

Psychological Features of Breast Cancer in Mexican Women I: Personality Traits and Stress Symptoms

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Abstract. Breast cancer (BC) is one of the leading causes of death among women worldwide. Identification of susceptible women might help us reduce BC-related deaths. Traditionally women's susceptibility to BC has been estimated based on family, reproductive and nutritional histories and/or genotyping. Unfortunately, predictions made based on all these factors remain imprecise. Research conducted over the past decades supports the premise that patients displaying some personality traits are prone to develop cancer. Nevertheless, conflicting results have been published. We then conducted a study aimed at evaluating relationships between specific personality traits and different types of breast pathology. This approach aimed at evaluating whether personality profiling, in conjunction with other parameters might help us, in the near future, to identify more accurately Mexican women susceptible to develop BC. As a first step towards this goal, we asked whether healthy women and patients having signs of benign breast pathology or cancer shared or not specific personality traits. We used the Courtauld Emotional Control Total Score, the Weinberger Adjustment Inventory and the Symptoms of Stress Inventory to identify personality traits. Our results indicated that women diagnosed with benign or malign breast pathology share low restraint, low global stress symptoms, low physical stress symptoms, low restraint-defensiveness composite and high distress before diagnosis. This outcome was independent of the educational level, as well as of family, reproductive and nutritional histories, supporting that the weight of the psychological traits is greater than that of the latter variables, at least in our sample.

Keywords: Breast cancer, psychological profile, distress, behavior, emotional suppression and repression

INTRODUCTION

Breast cancer (BC) is a leading cause of death among women worldwide [1]. Most BC cases (58%)

are diagnosed in low and middle-income countries where global trends show the fastest growing rates of BC morbi-mortality [1]. In Mexico, BC has the highest incidence of malignant neoplasias (11.34%) among women, specially, between 40 and 59 years of age [2–4]. Because BC prognosis has not improved significantly over the last 40 years [5], identifying BC-susceptible women stands as a primer measure to reduce BC-related deaths.

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In this respect, previous studies have shown that family, reproductive and nutritional histories are sources of information that can be used to estimate the relative risk of women to develop BC [6, 7]. We now accept that adult women having a positive BC family history, nulliparity, early menarche, high body mass index and/or prolonged use of contraceptives have an increased risk of developing BC. On the contrary, multiparity, breast-feeding and early full term pregnancy decreases the possibility of developing BC [8]. Genetic factors also influence BC susceptibility. Indeed, single nucleotide polymorphism genotyping has estimated that over a 1000 genetic loci might render women BC susceptible [9]. In spite of all this information, epidemiological, clinical and genetic factors alone or in conjunction identify, at best, from 25% to 40% of women at risk of developing BC [9, 10]. This lack of precision makes the estimation of BC-susceptibility for each woman based upon these factors alone, to some extent, unreliable [6, 11]. Lastly, even though genome wide association studies are now possible, genotyping is still costly and unavailable for most women living in middle and low income countries in which BC morbimortality rates are among the highest worldwide.

Psychologists have long recognized the existence of a relationship between some personality traits and the risk to develop cancer (i.e., extroversion and neuroticism, aggressive hostility and phobia, type C personality, etc.) [12–19]. Nonetheless, two of the most consistent features that seem to enhance cancer risk are the lack of expression of negative emotions [20] and the need for harmony, which leads to a coping style in which the person puts aside his needs to satisfy the other's wants and desires [21]. All these psychological features belong to the type C personality [19, 22]. Subjects displaying type C personality have chronic symptoms of distress, emotional suppression or emotional repression.

Distress, emotional suppression and/or repression are frequently associated with endocrine and immune dysfunctions [23, 24]. This circumstance predisposes subjects to develop cancer and/or favors cancer progression when they already have it [25, 26]. Personality profiling might then help identifying BC-susceptible women. In this scenario, women displaying type C personality might be prone to develop BC (for a thorough review see Dreher [27]). In support of this concept, Greer and Morris (1979) revealed that around 50% of women diagnosed with BC were extreme suppressors of anger, sadness and anxiety (cited by Dreher [27]). In addition, it has been shown

that suppression, repression and distress are good predictors of BC onset and progression [26, 28]. In spite of these positive results, different research groups have questioned their legitimacy based on methodological grounds (i.e., a small sampling, the use of different psychometric instruments, and the preponderance in the use of retrospective instead of longitudinal studies; [20, 29, 30]). One thing that research groups (both with positive and negative results) agree on is that the type C personality is not a rigid construct that must fit perfectly, but a coincidence of traits that generate harmful behaviors that promote the generation of a condition (i.e., smoking, drinking alcohol, being overweight and obese, sedentary lifestyle, etc.) but also a way of being and feeling that encourage a particular physiology. For example, several authors show that emotional suppression is one of the distinguishing characteristics of type C personality, in which the individual is rational, distant and anti-emotional with a repressive coping style (i.e., lack of negative emotions and a need for harmony; [21]). In addition, it is still possible that personality may impact on cancer risk, through an interaction between personality traits and high life stress. Verification of such hypotheses would open up new possibilities for preventive interventions in well defined groups of individuals with certain personality traits who may be susceptible to high life stress [30].

In Mexico, breast cancer is a leading cause of morbi-mortality among women. Up to date, there are no published studies aimed at evaluating the psychological traits of BC-susceptible women (e.g., women having mammary cystic fibrosis) or patients already diagnosed with it. The present study was thus devised to evaluate the relationship between women's personality traits and different types of breast pathology in order to begin validating the possibility of using personality profiling to identify Mexican women susceptible or not to develop BC, and to instrument preventive interventions based upon such traits. In this first document, the "Psychological Features of Breast Cancer in Mexican Women I", we focus on how specific personality traits and stress symptoms could be used to identify BC-susceptibility. In document that follows, the "Psychological Features of Breast Cancer in Mexican Women II", we studied the dynamics of the interactions of the psychological traits with genetic, life style and environmental factors and estimated their relative impact on BC evolution by conducting a network analyses.

METHODOLOGY

Cohorts

Our sample consisted of 150 women recruited for the study after signing an informed consent that assured confidentiality and anonymity. The recruited women (Table 1) were patients of the Hospital General de México “Dr. Eduardo Liceaga”. They all attended, during the first semester of the year 2012, their gynecological appointment for a regular check up. This allowed our study to include women between the ages of 16 to 79, an important factor considering that BC diagnosis among Mexican women is not limited to women over 50 years of age [3]. Women were grouped based upon their age and personality type and then matched with their final diagnosis. Women with no breast pathology formed the healthy (H) group ($n=50$). Those having fibrocystic breast disease, mammary fibroadenomas or mastitis formed the benign breast pathology (BBP) group ($n=50$). Finally, women having untreated BC ($n=50$) were clustered in the third group. To avoid bias of the psychosocial profiling, for this last group of women, we only assessed personality type before the BC positive diagnosis was made and disclosed to the patient.

To have a homogenous sample size, the recruitment was suspended after reaching $n=50$ for each

subgroup (H, BBP and BC). All patients recruited for the study were mestizo and born in Mexico (at least the last two generations along their genealogies born in Mexico) from middle class families. Age, educational level, marital status, family history of cancer, nutritional and reproductive backgrounds were all recorded and taken into consideration when interpreting the results (Table 1). Although the age of the subjects was heterogeneous in the three groups, there were no statistical differences in most of the psychological variables when a lineal regression model was carried out based on the age (only in the case of Subjective Experience of Distress (DSS) and Anxiety suppression (ANX) was there a statistical difference, but the explained variance was low, 6.4 and 3.3%, respectively). This result allows us to discard age as confounding variable. Pregnant women, as well as women exhibiting signs of autoimmune disease or having non-diagnosed breast abnormalities at the moment of the recruitment process were excluded from the study. Women that failed to answer the questionnaire were also excluded.

The protocol was reviewed and approved by the Ethical Committee for Clinical Research at the Hospital General de México “Dr. Eduardo Liceaga”, Secretaría de Salud (DI/12/111/03/064).

Table 1
Mean, standard deviation, frequencies and percentages of main characteristics of the sample

	BC ($n=50$) M (STD)	BBP ($n=50$) M (STD)	H ($n=50$) M (STD)
Age	50.61 (13.11)	41.14 (11.73)	39.79 (12.16)
Years of education	7.94 (3.86)	10.11 (3.62)	13.76 (4.34)
	BC ($n=50$) %	BBP ($n=50$) %	H ($n=50$) %
Marital status			
Never married	16	36	58
Married + common-law marriage	62	50	36
Others (divorced or widowed)	22	14	6
Menarche			
Early 8–10 years	1	2	2
Normal 11–12 years	23	27	28
Late ≥ 13 years	26	21	20
Menopause			
Yes	24	7	10
No	26	43	40
Childbirths			
Yes	37	23	24
No	13	27	26
Hormone replacement therapy			
Yes	25	10	4
No	25	40	46
IMC			
Normal 18.5–24.9	12	15	22
Overweight 25.0–29.9	26	22	13
Obesity ≥ 30	12	12	15

Identifying the personality traits and stress symptoms

The Courtauld Emotional Control Total Score (CECS)

This instrument evaluates suppression by rating the intensity of the individual's reactions when experiencing negative emotions. CECS was developed to evaluate suppression in BC-diagnosed women by Watson and Greer (1983) (cited by Dura et al., [31]). It was adapted for native Spanish speaking patients ($N=175$) by Dura et al. (2010). The internal consistency of the Spanish version of CECS proved to be statistically satisfactory with *Cronbach's alpha* coefficients reaching 0.86 for anger suppression (A), 0.88 for depression (D) and anxiety (ANX) sub-scales, and 0.95 for the Total Scale (Dura et al., 2010). The global score of the CECS explain up to a 13% of the variance. CECS is a 21-items questionnaire divided into three sub-scales that measure suppression of anger (A), depression (D) and anxiety (ANX). The responses to each item are scored based on 4-point scales that range from (1) "almost never" to (4) "almost always". Higher CECS scores signify greater suppression levels. In our study, women with low A, D and ANX magnitude scored between 0 and 15 points, with medium magnitude between 16 and 18 points and with high magnitude equal to or above 19 points. Global suppression was considered low if scores ranged between 0 and 50 points, medium between 51 and 55 points, and high if equal to or above 56 points. Categorization was based on the 95% confidence interval of the responses variable. This meant that women who qualified within the range of the average \pm standard error were grouped within the medium category, while women who were below or above the confidence interval of 95% were grouped within the categories low or high, respectively. The intervalar scale was transformed to binomial in order to evaluate the degree of similarity among participants across instruments. For binomial transformations, women who scored equal, above or below the cutoff points for each category were rated 1 or 0, respectively.

The Weinberger Adjustment Inventory (WAI)

This instrument estimates repression, defensiveness and restraint [32]. WAI was translated to Spanish and adapted and validated for the Mexican population ($N=452$) by Romo-González et al. [33]. The internal consistency of the WAI Spanish version proved to be statistically satisfactory with *Cronbach's alpha*

coefficients reaching 0.89 for self-control, 0.84 for subjective experience of distress, 0.69 for defensiveness and 0.74 for consideration for others. The factors extracted explain 43.17% of the total variance. WAI is a 44-items questionnaire divided into three sub-scales. The Subjective Experience of Distress (DSS) scale estimates anxiety, depression, low self-esteem and low wellbeing. The Restraint (RST) scale estimates suppression of aggression, impulse control, consideration for others and responsibility. Lastly, the Defensiveness (RD) scale estimates defensiveness and denial of distress. The response options for the first part of the WAI are: (1) "false" to (5) "true" and for the second part: (1) "rarely or never" to (5) "always or almost always". WAI allows the identification of six typologies of adjustment styles depending upon the DSS and RST scores, and the RD/RST relation values: 1) Reactive, 2) Sensitized, 3) Over-socialized, 4) Under-socialized, 5) Self-assured and 6) Repressive (Type C). In our study, women with a low DSS scored below 47 points, whereas those with a high DSS scored equal to or above 47 points. RST, on the other hand, was considered high if women scored equal to or above 108 points, medium if they scored between 107 and 95 points and low if they scored equal to or below 94. Lastly, RD/RST ratio was considered high if women scored equal to or above 58 points and low if they scored below 58 points. For binomial transformation, women who scored equal to, above or below the cutoff points for each category were rated 1 or 0, respectively.

Symptoms of Stress Inventory (ISE)

This instrument estimates distress under the assumption that stress has physical (SPhys), psychological (SPsych) and social (SSoc) manifestations. ISE was designed to assess the frequency of stress symptoms in psychologist ($N=203$) [34]. ISE consists of 30 questions aimed at establishing the daily frequency of stress symptoms based on a scale that ranges from (0) "never" to (4) "always." The internal consistency of ISE proved to be statistically satisfactory with *Cronbach's alpha* coefficients of 0.93. In our work, SPhys and SSoc were considered low if women scored between 0–5 points, medium if they scored between 6–8 points and high if they scored equal to or above 9 points for each scale. Similarly, SPsych was considered low if women scored between 0–11 points, medium if they scored between 12–19 points and high if they scored equal to or above 20 points. Finally, Global Stress Symptoms (SGlob) were considered low if women scored 0–22 points,

medium if they scored between 23–32 points and high if they scored above 33 points. For binomial transformation, women who scored equal to, above or below the cutoff points for each sub-scale were rated 1 or 0, respectively.

It is worth mentioning that, for binomial transformations of most of the data gathered, we kept the cutoff categories as low, medium and high 1) to fit the original criteria proposed by the authors that design each instrument and 2) to provide more certainty during data interpretation since borderline, inter-categorical repressors introduce errors when forced to belong to a clear cut repressor category [35]. The only exception we made of this guideline was CECS in which the categorization was based on the 95 % confidence interval of the responses variable. This is why in some cases there are low and high cutoff points for some sub-scales and in some others low, medium and high.

Data analysis

Data on suppression, repression and stress symptoms are presented as the average values \pm Standard Deviation. Mean differences were analyzed by using the General Linear Model (GLM) designed based upon a unifactorial ANOVA. Before applying the statistical tests, we verified that the response variables fulfilled the assumption of normality and homogeneity of variances. DICE correlation analyses allowed us to evaluate the degree of similarity of the binomial data among participants across instruments. The relationship between personality traits, stress symptoms and health condition was explored through similarity phenograms by using the Mega 5.0 software [36]. Similarity phenograms are used to explore in a more integral and complex way, the characteristics of an individual that are common to a population or groups of people with a particular condition; this proved to be very useful in our study since we were looking to find those psychological characteristics more frequent in women with cancer. Finally, principal component (PC) analyses were used to assess the similarity of the binomial data.

RESULTS

Mexican women with BC feature anxiety suppression before diagnosis

In our sample, independent of educational level, or family, reproductive and nutritional histories, women

that ended up having a positive BC diagnosis showed the greatest suppression scores ($M = 55.1 \pm 1.6$), followed by women with BBP ($M = 53.1 \pm 1.3$) and by H women ($M = 49.8 \pm 1.5$); differences among groups were statistically significant ($F = 3.29$, $p = 0.04$). Interestingly, anxiety was the most suppressed behavioral manifestation among women with BC ($F = 3.99$, $p = 0.02$).

Mexican women with BC feature high scores of distress but low scores of restraint before diagnosis

As for repression, independent of educational level and family, reproductive and nutritional histories, Mexican women with BC diagnosis showed higher scores of DSS than BBP or H women (BC $M = 49.6 \pm 1.5$, BBP $M = 43.2 \pm 1.6$ y H $M = 38.7 \pm 1.5$); these differences were statistically significant ($F = 12.79$, $p < 0.001$). It is noteworthy that among all subjective experience of distress (DSS) sub-scales, women with BC had the highest anxiety and depression scores among the women groups analyzed ($F = 5.89$, $p = 0.003$, $F = 13.91$, $p < 0.001$, respectively). Unexpectedly, women with BC showed the lowest restraint (RST) scores of all groups (BC $M = 101.2 \pm 1.8$, BBP $M = 104.4 \pm 1.8$ y H $M = 107.4 \pm 1.2$); the differences were statistically significant ($F = 3.61$, $p = 0.03$). Defensiveness (RD) and defensiveness/restrain composite (RDRST), in contrast, were similar among groups ($F = 0.37$, $p = 0.69$; $F = 2.21$, $p = 0.11$, respectively).

Mexican women with BC feature reduced stress symptoms before diagnosis

With respect to stress symptoms, the only variable that shows statistical differences compared with BBP and H counterparts was physical stress symptoms (SPhys) ($F = 7.59$, $p < 0.001$). Once again, unexpectedly, the SPhys symptoms decreased in women with BC (BC $M = 5.6 \pm 0.6$, BBP $M = 7.1 \pm 0.7$ y H $M = 9.3 \pm 0.7$). These results were independent of educational level and family, reproductive and nutritional histories.

Mexican women with BC display only some traits of the type C personality before diagnosis

Binomial transformation allowed us to identify the personality traits for H women and women with BBP and BC before the final diagnosis was made. Even

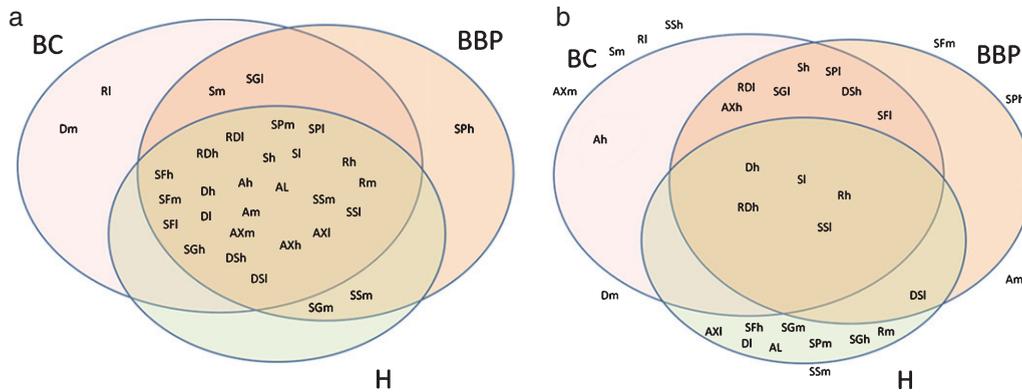


Fig. 1. Venn's Diagram of the Psychological variables frequencies. Because all variables were present in the three groups, ranges were established for "absent" and "present". a. Variables with a lower frequency to 22 (highest frequency for a psychological variable in the three groups) were assigned as "absent" and greater than or equal to 22 as "present". b. Variables with a frequency of less than 36 (average frequency in the three groups) were assigned as "absent" and greater than or equal to 36 as "present". Variables in which the average frequency is absent in the three groups are outside of the circles but near to the group in which the frequency was higher. The group separation is more evident when the frequency range of a Psychosocial feature is taken from the frequency average for each trait for group (Fig. 1b), than when the interval is defined by the highest frequency in a trait (Fig. 1a). Abbreviations: A = Anger, D = Depression, AX = Anxiety, S = Suppression, DS = Distress, R = Restraint, RD = Restraint-Defensiveness Composition, SF = Physical Symptoms, SP = Psychic Symptoms, SS = Social Symptoms, SG = Global Symptomatology of Stress; h = High, m = Medium, l = Low.

H women, women with BBP and BC, shared some personality traits irrespective of educational level and family, reproductive and nutritional histories (Fig. 1). Women with BC and women with BBP had higher frequencies of medium levels of emotional suppression, high levels of distress, a low ratio of restraint-defensiveness as well as of stress symptoms (with the exception of social stress symptoms; Table 2).

The personality traits of H women, women with BBP and BC were determined by plotting the frequencies of the psychological variables in a Venn diagram and also by exploring the relationship between trait frequency in H women versus women with BC and BP (BC+BBP) in scatter plots. Hence, Venn diagrams allowed us to identify the psychological traits that differentiate one group from another, as well as those that are shared among and/or between groups (Fig. 1). In other words, Venn diagrams show both the BC risk traits for women with BC and BC+BBP, and H women's psychological profile. In this regard, it is noteworthy that women with BC had only one variable ("high" Suppression of Anger (Ah)), while H group clustered eight features ("low" Suppression of Anger (Al), "low" Suppression of Depression (DI) and "low" Suppression of Anxiety (Axl), "medium" Restraint (Rm), "high" Physical Symptoms of stress (SFh), "medium" Psychological Symptoms of stress (SPm), "medium" and "high" Global Symptoms of stress (SGm and SGh) (Fig. 1b). Additionally, women with BBP did not show any

distinctive feature albeit they shared some traits with BC and H groups. This was especially true for women with BC with whom they shared eight variables (Axh, RDI, SGI, Sh, SPI, DSh, SFI) (Fig. 1b).

However, the greatest discernment of the profile was obtained in a scatter plot by relating the frequencies of the psychological variables of H women vs. women with BC and BP (BC+BBP); it was possible to distinguish those variables that have a low frequency in H women but a high frequency in women with BC (Fig. 2a) (i.e., "low" Restraint (RI), "medium" Suppression (Sm), "low" Global Symptoms of stress (SGlobl), "low" Psychological Symptoms (SPsychl), "low" Physical Symptoms (SPhysl), "low" Restraint-Defensiveness composition (RDI), "high" Distress (DSh)) and BP (Fig. 2b). From these scatter plots, the sensitivity and specificity of the psychological traits was calculated in order to discriminate between H women vs. women with BC, H women vs. women with breast pathology (BP), H women vs. women with BBP. The most characteristic psychological trait for women with BC was "low" Restraint (RI), with a 30% sensitivity and 94% specificity; sensitivity and specificity increases up to 76% and 66%, respectively, if "low" Restraint (RI), the "low" Global Symptoms of stress (SGlobl) and Physical Symptoms of stress (SPhysl) values are grouped together (Table 3). Finally, five personality traits (RI, SGlobl, SPhysl, RDI and DSh) scored the highest sensitivity (98%) when compared between women with BC and H

Table 2
Frequencies and odds ratios of the psychological variables of the three questionnaires applied

Psychological profile			BC (50)		BBP (50)		Healthy (50)		Odds ratio (BC/H)	Odds ratio (BC+BBP)/H	
			F	%	F	%	F	%			
Emotional suppression	Anger (A)	Low	15	30	16	32	22	44	0.68	1.41	
		Medium	12	24	16	32	13	26	0.92	2.15	
		High	23	46	18	36	15	30	1.53	2.73	
	Depression (D)	Low	16	32	17	34	21	42	0.76	1.57	
		Medium	13	26	9	18	10	20	1.30	2.20	
		High	21	42	24	48	20	40	1.05	2.25	
	Anxiety (AXN)	Low	11	22	15	30	24	48	0.46	1.08	
		Medium	16	32	13	26	11	22	1.45	2.64	
		High	23	46	22	44	15	30	1.53	3.00	
Global suppression (S)	Low	18	36	19	38	30	60	0.60	1.23		
	Medium	12	24	11	22	7	14	1.71	3.29		
	High	20	40	20	40	13	26	1.54	3.08		
Emotional repression	Distress (DS)	Low	16	32	31	62	33	66	0.48	1.42	
		High	34	68	19	38	17	34	2.00	3.12	
	Restraint (R)	Low	15	30	9	18	3	6	5.00	8.00	
		Medium	17	34	16	32	18	36	0.94	1.83	
		High	18	36	26	52	29	58	0.62	1.52	
	Restraint-defensiveness composition (RD)	Low	28	56	25	50	15	30	1.87	3.53	
		High	22	44	25	50	35	70	0.63	1.34	
	Stress symptomatology	Physical symptoms (SPHys)	Low	26	52	22	44	13	26	2.00	3.69
			Medium	13	26	14	28	11	22	1.18	2.45
High			11	22	14	28	26	52	0.42	0.96	
Psychic symptoms (SPSych)		Low	26	52	22	44	12	24	2.17	4.00	
		Medium	14	28	17	34	29	58	0.48	1.07	
		High	10	20	11	22	9	18	1.11	2.33	
Social symptoms (SSoc)		Low	28	56	25	50	24	48	1.17	2.21	
		Medium	6	12	11	22	12	24	0.50	1.42	
		High	16	32	14	28	14	28	1.14	2.14	
Global symptomatology (SGlob)		Low	28	56	22	44	10	20	2.80	5.00	
		Medium	9	18	11	22	21	42	0.43	0.95	
		High	13	26	17	34	19	38	0.68	1.58	

Odds ratios with scores above 3.0 in BC+BBP are in bold. F- Frequencies.

women, however, the specificity decreased to 32%. BBP is distinguished by obtaining similar but slightly lower values of sensitivity. These results indicate that psychological traits allow us to identify women with very high sensitivity (98%) as being at risk for BP, however, due to the subjectivity of the method, its specificity is a little bit low (32%).

To further corroborate whether some psychological traits are specific for women with BC, BBP or H women, we compared the similarity of their psychological profiles by using the similarity phenograms and the Dice coefficient (Fig. 3). This analytical tool positions each individual at the end of a particular branch set based upon the way the parameters evaluated per subject interact one another, regardless of the category each one was initially assigned to. Even though the similarity phenograms showed a great deal of data dispersion (Fig. 3), they allow the identification of branches across the phenograms that

cluster greater fractions of H women, women with BBP and BP (BC+BBP) or BC. This means that there are indeed distinctive psychological traits for women with BC, BBP or H women. For instance, whereas in branch IIA1b "H" 80% of women were healthy and the remaining 20% were diagnosed with benign breast pathology, branch IB "BC" grouped 5 women with BC (83%) and only one woman with BBP (17%). A differential distribution of women groups was also observed in branch IIB2b2b1 "BP" (Fig. 2, Table 4). It is noteworthy that branches IIB2b2b1 and IB of the phenogram have odds ratios of 6/0 and 9, respectively. This signifies that these personality traits are "pro-breast" pathology (BP = BC+BBP). To corroborate this presumption, we carried out a principal component analysis. The saturation factor indicated that out of 32 variables, only 17 had the highest linear combination score and their contribution was concentrated in the first three components, which account

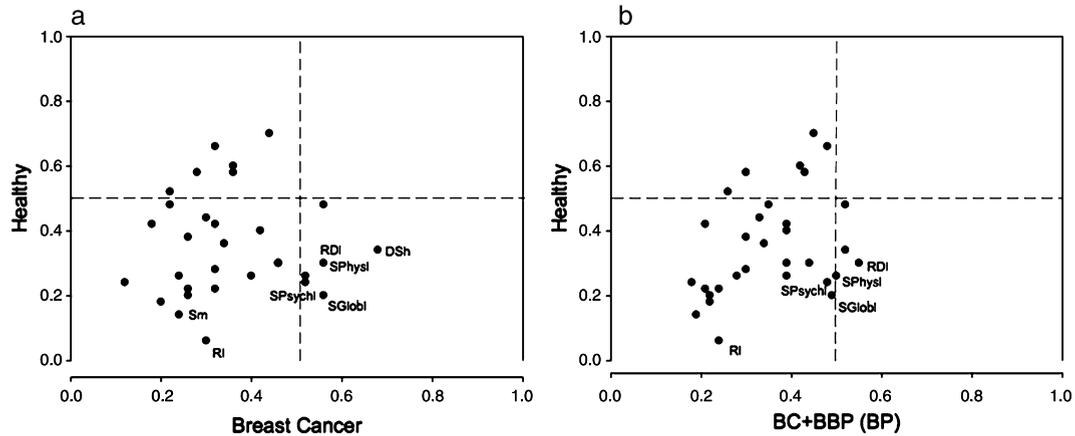


Fig. 2. Psycho-plot of the discernment of the psychological profiles among groups.

Table 3

Psychological profiles' sensitivity and specificity in discerning among groups

Psychological variables	BC %	BP (BC+BBP) %	BBP %	H %
RI	30	24	18	6
RI and SGlobl	72	64	56	26
RI, SGlobl and SPhysl	76	69	62	34
RI, SGlobl, SPhysl and RDI	90	85	80	54
RI, SGlobl, SPhysl, RDI and DSh	98	93	88	68

Abbreviations: RI=Restraint low, SGlobl=Global Symptomatology of Stress low, SPhysl=Physical Symptoms of Stress low, RDI=Restraint-Defensiveness Composition low DSh=Distress high.

for 56% of the total variation. PC1 reached a 32% change and was integrated by high suppression of anger (Ah), high suppression of depression (Dh), low suppression of depression (DI), high suppression of anxiety (AXNh), high global suppression (Sh) and low global suppression (SI). PC2 represented a 15% change and was comprised of high subjective experience of distress (DSh), low subjective experience of distress (DSI), high defensiveness (RDh) and low defensiveness (RDI). Finally, PC3 explained only 8% of the total variation associated with global stress symptomatology (SGlobh) (Table 5). It must be noted that some of these 17 variables were found in the scatter plot to be BC/BBP risk personality traits.

Women grouped in the IIB2B2b1 branch had the highest average factor score derived from PC1, whereas those located in the IB (BC) or the IIA1a (BBP and H) branches had the lowest values (Fig. 4A). In contrast, PC2 average factor score values were highest in the IB branch whereas those of the IIA1b branch were the lowest (Fig. 4B). Thus,

PC1 and PC2 grouped the personality traits that might increase BC susceptibility. PC3, on the contrary, cluster the personality traits that reduce BC susceptibility.

DISCUSSION

Breast cancer is a leading cause of death among women worldwide. Identification of BC-susceptible women seems a reasonable measure to reduce BC-related deaths. Traditionally, women's susceptibility to BC has been estimated based on family, reproductive and nutritional histories and/or genotyping [37–39]. In fact, there are some automated tools available (e.g., Gail, BOADICEA and Tyrer-Cuzick) that help clinicians estimate BC susceptibility based upon these factors. However, predictions made based upon epidemiological and genetic information are yet insufficient to readily pin point women living under the risk of developing BC. For instance, previous studies have shown that genetic BC risk factors identify 1 in 10 women as positive, a woman that later is diagnosed with BC [40]. In addition, genotyping is quite costly and most women, especially in low/middle income countries, have limited access to it. Hence, we still need to complement currently used BC predictive tool with parameters that could increase our probability to identify women susceptible to develop BC.

In this regard, research conducted over the past four decades supports the premise that patients displaying some personality traits are prone to develop cancer. In fact, estimates support that BC can be attributed to psychological risks factors related to lifestyle, in 5 out of 10 women [40]. Personality profiling might then help identify young women at risk of developing

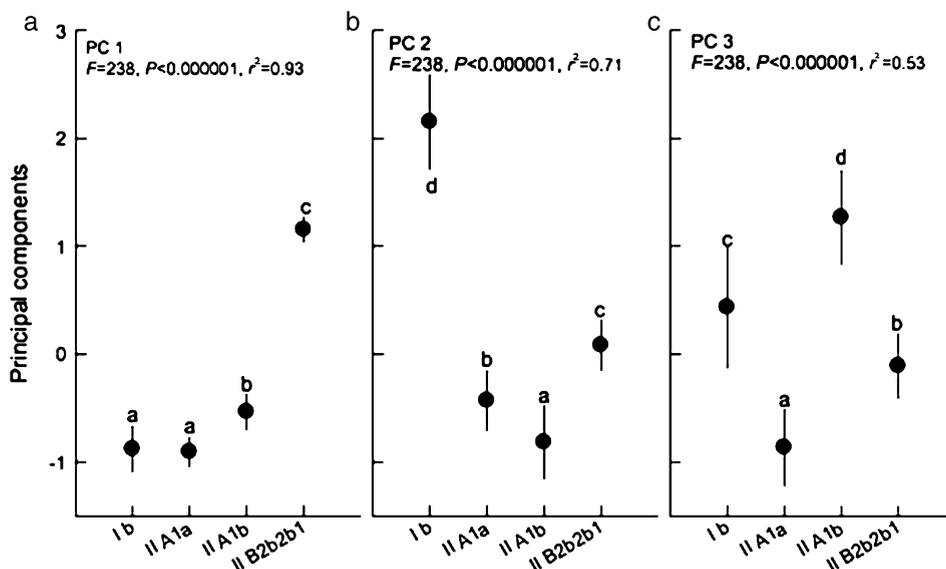


Fig. 4. Mean values (\pm CI 95%) of the factor score for the linear combination PC 1 (a), PC 2 (b) and PC 3 (c). They also describe the Generalized Linear Model adjustment and the percentage of variance explained (r^2). Lowercase letters represent differences in multiple comparisons. Importantly, the coefficient of determination (r^2) was higher when PC1 was the response variable, and in the case of PC2 and PC3 the percentage of variance explained was 50 to 71%, which delimits the group's defined women in the Branches.

Further support comes from data showing increased occurrence of BC in women who suppress emotions, especially anger [20, 29, 31] and those who suppress distress [57], including abnormally low distress with high arousal. Repression has been the most consistent emotional sign associated with the onset of BC [58]; it is also a predictor of rapid cancer progression [28, 54]. In this regard, it must be emphasized that even though our study confirms that women with BC display higher levels of suppression than BBP or H women, in the case of Mexican women, they suppress more anxiety than anger, as has been previously reported for women born in other countries [20, 29, 31]. These findings suggest that there is a need for increased mental health services for Mexican women with a predisposition towards suppressing anxiety, which could have a negative impact on their health.

In addition, Mexican women with BC also had high levels of DSS, and low RST and RDRST. Overall these findings support the fact that Mexican women with BC display a “sensitized” style adjustment typology (for similar results in other populations see McKenna et al. [58]), rather than a “repressive” one, as previously reported for North American women [56] and also for the pediatric cancer population [35]. Thus, it seems that Mexican women with BC had more conscientious emotional containment and less repression.

Nonetheless, it is intriguing that in our study of Mexican women with BC, they display a psychological profile with reduced symptoms of stress as compared with women with BBP and H women (for similar results for Israeli women with BC see Cohen [59]). Therefore, it seems that women that develop BC not only suppress emotions but also the perception of the stress symptoms. This combined profile may reflect the conscious efforts of BC women for reaching a state of harmony. It would be interesting to estimate physiological distress signs to corroborate this result.

A presumption that can be made based upon our results is that personality profiling might be used to identify Mexican women under the risk of developing BC or that have susceptibility to develop non-malignant breast pathologies. In fact, we were able to identify five personality traits (low restraint (RI), low global stress symptoms (SGlobl), low physical stress symptoms (SPhysl), low restraint-defensiveness composite (RDI) and high distress (DSh)) that are distinctive of women with BC and/or BP (BC+BBP). Psychological profiles (RI, SGlobl and SPhysl), being especially useful to estimate BC and breast pathology susceptibility. In addition, women having personality traits included in IB and IIB2b2b1 branches of the phenogram might have higher possibilities of developing breast pathologies. These women must then be recommended to

Table 4

Frequencies, percentages, and odds ratios in the branches groups of the phenogram of the psychological profile

Branch*	BC		BBP		H		Women per branch		Odds ratios (BC + BBP)/H
	n	%	n	%	n	%	n	%	
I B	5	83	1	17	0	0	6	4	∞
II A1a	2	13	4	27	9	60	15	10	0.66
II A1b	0	0	2	20	8	80	10	7	0.25
II B2b2b1	8	40	10	50	2	10	20	13	9.00

*The branch name of the Phenogram can be seen on Fig. 3.

Table 5

Saturation factor for the principal components (PC1, PC2 and PC3) derived from the linear combination of the similarity of the variables of the binomial data. Additionally, score and percentage of variance explained in the multivariate analysis are specified

	PC1	PC2	PC3
Ah	0.80	0.25	-0.03
Dh	0.87	-0.04	0.12
DI	-0.80	-0.19	-0.02
ANXh	0.78	0.05	-0.22
Sh	0.92	0.11	-0.06
SI	-0.81	-0.33	0.03
DSh	-0.10	0.78	-0.02
DSI	0.10	-0.77	0.02
RDh	0.25	-0.69	0.27
RDI	-0.25	0.69	-0.27
SPhySm	-0.46	0.29	-0.31
SPhysl	0.83	0.04	-0.11
SPsychl	0.71	-0.11	-0.09
SSocl	0.78	-0.19	-0.09
SGlobl	-0.29	0.004	0.80
SGlobm	-0.73	-0.07	-0.49
SGlobl	0.95	0.06	-0.09
Expl.Var	10.01	4.72	2.64
Prp.Totl	0.32	0.15	0.08

Abbreviations: A = Anger, D = Depression, AX = Anxiety, S = Suppression, DS = Distress, R = Restraint, RD = Restraint-Defensiveness Composition, SF = Physical Symptoms, SP = Psychic Symptoms, SS = Social Symptoms, SG = Global Symptomatology of Stress; h = High, m = Medium, l = Low.

practice not only regular mammogram follow-ups but also to be monitored by the application of an instrument capable of evaluating healthy life style (i.e., regular physical activity, a healthy diet low in fat and carbohydrates, reduce alcoholic beverages and not smoking). They also must be psychological intervened for them to be taught on emotional management and stress coping.

We recognized, however, that our cross-sectional study in a one-time survey with 150 women had limitations in its representativeness and is not definitive given the small sample size gathered and the fact that it has been proposed that the type C personality is not exclusive for a cancer propensity but also for chronic diseases in general [60, 61]. Nonetheless, we believe that it warrants future longitudinal studies aimed at

directly assessing the relationship between the presence of specific personality traits in Mexican women with BC and/or BBP occurrence at later stages of their lives. In addition, such studies, must use psychological instruments, aimed at estimating anxiety affection, subtle personality alterations influenced by the elusion of memories concerning cancer, the presence of active suppression related with the diagnosis and/or the existence of psychophysiological variables possibly featured by the repressor personality [35].

In conclusion, the results reported here support the premise that psychological profiling might be used as a tool to identify women at risk of developing cancer or other breast pathology. Psychological profiling might then be used to recommend women who score low in sub-scales such as RI, SPhysl, SGlobl, RDI) and high in DSh or that are placed on the Branches IIB2b2b1 and IB of the Similarity Phenogram, to conduct routine mammogram studies.

CONFLICT OF INTEREST

All authors declare that there are no conflicts of interest.

AUTHORS' CONTRIBUTIONS

AJM participated in statistical analysis. TRG and CL conceived of the study and participated in its design, statistical analysis and coordination. TRG and CL drafted the manuscript together. MRHP and GGO conducted a critical review of the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGMENTS

The authors would like to thank Gabriela Baltazar Rosario, Carin Martell Zamudio, Carlos Lara and the administrative staff of the Hospital General de México, who assisted during the women's recruitment. GGO academic exchanges were financially

supported by the Coordinación de la Investigación Científica, Universidad Nacional Autónoma de México and by Dirección General de Relaciones Internacionales Coordinación de Movilidad Estudiantil y Académica, Universidad Veracruzana. This project was funded by grant IT203014 (to C. Larralde) from PAPIIT (DGAPA, UNAM). Sara Robledo Waters proofread the whole manuscript.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The protocol was reviewed and approved by the Ethical Committee for Clinical Research at the Hospital General de México “Dr. Eduardo Liceaga”, Secretaría de Salud (DI/12/111/03/064).

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