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Perceived control, lifestyle, health, socio-demographic factors and menopause: Impact on hot flashes and night sweats

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ABSTRACT

Objective: To develop a model to predict the perceived severity of hot flashes (HF) and night sweats (NS) in symptomatic middle-aged women.
Methods: This was a cross-sectional study of a community-based sample of 243 women with vasomotor symptoms. Menopausal status was ascertained using the 'Stages of Reproductive Aging Workshop' criteria. Women's 'perceived control' over their symptoms was measured by a validated Portuguese version of the Perceived Control over Hot Flushes Index. Structural equation modelling was employed to construct a causal model of self-reported severity of both HF and NS, using a set of 20 variables: age, marital status, parity, professional status, educational level, family annual income, recent diseases and psychological problems, medical help-seeking behaviour to manage menopausal symptoms, use of hormone therapy and herbal/soy products, menopause status, intake of alcohol, coffee and hot beverages, smoking, physical exercise, body mass index and perceived control.
Results: Significant predictors of perceived severity were the use of hormone therapy for both HF ($\beta = -.245$; $p = .022$) and NS ($\beta = -.298$; $p = .008$), coffee intake for both HF ($\beta = -.234$; $p = .039$) and NS ($\beta = -.258$; $p = .029$) and perceived control for both HF ($\beta = -1.0$; $p < .001$) and NS ($\beta = -1.0$; $p < .001$). The variables explained respectively 67% and 72% of the variability in the perceived severity of HF and NS. Women with high perceived control had a significantly lower frequency ($t(235) = 2.022$; $p = .044$) and intensity of HF ($t(217) = 3.582$; $p < .001$); similarly, participants with high perceived control presented a lower frequency ($t(235) = 3.267$; $p < .001$) and intensity ($t(210) = 3.376$; $p < .001$) of NS.
Conclusion: Perceived control was the strongest predictor of the self-reported severity of both HF and NS. Other causal predictors were hormone therapy and caffeine intake. All three were associated with less severe vasomotor symptoms.

1. Introduction

Most women experience vasomotor symptoms during midlife; in particular, there is an increase in the reporting of these symptoms as women go from one menopausal stage to the next [1]. Although around 70% of women report vasomotor symptoms [2], only a few consider them bothersome: in one study just 9% considered hot flashes (HF) to be bothersome, while 6% described night sweats (NS) as troublesome [3]. These same two sets of symptoms are considered problematic by 12–20% of women [2,4]. Regarding the menopausal stages, it has been shown that late peri-menopause (during which amenorrhea lasting 2 months or more may occur) and post-menopause (which starts after the final menstrual period) [5] are strongly associated with bothersome HF [1].

Unsurprisingly, health- and menopause-related variables have been reported to have an effect on vasomotor symptoms: the use hormonal therapy decreases their bothersomeness [6,7]; having a good health status diminishes both their frequency and the associated distress [3]; and less medical help-seeking is associated with less frequent and less severe symptoms [8–10]. Furthermore, despite the physiological nature of these symptoms, it has been shown that socio-demographic and lifestyle factors have an impact: low caffeine intake predicts a lower symptom severity [11,12]; high perceived control is related to lower frequency and distress [13]; a higher educational level predicts lower prevalence and severity [4,8,14,15]; and not being divorced is associated with a lower rating of how bothersome these symptoms are reported to be [8].

Some other characteristics have been reported in some but not all studies to be associated with vasomotor symptoms. For instance, alcohol [3,11,12,14,16], smoking [1,3,8,12,17], physical exercise [1,10,11,14,15], body mass index (BMI) [4,12,14,18–20] and educational level [3] have all been reported to predict either an increase or a significant decrease in the reporting of vasomotor symptoms.

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Some factors may have an impact on both (HF and NS) or on only one symptom.

Research into a variety of health-related conditions has found that perceived control over symptoms is a strong predictor of less emotional distress [21], lower prevalence and severity of symptoms [22,23], and of engagement in health-protective behaviours [24].

The present research had the objective of exploring whether socio-demographic, health-related and menopause-related variables, as well as lifestyle factors and perceived control, predict the severity of vasomotor symptoms (measured as the frequency and intensity of HF and NS separately) in a symptomatic community sample of pre-, peri- and post-menopausal women.

2. Materials and methods

2.1. Participants

A community sample of women who had reported having hot flashes (HF) and/or night sweats (NS) in the previous month filled in a series of self-report measures (see below) that assessed the frequency and intensity of vasomotor symptoms, perceived control, socio-demographic, health- and menopause-related variables, and lifestyle characteristics.

Table 1 summarizes the characteristics of the sample. The inclusion criteria in this research were female gender, age 42–60 years and the experience of vasomotor symptoms in the last month (HF and/or NS). The study instruments (see below) were filled in by 302 women. From this total, 59 women were excluded for not providing information regarding the frequency and intensity of HF and NS, or because they had not experienced them in the previous month. This left 243 women for whom data could be analysed.

2.2. Procedure

The community sample was recruited mainly through schools and universities in the city of Lisbon. Questionnaires and forms for written informed consent were given to students, inside sealed envelopes, to take to their mothers.

The American Psychological Association's standards on ethical treatment of participants were followed. The informed consent form explained the aims of the study; it emphasized that participation in the research was voluntary and that participants could interrupt their collaboration at any time, without any consequences. Each participant kept a copy of the informed consent form, on which contact details for the responsible researcher were included (so that women could contact her if they had any questions during the course of the study).

2.3. Measures

Two items of the Menopause Symptoms' Severity Inventory (MSSI-38) [25] were used to assess HF and NS during the previous month, in terms of both frequency and intensity, on a five-point Likert scale (from 0 to 4) that ranged from 'never' to 'daily or almost every day', and from 'not intense' to 'extreme intensity'. The perceived severity of HF and NS was given by the mean of the frequency and intensity values for each symptom.

To evaluate perceived control, the Portuguese validated version of the Perceived Control over Hot Flushes Index was applied [13]. This version excluded item 15 ('I want to learn as much as I can about hot flashes and the menopause'), as it was not significantly correlated with the construct, presenting a negative standardized estimate ($\lambda = -.105$; $p = .134$), and only 1.1% of its variance was explained by the construct. Moreover, the modification index (MI = 33.785) showed that this item had the strongest negative influence on the quality of fit of the measurement model. The resulting 14-item instrument presented good psychometric properties. Confirmatory factor analysis of the instrument showed a good fit ($\chi^2/df = 2.239$; CFI = .888; GFI = .909; RMSEA = .072; CI 90% .057 to .086; $p = .009$). Its reliability (estimated by Cronbach's alpha) was also good (.78).

Menopausal status was defined according to the Stages of Reproductive Aging Workshop criteria [5]. Pre-menopausal women were those who had not experienced any changes in their menstrual cycle. Peri-menopausal participants were those who reported a variable cycle length (a difference from 'usual' of more than 7 days)

Table 1
Characterization of participants in relation to socio-demographic, health, menopause-related and lifestyle variables.

Characteristics	Participants	
	n	%
Age (*M*; *SD*)	51.8 ± 4.501	
Marital status		
Married or in a relationship	171	70.7
Not married nor in a relationship	71	29.3
Parity		
0	25	10.6
1	84	35.6
2	99	41.9
3	21	8.9
>3	7	2.9
Education		
Primary school	34	14.3
Middle school	65	27.4
High school	60	25.3
University degree	78	32.9
Professional status		
Active	197	82.8
Inactive	41	17.2
Family annual income		
≤10.000€	56	26.7
10.001–20.000€	52	24.8
20.001–37.500€	54	25.7
37.501–70.000€	34	16.2
≥70.001€	14	6.7
Recent disease		
Yes	62	26.3
No	174	73.7
Recent psychological problem		
Yes	55	23.1
No	183	76.9
Search for medical help to deal with menopause		
Yes	155	70.8
No	64	29.2
Hormone therapy (HT), herbal/soy therapy or nothing		
HT	23	10.5
Herbal/soy therapy	31	14.1
Nothing	166	75.5
Menopausal status		
Pre-	15	6.3
Peri-	75	31.5
Post-	148	62.2
Body mass index (kg/m^2) (*M*, *SD*)	26.3 ± 4.826	
≤24.9	112	46.9
>24.9	127	53.1
Physical activity		
Yes	105	43.8
No	135	56.3
Smoking behaviour		
Current smoker	58	24.2
Current non-smoker	182	75.8
Alcohol consumption		
Yes	129	53.5
No	112	46.5
Coffee consumption		
Yes	208	86.3
No	33	13.7
Hot beverages intake		
Daily	198	87.6
Occasionally or never	28	12.4

or who had missed two or more cycles and had had an episode of amenorrhea lasting over 60 days. Post-menopausal women were those who had had at least 12 months of amenorrhea.

Also assessed were socio-demographic characteristics (age, marital status, parity, professional status, educational level, family's annual income), and health- and menopause-related variables (recent diseases and psychological problems, medical help-seeking to manage menopause, and use of hormone therapy and herbal/soy products), as well as lifestyle (intake of alcohol, coffee and other hot beverages, smoking, physical exercise and body mass index). The lifestyle variables were assessed in terms of presence/absence, amount and/or frequency. For example, physical exercise was measured in terms of times per week, and for how many minutes the participant exercised; a mean value for weekly frequency and duration was used in the multivariate model. Intake of coffee and other hot beverages, when present, was assessed on a four-point scale, ranging from 'occasionally' to 'more than five per day'. Alcohol intake, when observed, was measured in terms of both frequency (daily, every weekend or rarely) and quantity (until I feel drunk, moderately, or less than one glass per occasion); a mean value of both was used as a single alcohol consumption variable in the causal model. Finally, for current smokers, smoking was quantified on a six-point Likert-type scale that ranged from 'fewer than 10 cigarettes per month' to 'more than 40 cigarettes per day'.

2.4. Statistical analysis

Values were imputed for variables where the frequency of missing data was lower than 10% of the sample. This was done using the mean interpolation method.

Multi-collinearity between the independent variables was explored with the variance inflation factor given by SPSS Statistics (v. 19, IBM SPSS Inc, Chicago, IL). All variables presented a value below 5, indicating the absence of collinearity [26,27].

To test the causal model for vasomotor symptoms, a structural equation model was built relating the two dependent variables (perceived severity of HF and of NS) with 20 independent variables: perceived control; age; marital status; parity; professional status; family's annual income; educational level; transition from pre- to peri- and from peri- to post-menopause; medical help-seeking behaviour; use of hormone therapy or herbal/soy products for menopausal symptoms; presence of a recent psychological problem or a disease; alcohol intake; intake of coffee and other hot beverages; smoking; physical exercise; and body mass index.

The model was evaluated with SPSS AMOS software (v.18, IBM SPSS Inc, Chicago, IL). The quality of the fit of the structural model was evaluated using chi-square statistics (χ^2/df), comparative fit index (CFI), goodness of fit index (GFI) and root mean square error of approximation (RMSEA), against the reference values currently recommended for structural equation modelling [27,28].

A two-step approach was employed to evaluate the causal structural model. First, each factor's measurement model was evaluated to demonstrate an acceptable fit. Thereafter, the structural causal model, encompassing the two dependent and the 20 independent variables, was adjusted and the significance of the causal trajectories was evaluated.

Group differences were evaluated with one-way analysis of variance (ANOVA) (followed by post-hoc Tukey's test) and Student-*t* tests implemented in SPSS Statistics (v. 19, IBM SPSS Inc, Chicago, IL). The homogeneity of the variances was confirmed before the Student *t*-tests were conducted.

A median split was used to divide the participants into a high perceived control (HPC) group and a low perceived control (LPC) group, for the purposes of comparison.

3. Results

Both the measurement model ($\chi^2/df = 2.786$; CFI = .891; GFI = .910; RMSEA = .077; CI 90% .065 to .090; $p < .001$) and the causal model ($\chi^2/df = 1.593$; CFI = .888; GFI = .890; RMSEA = .049; CI 90% .042 to .057; $p = .534$) showed a good fit. Significant predictors are highlighted in Fig. 1.

As shown, the causal model accounted for 72% and 67% of the variability in the perceived severity of night sweats (NS) and

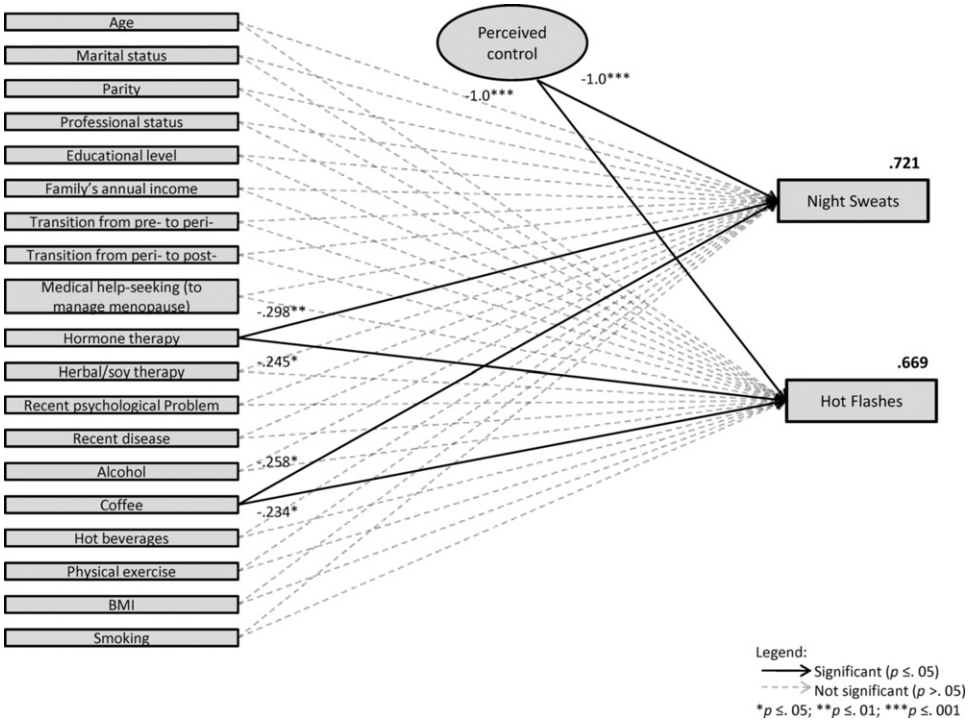

Fig. 1. Causal model for vasomotor symptoms' severity: its relation with socio-demographics, health and menopause-related variables, lifestyle and perceived control.

Table 2
Differences in frequency and intensity of hot flashes (HF) and night sweats (NS) between women with high (HPC) and low perceived control (LPC).

	M (*SD*)		*t*-Student HPC *vs.* LPC *t* (*df*) *p*[a]
	LPC	HPC	
Frequency of HF	3.4 (1.209)	3.1 (1.172)	2.022 (235)*
Intensity of HF	3.4 (1.188)	2.8 (1.110)	3.582 (217)***
Frequency of NS	3.3 (1.400)	2.7 (1.279)	3.267 (235)***
Intensity of NS	3.2 (1.388)	2.6 (1.172)	3.376 (210)***

[a] *p* (2-tailed)
* $p < .05$.
*** $p < .001$.

hot flashes (HF), respectively. Significant predictors were: hormone therapy for both HF ($\beta = -.245$; $p = .022$) and NS ($\beta = -.298$; $p = .008$); coffee intake for both HF ($\beta = -.234$; $p = .039$) and NS ($\beta = -.258$; $p = .029$); and perceived control for both HF ($\beta = -1.0$; $p < .001$) and NS ($\beta = -1.0$; $p < .001$).

The median perceived control score was 34.1 ($SD = 5.977$). This is similar to values found in previous studies [13,29]. Low perceived control (LPC), that is, below 34.1, was recorded for 104 women in the present sample; 139 recorded high perceived control (HPC) (scores above 34.1). In this symptomatic sample there were significant differences between the HPC and LPC groups regarding both the frequency and the intensity of vasomotor symptoms (Table 2).

Perceived control was not significantly associated with age (Pearson correlation $r = -.040$; $p = .536$).

Regarding perceived control in women who used hormone therapy (HT), herbal/soy products or nothing to manage the menopausal symptoms, there were significant differences between groups. Participants who did not take anything for the symptoms scored higher for perceived control than those who took HT (MD = .275; $p = .009$). Women who used herbal/soy products also had higher scores for perceived control than those who took HT (MD = .297; $p = .026$). No significant difference was observed between women who used herbal/soy therapy and those who did not use anything to manage symptoms (MD = .022; $p = .960$).

To explore whether these differences could be explained by different perceived severity scores, the three groups (women who used HT, who used herbal/soy products and who used nothing to manage their symptoms) were compared concerning the reported severity of vasomotor symptoms. There were no significant differences between the three groups in relation to HF ($F(2) = 1.848$; $p = .160$) or to NS ($F(2) = 1.491$; $p = .227$).

4. Discussion

Socio-demographic variables (age, marital status, professional status, parity, educational level, and annual income) and health-related variables were not significant predictors of the perceived severity of hot flashes (HF) and night sweats (NS). These results go against what has been reported from other studies [3,4,8–10,14,15]. Nevertheless, this absence of a relation has been reported previously [30].

Although intake of alcohol [3,11,12,14,16] and hot beverages [12], physical exercise [1,10,11,14,15], body mass index (BMI) [4,12,14,18–20] and smoking [1,3,8,12,17] have been considered predictors of vasomotor symptoms, the vast majority of lifestyle factors in the present study had no causal associations with the perceived severity of these symptoms.

In one of the previous studies which indicated that a high BMI is associated with HF, participants had a higher mean BMI (29.8 kg/m^2) [30] than participants in the present study ($M = 26.3$; $SD = 4.826$), and this could partially explain the absence of a causal relation found here.

Hormone therapy (HT) significantly predicted a lower perceived severity of both HF and NS, which is congruent with previous studies [6,7]. Moreover, and as Reynolds [13] also found, perceived control varies significantly between women who use HT, herbal/soy products or nothing for menopausal symptoms: participants who used no medication or who used herbal/soy products to ease vasomotor symptoms had a higher perceived control than those who were taking HT. This result was not due to differences in the symptoms' severity, as this did not significantly differ between the three groups. Additionally, in this symptomatic sample, women categorized as having high perceived control (i.e.,scores greater than 34, on a median split) had a lower frequency and intensity of both types of vasomotor symptoms than women categorized as low perceived control. Although the construct of perceived control is oriented to HT, significant differences were also found in relation to NS.

Congruent with Reynolds' [13,29] results, there was no association between age and perceived control. A previous study similarly found that perceived control and health changes are strongly associated in women over 65 years of age, but not in middle-aged participants [31].

Caffeine intake has previously been found to be a positive predictor of HF [11,12]. However, in the present study the amount of coffee consumed was a strong negative predictor of the perceived severity of vasomotor symptoms: women who drank more coffee had less severe vasomotor symptoms than the ones who drank less coffee. Caffeine is a central nervous system stimulant [32]; it increases clarity of thought, limits fatigue and drowsiness, increases concentration and motor activity and diminishes reaction time [33]. It is possible that these behavioural outcomes of caffeine intake are partially associated with effective coping strategies, which would eventually decrease vasomotor symptoms.

Also, certain selective serotonin reuptake inhibitors (SSRIs), which can be used in the treatment of HF [34], are metabolized by the same isoenzyme that is involved in the metabolism of caffeine [32]. Despite this high potential for pharmacokinetic interaction, with an expected inhibition of SSRI metabolism, coffee intake predicted a decrease in the self-reported severity of vasomotor symptoms in this sample. It can be hypothesized that this strong predictive effect results from an interaction of caffeine with other substances (i.e. other than SSRIs), which were not examined in this research and could reduce the severity of vasomotor symptoms. Moreover, decreased estrone levels have been observed in women with vasomotor symptoms [35], and caffeine intake is positively associated with estrone levels [36]. This might partially explain how coffee could be a strong negative predictor of the reported severity of HF and NS. This needs further exploration and confirmation in other samples, controlling for other sources of caffeine intake (such as tea and soft drinks).

High perceived control has been reported to be associated with the reporting of fewer and less severe symptoms in diverse areas [21–23], and also specifically in relation to HF [13,37]. In this sample, this association was very strong and significant, even after controlling for all the socio-demographic, health- and menopause-related factors, as well as a variety of lifestyle variables. In fact, perceived control had the strongest impact on the perceived severity of vasomotor symptoms. It could be hypothesized that, since perceived control has been associated with behavioural changes in other areas [24], some behavioural adjustments (perhaps dressing with several layers of clothing to allow more scope for adjusting to ambient temperature, avoiding spicy foods, effective stress management), strongly associated with a sense of control, may have led to the reduction in symptoms' severity.

The fact that perceived control had the strongest negative impact on self-reported symptoms' severity emphasizes the importance of cognitive appraisal. Reynolds [13] also highlighted this when concluding that, although the distress associated with HF was

higher in women who experienced the symptom more frequently, low levels of perceived control were even more predictive of distress than frequency itself. Furthermore, cognitive appraisals have been identified as accounting for some of the individual variation regarding HF [38]. These conclusions are supported by the fact that the frequency of HF can decrease by around 20–40% with placebo effects alone [39].

However, from the present study it could also be hypothesized that higher perceived control is a consequence of lower severity of HF and NS. Therefore, it is recommended that further investigation clarifies this, evidently strong, association.

The sample size (243 participants) was adequate for this type of statistical analysis, as 10 subjects per manifest variable is recommended for structural equation modelling [27,40]. Nevertheless, the fact that this research had a cross-sectional design, and used a sample where a third of the women had a college degree, limits the generalizability of the results.

5. Conclusions

Perceived control was the strongest negative predictor of the self-reported severity of vasomotor symptoms: women with high levels of perceived control reported lower symptoms' severity than women with low perceived control; this result was independent of socio-demographic, health-related, menopause-related and lifestyle factors. The use of hormone therapy and coffee intake were also significant negative predictors of symptoms' severity. The causal model explored in the study accounted for 72% and 67% of the variability in the perceived severity of night sweats and hot flashes, respectively.

This research emphasizes the importance of perceived control in the management of vasomotor symptoms and contributes with new data on the effects of caffeine on these symptoms.

Contributors

Isabel Leal participated in the supervision of the research and in the critical review of the article. João Maroco participated in the supervision of the research, in the statistical analysis and English review. Catarina Ramos participated in data collection and statistical analysis. Filipa Pimenta made the literature review, research design and article construction. She also participated in data collection and statistical analysis.

Conflict of interests

The authors of the article have no conflict of interest.

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