



Increase in breast size after menopause: prevalence and determinants

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Abstract

Objectives: To determine the prevalence and determinants of increases in breast size after menopause. **Methods:** Subjects were 1130 postmenopausal women, aged 54–71, participating in a population based breast cancer screening project, the DOM-project in Utrecht, The Netherlands. Questionnaire data on changes in breast size, parity, age at first childbirth, breast feeding, age at menarche, age at menopause, HRT use and usual weight between age 30 years and age at questionnaire were used. Weight and height were measured at three screening rounds and waist and hip circumference was measured once. **Results:** 18.6% of the women reported that they had to buy a larger bra because of changes in breast size, whereas 1.7% reported that they had to buy a smaller bra. Weight gain, waist circumference, hip circumference, Quetelet's index at third screening, Quetelet's index at first screening, waist-to-hip ratio and years since menopause were significantly associated with increased breast size (odds ratios between 2.5 and 1.4) (all tests for trend $P < 0.05$), whereas age at menopause, HRT use, parity and age at menarche were modestly, though not significantly associated with increased breast size. Age, usual Quetelet's index, age at first childbirth and number of months of full breast feeding were not associated with increased breast size. **Conclusion:** About one in five women experienced an increase in breast size after menopause. The most important factor associated with such an increase was found to be weight gain.

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1. Introduction

Little is known about changes in breast size, especially after menopause. On the one hand it is believed that breast size decreases after menopause because the amount of breast glandular tissue decreases under the influence of decreased oestrogen levels [1].

On the other hand it has been reported that 30% of all cases of reduction mammoplasty relates to postmenopausal women [2]. Efting Dijkstra [3] also discern postmenopausal women as one of the three groups of women who apply for reduction mammoplasty, the other groups being the young girl and the woman after one or more deliveries. However, these reports did not answer the question which percentage of women experience an increase in breast size after menopause.

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It has been suggested that after menopause women have a lower lipolytic response in abdominal and mammary adipose tissue [4]. This could result in increased breast size after menopause.

A Medline search with search terms “breast hypertrophy”, “reduction mammoplasty”, “mammoplasia”, “(breast size NOT cancer) AND menopause”, and “(breast NOT cancer) AND menopause” did not yield any study with prevalence data and only two studies addressing a possible determinant of breast symptoms [5,6]. One reported on breast enlargement during chronic antidepressant therapy [5], the other on HRT use in relation to breast symptoms [6].

In the orientation phase of this study, one of us (IdT) carried out a small structured telephone survey among five lingerie shop keepers who had worked for more than 9 years (mean: 19 years, range: 9–39) in the same lingerie shop. On the question at which age there may be a change in breast size, all reported that there was an increase around 50 years and four out of five spontaneously reported that it was around menopause. They were unanimous as to the high frequency of increases in breast size around menopause, namely 65–80% to “nearly all women”. The increase was reported to be one to two cup-sizes, and to be independent of body composition. Only the increase in the size of the bra circumference-size was reported to be related to weight gain. They also reported that this increase is usually not followed by a decrease in breast size, only in some occasions between ages 70 and 80 years, when some women lose appetite. However, the group of women who buy their bra at specialist lingerie shops may be a selected group with respect to breast size and changes in breast size.

In the same orientation phase one of us (IdT) also asked 10 gynaecologists visiting international menopause congresses whether they knew about changes in breast size after menopause. All answered, that if there would be any changes, breast size would decrease, because breast glandular tissue mass decreases.

In conclusion, data on the prevalence of increased breast size and its determinants were scarce and conflicting. We therefore carried out a study on the prevalence of increased breast size after menopause in a representative population of 1130 Dutch women. We also investigated whether anthropometric and reproductive factors were associated with increased breast size after menopause. Since the metabolism

of mammary adipocytes was found to resemble the metabolism of abdominal adipocytes [4], the analyses for weight change were stratified according to fat distribution, since we would expect that women with a predominant fat storage in the abdominal region would also store more fat in the breasts.

2. Methods

Subjects were women participating in a population-based breast cancer screening project, the DOM-project, Utrecht, The Netherlands [7]. Between 1974 and 1986, 55,519 women were invited to the screening in four different cohorts (DOM I–IV), each with one or more screening rounds. We here report on 1185 women born between 1917 and 1931 participating in the third screening round of the DOM II cohort, between 1986 and 1988. The first screening round was between 1981 and 1982. Median time between first and third screening round was 5.2 years. At third screening, round data on changes in breast size were collected by means of a questionnaire. The wording of this question was as follows: “After cessation of menses, did you have to buy another bra size, because your breasts changed?” with answer categories “not applicable”, “no”, “yes, a smaller bra”, “yes, a larger bra”. Weight and height were measured at each screening round. Quetelet’s index (QI), calculated as weight divided by height squared (kg/m^2), was used as an indicator of body fatness. Waist and hip circumference was measured at third screening round and waist-to-hip ratio (WHR) was calculated as waist circumference divided by hip circumference. All anthropometric measurements were performed by trained research assistants. Questionnaire data on parity, age at first childbirth, and age at menarche were collected at first screening round and data on breast feeding at second screening round. Data on age at menopause and HRT use in the past 12 months or since last screening, respectively, were collected at first, second and third screening round. Women were asked for their usual weight between age 30 years as compared to peers with answer categories “quite heavy”, “about equal”, “lighter”, “do not remember” and age at third screening round. Questionnaires were checked for completeness and inconsistencies by trained research assistants upon visit to the screening centre.

Women who were premenopausal ($n = 44$), who had had a mastectomy ($n = 3$), who had missing data for change in cup-size ($n = 8$) were excluded, leaving 1130 women for the analyses.

Determinants for increased breast size were analysed by means of univariate logistic regression analyses contrasting women who reported a larger bra size with women who reported no change in bra size. All continuous variables were analysed in quartiles and tests for trends were performed by entering the continuous variable in the logistic model. Additionally, the factor weight change was analysed in two separate strata of WHR, namely in women with a more android (above the median value of $\text{WHR} > 0.78$) and in women with a more gynoid fat distribution ($\text{WHR} \leq 0.78$). Interaction was tested by entering the interaction term WHR (dichotomously) \times weight change (continuously) to a model containing weight change (continuously) and WHR (dichotomously) and by evaluating the change in -2 log likelihood of the model.

3. Results

The mean age of the women at third screening round was 59.4 years and the age range was between 54 and 71 years. Other characteristics of the study population are presented in Table 1.

More than 18% of the women reported that they had to buy a larger bra because of changes in breast size, whereas less than 2% reported that they had to buy a smaller bra. (Table 2).

In the logistic regression analyses 210 women who reported a larger bra size were contrasted with 748 women who reported no change in bra size (Table 3). The factors associated with increased breast size were weight change between first and third screening round, waist circumference, hip circumference, QI at third screening, QI at first screening, WHR , and years since menopause (Table 3). The absolute risk of having increased breast size in the highest quartile of weight change was 26% (95% CI: 0.21–0.31%), whereas this was 12% (95% CI: 0.08–0.16%) in the lowest quartile. Age at menopause, HRT use, parity, and age at menarche were modestly though not significantly associated with increased breast size (Table 3). No trend with increasing number of children was observed. Age, usual

Table 1
Characteristics of the study population ($n = 1130$ women, aged 54–71 years)

	Mean (S.E.)
Age at 3rd screening	59.4 (0.11)
Anthropometric variables at 3rd screening	
Weight (cm)	70.0 (0.32)
Height (cm)	163.9 (1.76)
Quetelet's Index	26.0 (0.11)
Waist (cm)	80.0 (0.26)
Hip (cm)	102.7 (0.24)
Waist-hip ratio	0.78 (0.002)
Other anthropometric variables	
Usual weight between 30 years and 3rd screening (kg)	64.8 (0.25)
Quetelet's Index between 30 years and 3rd screening	24.0 (0.09)
Weight change (3rd screening–30 years and now) (kg)	5.0 (0.19)
Quetelet's index 1st screening	25.4 (0.10)
Weight change (3rd screening–1st screening) (kg)	1.5 (0.13)
Reproductive variables	
Age at menopause (years)	49.7 (0.13)
Years since menopause (years)	10.4 (0.17)
Age at menarche (years)	13.8 (0.05)
Age at first childbirth (years)	26.4 (0.13)
Number of months of complete breast feeding	7.9 (0.30)
HRT use in the past 6 years	8.9%
Number of children	
0	14.7%
1	8.4%
2	24.6%
3	23.5%
4 or more	28.8%

QI between age 30 years and age at third screening, age at first childbirth, and number of months of full breast feeding were not associated with increased cup-size (confidence intervals for all quartiles

Table 2
Self reported changes in cup-size after cessation of menses in 1130 women

Changes in cup-size (%)	
Not applicable	13.5
No change	66.2
Smaller cup-size	1.7
Larger cup-size	18.6

Table 3

Odds ratio's (OR) and 95% Confidence intervals (CI) for having increased cup-size after menopause in quartiles of demographic and anthropometric variables; univariate analyses

	OR	95% CI	<i>P</i> for linear trend
Age			
<57 years	1		0.62
57–58 years	0.74	0.46–1.17	
59–61 years	1.18	0.78–1.80	
>61 years	1.01	0.65–1.59	
Weight change (3rd–1st screening)			
<–0.5 kg	1		<0.001
–0.5–1.5 kg	1.25	0.76–2.07	
1.5–3.5 kg	1.93	1.21–3.07	
>3.5 kg	2.48	1.56–3.93	
Waist 3rd screening			
<74 cm	1		<0.001
74–78 cm	1.29	0.81–2.05	
79–85 cm	1.56	0.99–2.46	
>85 cm	2.50	1.61–3.88	
Hip 3rd screening			
<97.5 cm	1		<0.001
97.5–101.5 cm	1.26	0.79–1.99	
102.0–107.0 cm	1.47	0.93–2.32	
>107.0 cm	2.01	1.29–3.11	
Quetelet's Index 3rd screening			
<23.5 kg/m ²	1		<0.001
23.5–25.5 kg/m ²	1.39	0.87–2.23	
25.6–27.9 kg/m ²	2.03	1.29–3.19	
>28.0 kg/m ²	2.07	1.32–3.26	
Quetelet's index 1st screening			
<23.0 kg/m ²	1		0.03
23.0–24.8 kg/m ²	1.28	0.81–2.02	
24.9–27.2 kg/m ²	1.58	1.02–2.46	
>27.2 kg/m ²	1.76	1.13–2.76	
Waist–hip ratio			
<0.74	1		0.01
0.74–0.77	1.09	0.69–1.72	
0.78–0.81	1.26	0.80–1.96	
>0.81	1.68	1.09–2.59	
Years since menopause			
<6 years	1		0.04
6–8 years	1.28	0.82–2.00	
9–14 years	1.58	1.01–2.48	
>14 years	1.41	0.91–2.20	
Age at menopause			
<48 years	1		0.06
48–49 years	0.96	0.63–1.45	
50–53 years	0.68	0.43–1.09	
>53 years	0.66	0.42–1.02	

Table 3 (Continued)

	OR	95% CI	P for linear trend
HRT use in the past 6 years			
No	1		
Yes	1.55	0.94–2.56	
Parity			
0	1		
≥1	1.52	0.93–2.49	
Age at menarche			
<12.7 years	1		0.19
12.7–13.9 years	0.99	0.63–1.54	
14.0–15.0 years	1.12	0.71–1.76	
>15.0 years	1.28	0.85–1.94	

Table 4

Odds ratio's (OR) and 95% Confidence intervals (CI) for having increased cup-size after menopause in quartiles of weight change between first and third screening round, stratified by waist-hip ratio

	WHR ≤ 0.78		WHR > 0.78	
	OR	95% CI	OR	95% CI
Weight change				
<−0.5 kg	1		1	
−0.5–1.5 kg	0.89	0.42–1.88	1.80	0.89–3.67
1.5–3.5 kg	1.63	0.86–3.10	2.47	1.24–4.89
>3.5 kg	2.53	1.32–4.82	2.61	1.34–5.10
P trend	<0.001		<0.006	

P for interaction not significant.

included 1 and tests for trend $P > 0.50$; data not shown).

After stratification by WHR, changes in weight appeared to be associated with increased breast size in both strata (Table 4). Women in the upper stratum of WHR (WHR > 0.78) with a weight increase of 1.5–3.5 kg were 2.5 times more likely to have an increased breast size compared to women with a weight decrease of more than 0.5 kg, and this was only 1.6 for women in the lower stratum of WHR. However, the interaction term of WHR and weight change was not significant.

4. Discussion

The most important finding of this study was that almost one in five women reported that, after

menopause, they had to buy a larger bra because of changes in breast size. Furthermore, women in the highest quartile of weight change (weight gain more than 3.5 kg in the past 5 years) reported 2.5 times more often an increase in breast size compared to women in the lowest quartile of weight change (weight reduction 0.5 kg or more). Usual Quetelet's index before menopause was not associated with an increase in breast size, whereas having a more abdominal fat distribution and having a higher Quetelet's index after menopause was associated with increased breast size.

When discussing strengths and limitations of this study, a strong point with respect to the prevalence estimate is that the data were collected within a population-based breast cancer screening project, where non response bias or recall bias is not very likely to have occurred. Self report may not be a very accurate way of assessing changes in breast size. On the other hand, if women report that they had to buy another bra because of changes in breast size, the change must have been substantial.

The group of women who answered "not applicable" to the question "After cessation of menses, did you have to buy another bra size, because your breasts changed?" needs further attention. The item "not applicable" was added for those women who were still premenopausal. However, it appeared that 13.5% of the postmenopausal women had also marked this option. The possibility that it concerned women who did not wear a bra, is not very likely, since the mean Quetelet's index at first screening of this group was even higher than that of the group who reported an increase in cup-size. The group of women who

reported “not applicable” did not differ in mean weight gain between first and third screening round from those who reported no change, however, when we had a closer look at weight changes between first and second and between second and third screening it appeared that women in the “not applicable” group had significantly more often both weight increases and weight decreases of more than 3 kg. Thus, we assume that this group consists mainly of women who had both increases and decreases in cup-size and therefore reported “not applicable”. An interesting finding was also that these women were more often childless, contrary to the group of increased cup-size who were less often childless compared to women with no change in cup-size.

Our finding that weight gain was associated with increased breast size may be confounded by HRT use, since some women may gain weight when using HRT. However, adjustment for HRT use resulted in similar odds ratios for quartiles of weight gain (1.32, 2.03 and 2.49, respectively). We therefore conclude that weight gain has an independent effect on increase in breast size.

Our finding that women who used HRT tended to report an increase in bra size more often is in line with observations that women assigned to HRT use reported breast symptoms, including both breast pain and breast swelling, more often (40% versus 9% in the first year) than women assigned to placebo [6]. This is probably mainly an effect of increased breast glandular tissue mass [1], although water retention has also been mentioned as a potential adverse effect of HRT [8].

Although weight gain was strongly associated with an increase in bra size, this increase cannot completely be explained by weight gain. Still 12% of the women with a decrease in weight of 0.5 kg or more reported to have an increase in cup-size. When the factors Quetelet’s index, weight change, waist–hip ratio, age, age at menopause, age at menarche, use of HRT and parity were entered in the logistic model simultaneously, the explained variance, as measured by Nagelkerke R^2 , was estimated to be less than 7%. This leaves room for other factors, such as heritable factors, to explain variation in having increased breast size after menopause.

With respect to the biological mechanisms underlying changes in breast size after menopause, two op-

posing mechanisms play a role. On one hand, withdrawal of sex hormones following menopause results in atrophic changes in the glands and ducts [1], on the other hand lipolysis in mammary adipocytes was found to be reduced after menopause [4], resulting in both a relative and an absolute increase in adipose tissue.

The metabolism of mammary adipocytes was found to resemble the metabolism of abdominal adipocytes [4]. We would therefore expect that women with a predominant fat storage in the abdominal region would also store more fat in the breasts. However, when we stratified our analyses according to waist–hip ratio no significant interaction appeared.

This study might have implications for breast cancer research as the results draw attention to a lack of knowledge about determinants of breast size and their potential role as risk factors. Breast size as reflecting the amount of glandular target tissue may in itself be an important risk factor for breast cancer [9] though most of what determines total breast size seems to relate to the amount of fat in the breast [10]. This might explain why no differences in total breast volume between women with and without breast cancer could be found [11].

In conclusion, about one in five women experiences an increase in breast size after menopause. The most important factors associated with such an increase were found to be weight gain in the past 5 years, a high waist and a high hip circumference, and a high Quetelet’s index after menopause.

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References

- [1] Wren BG. The breast and the menopause. *Baillieres Clin Obstet Gynaecol* 1996;10(3):433–47.
- [2] Fogli A. Reduction mammoplasty according to McKissock’s technique. A review of 312 cases. *Ann Chir Plast Esthet* 1993;38(2):198–206.
- [3] Efting Dijkstra JD. Borstcorrecties: plastische chirurgie ter correctie van de borst. Haarlem: De Toorts; 1995.

- [4] Rebuffé-Scrive M. Metabolism of mammary, abdominal and femoral adipocytes in women before and after menopause. *Metab Sep* 1986;35(9):792–7.
- [5] Amsterdam JD. Breast enlargement during chronic antidepressant therapy. *J Aff Disord* 1997;46(2):151–6.
- [6] Barnabei VM, Grady D, Stovall DW, Cauley JA, Flin F, Stuekel CA, et al. Menopausal symptoms in older women and the effects of treatment with hormone therapy. *Obstet Gynaecol* 2002;100(6):1209–18.
- [7] Waard de F, Collette HJA, Rombach JJ, Baanders-van Halewijn EA, Honing C. The DOM project for the early detection of breast cancer, Utrecht, The Netherlands. *J Chronic Dis* 1984;37:1–44.
- [8] Dawood MY. Menopause. In: Copeland LJ, editor. *Textbook of gynecology*. Philadelphia: Saunders; 1993. p. 631.
- [9] Trichopoulos D, Lipman RD. Mammary gland size and breast cancer risk. *Epidemiology* 1992;3:523–6.
- [10] Beijerinck D, van Noord PAH, Kemmeren JM, Seidell JC. Breast size as a determinant of breast cancer. *Int J Obes* 1995;19:202–5.
- [11] Katarinya RN, Forrest AP, Gravelle IH. Breast volumes in cancer of the breast. *Br J Cancer* 1974;29:270–3.