Climacteric symptoms in Quechua and Mestizo women from the Andean region of Cusco, Peru: Effects of altitude and ethnicity

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A B S T R A C T

Background: Latin-American women present a greater severity of climacteric symptoms than women from other parts of the world. Previous studies suggest that this could be due to either its Amerindian crossbreeding or the altitude in which a huge proportion of the Latin-American population lives.
Objective: To answer this question, climacteric symptoms between Peruvian women ("Hispanic-Mestizas" and "Quechuas") living in similar altitude (around 3000 MASL) were compared.
Method: This is a cross sectional descriptive study of healthy women of 40–59 years of age living in Departamento de El Cusco, Peru. Using the MRS questionnaire climacteric symptoms were assessed in 395 "Hispanic-Mestizas" (Quechua-Spaniard breeding) and 376 pure "Quechuas".
Results: The "Quechuas" compared with "Hispanic-Mestizas" have comparable similar age, but less: obesity, schooling years, cigarette smoking, use of hormonal therapy, diabetes and hypertension; and a greater: proportion of postmenopausal women and number of children. "Quechuas" showed a greater prevalence in ten of the eleven symptoms evaluated by the MRS scale, except for insomnia. The total MRS score was 14.54 ± 7.51 vs. 9.87 ± 6.26 ($p < 0.0001$), respectively. As a consequence of this, 46.5% of the "Quechuas" had a deteriorated quality of life due to severe climacteric symptomatology, compared to only 14.2% of "Hispanic-Mestizas" women ($p < 0.0001$). After adjusting for confounding variables menopause was associated with increased risk of severe menopausal symptoms (OR: 5.86, 95% CI: 3.93–8.75), followed by lack of partner (OR: 3.52, 95% CI: 1.91–6.48), arterial hypertension (OR: 2.62, 95% CI: 1.28–5.39) and Quechua being (OR: 2.38, 95% CI: 1.27–4.45).
Conclusions: Peruvian "Quechuas" women have severer climacteric symptoms than the Peruvian "Hispanic-Mestizas" who live in a comparable altitude. This could suggest that the ethnicity could be one of the factors that could explain the augmented symptoms in Latin-American climacteric woman.

1. Introduction

In a previous study it was shown that Latin-American women had severer climacteric symptoms, assessed with the MRS scale, than women of other parts of the world [1]. Latin Americans had a MRS score of 11.3 ± 8.5 points, while the Europeans (8.8 ± 7.1), North Americans (9.1 ± 7.6) and Asians (7.2 ± 6.0) had scores

significantly lower [2]. Although climacteric symptoms are multifactorial, including intrinsic variables (hormone and age changes, stress perception, comorbidity, life satisfaction) and extrinsic or environmental (ethnicity, economic factors, occupation or job, education, male factors, intimate partner violence, etc.), we hypothesized that the greater severity of climacteric symptoms detected in the Latin-American women, compared with women of other parts of the world, could be due to its indigenous ethnic component. For that, we studied a group of Zenues (Colombia) and Quechuas (Peru) ethnic women. It was seen that the indigenous had even greater climacteric symptoms (greater score in the MRS scale) than the Latin-Americans [3]. Nevertheless, the fact than the "Quechuas" had a MRS score far more elevated than the Zenues (22.7 ± 5.7 vs. 14.7 ± 2.5), lead us to hypothesize that the greater climacteric symptoms could be due to the higher altitude in which the "Quechua" group lives in the Andes mountains, 3000 m above

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the sea level (MASL). This hypothesis was backed up by the observation of a multinational Latin American study that found than women living in Latin-American cities located at altitudes higher than 2000 MASL had 43% greater risk of presenting severe climacteric symptoms [1]. However, most of the high altitude cities have a population with a strong "Quechua" ethnic component. Thus, it was not possible there to elucidate if it was either the altitude or the ethnic origin, which is present in the majority of the population in the western South American countries, what explains the greater prevalence of climacteric symptoms that was found.

To further clarify the previous incomplete observation, it was decided to undertake a study of climacteric symptoms, using the same instrument (MRS scale), in women living between 2500 and 3500 MASL either in "Quechuas" villages in El Cusco District ("Quechuas") or living in the city of El Cusco ("Hispanic-Mestizas", crossbreed from Spaniards and "Quechuas").

2. Method

2.1. Type of study

A cross sectional descriptive study, carried out in the city of El Cusco (400,000 habitants, 3399 MASL) and in Indian's villages of the Cusco District: Anta (3345 MASL), Checacupe (3446 MASL), Chiara (3527 MASL), Combapata (3470 MASL), Curahuasi (2688 MASL), Limatambo (2577 MASL), Ocongate (3533 MASL), Pampamarca (3350 MASL) and Pitumarca (3570 MASL).

2.2. Participants

Women between 40 and 59 years of age that lives in the District of El Cusco and that have a normal health, defined as compatible with the realization of their daily activities [4]. "Hispanic-Mestizas": women living in the city of El Cusco accompanying a patient that consulted in a Health Center of that city during the interview period, and that had at least two Spaniard family names and her language was Spanish were offered to be interviewed. "Quechuas" (Indians): women that were living in Indian's villages, whose four family names were of "Quechua" origin and their language was also "Quechua". A group of trained interviewers (health professionals) did a door to door visit looking for women whose ages fluctuate between 40 and 59 years of age. An appointment for a next visit with the selected women was then set, time at which they were interviewed in "Quechua" language. The interviewers were all well known to the Indian's communities; the interviews were held on Sundays, day in which women do not perform agricultural and/or shepherding labors, meeting in her towns.

2.3. Procedure

Volunteers were informed about the objective of the investigation, the type of questions that were going to be asked, and asked if they had understood the activity to be performed. They were asked to answer the MRS questionnaire and general data questions. Previously to the interview they were asked to sign in an Informed Consent Form in accordance with the Helsinki [6] declaration. The study has previously been approved by PROSAM's Foundation Bioethical Committee, Santiago de Chile, Chile.

2.4. Instrument and variables

2.4.1. General data

A previously validated questionnaire (in 50 women) was given to all participants to record general data.

2.4.2. Variables

Data for the following variables was registered: ethnic group ("Hispanic-Mestizas"/Quechuas), age (years), weight (kg), height (cm), schooling (expressed in years of study), paid work (yes/no), has a couple (yes/no), number of children, menopause (pre, peri, post menopause, STRAW) [6], use of hormonal therapy (yes/no), cigarette smoking (yes/no), arterial hypertension (>140/90 mm of Hg and/or use of antihypertensive drugs), diabetes mellitus (history of fasting blood glucose > 125 mg/dL and/or use of hypoglycemic drugs).

2.4.3. Menopause Rate Scale (MRS)

The instrument used for assessing the climacteric symptoms was the MRS [7], questionnaire compounded by eleven symptoms and divided in three sub-scale: somatic-vegetative: hot flashes, cardiac annoyances, sleeping disorders, muscular and articulations annoyances (items 1–3 and 11, respectively); psychological: depressive state, irritability, anxiety, physic and mental tiredness (items 4–7, respectively); urogenital: sexual problems, bladder problems and vaginal dryness (items 8–10, respectively). Each one of the 11 items was graded as: 0 (absent), 1 (mild), 2 (moderate), 3 (severe) and 4 (very severe), being able to establish the mean and its standard deviation obtained by each population for each one of the items. The sum of the medias of the defined items in each dimension divided by the number of items in the dimension, establish the population mean of each of the dimensions and the sum of the means (summary value) obtained for each of the three dimensions establish the total score or global dimension of the scale. As greater is the figure obtained, greater is the deterioration in quality of life. This instrument defines as a severe compromise of quality of life by climacteric symptoms if the total punctuation of the scale is above 16 points [8]. This scale has been validated for Spanish language and used in various countries of Latin-America [9,10]. During the interview health workers used a Quechua translation of MRS Scale whose internal consistency measured with Cronbach's alpha was 0.94.

3. Statistical analysis

Statistical analysis was done using an EPI-INFO software (Version 7.1.0.6; 2012, Centers for Disease Control and Prevention, Atlanta, GA, USA). Results are presented as means (±SD) and proportions (CI 95%). The test of Kolmogorov–Smirnov was used for assessing the normality of the distribution of the data, and the Bartlett test for testing the homogeneity of the variance. The Student-t or the Mann–Whitney tests were used for the comparison of medias. Differences of proportion between groups were assessed with the Chi-square test; and the Fisher exact test was applied if a box in the Chi-square test had five or less cases in it. A value of $p < 0.05$ was consider statistically significant.

A logistic regression analysis was done for the assessment of various variables that simultaneously influence the severity of the climacteric symptoms. It was consider as dependent variable the presence of severe symptoms (MRS score >16 points) and independent variables: the "Quechua" ethnic group, age (>50 years), presence of menopause, use of hormonal therapy, number of children (>3), has a stable couple, schooling (>6 years), has a paid work, obesity (BMI >30), cigarette smoking, diabetes mellitus and arterial blood hypertension.

4. Results

771 Peruvian women were studied, 395 "Hispanic-Mestizas" of El Cusco city and 376 "Quechuas" that lived in "Quechuas" communities in the region (Anta, 46 women; Checacupe, 32; Chiara,

Table 1
Characteristics of women by ethnic group.

	"Hispanic-Mestizas"	Quechuas	$p<$
No. women	395	376	
Age (years)	48.6 ± 4.9	48.2 ± 5.1	ns[b]
Weight (kg)	65.9 ± 10.3	55.0 ± 7.1	0.0001[a]
Height (cm)	156.7 ± 5.5	150.7 ± 5.9	0.0001[b]
BMI (kg/m^2)	26.9 ± 4.2	24.2 ± 2.5	0.0001[a]
Obesity (%)	19.7 (16.0–24.1)	1.3 (0.5–3.3)	0.0001[c]
Paid work (%)	69.4 (64.5–73.8)	8.5 (6.0–11.9)	0.0001[c]
Years of study	12.1 ± 3.9	2.8 ± 2.3	0.0001[a]
Speaks Spanish (%)	100.0	57.3 (52.9–61.8)	0.0001[d]
Speaks Quechua (%)	45.5 (40.1–50.8)	100.0	0.0001[d]
With stable couple (%)	80.5 (76.2–84.2)	82.2 (77.9–85.8)	ns[c]
Parity (no. children)	3.0 ± 1.7	4.4 ± 1.6	0.0001[b]
Postmenopausal (%)	51.4 (46.3–56.4)	58.2 (53.1–63.3)	0.05[c]
Use of TH (%)	7.6 (5.3–10.8)	0	0.0001[d]
Cigarette smokers (%)	2.0 (0.9–4.1)	0	0.007[d]
Arterial hypertension (%)	10.9 (8.1–14.5)	1.1 (0.3–2.9)	0.0001[d]
Diabetes (%)	2.8 (1.5–5.1)	0.5 (0.1–2.1)	0.02[d]

ns: not significant.
Data presented as means ± standard deviation or proportions with its 95% confidence interval.

[a] Mann–Whitney.
[b] Student t.
[c] Chi-square.
[d] Fisher's exact test.

23; Combapata, 77; Curahuasi, 35; Limatambo, 54; Ocongate, 36; Pampamarca, 29; and Pitumarca, 44). Table 1 shows the comparison between "Quechuas" and "Hispanic-Mestizas", the only similarities that they have are in age and proportion of women that had a stable couple. In contrast, the other variables shows that the "Quechuas" had significantly less weight, height, body mass index), paid work and school years. While 100% of the "Quechuas" spoke the "Quechua" language, only 45.5% of the "Hispanic-Mestizas" were capable of communicate in that language (Quechua). "Hispanic-Mestizas" had fewer children and had greater prevalence of obesity, cigarette smoking, diabetes, arterial hypertension and use of hormonal therapy. In the "Hispanic-Mestizas" group there were less women in the post menopause stage than between the "Quechuas", although the ages were similar in both ethnic groups.

In Table 2 it can be observed that the "Quechuas" have higher climacteric symptoms that the "Hispanic-Mestizas". Globally, the total mean score of the MRS scale is of 14.54 ± 7.51 vs. 9.87 ± 6.26, respectively ($p < 0.0001$). As consequence of it, 46.5% of the "Quechuas" women have bad quality of life defined by climacteric symptoms, with an MRS score greater than 16 points, compared with only 14.2% of the "Hispanic-Mestizas" women ($p < 0.0001$). When analyzed each one of the symptoms in particular it was observe that, of the eleven assessed by the MRS scale, all have greater severity (greater scores) in the "Quechuas" women.

In relation to prevalence of climacteric symptoms, it draws the attention that the vasomotor symptoms affect to almost all of the "Quechuas" women (93.4%). Following, anxiety (85.4%), irritability (84.8%), depressive mood (83.0%) and osteomuscular discomfort (81.9%). Instead, "Hispanic-Mestizas", have osteomuscular discomfort as the most prevalent symptom involving 73.9% of women of this ethnic group. Then comes, sleeping disorders (72.9%), vasomotor symptoms (72.7%), tiredness (72.2) and irritability (68.4%). Nevertheless, independently of which are the more prevalent climacteric symptoms in each of these ethnic groups, the "Quechuas" women will present a greater prevalence than the "Hispanic-Mestizas" in all of the eleven symptoms that the MRS scale evaluates, excepting insomnia, symptom that had equal prevalence in both ethnic groups.

A logistic regression model to evaluate the factors influencing the severity of climacteric symptoms included the following variables: age (>50 years), presence of menopause, use of hormonal therapy, number of children (>3), has an stable couple, schooling (>6 years), has a paid work, obesity (BMI >30), cigarette smoking, treatment for diabetes mellitus and arterial hypertension. Menopause was associated with increased risk of severe menopausal symptoms that impair quality of life (OR: 5.86, 95% CI: 3.93–8.75), followed by lack of partner (OR: 3.52, 95% CI: 1.91–6.48), arterial hypertension (OR: 2.62, 95% CI: 1.28–5.39) and being Quechua compared to Hispanic-Mestiza (OR: 2.38, 95% CI: 1.27–4.45).

5. Discussion

Different authors have shown that different factors can modulate climacteric symptoms [1,11–16]. The principal factor is the declination of the hormonal function of the ovary, but age, schooling, obesity, consumption of alcohol, number of children, ethnic group, psychiatric history, use of hormonal therapy, etc.; can influence the prevalence and intensity of climacteric symptoms. In a previous multicenter study we have concluded that the altitude above the sea level in that the populations were located could also be a significant factor in the greater intensity of climacteric symptoms that had the Latin American's compared with women of other parts of the world. But in that study the impact that the ethnic origin could have was not assessed [1]. That was an important flaw because many of the cities where the study was done were located in the Andes mountains at more than 2500, and even 3000 MASL (La Paz, Cochabamba, Cusco, Quito, Bogotá, Ciudad de México), and had also greater prevalence of population with a high indigenous crossbreeding than the cities located at lower altitude or at the coastal level. For what, the greater prevalence of climacteric symptoms in Latin American's could be due to the ethnicity and not to the city altitude itself. Afterward, as already mentioned, we studied Zenues (Coastal Colombia) and "Quechuas" (Peru, 3500 MASL) and we concluded that both groups had more prevalence and intensity of climacteric symptoms than the Latin Americans, mainly "Hispanic-Mestizas" [3]. Nevertheless, the "Quechuas" that lived at a greater altitude had more symptoms than the "Zenues" that lived in the coast. This result pinpoints not only the ethnicity but also the altitude as a determinant factor for climacteric symptoms. Although the "Zenues" and the "Quechuas" are "Amerindians", they are different ethnic groups with a highly different phenotype, what would also not allow discarding that the observed difference in climacteric symptoms between these indigenous groups has an ethnic substrate.

This study finds than the "Quechuas", living in "Quechuas" communities, present more climacteric symptoms than the "Hispanic-Mestizas" women that live in the city of El Cusco at a similar altitude. This observation is compatible with the hypothesis that the ethnicity could be one of the factors that could explain the greater prevalence and intensity of climacteric symptoms in Latin-American women and also compatible with the concept that menopausal symptoms are the result of the interaction of the estrogenic deprivation, influenced by psychosocial and genetics factors [17]. Within the genetic factors, polymorphism of the genes that codify enzymes that participate in the metabolism of the ovarian steroids, as also in the synthesis of the estrogenic receptors, can influence the endogenous hormone levels and climacteric symptoms [18–21]. Not only the polymorphism that changes the hormonal levels can be associated to higher climacteric symptoms, Malacara has shown that in post menopausal women also the polymorphism of the estrogenic receptors alpha was associated to higher intensity of hot flashes and more vaginal dryness [22].

The prevalence of different gene polymorphisms linked to estrogenic activity varies between the different ethnic groups. For example, the Study of Women's Health Across the Nation (SWAN)

Table 2
Score and prevalence of climacteric symptoms (MRS) in women Peruvian "Hispanic-Mestizas" and in "Quechuas".

Domains	MRS score (mean ± SD)			Symptoms prevalence % (CI 95%)		
	Hispanic-Mestizas	Quechuas	p<	Hispanic-Mestizas	Quechuas	p<
Somatic						
Hot flashes, sweating	1.04 ± 0.86	1.65 ± 0.76	0.0001[a]	72.7 (67.9–76.9)	93.4 (90.2–95.6)	0.0001[c]
Palpitations	0.52 ± 0.77	1.10 ± 0.80	0.0001[b]	38.0 (33.2–43.0)	75.5 (70.8–79.7)	0.0001[c]
Sleeping disorders	1.01 ± 0.84	1.13 ± 0.89	0.02[b]	72.9 (68.2–77.2)	71.8 (66.9–76.2)	ns
Osteomuscular discomfort	1.13 ± 0.92	1.79 ± 1.09	0.0001[a]	73.9 (69.2–78.1)	81.9 (77.6–85.6)	0.007[c]
Score of the domain	3.71 ± 2.39	5.67 ± 2.94	0.0001[a]	–	–	
Psychological						
Depressive mood	0.96 ± 0.85	1.42 ± 0.84	0.0001[b]	67.3 (62.4–71.9)	83.0 (78.7–86.6)	0.0001[c]
Irritability	1.02 ± 0.88	1.47 ± 0.87	0.0001[b]	68.4 (63.5–72.9)	84.8 (80.7–88.2)	0.0001[c]
Anxiety	0.84 ± 0.86	1.46 ± 0.83	0.0001[b]	58.2 (53.2–63.1)	85.4 (81.3–88.7)	0.0001[c]
Tiredness	1.04 ± 0.86	1.19 ± 0.88	0.005[b]	72.2 (67.4–76.5)	74.5 (69.7–78.7)	ns[c]
Score of the domain	3.86 ± 2.78	5.54 ± 2.94	0.0001[b]	–	–	
Urogenital						
Sexual problems	0.77 ± 0.98	1.24 ± 0.93	0.0001[b]	46.8 (41.8–51.9)	71.3 (66.4–75.7)	0.0001[c]
Urinary discomfort	0.75 ± 0.85	0.95 ± 0.93	0.003[b]	51.9 (46.9–56.9)	59.6 (54.4–64.5)	0.03[c]
Vaginal dryness	0.77 ± 0.86	1.15 ± 0.94	0.0001[b]	54.4(49.4–59.4)	66.5 (61.4–71.2)	0.0001[c]
Score of the domain	2.30 ± 2.11	3.33 ± 2.24	0.0001[b]	–	–	
Total	9.87 ± 6.26	14.54 ± 7.51	0.0001[a]	–	–	

MRS: Menopause Rating Scale.
[a] Mann–Whitney.
[b] Student *t*.
[c] Chi-square.

assessed Afro-American, Caucasian, Chinese and Japanese women and found that the polymorphism of genes related with the estrogenic metabolism varied significantly between different races and that the prevalence of hot flashes was associated to different polymorphisms in the different ethnic groups studied [18,23]. For which, it is biologically plausible that the different prevalence of climacteric symptoms in different populations in the world was due in part to the existence of different ethnic distributions of gene polymorphism linked to the estrogenic activity. Unfortunately, we have not found in the world literature studies in Latin American Indians that assesses the prevalence of genetic disorders related with the estrogenic metabolism. Nevertheless, in the same way as in a study done in Latin American Indians that relates the presence of polymorphism of genes linked to the immune answer with a greater susceptibility to tuberculosis [24], variations of the prevalence of polymorphism of the genes that modify the estrogenic activity could also explain the greater prevalence of climacteric symptoms that were have observed in "Quechuas" Indians and in a lower magnitude in Latin-American women.

It cannot be discarded that the altitude where a woman lives does not influence the prevalence of climacteric symptoms. It is known that the higher altitude of the city lowers the menopause age; in Latino America we have observed that a woman of 49 years that lives in a city located at more than 2.000 MASL has doubled the risk of presenting menopause at that age than a woman that lives in a city located at a lower altitude [25]. This data is concordant with other studies of cities of high altitude in Peru and Tibet [26,27]. Chedraui has also found than a Latin-American woman that lives at more than 2000 MASL has a 43% greater risk of having a deterioration of her quality of life because of climacteric symptoms [1]. This observation could be due to that women that live in higher altitudes have an earlier menopause and thus we find within this populations more women in the peri and post menopause stages, two highly symptomatic groups, than what it was found in populations that live at lower altitudes. Nevertheless, it cannot be discarded that the altitude is also influencing the severity of climacteric symptoms when describing the South American Indians that live in the coast, although having climacteric symptoms of greater intensity than the Latin American "Mestizas", they have lower severity than the Indians that live in higher altitude [3]. A study of the International Menopause Society showed that the altitude does not influence the vasomotor symptoms [28], but this study only included 198

women from Quito, while the study of Chedraui included almost 2000 women living in high altitude in seven different cities of Latin America [1].

One factor that should be considered in our study is rurality. Lifestyles that involve living in the city can significantly influence climacteric symptoms. A Spanish study has indicated that in postmenopausal rural women the symptoms were less severe than those living in cities. We have observed the opposite, reflecting the multifactorial dimension of climacteric symptoms [29].

Other factor that could influence the difference in symptoms between the two ethnic groups that we have studied is the diet. Zhang has stipulated that in climacterics women an omnivore diet was associated to a lowering of hot flashes prevalence in perimenopausal women [30]. There are no studies that guarantee the existence of differences in the diets between the "Hispanic-Mestizas" at El Cusco and of the one of the "Quechuas". Although there is no specific nutritional survey performed, based in interviewers, who eat on their trips in indigenous villages, there are no greater differences in the nutritional habits of both ethnic groups.

We cannot avoid mentioning the influence that could have in the higher climacteric symptoms founded in the "Quechuas", a series of factors that were present with a highly different prevalence in this ethnic group compared with the Peruvian "Hispanic-Mestizas". There are great differences in weight, schooling, a paid work, number of children, proportion in post menopause, use of TH, cigarette smoking, prevalence of diabetes and hypertension. All this factors, interacting between them, will also modulate climacteric symptoms [3]. Nevertheless, this study shows that the "Quechua" ethnic group, after adjusting for confounding factors, more than doubled the risk of having severe climacteric symptoms that deteriorate their quality of life.

6. Conclusion

We could conclude saying, than the "Quechuas" women present severer climacteric symptoms than the Peruvian "Hispanic-Mestizas" that live at similar altitude. This could suggest that ethnic's factors, perhaps gene polymorphism linked to estrogenic activity, could be the cause of this difference. The wide geographic distribution of the "Quechuas" in South America could be one of the factors that explain the greater symptoms present in climacteric women in this subcontinent.

Contributors

Contributors	Design	Implementation	Data obstencion	Statistical analysis	Analysis of results	Writing and translating	Delivery to publication
Ojeda		X	X				
Blümel	X			X	X	X	X
Vallejo	X				X	X	
Lavín				X	X	X	

Competing interest

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Ethical approval

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