Original Article

Obesity and Perimenopausal Symptoms in Mid-life Women in Southern Taiwan

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Article info

Abstract

Objective: Body mass index (BMI) has been found to be associated with perimenopausal symptoms. This study focused on the relationship between overall perimenopausal symptoms and obesity in Taiwanese women living in rural communities.

Materials and Methods: This study was cross-sectional and descriptive, and the subjects included 56 climacteric women from a rural community in southern Taiwan. Data were collected using the Perceived Perimenopausal Disturbances Scale and face-to-face interviews, and obesity was assessed by anthropometric measurements (height, weight, and waist circumference).

Results: The current analysis included 56 women 40–60 years of age (mean age=47.11 years). Twenty-five percent of the women were obese (BMI $\geq 27\,kg/m^2$) and 39.3% presented with central obesity (waist circumference $\geq 80\,cm$). Based on the subscale for perimenopausal symptoms, we found that for postmenopausal women, a higher BMI and waist circumference were associated with more frequent urinary complaints and reproductive system symptoms.

Conclusion: Participants reported more frequent urinary problems when they were postmenopausal, and these problems were associated with a higher BMI. The findings suggest that clinical practitioners should consider developing strategies to reduce BMI in mid-life women. (*Tzu Chi Med J* 2009;21(4):289–295)

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1.   Introduction

The onset of menopause begins between the ages of 45 and 55 years. The process of menopause can be classified into three states: premenopause, perimenopause, and postmenopause. Perimenopause may last from 2 to 8 years [1]. Menopausal transition leads to the presentation of a series of clinical signs and symptoms such as vasomotion disorders, which are caused by progressive estrogenic deficiency [2,3]. Both physiological and psychosocial changes among perimenopausal women in Taiwan have recently been described [4,5].

Obesity is a public health problem in many countries. Research has shown that the prevalence of obesity in females is higher than in males and increases gradually with age, especially for women aged 40–59 years [6,7]. Recent research has shown that obesity is associated with metabolic syndrome diseases. The causes of obesity, including being overweight and fat distribution changes, may be related to hormonal changes during the menopause transition [8,9]. In this regard, obesity problems in middle-aged women have attracted renewed attention.

Several studies have focused on the correlation between body mass index (BMI) and perimenopausal symptoms. A study found that women aged 40–44 years with a high BMI tend to have a higher incidence of hot flashes [10]. Erlik et al, however, found that postmenopausal women who are below average in weight are more likely to have hot flashes, which are associated with decreasing levels of estrogen [11]. Another study found that BMI is unrelated to the climacteric vasomotion symptoms of women [12], and it has been suggested that weight gain in middle-aged women is unrelated to the transition from pre- to peri- to menopause [13]. Another study found that women with stress urinary incontinence have a higher BMI [14]. Recent studies have further confirmed the previously well-known role of obesity as a risk factor for stress urinary incontinence [15–17]. Taken together, the findings of these various studies present no clear relationship between perimenopausal symptoms and BMI in mid-life women.

The most frequently reported symptoms in overweight or obese women in perimenopause are joint ache/stiffness, bone pain, paresthesia in the extremities, hot flashes, and urinary incontinence [18]. Hence, the present study focused on the relationship between overall perimenopausal symptoms and obesity in Taiwanese women living in rural communities who were engaged in farming or household work, and had a lower socioeconomic status. We also examined the relationship between perimenopausal symptoms and obesity, age, and menopausal transition in our sample of women.

Our hypotheses were as follows: (1) perimenopausal symptoms, BMI, and waist circumference are significantly different among pre-, peri-, and postmenopausal women; and (2) women's BMI and waist circumference are significantly associated with the experience of perimenopausal symptoms.

2.   Materials and methods

2.1.   Aims

The aims of this study were to: (1) compare the women's BMI, waist circumference, and experience with perimenopausal symptoms based on menopausal state; and (2) assess the differences in the women's experience with perimenopausal symptoms based on BMI and waist circumference.

2.2.   Design

This study was a cross-sectional descriptive survey adopting a questionnaire that was used to collect data and anthropometric measurements (height, weight, and waist circumference) to assess obesity in mid-life women.

2.3.   Setting

Four activity centers in a rural area of southern Taiwan were randomly selected for the sampling of participants. Data were collected between October 2006 and January 2007.

2.4.   Sample

To qualify for participation, each woman needed to meet the following criteria: (1) aged between 40 and 60 years of age; (2) ability to speak Mandarin or the Taiwanese dialect; (3) willingness to participate in a face-to-face interview; (4) residency in a rural area in southern Taiwan; and (5) not taking hormone replacement drugs. The participants signed consent forms and agreed to provide study information. Data collection methods included a face-to-face interview conducted to help the participant complete the questionnaire and to collect physiological data such as height and weight. The interview time was approximately 30 minutes.

Sixty women participated in this study; four women were excluded because they were taking hormone replacement drugs or had had a hysterectomy. Thus, a total of 56 women entered the study for data analysis. Menopausal states were defined as follows: (1) premenopausal period: experiencing 12 or more regular menstruations during the last 12 months; (2) perimenopausal period: experiencing fewer than 12 irregular menstruations during the last 12 months; and (3) postmenopausal: not having menstruated for the last 12 months [19].

2.5.   Measurements

The subject data included in this study were age, education, employment, marriage, current state of menopause, menstruation, and anthropometric data. Anthropometric evaluation consisted of measurements

of height, weight, and waist circumference, which were obtained before the participant ate a meal. Measurements were taken by the same investigator to minimize variability in the data. Body sites for measurements were confirmed by a registered nurse who had received special training. Participants were weighed without shoes but with light indoor clothing. A measuring stick was used to measure the participants' standing height without shoes. A plastic-coated measuring tape was used to measure the waist circumference (cm) at the end of expiration, with the navel as the pivot. BMI was calculated as the weight in kilograms divided by the square of the height in meters (kg/m^2). We adapted the following definition from the Department of Health in Taiwan: women with a BMI ≥ 27 kg/m^2 were considered obese, while those with a BMI < 27 kg/m^2 were considered non-obese. Central obesity in Asian and Chinese women is defined by a waist circumference ≥ 80 cm [20].

The Perceived Perimenopausal Disturbances Scale was developed by Tsao et al [21]; and the scale has demonstrated good validity and reliability, with a Cronbach's α of 0.95. Symptoms are categorized across five subscales (domains): cardiovascular and autonomic nervous system symptoms (e.g. palpitations, hot flashes, headache, dizziness, and perspiration); osteoarthritis symptoms (e.g. joint pain and back pain); urinary system symptoms (e.g. nocturia, stress urinary incontinence, and micturition); reproductive system symptoms (e.g. vaginal itching, vaginal dryness, dyspareunia, and decline in sexual interest); and psychological and psychiatric symptoms (e.g. fatigue, depression, anxiety, insomnia, forgetfulness, insecurity, and inability to concentrate). There is a total of 38 questions. All questions are rated on a 4-point Likert-type scale (1=not present, 2=mild, 3=moderate, and 4=severe). The score of each domain is the sum of the mean scores of the symptoms within that domain, and the total score is the sum of the mean scores of all symptoms. The symptoms become more obtrusive as the score increases. This scale was adopted to assess perimenopausal women in Taiwan, has been previously published (22,23), and its validity is sound. In our study, the Cronbach's α value for the overall scale was 0.89.

2.6. Data analysis

Except for the descriptive statistics, analysis of covariance (ANCOVA) was used to evaluate the potential confounding of age in identifying differences in the BMI, waist circumference, and perimenopausal symptoms under different states of menopause. Finally, if the confounding variable was not significant and states of menopause were significant, analysis of variance (ANOVA) was used. We used ANOVA to compare the

differences in perimenopausal symptom disturbance under different states of menopause and the Bonferroni test for multiple comparisons. Because the data were not normally distributed and the standard deviations were not equal, the Kruskal-Wallis test was used to compare differences under different states of menopause, specifying BMI, and the Mann-Whitney U test was performed three times for multiple comparisons under a type I error correction. Disturbance of perimenopause was assessed according to the level of BMI and waist circumference by the Mann-Whitney U test.

2.7. Ethical considerations

This study was approved by the local community committee, and participation was voluntary. Participants were verbally invited to be involved in this study and gave written consent to be interviewed.

3. Results

3.1. The study population

Data from the women are shown in Table 1. A total of 56 women between 40 and 60 years of age in southern Taiwan were selected to participate in this study. Participants included 24 premenopausal women, 14 perimenopausal women, and 18 postmenopausal women. Their mean age was 47.11 years. Most (92.9%) of the participants were married and 53.6% were

Table 1 — Demographics and anthropometrics of women (n=56)*

Age (yr)	47.11±5.20 (40–60)
Education	
Elementary school or below	27 (48.2)
Junior high school	16 (28.6)
Senior high school or above	13 (23.2)
Marital status	
Married	52 (92.9)
Divorced+other	4 (7.1)
Employed	
Yes	30 (53.6)
No	26 (46.4)
State of menopause	
Premenopause	24 (42.5)
Perimenopause	14 (25.0)
Postmenopause	18 (32.1)
Body mass index	
< 27 kg/m^2	42 (75.0)
≥ 27 kg/m^2	14 (25.0)
Waist circumference	
< 80 cm	34 (60.7)
≥ 80 cm	22 (39.3)

*Data presented as mean±standard deviation (range) or *n* (%).

employed. Approximately half of the participants had low levels of education (48.2% were elementary school graduates or below). Approximately 25% of the women had a BMI ≥ 27 kg/m^2 and 39.3% had a waist circumference ≥ 80 cm.

3.2. Anthropometric measurements and experience with perimenopausal symptoms related to menopause states

Comparison of BMI and waist circumference by menopause stage is depicted in Table 2. In general, a trend towards an increase in age, level of BMI, waist circumference, and experience with perimenopause symptoms was observed from the premenopausal to postmenopausal states. Menopause states (pre- vs. peri- and postmenopausal) were significantly differentiated by BMI ($p < 0.017$, Bonferroni type I correction: $0.05/3 \approx 0.017$) and waist circumference ($p < 0.01$). Postmenopausal women had higher BMI values and waist circumferences compared with premenopausal women. Overall, perimenopausal symptom scores had statistically significant differences by menopause

status as shown by the Kruskal-Wallis test ($p = 0.025$), whereas the Mann-Whitney U test processed multiple comparisons without showing any statistical significance ($p > 0.017$) (pre- vs. peri-, $p = 0.027$; pre- vs. post, $p = 0.021$; and peri- vs. post, $p = 0.98$). For the five symptom subscales (domains), perimenopausal and postmenopausal women were significantly older and had higher reproductive symptom scores than premenopausal women ($p < 0.01$). Cardiovascular, osteoarthritis, urinary, and psychological symptoms did not show significant differences in the three groups of menopause states.

3.3. Experience with perimenopausal symptoms related to the level of BMI and waist circumference

Experience with perimenopausal symptoms was assessed according to the level of BMI and waist circumference, and the results are presented in Table 3. Being older was associated with significant differences in centrally obese women (waist circumference = 80 cm) when compared with non-centrally obese

Table 2 — DPS, BMI, and waist circumferences according to menopausal states ($n = 56$)*

	Premenopausal ($n=24$)	Perimenopausal ($n=14$)	Postmenopausal ($n=18$)
Age (yr)	43.08±2.70	48.71±3.64[†]	51.22±4.94[†]
BMI (kg/m^2)	23.65 (21.65–24.85)	25.50 (23.43–27.82)	25.79 (23.23–30.21)[‡]
Waist circumference (cm)	74.60±5.4	79.65±6.98	81.57±8.50[†]
DPS (items)	48.00 (42.25–58.00)	56.50 (49.25–70.50)	57.00 (49.50–65.25)
Cardiovascular/autonomic nervous symptoms (9)	11.83±2.82	13.07±3.83	11.78±4.32
Osteoarthritis symptoms (2)	2.50 (2.00–4.00)	2.50 (2.00–4.00)	4.00 (2.75–4.00)
Urinary symptoms (5)	6.00 (5.00–7.75)	6.00 (5.00–7.75)	6.50 (5.00–8.25)
Reproductive system symptoms (8)	8.50 (8.00–10.00)	12.50 (10.75–16.25)[†]	12.50 (9.75–16.50)[†]
Psychological/psychiatric symptoms (14)	19.21±4.64	22.21±6.54	23.00±6.65

*Data presented as mean±standard deviation or median (Q$_1$–Q$_3$); [†]significant difference compared with premenopause, two-tailed ($p < 0.01$); [‡]significant difference compared with premenopause, two-tailed ($p < 0.017$). DPS=overall disturbance of perimenopausal symptoms; BMI=body mass index.

Table 3 — Disturbance of perimenopausal symptoms according to BMI and waist circumference by Mann-Whitney U test ($n = 56$)*

	BMI		WC	
	Not obese <27 ($n=42$)	Obese ≥27 ($n=14$)	No central obesity <80 cm ($n=34$)	Central obesity ≥80 cm ($n=22$)
Age (yr)	46.00 (41.75–50.25)	49.00 (47.75–51.25)	45.00 (40.00–48.00)	49.00 (47.75–53.25)[†]
DPS	50.50 (44.50–62.00)	56.50 (50–75.25)[‡]	50.50 (43.0–62.0)	56.50 (47.75–64.75)
Cardiovascular/autonomic nervous symptoms	11.00 (9.00–14.00)	10.50 (9–15.50)	11.50 (9.00–14.00)	10.50 (9.00–13.50)
Osteoarthritis symptoms	3.00 (2.00–4.00)	3.00 (2.00–4.00)	3.00 (2.00–4.00)	3.00 (2.00–4.00)
Urinary symptoms	6.00 (5.00–14.00)	7.00 (6.00–10.00)[‡]	6.00 (5.00–7.25)	7.00 (5.00–8.25)
Reproductive system symptoms	10.00 (8.00–14.00)	14.00 (10.50–16.50)[‡]	9.50 (8.00–12.25)	13.50 (10.50–16.25)[†]
Psychological/psychiatric symptoms	20.00 (15.00–23.25)	25.00 (16.75–29.00)	19.50 (14.75–24.00)	21.50 (16.75–28.0)

*Data presented as median (Q$_1$–Q$_3$); [†]$p < 0.01$, two-tailed; [‡]$p < 0.05$, two-tailed. BMI=body mass index; WC=waist circumference; DPS=overall disturbance of perimenopausal symptoms.

women (waist circumference <80 cm, p<0.05), but not with obese women (BMI≥27, p=0.105). Obese women had higher overall perimenopausal symptoms as well as urinary and reproductive symptom complaint scores than non-obese women (p<0.05). Similarly, women with central obesity had higher reproductive system complaint scores than non-central obese women (p<0.01). While centrally-obese women had higher urinary symptoms scores than non-centrally obese women, there were no statistically significant differences (p=0.123).

4.   Discussion

According to the categories of BMI for identifying obesity used in this study, 25% of mid-life women were obese, with a BMI level at or above 27 kg/m^2, indicating a potential risk of obesity for mid-life women in rural communities. Additionally, just under half of the women had a waist circumference ≥80 cm. The results showed an increase with age in body fat mass and central distribution of body fat. These findings are similar to the results of a study by Douchi et al [24].

Menopause is a process from pre- to peri- to postmenopausal periods in a woman's life. Women gradually mature, age, and enter menopause. Brett and Cooper found that an increasing BMI was associated with being in menopausal transition [25]. Previous studies have shown that weight gain is not significantly associated with menopausal status [26,27]. However, increasing waist and hip circumferences, and central distribution of body fat in postmenopausal women has been supported by other studies [28].

In this study, the BMI showed significant variance with menopausal status. A comparison of postmenopausal women shows that being in postmenopause is associated with having a higher BMI and waist circumference when compared with premenopause. According to data from the International Diabetes Federation in 2006, central obesity in Asian and Chinese women is defined by a waist circumference >80 cm. Central obesity is one of the important factors associated with metabolic syndrome [29]. In this study, almost half of the participants had a waist circumference ≥80 cm, demonstrating that central obesity remains an important concern. Thus, developing a protocol to treat or reduce central fat distribution in women in the postmenopausal years is required.

This study found that an older age was significantly associated with significant differences in centrally obese women (waist circumference ≥80 cm) compared with non-centrally obese women (waist circumference <80 cm), but this relationship was not found in obese women (BMI ≥27). This shows that age may also be a risk factor for central obesity. In particular, fat distribution tends to centralize in the body after menopause, resulting in an increase of waist circumference with age. Results of the current study indicate that increased central fat distribution in the body with age is a concern for menopausal women [27].

Previous studies have concluded that the rate of obesity associated with a higher BMI, increases with age [6,30]. In our study, obese women were older than non-obese women, but this was not statistically significant (p=0.052), although it was a strong trend. The reason for this finding might be that the sample size was too small to show a significant difference. Nevertheless, it is important that BMI levels be measured and matched with measurements of waist circumference when assessing the obesity status of mid-life women. It is very easy for people to measure waist girth. Nurses could teach women how to measure waist girth to track a change in their weight over time.

The menopausal transition leads to the presentation of a series of clinical signs and symptoms due to progressive estrogen deficiency [2,3]. This study validated previous findings that women in the postmenopausal years had higher levels of perimenopausal symptoms than those in peri- and premenopause [31]. In this study, only reproductive system symptoms had a statistically significant difference among the three groups (pre-, peri-, and postmenopausal). Similarly, obese women had more frequent complaints of overall perimenopausal symptoms and higher urinary and reproductive system complaint scores than non-obese women. Women in postmenopause presented with reproductive system symptoms such as vaginal itching (22.3%), vaginal dryness (55.6%), dyspareunia (44.5%) and decline in sexual interest (94.5%) (data not shown). Similar results were found by Malacara et al [32]. Declining estrogen levels begin at the time of menopause and thereafter result in atrophic vaginitis. This can lead to vaginal dryness and dyspareunia [33]. Furthermore, we found that women with these reproductive system symptoms also tended to be obese.

Here, we found that women with a higher BMI and waist circumference reported more frequent urinary symptom complaints. This result is consistent with previous findings [34–36]. However, differentiating between symptoms that are genuinely hormone-related (menopause-related) and those that are age-related is difficult. The results also indicated that obese postmenopausal women (BMI ≥27) had urinary symptoms such as nocturia (50%); incontinence (50%), and when coughing, laughing, or lifting heavy weights; frequent micturition (37.5%); and urgency (37.5%) (data not shown). These findings suggest that interventions targeted to relieve urinary symptoms experienced by postmenopausal obese women are required.

Evidence has indicated that menopausal women are likely to become obese due to menopausal transition or an increase in age. Women in postmenopause

report higher BMI levels and have significant central body fat distribution. Therefore, it is suggested that Taiwan's perimenopausal women should measure waist circumference and BMI to assess obesity states.

Our participants reported more frequent urinary problems in postmenopause and with higher BMI levels. The findings suggest that clinical practitioners should develop strategies to reduce BMI for menopausal women. Future studies are required to determine if women can lose weight to relieve perimenopausal symptoms.

An inherent limitation of any study in which the participants are volunteers is the potential for non-response bias. There may be different perceptions of perimenopausal symptoms between respondents and non-respondents. Unfortunately, there was no way to compare the BMI and premenopausal symptoms of the respondents and non-respondents in this study. The study participants were restricted to those in a rural community who volunteered to participate; this limited the representativeness of the sample for generalization to other mid-life women. Another limitation of this study was not considering other variables (e.g. number of births and employment) that may have influenced study outcomes.

Acknowledgments

References

1. Greendale GA, Lee NP, Arriola ER. The menopause. *Lancet* 1999;353:571–80.
2. Burger HG, Dudley EC, Robertson DM, Dennerstein L. Hormonal changes in the menopause transition. *Recent Prog Horm Res* 2002;57:257–75.
3. Buckler H. The menopause transition: endocrine changes and clinical symptoms. *J Br Menopause Soc* 2005;11: 61–5.
4. Pan HA, Wu MN, Hsu CC, Yao BL, Huang KE. The perception of menopause among women in Taiwan. *Maturitas* 2002; 41:269–74.
5. Shu BC, Luh WM, Li SM, Lu SY. Self-concept and menopause among mid-life women: a survey in southern Taiwan. *Maturitas* 2007;57:132–8.
6. Arroyo P, Loria A, Fernandez V, et al. Prevalence of pre-obesity and obesity in urban adult Mexicans in comparison with other large surveys. *Obes Res* 2000;8:179–85.
7. Shapo L, Pomerleau J, Mckee M, Coker R, Ylli A. Body weight pattern in a country in transition: a population-based survey in Tirana City, Albania. *Public Health Nutr* 2003;6:471–7.

8. Poehlman ET, Toth MJ, Gardner AW. Changes in energy balance and body composition at menopause: a controlled longitudinal study. *Ann Intern Med* 1995;123:673–5.
9. Simkin-Silverman LR, Wing RR. Weight gain during menopause. Is it inevitable or can it be prevented? *Postgrad Med* 2000;108:47–50.
10. Den Tonkelaar I, Seidell JC, van Noord PAH. Obesity and fat distribution in relation to hot flashes in Dutch women from the DOM-project. *Maturitas* 1996;23:301–5.
11. Erlik Y, Meldrum DR, Judd HL. Estrogen level in postmenopausal women with hot flashes. *Obstet Gynecol* 1982;59: 403–7.
12. Stevens RE, Ayres SA, Klein R, Phelps KV. Effect of estrogen replacement therapy on climacteric symptoms in African-American and Caucasian menopausal women: influence of body mass index. *Obstet Gynecol* 2001;97:24S.
13. Crawford SL, Casey VA, Avis NE, Mckinlay SM. A longitudinal study of weight and the menopause transition: results from the Massachusetts Women's Health Study. *Menopause* 2000;7:96–104.
14. Keane DP, Sims TJ, Abrams P, Bailey AJ. Analysis of collagen status in premenopausal nulliparous women with genuine stress incontinence. *Br J Obstet Gynaecol* 1997;104: 994–8.
15. Fritel X, Ringa V, Varnoux N, Fauconnier A, Piault S, Bréart G. Mode of delivery and severe stress incontinence. A cross-sectional study among 2625 perimenopausal women. *Br J Obstet Gynaecol* 2005;112:1646–51.
16. Danforth KN, Townsend MK, Lifford K, Curhan GC, Resnick NM, Grodstein F. Risk factors for urinary incontinence among middle-aged women. *Am J Obstet Gynecol* 2006;194:339–45.
17. Townsend MK, Danforth KN, Rosner B, Curhan GC, Resnick NM, Grodstein F. Body mass index, weight gain, and incident urinary incontinence in middle-aged women. *Obstet Gynecol* 2007;110:346–53.
18. Shakhatreh FM, Mas'ad D. Menopausal symptoms and health problems of women aged 50–65 years in southern Jordan. *Climacteric* 2006;9:305–11.
19. Barentsen R, van de Weijer PHM, van Gend S, Foekema H. Climacteric symptoms in a representative Dutch population sample as measured with the Greene Climacteric Scale. *Maturitas* 2001;38:123–8.
20. International Diabetes Institute, World Health Organization. *The Asia-Pacific Perspective. Redefining Obesity and Its Treatment.* Health Communications Australia Pty Ltd, February 2000. Available from http://www.diabetes.com.au/pdf/obesity_report.pdf
21. Tsao LI, Su MC, Chiu HF. An exploration of self-perceived disturbance of perimenopausal symptoms among perimenopausal women in traditional Chinese medicine clinics and Western medicine clinics. *J Chang Gung Inst Technol* 2002;1:91–102.
22. Tsao LI, Su MC, Hsiao PJ, Gau YM, An C, Lin KC. The longitudinal effects of a perimenopausal health education intervention on the mid-life women in Taiwan. *Maturitas* 2007; 57:296–305.
23. Pai HC, An C, Huang HL, Tsao LI. The effects of perimenopausal health education intervention on perimenopausal symptoms, uncertainty and health behavior among midlife women in rural communities in southern Taiwan. *J Nurs Healthc Res* 2009;5:60–7.
24. Douchi T, Kosha S, Uto H, et al. Precedence of bone loss over changes in body composition and body fat distribution within a few years after menopause. *Maturitas* 2003; 46:133–8.

25. Brett KM, Cooper GS. Associations with menopause and menopausal transition in a nationally representative US sample. *Maturitas* 2003;45:89–97.

26. Nagata C, Takatsuka N, Kawakami N, Shimizu H. Weight change in relation to natural menopause and other reproductive and behavioral factors in Japanese women. *Ann Epidemiol* 2002;12:237–41.

27. Torng PL, Su TC, Sung FC, et al. Effects of menopause on intraindividual changes in serum lipids, blood pressure, and body weight: the Chin-Shan Community Cardiovascular Cohort study. *Atherosclerosis* 2002;161:409–15.

28. Espeland MA, Stefanick ML, Kritz-Silverstein D, et al. Effect of postmenopausal hormone therapy on body weight and waist and hip girths. Postmenopausal Estrogen-Progestin Interventions Study Investigators. *J Clin Endocrinol Metab* 1997;82:1549–56.

29. Mesch VR, Boero LE, Siseles NO, et al. Metabolic syndrome throughout the menopausal transition: influence of age and menopausal status. *Climacteric* 2006;9:40–8.

30. Ball K, Mishra GD, Crawford D. Social factors and obesity: an investigation of the role of health behaviours. *Int J Obes* 2003;27:394–403.

31. Jokinen K, Rautava P, Makinen J, Ojanlatva A, Sundell J, Helenius H. Experience of climacteric symptoms among 42–46- and 52–56-year-old women. *Maturitas* 2003;46:199–205.

32. Malacara JM, Canto de Cetina T, Bassol S, et al. Symptoms at pre- and postmenopause in rural and urban women from three States of Mexico. *Maturitas* 2002;43:11–9.

33. Abernethy K, Tiran D. *The Menopause and HRT*. Edinburgh: Baillière Tindall, 2002.

34. Bai SW, Kang JY, Rha KH, Lee MS, Kim JY, Park KH. Relationship of urodynamic parameters and obesity in women with stress urinary incontinence. *J Reprod Med* 2002;47:559–63.

35. Panugthong P, Chulyamitporn T, Tanapat Y. Prevalence and risk factors of urinary incontinence in Thai menopausal women at Phramongkutklao Hospital. *J Med Assoc Thai* 2005;88:S25–30.

36. Mishra GD, Hardy R, Cardozo L, Kuh D. Body weight through adult life and risk of urinary incontinence in middle-aged women: results from a British prospective cohort. *Int J Obes* 2008;32:1415–22.