklists and performed the examinations under international standard protocols by using calibrated instruments (24). Weight was measured to the nearest 200 g in barefoot and lightly dressed condition. Body mass index (BMI) was calculated as weight (kg) divided by height (Ht) squared (m2). Waist circumference (WC) was measured by a nonelastic tape to the nearest 0.2 cm at the end of expiration at the midpoint between the top of iliac crest and the lowest rib in standing position. Hip circumference (HC) was measured at the widest part of the hip at the level of the greater trochanter to the nearest 0.1 cm. Wrist circumference was measured to the nearest 0.1 cm on the dominant arm using a nonelastic tape meter. A Gulick measuring tape was used to measure neck circumference with an accuracy of 0.1 centimeters (cm) with the most prominent portion of the thyroid cartilage taken as a landmarkn(23, 24).

2-3. Statistical analysis

Categorical and continuous variables presented as a percentage [95% confidence interval (CI)] and mean (95% CI) respectively. Comparisons of continuous and categorical variables across BF categories were assessed by using analysis of variance (ANOVA) and Pearson Chi-square tests. Logistic regression analyses were used to evaluate the association of BF duration and weight disorders (underweight, overweight, obesity and abdominal obesity) in crude and adjusted model. Linear regression analyses were used to evaluate the association of BF duration and anthropometric measures (BMI, WC, hip circumference, neck circumference, wrist circumference) in crude and adjusted model. In adjusted model, the association was adjusted for age, gender and living area, family history of obesity, SES, physical activity, screen time, birth order, type of complementary feeding and birth weight.

2-4. Data analyses

Data were analyzed using survey data analysis methods in the STATA Corp. 2011 (Stata Statistical Software: Release 12. College Station, TX: Stata Corp LP. Package); p value less than <0.05 was considered as statistically significant.

2-5. Ethical consideration

The study was reviewed and approved by ethical committees of Isfahan and Tehran University of Medical Sciences. The process of sampling and examination began after 121a43dAQQAAexplaining the project to the students and their parents. Participation in the study was voluntary. Written informed consent, and verbal consent, were obtained from parents and students, respectively.

3- RESULTS

Overall, 23,043 students completed the survey (participation rate: 92.17%). They consisted of 50.8% boys, 73.4% urban residents, with the mean age of 12.55 ± 3.31 years. The data of BF was available for 22,393 (97%) of participant. Mean (95% CI) of duration of brestfeeding, BMI and WC was 16.15(15.89,16.42), 18.81(18.66,18.96) and 66.77(66.32,67.23) respectively. Prevalence (95 %CI) of overweight, obesity and abdominal obesity was 13.02(12.5,13.56), 6.49(6.07,6.93) and 17.55(16.8,18.34) respectively. The general characteristics of the study participants by duration of BF are presented in (**Table.1)**.

The association of BF with living area (P-<0.001), birth order (P= 0.001), SES (P<0.001), birth weight (P<0.001), type of complementary feeding (P<0.001) and type of milk consumed (P<0.001) was statistically significant). Mean of BMI, WC, hip circumference, neck circumference, wrist circumference, in student with short (less than 6-month) and long duration (≥ 6-month) of BF was not significant different (P>0.05). Also, prevalence of overweight, obesity and abdominal obesity in student with short (less than 6-month) and long (≥ 6-month) duration of BF was not significant different (P>0.05).

Association of different categories of BF duration with weight disorders in univariate and multivariate logistic regression analysis is presented in **Table.2**. In univariate and multivariate models, the association of duration of BF (as continuous variable) with all weight disorders (underweight, overweight, obesity and abdominal obesity) was not statistically significant (P>0.05).

In univariate model students with duration of BF more than 8 months (compare to duration of BF less than 8 months) and more than 12 months (compare to duration of BF less than 12 months) had lower risk of obesity. In multivariate model, only the association of duration of BF duration with overweight was statistically significant, so the children with history of BF more than 6 months versus less than 6 months, had decreased risk for overweight (OR: 0.86, 95% CI: 0.74,0.98). There was not any other significant association between duration of BF and different types of weight disorders in multivariate model.

Table.3 shows the association of BF with anthropometric measures (BMI, WC, hip circumference, neck circumference, wrist circumference) in univariate and multivariate linear regression analysis. The association of duration of BF with all anthropometric measures in univariate and multivariate models was not statistically significant (P> 0.05).

4- DISCUSSION

The results of our study showed that the duration of BF was not associated with anthropometric measures [except overweight in (BF ≥ 6 versus < 6 month)]. There are many studies about a relationship between overweight and obesity and in some of them were shown a significant relationship(13, 15). However in our study was not observed any relation between BF and weight disorders. Disaffiliation between BF and weight disorders in our study consists with other studies being undertaken(16, 17). In this study, we could not found significant correlation between BF duration and the risk of obesity abdominal obesity among children and adolescents. In another study, no significant correlation was found between duration of BF and obesity in adulthood (30). Furthermore, in study on Iranian children 11-13 year-old was shown an inverse relationship between duration of BF and overweight (31). In another nationwide study in Iranian children and adolescents, a significant association was observed between the duration of BF and the risk overweight, obesity and abdominal obesity (32).

Various studies have shown that compounds found in breast milk can be effective in the prevention of overweight and obesity. Breast milk contains chemicals that can trigger factors such as tumor necrosis factor and epidermal growth factor that inhibits cell division and differentiation of fat (33-36). Protein exists more than other nutrients in breast milk which can also be effective in obesity prevention (37). As part of the breast milk proteins such as immunoglobulins and proteolysis are resistant to acidic PH and therefore, they cannot be completely

digested and absorbed. Consuming too much protein in artificial valves can lead to the secretion of insulin and insulin-link growth factor (37). Also observed that plasma insulin concentration was higher in subjects who consumed milk than subjects with BF(38). It can increase fat deposits and they lead to increase the formation and growth of adipocytes cells in the body. Duration of BF after adjusting for confounding variables had no effect on obesity in children and adolescents. In this study, we have only one significant relationship between overweight and BF ≥ 6 versus < 6 when adjusted for confounding variables were observed (OR: 0.86; CI: 0.74-0.99). Another study demonstrated a longer BF may lead to a lower risk of obesity in later life (33). It has also been shown that long-term BF cannot have relationship with BMI, waist circumference, hip circumference and skin fold (34). The results of a meta-analysis study is in contradiction with the study that was conducted by Harder and colleagues demonstrated that for every month of BF, 3% reduced risk of obesity(18).

Studies of the relationship between BF and its duration and obesity risk has been reported, it is due to consider a number of factors that could be related to breast milk, such as adipokines (35), leptin (36), insulin(37) and ghrelin(38) in breast milk or related to complementary foods and infant formula that are alternative to breast milk (39). Moreover, Koletzko and colleagues (40) showed that children who grow low-protein formula used, the same children who had been breastfed; they believe that this effectiveness due to the formula, not breast milk. However, we could not found a significant association between BF and anthropometric indicators in adolescents (41-42).

Previous studies have shown that prolonged BF is associated with a reduced risk of type 2 diabetes (41), insulin resistance (34), blood pressure, dyslipidemia (43) and post neonatal mortality (44). In the first two years of life BF reduced risk of mortality due to diarrhea. Furthermore, in the first year of life is a risk of respiratory diseases and infection in childhood reduces (45, 46). The positive effect of exclusive breast-feeding in the first months of life the child survival has been observed (46). In another study, a significant positive correlation between BF and has been observed in adults (47). In the other study, BF for mother and children both physically and psychologically has its benefits (47). BF has positive effect on intelligence. Promote BF and use of human milk for infant feeding has many benefits, including socially, economically and environment (48). Babies are breastfed who has better health nutrition, growth, development and psychologically; also, they are facing less with sudden infant death syndrome (49).

According to the World Health Organization increased BF can save 800,000 children' lives. Also $ 300 million are saved annually by America store, as well as BF as an intervention with a huge impact for the Global Strategy for Women's, Children's and Adolescents' Health (2016-2030) (50). The results of a study showed that BF will begin the first day all-cause mortality during the neonatal period can be reduced with 16.3% and if BF starts the first hour of birth reduced to 22.3%. The risk of mortality is increased fourfold if liquids or solids based on milk to infants who fed with breast milk be given. Strong positive impact on the survival of infants exclusively breastfed in the first months of life have been observed (50). In addition to child, BF protect mother against breast cancer, ovarian cancer, and obesity protects (51). Therefore, BF is recommended, especially in the first six months of life. One of the strengths of the present study is using a large sample of children and adolescents at the national level. An important limitation

of this study is cross-sectional study was conducted that this study has limitations, including bias in mind.

4-1. Study limitations and strengths

One of the strengths of the present study is using a large sample of children and adolescents at the national level. An important limitation of this study is cross-sectional study was conducted that this study has limitations, including bias in mind.

5- CONCLUSIONS

Results of present study show that mean of anthropometric measures in student with short and long duration of BF was not significant different. Also, prevalence of weight disorders in student with short and long duration of BF was not significant different. Results of multivariate regression analysis show that although the longer duration of BF was associated with lower risk of becoming overweight, longer duration of BF was not associated with anthropometric measures in Iranian childeren and adolescence. To confirm the results of the present study, more longitudinal studies in Iranian children and adolescents are warranted.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGMENTS

The authors are thankful of the large team working on this study and all participants in different provinces.

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Table-1: General characteristics of the study participants by duration of breastfeeding: the weight disorders of the CASPIAN IV study

Variables	Duration of Breastfeeding			
	Total (n= 22393)	<6 months (n=2660)	≥ 6 months (n=19733)	P-value
Duration of breastfeeding (month)[1]	16.15(15.89,16.42)	2.64(2.56,2.72)	17.98(17.73,18.22)	0.001
Age (year)[1],	12.53(12.34,12.71)	12.54(12.28,12.81)	12.53(12.34,12.71)	0.79
Weight (kg) [1]	42.53(41.73,43.32)	42.73(41.55,43.91)	42.49(41.68,43.29)	0.62
Height (cm) [1]	147.41(146.47,148.35)	147.29(145.98,148.61)	147.41(146.46,148.36)	0.82
BMI (kg/m2) [1]	18.81(18.66,18.96)	18.94(18.63,19.20)	18.79(18.64,18.94)	0.21
WC (cm) [1]	66.77(66.32,67.23)	66.81(66.10,67.52)	66.76(66.30,67.71)	0.85
WHtR[1]	0.453(0.452,0.4555)	0.454(0.451,0.457)	0.453(0.451,0.454)	0.57
Wrist (cm) [1]	15.33(15.09,15.56)	15.15(14.86,15.44)	15.36((15.10,15.62)	0.26
Hip (cm) [1]	81.02(80.40,81.63)	81.22(80.28,82.16)	80.98(80.36,81.60)	0.55
WhR[1]	0.82(0.82,0.83)	0.830(0.821,0.838)	0.829(0.826,0.832)	0.80
Neck[1]	30.36(30.18,30.54)	30.36(30.04,30.67)	30.36(30.18,30.54)	0.97
Overweight[2]	13.02(12.5,13.56)	14.17(12.84,15.61)	12.86(12.32,13.42)	0.06
Generalized obesity[2]	6.49(6.07,6.93)	7.32(6.33,8.46)	6.38(6.07,6.93)	0.06
Abdominal obesity[2]	17.55(16.8,18.34)	18.37(16.71,20.15)	17.45(16.67,18.25)	0.24
Living place[2]				
Urban	73.43(70.89,75.82)	78.27(75.01,81.21)	72.78(70.18,75.23)	<0.001
Rural	26.57(24.18,29.11)	21.73(18.79,24.99)	27.22(24.77,29.82)	
Gender [2]				
Boy	50.68(47.96,53.39)	49.30(45.42,53.2)	50.86(48.12,53.6)	

Girls	49.32(46.61,52.04)	50.70 (46.8,54.58)	49.14(46.4,51.88)	0.33
Family history of Obesity[2]				
No	76.11(75.37,76.83)	75.23(73.43,76.95)	76.22(75.46,76.97)	0.27
Yes	23.89(23.17,24.63)	24.77(23.05,26.57)	23.78(23.03,24.54)	
Birth order[2]				
1st	44.68(43.86,45.5)	46.98 (45.01,48.96)	44.36 (43.5,45.23)	0.001
2nd	31.06(30.38,31.74)	31.49(29.66,33.37)	31(30.28,31.72)	
3rd	16.13(15.57,16.71)	15.16(13.79,16.64)	16.26 (15.67,16.87)	
> 4th	8.13(7.70,8.58)	6.37(5.44,7.452)	8.37(7.925,8.852)	
Family size[2]				
≤4 person	83.36(82.45,84.23)	85.17(83.37,86.81)	83.12(82.17,84.02)	0.02
>4 person	16.64(15.77,17.55)	14.83(13.19,16.63)	16.88(15.98,17.83)	
Screen time[2]				
< 2 hour per day	59.25(58.23,60.27)	59.58(57.32,61.8)	59.21(58.15,60.26)	0.74
≥ 2 hour per day	40.75(39.73,41.77)	40.42(38.2,42.68)	40.79(39.74,41.85)	
Physical activity[2]				
Active	76.53(75.32,77.71)	75.87(73.64,77.98)	76.62(75.39,77.81)	0.45
Inactive	23.47(22.29,24.68)	24.13 (22.02,26.36)	23.38(22.19,24.61)	
Socio-economic status[2]				
Quintile 1	20.15(19.09,21.25)	20.49(18.34,22.83)	20.11(19.02,21.24)	<0.001
Quintile 2	19.79(19.02,20.59)	16.41(14.79,18.18)	20.22(19.41,21.06)	
Quintile 3	20.10 (19.37,20.85)	19.07(17.36,20.91)	20.22(19.47,21)	
Quintile 4	19.97(19.19,20.79)	20.97(19.13,22.93)	19.85(19.05,20.67)	
Quintile 5	19.99 (18.72,21.31)	23.06[20.67,25.63)	19.60[18.33,20.94)	

Type of complementary feeding[2]				
Always homemade foods	73.55(72.47,74.61)	65.68(63.46,67.84)	74.61 (73.49,75.7)	<0.001
Always formula	2.45(2.21,2.72)	3.90 (3.05,4.96)	2.25(2.02,2.52)	
Usually homemade foods	21.06(20.13,22.02)	25.83(23.92,27.84)	20.42(19.46,21.41)	
Usually formula	2.93(2.651,3.248)	4.58(3.78,5.54)	2.71(2.42,3.03)	
Type of milk consumed[2]				
Breast feeding	82.19(81.49,82.87)	30.87(28.14,33.73)	89.06(88.44,89.65)	<0.001
Formula	3.23(2.98,3.50)	21.60(19.81,23.5)	0.77(0.65,0.92)	
Cow's milk	5.73 (5.29,6.20)	19.10(17.25,21.09)	3.94(3.56,4.35)	
Mixed	8.84(8.34,9.36)	28.44 (26.25,30.72)	6.22(5.78,6.69)	
Birth weight[2]				
<2500g	9.47(8.97,9.99)	16.45(14.96,18.07)	8.53(8.03,9.06)	<0.001
2500-4000 g	82.8(82.13,83.46)	76.11 (74.29,77.84)	83.70(83,84.38)	
>4000g	7.72(7.28,8.19)	7.43(6.38,8.64)	7.76(7.29,8.25)	

[1]are presented as mean (95% CI.)

[2] are presented as percentage (95% CI).

BMI=body mass index.

WC = waist circumference.

WHtR = waist to height ratio.

WhtR = waist to hip ratio.

Table-2: Association of breastfeeding with weight disorders in logistic regression analysis: the weight disorders of the CASPIAN IV study

	BF duration (month)	BF ≥ 6 vs. < 6 months	BF ≥ 8 vs. < 8 months	BF ≥ 12 vs. < 12 months
Underweight				
Unadjusted	0.99 (0.99,1.00)	0.94(0.81,1.08)	0.95(0.83,1.09)	0.95(0.83,1.08)
Adjusted**	0.99 (0.99,1.00)	1.00(0.83,1.21)	1.01(0.86,1.17)	0.99(0.86,1.15)
Obesity				
Unadjusted	0.99 (0.98,1.00)	0.86(0.73,1.00)	0.84(0.73,0.95)*	0.86(0.76,0.97)*
Adjusted**	0.99 (0.98,1.00)	0.97(0.79,1.19)	0.90(0.773,1.047)	0.90(0.78,1.04)
Overweight				
Unadjusted	0.99 (0.99,1.00)	0.89(0.79,1.00)	0.94(0.86,1.03)	0.95(0.87,1.05)
Adjusted**	0.99 (0.99,1.00)	0.86(0.74,0.98)*	0.94(0.85,1.05)	0.96(0.87,1.07)
Abdominal obesity				
Unadjusted	0.99(0.99,1.00)	0.93(0.83,1.05)	0.93(0.85,1.02)	0.93(0.85,1.01)
Adjusted**	1.00(0.99,1.01)	1.01(0.88,1.17)	1.00(0.90,1.11)	0.99(0.89,1.09)

Data are presented as OR (95% CI).

BF= breastfeeding.

*Statistically significant.

**Adjusted for age, sex and living area, family history of obesity, socioeconomic status, physical activity, screen time, birth order, Type of complementary feeding and birthweight.

Table-3: Association of Breastfeeding with anthropometric measurements in linear regression analysis: the weight disorders of the CASPIAN IV study

	BFduration (month)	BF ≥ 6 vs. < 6 months	BF ≥ 8 vs.< 8 months	BF ≥ 12 vs.< 12 months
BMI ($kg/m^{2)}$				
Unadjusted	-0.007(-0.019,0.004)	-0.14(-0.38,0.08)	-0.18(-0.41,0.03)	-0.18(-0.40,0.03)
Adjusted*	0.001(-0.006,0.009)	0.03(-0.17,0.24)	-0.06(-0.22,0.10)	-0.04(-0.19,0.10)
Waist (cm)				
Unadjusted	-0.005(-0.03,0.02)	-0.05(-0.67,0.56)	-0.31(-0.96,0.34)	-0.40(-1.04,0.23)
Adjusted*	0.02(-0.001,0.04)	0.08(-0.44,0.60)	0.06(-0.36,0.50)	0.08(-0.33,0.50)
Wrist (cm)				
Unadjusted	0.01(-0.006,0.04)	0.20(-0.15,0.57)	0.25(-0.09,0.61)	0.28(-0.07,0.64)
Adjusted*	0.02(-0.008,0.05)	0.41(-0.04,0.87)	0.38(-0.05,0.82)	0.40(-0.05,0.85)
Hip (cm)				
Unadjusted	-0.002(-0.04,0.04)	-0.24(-1.05,0.56)	-0.22(-1.11,0.66)	-0.30(-1.14,0.54)
Adjusted*	-0.003(-0.05,0.06)	-0.02(-0.56,0.51)	0.13(-0.35,0.63)	0.19(-0.27,0.67)
Neck (cm)				
Unadjusted	-0.001(-0.01,0.01)	0.004(-0.29,0.29)	-0.07(-0.36,0.21)	-0.10(-0.38,0.16)
Adjusted**	0.0001(-0.01,0.01)	0.04(-0.30,0.39)	-0.04(-0.21,0.19)	-0.02(-0.25,0.19)

Data are presented as β coefficient (95% CI).

BF= breastfeeding.

*Adjusted for age, sex and living area, family history of obesity, socioeconomic status, physical activity, screen time, birth order, Type of complementary feeding and birthweight.