



Published in final edited form as:

Am J Hum Biol. 2009 ; 21(1): 127–129. doi:10.1002/ajhb.20834.

The Association Between Physical Activity and Hot Flash Severity, Frequency, and Duration in Mid-Life Women

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Abstract

The value of physical activity to reduce vasomotor symptoms has yet to be determined conclusively. As a result, we used a cross-sectional population-based design to examine the association between self reported physical activity level and hot flash symptoms in 45–54-year-old women. Participants ($n = 603$) completed a detailed survey to report physical activity level at work, home, and leisure as well as a detailed history of the frequency and severity of hot flash symptoms. Results showed that higher levels of physical activity were significantly associated with increasing odds of moderate or severe hot flashes (P for trend = 0.02). These findings suggest that there is a positive relation between physical activity and moderate or severe hot flash symptoms but no relation between physical activity and the reporting of any hot flashes, daily hot flashes, or hot flashes experienced for greater than 1 year. *Am. J. Hum. Biol.*

Hot flashes are a common complaint of women entering the menopause transition and often result in medical intervention (Whiteman et al., 2003; Williams et al., 2007). Although hormone therapies have been shown to be effective at modulating the severity and frequency of hot flashes (Gambacciani et al., 2001), their adverse effects have placed an emphasis on alternative approaches such as behavioral or lifestyle modifications (Grady et al., 2002). Exercise and physical activity have been proposed as potential methods of vasomotor symptom reduction. However, previous studies that have examined the relation between self reported levels of exercise (Ivarsson et al., 1998; Li and Holm, 2003; Whitcomb et al., 2007) or exercise interventions (Ivarsson et al., 1998; Kemmler et al., 2004) and vasomotor symptoms have been inconclusive. Some of these studies have been limited by small sample size (Li and Holm, 2003) or a low prevalence of women experiencing vasomotor symptoms (Gambacciani et al., 2001; Ivarsson et al., 1998). Therefore, we studied the association between self reported activity level and hot flashes in a large population-based study of midlife women, 58% of whom reported vasomotor symptoms.

A cross-sectional population-based study of women aged 45–54 years was conducted in Baltimore and its surrounding counties to examine the associations between demographic characteristics, health and lifestyle behaviors, and the occurrence of menopausal symptoms. The methods of this study have been described in detail elsewhere (Gallicchio et al., 2006;

Visvanathan et al., 2005) and were approved by the University of Illinois, University of Maryland School of Medicine, and Johns Hopkins University Institutional Review Boards. Briefly, women aged 45–54 years were recruited from the general population by mailing an invitation to participate to area households.

Women who were interested in participating contacted the clinic and were screened by telephone. If the staff determined that they met the eligibility criteria, an appointment was scheduled for a clinic visit. Women were eligible if they were 45–54 years old, had at least three menstrual periods in the past 12 months, were not on hormone therapy (HT), were not pregnant, had an intact uterus and at least one ovary, and did not have a history of ovarian, endometrial, or breast cancer. A total of 639 women were recruited into the study and completed the clinic visit. Over 80% of the women in this study were Caucasian and had some college education. Almost 9 of 10 were nonsmokers.

All participants completed a 26-page survey that obtained information on demographics, reproductive history, menstrual cycle characteristics, hormonal contraceptive use, hot flashes, medical history, and health behaviors, including physical activity. Based on survey responses, usual physical activity was categorized as inactive/light and moderate/heavy using participant responses to questions regarding usual physical activity performed at work, home, and leisure during the last 12 months. For each area (work, home, and leisure), a participant was asked to think about the things she usually did during the last 12 months and to describe the kind of physical activity she performed. Possible responses were: inactive, light, moderate, and heavy. Detailed definitions of these responses were provided for the participant on the questionnaire (for example, heavy physical activity was defined as performing vigorous activity on a regular basis, including jogging, singles tennis, paddleball, high intensity aerobics, or engaging in heavy activities such as carrying weights, strenuous farm work or gardening). A score was assigned to each response such that inactive equaled one and heavy equaled four. For women who were employed, home, leisure, and work physical activity scores were added; for women who were not employed, the total score equaled the home score plus the leisure score plus the average of the home and leisure score. A woman who had a physical activity score of seven or less was categorized as inactive or having light overall physical activity; a woman who had a physical activity score of eight or greater was categorized as having moderate/heavy overall physical activity.

A detailed hot flash history was obtained through a series of questions on the enrollment questionnaire that asked for information on the following: whether the woman had experienced hot flashes within the last 30 days; the number of hot flashes experienced within the past 30 days; the age when hot flashes first occurred; and the severity and frequency of the hot flashes. Each woman was also asked to describe the duration of her hot flashes as occurring for less than 1 month, 1–5 months, 6–11 months, 1–2 years, 3–4 years, or 5 years or longer. Outcomes examined were the experiencing of any hot flashes, moderate to severe hot flashes, daily hot flashes, and duration of hot flashes. A woman was classified as having moderate to severe hot flashes if she had hot flashes that were described as a sensation of heat accompanied by sweating that may have interrupted usual activity. Mild hot flashes were hot flashes that were described as a warm sensation without sweating or disruption of usual activity.

Because the use of HT may affect the experiencing of menopausal symptoms, women in the study sample who reported past use of HT were excluded from the analysis ($n = 36$); therefore, data from a total of 603 women were analyzed. Logistic regression analyses were conducted to assess the associations between the overall physical health variable and the hot flash outcomes controlling for confounders. Although a number of variables (such as education, race, and smoking) were considered for inclusion into the model as confounders, only participant age and body mass index were associated ($P < 0.1$) with both overall physical health

and the hot flashes outcome variables and were analyzed in the final model. For those associations that appeared to be linear, a trend test was performed by treating the categorical physical activity variable as continuous in the model. A two sided P-value of less than 0.05 was considered statistically significant.

The results showed that higher levels of physical activity were significantly associated with increasing odds of moderate or severe hot flashes (P for trend = 0.02). Physical activity was not significantly associated with the reporting of any hot flashes, daily hot flashes, or hot flashes for greater than 1 year (Table 1).

The literature is inconsistent as to the impact of physical activity on hot flash symptoms. Similar to the results of this study, previous work from our group examining the relation between physical activity before the last menstrual period and hot flashes in a different study population demonstrated that highly active women between 35–40 years of age were significantly more likely to report moderate to severe hot flashes than minimally active women (Whitcomb et al., 2007). In addition, in the Study of Women's Across the Nation, Gold et al. reported that the frequency of vasomotor symptoms was significantly associated with physical activity during midlife in women with lower concentrations of the progesterone and estradiol byproduct pregnanediol-glucuronide (PdG) (Gold et al., 2007). In contrast, our findings contradict other investigations that suggest that physical activity has no relation to (Kemmler et al., 2004) or decreases the risk (Di Donato et al., 2005; Ivarsson et al., 1998) of hot flash symptoms.

It is not clear why our findings differ from some of the other previous studies, although the differences in findings may be due in part to study sample characteristics. For example, the women in the present study were between 45–54 years old and had no history of using HT. In contrast, previous studies included older women (Ivarsson et al., 1998), women past the menopausal transition, women using HT (Di Donato et al., 2005; Ivarsson et al., 1998), women with less formal education (Di Donato et al., 2005), or women of a greater racial mix (Di Donato et al., 2005; Ivarsson et al., 1998). In each of these studies, the participant's age, menopausal status, or use of HT may have influenced their hormonal milieu and thus, their response to physical activity in a way that differed from our participants. Fluctuating sex hormone and β -endorphin concentration is one of the most commonly proposed physiologic mechanisms for the relation between physical activity and vasomotor symptoms (Genazzani et al., 1984; Reid et al., 1983). Because β -endorphin concentrations also decrease following menopause (Reid et al., 1983), fluctuate during hot flashes (Genazzani et al., 1984), and have been shown to correlate with estrogen levels (Reid et al., 1983), it is possible that hot flash symptoms are somehow modulated by β -endorphins. We did not measure endorphins in our subjects, and therefore, it is unclear whether our subjects may have responded differently to endorphins than subjects in earlier studies.

There are some limitations to the present study. Although categorical self report measures of hot flashes and physical activity have been shown to be reliable in similar populations (Winters-Hart et al., 2004), some misclassification still may have been present if our instrument did not capture the variability in activity levels experienced by our subjects. As 59.8% of our subjects reported exercising at an inactive/light level, it is possible that the overall level of exercise may have not been intense enough to observe differences in all of the outcomes by activity level. This may help to explain why there was a significant relation between physical activity and moderate or severe hot flashes in our subjects, but not between physical activity and overall hot flashes.

As the emphasis on alternatives to HT increases, it will remain important to develop other methods of treating the most severe vasomotor symptoms during the menopausal transition. Physical activity has been proposed as a mechanism to decrease the risk and severity of hot

flashes. However, our results show no relationship between any hot flashes, daily hot flashes, or hot flashes for greater than 1 year, and that physical activity may actually increase, not decrease, the severity of hot flashes.

Acknowledgments

Contract grant sponsor: National Institute of Health, Bethesda, Maryland; Contract grant numbers: NIH AG18400 and NICHD 5 K12 HD043489.

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TABLE 1

The confounder-adjusted associations between overall physical activity and the hot flash outcomes

Variable	Any hot flashes	Moderate/severe hot flashes	Daily hot flashes	Hot flashes >1 year
	OR (95% CI) ^a	OR (95% CI) ^a	OR (95% CI) ^a	OR (95% CI) ^a
Overall physical activity				
Inactive	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Light	1.40 (0.68, 2.89)	2.16 (0.87, 5.37)	1.82 (0.48, 6.90)	1.48 (0.65, 3.38)
Moderate	1.86 (0.88, 3.97)	2.88 (1.12, 7.40)	1.92 (0.48, 7.63)	2.24 (0.95, 5.29)
Heavy	1.67 (0.43, 6.53)	4.16 (0.96, 18.08)	3.88 (0.55, 27.31)	2.13 (0.47, 9.58)
<i>P</i> -for-trend	**	0.02	0.3	**
Participant age (years)	1.17 (1.08, 1.25)	1.14 (1.06, 1.24)	1.33 (1.19, 1.59)	1.15 (1.06, 1.24)
Body mass index (kg/m ²)	1.05 (1.02, 1.08)	1.05 (1.02, 1.08)	1.02 (0.98, 1.06)	1.06 (1.03, 1.09)

^aOR = odds ratio; 95% CI = 95% confidence interval.