

Breastfeeding History and the Risk of Overweight and Obesity in Middle-aged Women

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Abstract

Background: Breastfeeding is considered to be a factor that stimulates fat reserves accumulated during pregnancy to produce milk. The aim of the study was to assess the association between breastfeeding duration and fatness indices in middle-aged women.

Methods: The analysis was carried out in a group of 7,500 parous women aged 55.5 ± 5.3 . Body mass index, percentage of body fat and waist-to-height ratio were included in the analysis. The likelihood of overweight and obesity depending on the total breastfeeding time was assessed using multivariate logistic regression analyzes.

Results: An analysis of adjusted odds ratios did not show significant associations between breastfeeding duration and the risk of overweight and obesity in premenopausal women. After menopause, women who gave birth to 2 children and breastfed 1-6 and >12 months had a lower risk of abdominal obesity (OR=0.70; 95% CI=0.50-0.99; $p=0.042$; and OR=0.68 ; 95% CI=0.47-0.98; $p=0.039$), and in those women who gave birth to 3 or more children and breastfed for 1-6 months, also showed a lower risk of overweight (OR=0.52; 95% CI=0.27-0.99; $p=0.047$), compared to those ones that have never breastfed. There was no relationship found between the duration of lactation and the risk of excessive body fat.

Conclusion: Breastfeeding may have some beneficial, long-term effect on the risk of overweight and abdominal obesity in women.

1. Background

Excessive body fat is one of the most important risk factors for diseases such as type 2 diabetes, cardiovascular disease and cancer [1–6]. Epidemiological data indicate that obesity is usually more common in women than in men [7, 8]. Factors related to the risk of obesity which are specific to women include the duration of lactation, parity, and menopausal status.

In pregnant women, there is an increase in energy demand associated with the development and growth of the fetus, placenta, enlargement of the uterus, mammary glands and an increase in blood volume. During pregnancy, the woman's body also prepares for breastfeeding later, by accumulating nutrients and energy needed for milk production. An excessive amount of energy intake during this period, in relation to needs, may increase the body's fatty tissue, making it difficult to regain the pre-pregnancy mass, as well as to maintain normal body mass over a longer period of time [9, 10]. Breastfeeding is considered to be a factor that stimulates milk production from fat reserves accumulated during pregnancy [11]. It has been estimated that breastfeeding mothers need additionally about 2.8 megajoules (MJ) (670 kcal) energy per day to produce milk, of which about 2.1 MJ (500 kcal) should be provided from food, and the rest should come from fat stores accumulated during pregnancy [12]. Breastfeeding can therefore have a beneficial effect on the body fat index in women. 14 out of 35 prospective studies in which women were evaluated for weight ≤ 2 years after delivery, found a beneficial effect of breastfeeding on body weight changes, whereas the remaining 21 did not show such relationships [13]. From 8 retrospective studies of the same authors, a positive association between breastfeeding and weight changes was noted only in 2 papers. The results of studies on the relationship between breastfeeding and long-term weight changes in women are also inconclusive. Results of a cluster-randomized controlled trial did not confirm that longer breastfeeding led to a significant reduction in fatty tissue of the mother more than 11 years after delivery [14]. McClure et al. found that 7 years after delivery, the amount of visceral fat measured by computed tomography was greater among those mothers who breastfed for less than 3 months after the birth of each child, compared to those who breastfed longer [15]. However, they did not observe such a relation regarding body mass index (BMI) and other fatness indicators, while Bobrow et al. showed that postmenopausal women who had breastfed, had a significantly lower BMI than those who had never breastfed [16]. It is therefore important to examine breastfeeding history as an independent factor that can potentially have a long-term effect on female fatness.

Most studies have confirmed that parity is a factor that strongly increases the risk of excess body mass in women whilst extended breastfeeding duration has the opposite effect i.e. lower body mass [8, 17, 18]. It was found that the weight gain that occur in women who have given birth are much larger than the weight gain in those who have never given birth [17, 18]. Many studies show that menopausal transformation in women leads to an increased risk of obesity [19–23]. Menopause onset is connected with decreased energy expenditure and fat oxidation that can predispose to excess of body fat mass [19, 23].

The aim of the study was to assess the relationship between breastfeeding duration and body fat indices: BMI, body fat percentage (%BF) and waist-to-height ratio (WHtR) in middle-aged women. All analyzes were carried out separately in three fertility categories and separately for premenopausal and postmenopausal women.

2. Methods

2.1. Design and Sample

The research material consists of the data of 8,725 participants of the PONS (Polish-Norwegian Study) project, carried out 2010–2012, in the province of Świętokrzyskie in Poland [24]. Ethics Committee from the Cancer Centre and Institute of Oncology in Warsaw, No. 69/2009/1/2011 (data collection), and Committee on Bioethics at the Faculty of Health Sciences, Jan Kochanowski University in Kielce, Poland (No. 29/2015) (data analysis) approved the study. The analysis excluded 327 women with diagnosed cancer, 263 with incomplete data and 635 women who had never given birth. The final sample consisted of 7,500 parous women (Figure SM1).

2.2. Measurements

All measurements were performed by trained nurses. The following data was used in this study: anthropometric measurements of body weight height and waist circumference, on the basis of which BMI (kg/m^2) and WHtR (waist circumference/height) were calculated, as well as percentage of body fat (% BF) measurement performed using the bioelectrical impedance method.

2.3. Sociodemographic and Lifestyle Data

The questionnaire interview was conducted by trained nurses. The following socio-demographic and lifestyle information was collected in the survey: age (years), education (years), place of residence (urban; rural), marital status (married or in a stable relationship; single or a widow/widower), parity (1, 2, 3 and more children), menopausal status (premenopausal, postmenopausal), total duration of breastfeeding (in months, then divided into breastfed 1–6; 7–12; >12 months or never breastfed) and the use of hormone therapy (ever, never). Due to smoking status, the studied women were divided into never, former or current smokers. The International Physical Activity Questionnaire (IPAQ) – the long form, was used to assess physical activity and it was expressed as Moderate-to-Vigorous (MVPA) and light physical activity (LPA) (MET/min/day⁻¹) [25]. Sitting time was expressed in minutes/day. Food consumption data was collected using the Food Frequency Questionnaire (FFQ), which was constructed on the basis of a previously-developed and validated FFQ for the Polish branch of the PURE study [26]. The answers related to the consumption frequency of standard size portioned products. As it was not possible to calculate the calorific value of the diets of the subject population of women on the basis of the collected data, the analysis included 3 groups of products that could potentially have the greatest impact on fatness: fats (butter, lard, margarine, mayonnaise, rapeseed oil, soya, sunflower oil, olive oil, and other oils), sweets (sugar, chocolate and chocolate-products, candies, cakes, cookies), whole grains (whole grain bread, groats, cereals). Answers related to the frequency of consumption of products with standard portion sizes were transformed into daily consumption doses and standardized by z-score.

2.4. Definition of Terms

The overweight group included women with BMI ≥ 25.0 kg/m², it was assumed that the excess fatty tissue indicating obesity was >35% BF [27], and for abdominal obesity it was WHtR ≥ 0.5 [28]. According to the North American Menopause Society, postmenopausal women include those with amenorrhea for at least 12 months [29].

2.5. Statistical analysis

All categorical variables were expressed as frequency and percentage (n, %) and all continuous variables were reported as means and standard deviations (X \pm SD). Differences in baseline characteristics between normal and abnormal adiposity were assessed using the Mann-Whitney U test for continuous variables and the Chi-square test for categorical variables. The probability of overweight and/or obesity depending on the total breastfeeding duration was assessed using multivariate logistic regression analyzes, calculating the odds ratios (ORs) and 95% confidence intervals (CIs). The analyzes were carried out separately in three categories of parity, in raw and adjusted models for confounding variables. The control group (ref.) consisted of women who had never breastfed. In models adjusted as confounders, the following were adopted: age; years of education, moderate to vigorous PA, light PA, sitting time, consumption of fats, sweets, whole grains, (continuous variables), and place of living (ref. urban), marital status (ref. single), smoking (ref. never smokers), and hormone therapy (ref. never). Analyses were performed using the statistical package Statistica 13.3 (TIBCO SOFTWARE INC, Polish version, PL, Cracow). A p value ≤ 0.05 represented statistical significance.

3. Results

The average age of the study group of women was 55.5 \pm 5.3 years. In the group of premenopausal women, overweight and obese participants were older, less well-educated, more often inhabited rural areas than urban and more often remained in stable relationships compared to participants with normal weight (Table 1). They also devoted less time to light physical activity, more often they declared a lower consumption of sugar and sweets. Women with more body fat (%BF >35%) also more often declared limiting fat intake. Women with abdominal obesity (WHtR ≥ 0.5) consumed sweets with a similar frequency as women without abdominal obesity, while declaring a lower intake of whole grains. In the compared groups, no significant differences were found in the time spent on Moderate-to-Vigorous physical activity and sitting time. The percentage of smokers was also similar in the compared groups. Women with overweight and obesity more often gave birth to 3 or more children and less often used hormonal therapy. The percentage of women who breastfed for more than 12 months was higher in the overweight group (BMI ≥ 25 kg/m²) than in the group with normal weight. For the other obesity indices, the differences between the compared groups were not statistically significant.

Among post-menopausal women, overweight and obesity women were also older, less well-educated and inhabited rural more often than urban areas, compared to women with normal weight (Table 2). Marital status was not a factor that significantly differentiated the occurrence of overweight and abdominal obesity. It was only noted that the participants remaining in stable relationships had a higher body mass (%BF >35%). Women with overweight and obesity spent less time on light physical activity and declared a lower sugar and sweets consumption, and women with abdominal obesity (WHtR ≥ 0.5) - also declared a lower consumption of whole grains. In the compared groups there were no significant differences in fat intake or sitting time. Participants after menopause with overweight and obesity, smoked less often, used hormone therapy less often and the percentage of women who gave birth to 3 and more children was higher, whereas the percentage of women who gave birth to only 1 child was smaller. Also, the percentage of women who breastfed >12 months was higher, and lower than those ones who breastfed 1-6 months.

An analysis of the unadjusted odds ratios in premenopausal women showed that there were no significant associations between the duration of lactation and the risk of overweight and obesity in any of the three categories of parity (Table SM1). In postmenopausal women who gave birth to 2 children, the risk of abdominal obesity was significantly lower in those who breastfed for 1-6, as well as >12 months, compared to those who had never breastfed (Table SM2). In the group of women who gave birth to 3 or more children, the risk of overweight (BMI ≥ 25 kg/m²) as well as abdominal obesity (WHtR ≥ 0.5), was significantly lower in those who breastfed for 1-6 months compared to non-breastfeeding mothers. A similar tendency could also be observed with longer lactation, but it did not reach the level of statistical significance. There was no association, though, between the duration of lactation and the risk of excessive body fat (%BF >35%).

The analysis of adjusted odds ratios did not show any significant associations between the length of breastfeeding and the risk of overweight and obesity in pre-menopausal women in any of the analyzed parity categories (Table 3). In postmenopausal women who gave birth to one child and breastfed for 7-12 months had a higher risk of abdominal obesity compared to those who did not breastfeed (Table 4). Among women who gave birth to 2 children, breastfeeding was associated with a lower risk of abdominal obesity (WHtR ≥ 0.5). Participants who gave birth to 3 or more children and breastfed for 1-6 months had a lower risk of being overweight (BMI ≥ 25 kg/m²) compared to those who had never breastfed.

4. Discussion

An analysis of the results of the study showed that in postmenopausal women who had given birth to 2, 3 or more children, breastfeeding was associated with a lower risk of overweight and abdominal obesity, compared to women of the same parity who did not breastfeed at all. Adjustment for confounding factors did make the associations slightly weaker, but they still remained statistically significant in many groups.

Most studies confirm an inverse association between breastfeeding duration and the risk of obesity [8, 30–32]. In the Norwegian population, the probability of obesity in women under the age of 50, who had never breastfed, was 3.37 times higher compared to those who had breastfed for at least 24 months [33]. Bobrow et al. reported that in postmenopausal women, the mean BMI was 0.22 kg/m² lower for each additional 6 months of breastfeeding [8]. However, some studies have not confirmed the association between the duration of lactation and fatness [6, 34]. Sharma et al., while examining women with obesity six years after delivery, noted that those who fully complied with the recommendations regarding breastfeeding at that time (i.e., they were exclusively breastfeeding for ≥ 4 months and continuing breastfeeding for ≥ 12 months) had a lower body mass than obese women that have never breastfed. However, they did not find such associations in women with normal weight or overweight [35]. The results of our study are largely consistent with those studies in which the positive effect of breastfeeding on reducing the risk of abdominal obesity has been demonstrated. The amount of visceral adipose tissue measured by computed tomography was higher among mothers who breastfed for less than 3 months after the birth of each child, compared to those who breastfed longer [7, 31]. Women who breastfed for more than 6 months, had a significantly smaller waist circumferences 10 years after delivery than those who breastfed for a shorter period [36]. Kirkegaard et al., who showed a weak but significant inverse association between breastfeeding duration and body weight 7 years after delivery, found that this association was much stronger in the case of BMI-adjusted waist circumference analysis [32]. The mechanism by which a longer period of breastfeeding can reduce the risk of abdominal obesity in the long term is poorly understood. Visceral adipose tissue has been found to be more susceptible to reduction compared to subcutaneous adipose tissue because adipocytes of the epiploic and mesenteric adipose tissue, the main components of visceral fat, show greater metabolic activity and lipolytic sensitivity [37–39]. Numerous studies suggest that following a low calorie diet and increased physical activity, causes a much greater reduction of visceral fat than subcutaneous adipose tissue [40–42]. It is therefore possible that a similar phenomenon also occurs during lactation. Kirkegaard et al., however, explain this association by the strong confounding effects of visceral adipose tissue before pregnancy [32]. If the greater amount of abdominal fat before pregnancy is associated with shorter breastfeeding, this may also explain the direct relationship between breastfeeding and waist circumference after delivery.

In the group of postmenopausal women we studied, those who gave birth to one child and breastfed for 7–12 months, ran a greater risk of abdominal obesity compared to those who did not breastfeed, which is contrary to what was expected. This result could have been due to the relatively small number of women who gave birth to only one child, but breastfed more than 6 months. Analysis of our research results did not reveal any significant association between breastfeeding and the risk of overweight and obesity in pre-menopausal women. The values of adjusted odds ratios (ORs) in this group, however, indicate a clear tendency of a lower probability of lactating women to be overweight and have abdominal obesity, compared to those who have never breastfed. The results for those in the breastfeeding group who gave birth to 3 and more children were as follows: from 0.39 to 0.51 for BMI ≥ 25 kg/m², and for WHtR ≥ 0.5 , from 0.54 to 0.76. These values, although they did not reach the level of statistical significance, were, however, similar, and sometimes even lower than in postmenopausal women. The results of our study also showed no correlation between the duration of lactation and the risk of excessive fatness, determined by the percentage of body fat. Similarly, McClure et al., despite the fact that the amount of visceral adipose tissue, measured by computed tomography 7 years after delivery, was greater among those mothers who breastfed for less than 3 months after the birth of each child, compared to those who breastfed longer, they did not observe a similar association in relation to BMI and other body fat indices [7]. Only Wiklund et al. found that mothers who breastfed their children for less than 6 months had a higher body fat mass and fat mass percentage measured using dual-energy X-ray absorptiometry (DEXA), compared to those who breastfed for longer [30]. It is therefore possible that these associations are only revealed by more precise measurements of body fat, such as DEXA.

The main limitation of the study is the fact that the study was cross-sectional. The nutritional status of the examined women before pregnancy was not known, nor was the amount of pregnancy weight gain. Therefore, these variables could not be included in the analysis as confounders. We also did not have detailed information on the intensity and regularity of feeding. Some studies indicate that the effect of lactation on the risk of obesity may depend on whether the examined women breastfed their children exclusively or not [43]. The strength of the work is primarily the large number of women included in the analysis (7.5 thousand), taking into account the large number of confounding factors, including physical activity and nutritional factors, as well as conducting separate analyzes due to parity and menopausal status.

5. Conclusions

In women who gave birth to at least 2 children, breastfeeding was associated with a slightly lower risk of overweight and abdominal obesity after menopause, compared with women of the same parity who did not breastfeed at all. Breastfeeding may therefore have some beneficial, long-term effect on female fatness. In order to confirm the above association, it is necessary to conduct long-term studies.

Abbreviations

%BF – body fat percentage

BMI – Body Mass Index

CI – confidence intervals

LPA - light physical activity

MJ – Megajoules

MVPA – Moderate to Vigorous Physical Activity

OR – Odds Ratio

PA – Physical Activity

WHtR – Waist to Height Ratio

Declarations

Ethics approval and consent to participate

Written informed consent was obtained from all study participants.

Ethics Committee from the Cancer Centre and Institute of Oncology in Warsaw, No. 69/2009/1/2011 (data collection), and Committee on Bioethics at the Faculty of Health Sciences, Jan Kochanowski University in Kielce, Poland (No. 29/2015) (data analysis) approved the study. We declared that all methods we performed in accordance with the relevant guidelines and regulations.

Consent for publication

Not applicable

Availability of data and materials:

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interest: The authors declare that they have no competing interests

Availability of data and materials: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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All authors have read and agreed to the published version of the manuscript.

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Tables

Table 1. Characteristics of premenopausal participants included in these analyses (N=2048).

Variables		BMI			%BF			WHtR	
		< 25kg/m ²	≥ 25kg/m ²	p	≤ 35%	> 35%	p	< 0.5	≥ 0.5
		n=815	n=1233		n=1094	n=954		n=803	n=124
Age, X±SD		48.98±3.02	50.02±3.22	<0.001 ^A	49.22±3.08	50.05±3.23	<0.001 ^A	48.92 (3.02)	50.05
Years of education, X±SD		14.68±3.06	13.80±3.15	<0.001 ^A	14.51±3.11	13.73±3.13	<0.001 ^A	14.92 (2.97)	13.65
Place of living, N (%)	City	517 (63.44)	663 (53.77)	<0.001 ^B	670 (61.24)	510 (53.46)	<0.001 ^B	541 (67.37)	639 (51.80)
	Village	298 (36.56)	570 (46.23)		424 (38.76)	444 (46.54)		262 (32.63)	606 (49.20)
Marital status, N (%)	Single	159 (19.51)	177 (14.36)	0.002 ^B	197 (18.01)	139 (14.57)	0.036 ^B	151 (18.80)	185 (15.00)
	Married	656 (80.49)	1056 (85.64)		897 (81.99)	815 (85.43)		652 (81.20)	1060 (85.00)
Physical activity (MET/min/day ⁻¹) X±SD	Moderate-to-Vigorous	495.57±499.05	510.56±500.87	0.352 ^A	505.11±503.18	504.00±496.76	0.686 ^A	487.00±484.55	515.92±500.87
	Light	253.82±228.54	237.84±228.99		0.050 ^A	253.22±228.92		233.85±228.53	0.020 ^A
Sitting time (min/day) X±SD		307.94±139.99	310.84±141.81	0.747 ^A	307.19±140.02	312.55±142.26	0.426 ^A	316.44±141.92	305.33±139.99
Fats (servings/day) X±SD		2.87±1.94	2.76±1.99	0.071 ^A	2.87±1.94	2.73±2.00	0.044 ^A	2.82±1.92	2.79±1.99
Sweets (servings/day) X±SD		3.62±3.27	3.20±3.01	0.004 ^A	3.54±3.17	3.17±3.05	0.004 ^A	3.37±3.18	3.36±3.01
Whole grains (servings/day) X±SD		2.01±2.18	1.86±2.01	0.526 ^A	1.93±2.14	1.90±2.01	0.370 ^A	2.12±2.19	1.79±2.01
Smoking, N (%)	Current smokers	174 (21.35)	219 (17.76)	0.026 ^B	212 (19.38)	181 (18.97)	0.253 ^B	161 (20.05)	232 (18.50)
	Never smokers	462 (56.69)	699 (56.69)		634 (57.95)	527 (55.24)		456 (56.79)	705 (56.00)
	Former smokers	179 (21.96)	315 (25.55)		248 (22.67)	246 (25.79)		186 (23.16)	308 (24.50)
Hormone therapy N (%)	Yes	195 (23.93)	221 (17.92)	0.001 ^B	248 (22.67)	168 (17.61)	0.004 ^B	209 (26.03)	207 (16.50)
	No	620 (76.07)	1012 (82.08)		846 (77.33)	786 (82.39)		594 (73.97)	1038 (83.50)
Parity, N (%)	1	173 (21.23)	190 (15.41)	<0.001 ^B	212 (19.38)	151 (15.83)	0.011 ^B	187 (23.29)	176 (14.00)
	2	440 (53.99)	606 (49.15)		569 (52.01)	477 (50.00)		433 (53.92)	613 (49.00)
	3 and more	202 (24.79)	437 (35.44)		313 (28.61)	326 (15.92)		183 (22.79)	456 (36.50)
Breastfeeding status, N (%)	Never breastfed	79 (8.69)	121 (9.81)	0.059 ^B	102 (9.32)	98 (10.27)	0.371 ^B	80 (9.96)	120 (9.60)
	Breastfed 1-6 months	264 (32.39)	337 (27.33)		333 (30.44)	268 (28.09)		256 (31.88)	345 (27.50)
	7-12 months	187 (22.94)	283 (22.95)		259 (16.26)	211 (22.12)		183 (22.79)	287 (22.90)
	> 12 months	285 (34.97)	492 (39.90)		400 (36.56)	377 (39.52)		284 (35.37)	493 (39.00)

BMI – body mass index; %BF – body fat percentage; WHtR – waist-to-height ratio; X – arithmetic mean; SD – standard deviation; ^A – Mann-Whitney U test; ^B – chi-square test

Table 2. Characteristics of postmenopausal participants included in these analyses (N=5452).

Variables	BMI			%BF			WHtR		
	< 25kg/m ²	≥ 25kg/m ²	P	≤ 35%	> 35%	p	< 0.5	≥ 0.5	
	n=1400	n=4052		n=1909	n=3543		n=1118	n=430	
Age X±SD	56.70 ±4.24)	58.05 ±4.07)	<0.001 ^A	56.91 ±4.25)	58.13 ±4.04)	<0.001 ^A	56.52 ±4.21)	58.01	
	57.00 ±6.00)	58.00 ±6.00)		57.00 ±6.00)	59.00 ±6.00)		57.00 ±6.00)	58.00	
Years of education X±SD	13.46 ±2.97)	12.51 ±3.08)	<0.001 ^A	13.25 ±3.03)	12.48 ±3.07)	<0.001 ^A	13.83 ±2.95)	12.48	
	13.00 ±4.00)	12.00 ±3.00)		13.00 ±4.00)	12.00 ±3.00)		13.00 ±4.00)	12.00	
Place of living N (%)	City	2442 (60.27)	<0.001 ^B	1312 (68.73)	2123 (59.92)	<0.001 ^B	831 (74.33)	2604	
	Village	407 (29.07)		1610 (39.73)	597 (31.27)		1420 (40.08)	287 (25.67)	1730
Marital status N (%)	Single	988 (24.38)	0.541 ^B	496 (25.98)	1318 (23.20)	<0.001 ^B	263 (23.52)	1055	
	Married	1070 (76.43)		3064 (75.62)	1413 (74.02)		2721 (76.80)	855 (76.48)	3279
Physical activity (MET/min/day ⁻¹) X±SD	Moderate-to-Vigorous	435.74±459.93	0.055 ^A	417.58±431.55	434.76±462.53	0.160 ^A	416.34±434.02	431.9	
	Light	221.99±207.32	<0.001 ^A	225.63±215.17	196.51±196.70	<0.001 ^A	236.60±220.01	199.0	
Sitting time (min/day) X±SD	287.17±134.84	284.69±128.72	0.968 ^A	284.89±135.31	285.57±127.56	0.411 ^A	291.48±138.47	283.7	
Fats (servings/day) X±SD	2.62±1.89	2.71±1.94	0.414 ^A	2.62±1.90	2.73±1.94	0.153 ^A	2.58±1.89	2.72±	
Sweets (servings/day) X±SD	3.57±4.32	2.90±2.96	<0.001 ^A	3.36±4.01	2.91±2.97	<0.001 ^A	3.30±4.35	3.01±	
Whole grains (servings/day) X±SD	1.91±2.00	1.98±2.05	0.175 ^A	1.96±2.06	1.97±2.03	0.879 ^A	2.11±2.14	1.93±	
Smoking N (%)	Current smokers	590 (14.56)	<0.001 ^B	485 (24.41)	498 (14.06)	<0.001 ^B	286 (25.58)	697 (
	Never smokers	617 (44.07)		2175 (53.68)	887 (46.46)		1905 (53.77)	506 (45.26)	2286
	Former smokers	390 (27.86)		1287 (31.76)	537 (28.13)		1140 (32.18)	326 (29.16)	1351
Hormone therapy N(%)	Yes	351 (8.66)	<0.001 ^B	238 (12.47)	299 (8.44)	<0.001 ^B	170 (15.21)	367 (
	No	1214 (86.71)		3701 (91.34)	1671 (87.53)		3244 (91.56)	948 (84.79)	3967
Parity N (%)	1	601 (14.83)	<0.001 ^B	411 (21.53)	500 (14.11)	<0.001 ^B	277 (24.78)	634 (
	2	720 (51.43)		2018 (49.80)	962 (50.39)		1776 (50.13)	578 (51.70)	2160
	3 and more	370 (26.43)		1433 (35.37)	536 (28.08)		1267 (35.76)	263 (23.52)	1540
Breastfeeding status N (%)	Never breastfed	474 (11.70)	<0.001 ^B	237 (12.41)	406 (11.46)	<0.001 ^B	140 (12.52)	503 (
	Breastfed	545 (12.07)		1305 (32.21)	726 (38.03)		1124 (31.72)	451 (40.34)	1399
	1-6 months								
	7-12 months	327 (23.36)		943 (23.27)	436 (22.84)		834 (23.54)	242 (21.65)	1028
	> 12 months	359 (25.64)		1330 (32.82)	510 (26.72)		1179 (33.28)	285 (25.49)	1404

BMI – body mass index; %BF – body fat percentage; WHtR – waist-to-height ratio; X – arithmetic mean; SD – standard deviation; ^A – Mann-Whitney U test; ^B – chi-square test

Table 3. Multivariable logistic regression analysis for overweight and obesity in relation to breastfeeding duration in premenopausal women (adjusted).

Parity	Breastfeeding status	BMI \geq 25 kg/m ²		%BF > 35%		WHtR \geq 0.5	
		OR; 95%CI	p	OR; 95%CI	p	OR; 95%CI	p
1 child	Did not breastfeed	1.00		1.00		1.00	
	breastfeed 1-6 months	1.04; 0.61-1.79	0.880	0.95; 0.55-1.63	0.842	0.93; 0.54-1.59	0.787
	7-12 months	1.01; 0.49-2.09	0.971	0.77; 0.37-1.61	0.491	0.92; 0.45-1.89	0.821
	> 12 months	0.67; 0.30-1.51	0.331	0.46; 0.19-1.09	0.079	0.57; 0.25-1.29	0.176
2 children	Did not breastfeed	1.00		1.00		1.00	
	breastfeed 1-6 months	0.78; 0.48-1.29	0.334	0.75; 0.47-1.22	0.255	0.91; 0.55-1.51	0.721
	7-12 months	0.94; 0.57-1.55	0.800	0.80; 0.49-1.31	0.381	0.89; 0.54-1.49	0.666
	> 12 months	1.07; 0.65-1.78	0.780	0.98; 0.60-1.59	0.932	1.02; 0.61-1.71	0.922
3 and more children	Did not breastfeed	1.00		1.00		1.00	
	breastfeed 1-6 months	0.39; 0.12-1.19	0.099	0.93; 0.37-2.38	0.887	0.54; 0.17-1.70	0.294
	7-12 months	0.44; 0.15-1.31	0.142	0.88; 0.36-2.12	0.769	0.76; 0.25-2.27	0.622
	> 12 months	0.51; 0.18-1.45	0.210	1.07; 0.47-2.44	0.875	0.71; 0.25-2.00	0.515

BMI – body mass index; %BF – body fat percentage; WHtR – waist-to-height ratio; OR – odds ratio; CI – confidence interval

Table 4. Multivariable logistic regression analysis for overweight and obesity in relation to breastfeeding duration in postmenopausal women (adjusted).

Parity	Breastfeeding status	BMI \geq 25 kg/m ²		%BF > 35%		WHtR \geq 0.5	
		OR; 95%CI	p	OR; 95%CI	p	OR; 95%CI	p
1 child	Did not breastfeed	1.00		1.00		1.00	
	breastfeed 1-6 months	1.16; 0.83-1.63	0.708	1.01; 0.73-1.39	0.752	1.29; 0.91-1.82	0.157
	7-12 months	1.41; 0.86-2.33	0.411	1.33; 0.83-2.12	0.156	1.78; 1.05-3.00	0.031
	> 12 months	1.34; 0.69-2.60	0.693	0.89; 0.48-1.66	0.480	1.29; 0.66-2.53	0.461
2 children	Did not breastfeed	1.00		1.00		1.00	
	breastfeed 1-6 months	0.82; 0.60-1.12	0.433	0.95; 0.72-1.25	0.715	0.70; 0.50-0.99	0.042
	7-12 months	0.78; 0.56-1.08	0.171	0.94; 0.71-1.26	0.700	0.76; 0.53-1.09	0.139
	> 12 months	0.89; 0.63-1.24	0.171	1.03; 0.76-1.38	0.863	0.68; 0.47-0.98	0.039
3 and more children	Did not breastfeed	1.00		1.00		1.00	
	breastfeed 1-6 months	0.52; 0.27-0.99	0.047	0.75; 0.44-1.26	0.273	0.56; 0.27-1.13	0.105
	7-12 months	0.64; 0.34-1.20	0.160	0.89; 0.54-1.48	0.667	0.68; 0.34-1.38	0.288

BMI – body mass index; %BF – body fat percentage; WHtR – waist-to-height ratio; OR – odds ratio; CI – confidence interval; **bold** indicate statistically significant results

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