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ORIGINAL ARTICLE

Differences in emotional personality traits and stress between sustained hypertension and normotension

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This study was aimed at determining whether there are differences in emotional personality traits and psychosocial stress between hypertension and normotension. From a large community sample of adults, 14 individuals having hypertension and showing clinic blood pressures (BP) $\geqslant$140/90 mm Hg and self-measured BPs $\geqslant$135/85 mm Hg (sustained hypertensives) were selected and compared with a sex- and age-matched group of 14 individuals with normotension (clinic BPs $<$140/90 mm Hg and self-measured BPs $<$135/85 mm Hg) on measures of trait anxiety, trait depression, trait anger and stress derived from standardized questionnaires. There were no significant differences between hypertensives and normotensives on trait anger, but, in line with hypotheses, the sustained hypertensive group showed higher levels of trait anxiety, trait depression and stress than did the normotensive group. A discriminant analysis revealed that trait depression was the most important psychological variable to discriminate between sustained hypertension and normotension. Results provide support to the hypothesized relationship of emotional personality traits and stress with hypertension, and underscore the need to define hypertension on the basis of both clinic and home/ambulatory BP measurements and to simultaneously evaluate all relevant negative emotional constructs, when conducting research on psychological factors in hypertension.
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INTRODUCTION

Meta-analytic and narrative reviews of studies have supported the hypothesis that psychological factors, including psychosocial stress, and some emotional personality traits, such as trait anxiety, trait anger and trait depression, are associated with hypertension.[1–5] However, such associations are small and highly variable, and further studies are warranted because inconsistent results have been frequently reported.

Thus, several cross-sectional case–control studies have found that, in comparison with individuals with normotension, hypertensive patients exhibit higher levels of trait anxiety,[6,7] anger trait[5] and chronic stressors, particularly on the job.[4] However, other studies have failed to show differences between normotensives and hypertensives in trait anxiety,[8] trait anger[9] and stress.[10]

Concerning trait depression, the data linking this emotional trait to hypertension are indirect and at best ambiguous. There are cross-sectional case–control studies showing that hypertensive patients have higher levels of depression than do normotensive persons.[6,11] However, there are also cross-sectional studies whose findings do not support that hypothesis.[12] More important is the fact that all these studies have defined depression as the presence of depressive symptomatology and have used state measures of depressive symptomatology; therefore, to the best of our knowledge, the specific relationship between trait depression and hypertension remains essentially unexplored.

The inconsistencies concerning the role of trait anger, trait anxiety, trait depression, and stress in hypertension are not surprising as much of the previous work has been methodologically limited by a number of factors, including the inherent difficulty in measuring blood pressure (BP), the troubles in categorizing individuals as having hypertension, and the difficulty in controlling some possible confounding variables.

The classification of participants into hypertensive and normotensive groups is a crucial aspect of cross-sectional case–control studies examining the role of psychological factors in hypertension. Most studies have used casual BP measurement taken in the clinic as the standard for categorizing individuals as having hypertension. However, there is ample evidence that this standard may not be a reliable estimation of individuals' average level of BP over a prolonged period of time, and that pressures measured outside the clinic, either by self-measurement or by ambulatory monitoring, may improve the reliability and validity of such an estimation.[13,14] Thus, persons categorized as having hypertension on the basis of casual clinic measurements might not be so classified if the BP readings were obtained outside the clinic. In fact, it has been estimated that as many as 20–30% of all diagnosed patients with hypertension may have isolated clinic (or office) hypertension (also known as white-coat hypertension), a clinical condition characterized by persistently

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elevated clinic BPs in a patient with normal daytime ambulatory or self-measured BPs.[14,15] Given that evidence to date suggests that the cardiovascular risk associated with isolated clinic hypertension is lower than that of sustained hypertension and similar to or slightly higher than that of true normotension,[16,17] the potential inclusion of individuals with isolated clinic hypertension in the comparison between hypertensives and normotensives is an important confounding factor that might obscure the differences in emotional personality traits between hypertension and normotension, and might explain the inconsistency of previous studies. Obviously, the previous studies that only considered clinic BP measures were not able to detect and control the potential presence of participants with isolated clinic hypertension.

In this sense, Sanz *et al.*[18] found that patients with sustained hypertension showed higher levels of trait anxiety, Type A behavior pattern, and hard-driving behaviors/competitiveness than did individuals with normotension, whereas patients with isolated clinic hypertension occupied an intermediate position between sustained hypertension and normotension. Therefore, Sanz *et al.*'s results stress the need to exclude patients with isolated clinic hypertension in studies on the differences in psychological factors between normotension and hypertension, as these differences could be obscured by the unnoticed inclusion of isolated clinic hypertensives in the sustained hypertensive group.

On the other hand, many studies examining the potential relationship between psychological variables and hypertension have not carefully excluded participants with other cardiovascular disorders. There is a wide literature providing evidence that stress, depression, and emotional personality traits such as trait anxiety and trait anger are also associated with other cardiovascular disorders, especially with coronary heart disease.[2,19] Therefore, the presence of persons with coronary heart disease in the normotension group, in the hypertension group, or in both groups, could not only significantly confuse the relationship between psychological variables and hypertension, but could also explain the inconsistencies of previous studies on this topic.

The aim of this study was to examine whether there are differences in trait anxiety, trait depression, trait anger and stress between patients with hypertension and persons with normotension, in a manner that addresses the concerns described above. Thus, we used self-measured BPs to distinguish between sustained hypertension and isolated clinic hypertension, and only patients with sustained hypertension were selected for this study. Second, participants with other cardiovascular disorders were excluded. On the basis of data from the abovementioned literature, we hypothesized that patients with sustained hypertension would show higher levels of trait anxiety, trait depression, trait anger and stress than individuals with normotension.

METHODS

Participants

Two groups of individuals with hypertension and normotension were selected from a larger sample of 350 adults from the Region of Madrid who were recruited by a 'snowball' technique in which psychology undergraduates invited their relatives to voluntarily participate in a research on personality and high BP. All the individuals in this incidental sample had their BP assessed at the laboratories of the Complutense University of Madrid (clinical BP) and were required to measure and record their BP themselves both at home and at work (self-measured BP). For the hypertension group, we selected all individuals out of that sample who met the following criteria: (a) they reported having hypertension; (b) their hypertension was confirmed by an average clinic BP equal to or above 140/90 mm Hg and an average self-measured BP equal to or above 135/85 mm Hg (see procedure), and (c) they reported not having heart troubles, atherosclerosis, or circulation troubles, and not having had a stroke. Fourteen individuals (nine males and five females) fulfilled these criteria and formed the sustained hypertension group. For the normotension group, we selected all individuals out of that sample who met the following criteria: (a) they reported not having hypertension, not having a history of hypertension, and not taking antihypertensive medication; (b) their normotension was confirmed by an average clinic BP below 140/90 mm Hg and an average self-measured BP below 135/85 mm Hg (see procedure); (c) they reported not having heart troubles, atherosclerosis, or circulation troubles and not having had a stroke, and (d) their ages ranged from 38 to 79 years (just the age range of the hypertensive individuals). Individuals who fulfilled these criteria were matched with hypertensive persons. Matching criteria were sex and age. When several normotensive matches were found, a final selection was randomly performed by a table of random numbers. Finally, 14 individuals (nine males and five females) formed the normotension group. The demographic and clinical characteristics of these two participant groups are shown in Table 1.

Apparatus and materials

Blood pressure measurement. Clinic BP readings were taken with an OMRON 705IT digital BP monitor (Omron Corporation, Kyoto, Japan), and this same device was given to participants to self-record their BP and heart rate. The accuracy of this monitor has been confirmed by Coleman *et al.*[20]

Psychological measurements. State-Trait Anxiety Scale (STAI).[21] We used the Spanish version of the trait anxiety scale of the STAI.[22] High scores in this scale indicate a greater tendency to respond to situations perceived as threatening with anxiety. Although the Spanish version uses for each of its 20 items a 0–3 response scale instead of the 1–4 response scale of the original, this change does not affect the reliability or validity indices of the STAI, and in fact they are satisfactory.[22]

Revised NEO Personality Inventory (NEO PI-R).[23] We used three facet scales of the NEO PI-R: Anxiety, Angry Hostility, and Depression. High scores in the Anxiety facet scale identify individuals who are apprehensive, fearful, nervous and with a trend to worry and have frightening thoughts, whereas high scores in the Angry Hostility facet scale identify individuals who are prone to experience anger and related states such as frustration and bitterness, and high scores in the Depression facet scale indicate a greater tendency to experience depressive affect and feelings of discouragement, guilt and worthlessness. This study used the Spanish adaptation of the NEO PI-R,[24] whose psychometric properties are similar to those shown by the original.[24,25]

The State-Trait Anger Expression Inventory-2 (STAXI-2).[26] The STAXI-2 is a self-report questionnaire that measures the experience and expression of anger. In this study, only scores in the Trait-Anger scale were analyzed. High scores in the Trait-Anger scale indicate the general disposition toward angry feelings without provocation and the tendency to feel anger when one is criticized. We used the Spanish adaptation of the STAXI-2.[27] Reliability and validity indices of the Trait-Anger scale of the Spanish adaptation are similar to those shown by the original scale.[27]

Survey of Recent Life Experiences (SRLE).[28] The SRLE is a self-report measure of exposure to mundane stressors or daily hassles over the past month. This study used the shortened version of the SRLE,[28] which consists of 41 items. We used a Spanish version developed by Sanz (Sanz *et al.*, 2009, unpublished data). The psychometric properties of this version are appropriate and similar to those of the original version (Sanz *et al.*, 2009, unpublished data).[28]

Procedure

Participants were invited to an individual assessment of their cardiovascular health and personality to be held in the laboratories of the Faculty of Psychology of the Universidad Complutense de Madrid. After giving written informed consent for participation in the study, participants completed an interview that assessed their cardiovascular health and several risk factors associated with hypertension. Next, participants had their BP taken 6 times, with a 2-min interval between readings. Clinic BP was the average of those six BP readings. Later, participants filled out several personality questionnaires including, in this order, the NEO PI-R, STAI, STAXI-2 and SRLE. Then, the participants were carefully instructed on how to self-measure and self-record BP readings correctly, and carried out several practice trials. Participants were asked to self-measure their BP two consecutive times (with a 2-min interval between measurements) on three settings per day (at home when getting up in

Table 1 Demographic and clinical characteristics of sustained hypertensive and normotensive participants

	Groups of participants		*ANOVA/χ^2*	
Measure	*Sustained hypertensive* (n=*14*)	*Normotensive* (n=*14*)	F/χ^2	P-*value*
Sex (% of males)	64.3	64.3		
Age (years)	57.5 (11.6)	53.6 (6.9)	1.18	<0.288
Measurement at clinic				
Systolic blood pressure (mm Hg)	144.5 (14.6)	110.1 (9.3)	55.04	<0.001
Diastolic blood pressure (mm Hg)	86.1 (11.6)	66.8 (6.9)	28.46	<0.001
Heart rate (beats min^{-1})	74.1 (12.4)	64.3 (10.2)	5.12	<0.032
Self-measurement at home/work				
Systolic blood pressure (mm Hg)	145.6 (12.2)	111.6 (10.9)	60.54	<0.001
Diastolic blood pressure (mm Hg)	86.5 (11.2)	67.6 (7.6)	27.02	<0.001
Heart rate (beats min^{-1})	74.7 (11.4)	66.8 (8.6)	4.14	<0.053
Taking antihypertensive medications (%)	85.7%	0%		
Smokers (%)	21.4%	35.7%	0.70	<0.403
Civil status (%)			3.39	<0.335
Married or living in a stable relationship	71.4%	92.9%		
Single	7.1%	0%		
Widowed	14.3%	0%		
Divorced or separated	7.1%	7.1%		
Education level (%)			0.254	<0.881
Primary	21.4%	28.6%		
Secondary/high school	35.7%	28.6%		
University	42.9%	42.9%		

Abbreviation: ANOVA, analysis of variance.
Note: Data are means (s.d. values are given between parentheses) unless otherwise indicated.

the morning, at home before bedtime and at work) for 6 days (36 BP measures in total). In addition, participants were also given self-recording sheets that included reminders on how to carry out self-measurement of BP correctly. Self-measured BP was the average of those 36 home and work BP readings, a number that offers reliability indexes above 0.90 for BP estimates.[29]

Statistical analyses

Demographic, clinic and psychological variables were analyzed by one-way analysis of variances with participant group (sustained hypertensives *vs.* normotensives) as between-subject factor, except for education level, civil status and smoker status that were analyzed by Pearson's χ^2. For 2×2 contingency tables, Fisher's exact test was calculated, in addition to χ^2, if the table had a cell with an expected frequency of less than 5. When the variances of the continuous dependent variables were not equal between groups, we used the Welch test as a more robust and conservative alternative to the usual *F*-test. Effect sizes for psychological variable comparisons were measured by Cohen's *d* statistic.

RESULTS

Demographic and clinical characteristics

The demographic and clinical characteristics of the two participant groups (sustained hypertensives and normotensives) are displayed in Table 1. There were no significant differences between the two groups in age ($F(1, 27)=1.18$, nonsignificant (NS)), percentage of smokers (χ^2 (1, $N=28$)=2.63, NS; two-sided probability by Fisher's exact test=0.678), education level or civil status (both χ^2-tests NS; see Table 1). However, as expected, the hypertensive group showed higher levels of clinic systolic and diastolic BPs, clinic heart rate, and self-measured systolic and diastolic BPs than did the normotensive group (all *F*-tests with $P<0.05$; see Table 1). Concerning self-measured heart rate, although the hypertensive group also showed higher levels than did the normotensive group (74.1 *vs.* 64.3 beats min^{-1}), the difference did not reach statistical significance ($F(1, 27)=4.14$, $P<0.053$).

Psychological characteristics

The psychological test score means of the two participant groups are presented in Table 2. Group differences on all psychological variables showed the same pattern: sustained hypertensives had higher levels of trait anger, trait anxiety, trait depression and stress than did the normotensives. However, group differences in trait anxiety as measured by the STAI, trait depression, and stress were statistically significant (all *F*-tests with $P<0.05$; see Table 2), whereas group differences in trait anxiety, as measured by the NEO PI-R, and trait anger, as measured by both the STAXI and the NEO PI-R, did not reach statistical significance (all *F*–tests, NS; see Table 2).

Interestingly, depression, stress and STAI-anxiety differences between sustained hypertensives and normotensives were not only statistically significant, but also they were large in terms of effect size, with *d* statistics ranging from 0.81 for trait anxiety, as measured by the STAI, and stress, to 0.95 for trait depression (see Table 2).

The trait anxiety subscale of the STAI correlated significantly with the trait depression subscale of the NEO PI-R ($r=0.80$, $P<0.001$), whereas the stress measure of the SRLE did not correlate significantly with the trait depression subscale of the NEO PI-R ($r=0.31$, NS), but it did with the trait anxiety subscale of the STAI ($r=0.51$, $P<0.01$). Given these significant correlations, to determine whether the differences in trait anxiety, trait depression, and stress between sustained

Table 2 Differences between sustained hypertensive and normotensive participants in emotional personality traits and stress

	Groups of participants		*ANOVA*		
Measure	*Sustained hypertensive* (n=*14*)	*Normotensive* (n=*14*)	F	P-*value*	*Effect size* (d)
Trait anger (STAXI-2)	23.0 (6.4)	20.1 (5.7)	1.61	<0.215	0.47
Trait anxiety (STAI)	28.4 (10.8)	19.6 (9.4)	5.14	<0.032	0.81
Trait anxiety (NEO PI-R)	19.4 (5.1)	16.6 (5.5)	1.89	<0.180	0.51
Trait anger (NEO PI-R)	15.0 (5.2)	13.4 (5.1)	0.71	<0.408	0.32
Trait depression (NEO PI-R)	19.2 (6.1)	13.9 (3.6)	8.01	<0.009	0.95
Stressful events (SRLE)	31.1 (13.3)	20.6 (10.3)	5.39	<0.028	0.81

Abbreviations: ANOVA, analysis of variance; STAXI-2, State-Trait Anger Expression Inventory-2;[24] STAI, State-Trait Anxiety Scale;[19] NEO PI-R, Revised NEO Personality Inventory;[21] SRLE; Short form of the Survey of Recent Life Experiences.[26]
Note: Data are means (s.d. values are given between parentheses) unless otherwise indicated.

hypertensives with normotensives could be explained by only a subset of these variables, a stepwise discriminant analysis was conducted. The stepwise discriminant analysis provided a canonical discriminant function that significantly distinguished between sustained hypertensives and nomortensives (Wilks' λ=0.77; χ^2=6.26, $P<0.012$), allowed one to correctly classify 71.4% of the cases, and only included one variable: trait depression.

DISCUSSION

The aim of this study was to examine whether there are differences in trait anxiety, trait anger, trait depression, and stress between hypertension and normotension when hypertension is diagnosed on the basis of both clinic and self-measured BPs, and therefore isolated clinic hypertension can be controlled. In this vein, our first hypothesis in this study was that, in comparison with normotensives, true hypertensives (sustained hypertensives) could be characterized by higher levels of those psychological variables. Our results revealed statistically significant differences between sustained hypertensives and normotensives in trait anxiety (as measured by the STAI), trait depression, and stress, with higher scores in these psychological variables for sustained hypertensives. In fact, these differences in psychological factors between normotensives and sustained hypertensives were large in function of Cohen's conventions for effect sizes ($d>0.80$).[30] However, we did not find statistically significant differences between sustained hypertensives and normotensives in two measures of trait anger derived from the STAXI and the NEO PI-R and in a measure of trait anxiety derived from the NEO PI-R, although all of these differences were in the predicted direction.

In sum, our results support our hypothesis concerning differences in emotional personality traits and stress between normotension and sustained hypertension, and are consistent with those obtained in previous studies that also support the role of trait anxiety and stress in hypertension.[1–4,6,7]

Of course, there are studies that have failed to show differences in trait anxiety, depression and stress between normotensives and hypertensives.[8,10,12] However, most of these studies did not use, along with clinic BPs, out-of-clinic (self-measured or ambulatory) BPs to diagnose hypertension, and therefore they were not able to detect and control isolated clinic hypertension. Therefore, the differences in stress and personality between normotension and hypertension could be obscured by the unnoticed inclusion of isolated clinic hypertensives in the sustained hypertensive group.[18]

In a related vein, and after reviewing studies exploring the association between work stressors and hypertension, Landsbergis *et al.*[2] pointed out that few studies of job strain and hypertension have shown significant associations when using clinic measures of BP, whereas strong evidence of an association is found in studies where BP is measured by ambulatory monitoring.

In sum, the limitations of clinic BP measurements and, consequently, the failure to exclude persons with isolated clinic hypertension could explain why research literature on the role of psychological factors in hypertension has yielded mixed findings and, although suggestive, it is far from conclusive. Further studies on this issue should, therefore, distinguish between different types of hypertensive patients on the basis of discrepancies observed between clinic and nonclinic measures of BP, and examine differentially patients with isolated clinic and sustained hypertension, as well as subjects with normal clinic BP but high self-measured or ambulatory BPs (which has been termed 'isolated clinic normotension' or 'white-coat normotension').

In this study, sustained hypertensives significantly differed from normotensives on trait anxiety, trait depression and stress; however, the results of the discriminant analysis indicated that trait depression was the most important psychological variable to discriminate between sustained hypertension and normotension.

Although future studies should replicate this last finding, it has several implications. First, it could partially explain why, in this study, trait anxiety differences between hypertension and normotension were observed with the STAI, but not with the Anxiety facet scale of the NEO PI-R, as previous research suggests that the trait scale of the STAI may assess depression as well as anxiety.[31] In fact, in this study, the correlation between the trait anxiety scale of the STAI and the Depression facet scale of the NEO PI-R was significantly higher than the correlation between the Depression and Anxiety facet scales of the NEO PI-R (0.80 *vs.* 0.59; $t(25)$=1.89, $P<0.035$), in spite of the fact that the latter scales share method variance, because they belong to the same instrument. Second, and more importantly, the abovementioned finding points out difficulties for research on psychological factors in hypertension that result from the high correlation among negative emotional variables. This high correlation is likely because of both the lack of discriminant validity of instruments currently available for the evaluation of negative emotional variables and the overlapping features among the negative emotional variables themselves.[19] In any case, it may create interpretational problems for researchers examining the role of psychological factors in hypertension as some negative emotional variables (for example, trait anxiety, stress) may only appear to be related to hypertension because they are correlated with the others (for example, trait depression). As a consequence, researchers should abandon the old strategy of analyzing or measuring only a single negative emotional variable at a time, and, instead, they should conduct studies involving simultaneous evaluation of all relevant negative

emotional constructs (for example, trait depression, trait anxiety, trait anger, stress).

It is important to point out some limitations of this study. The correlational and cross-sectional nature of the same prevent inferences being formed regarding whether trait anxiety, trait depression and stress are factors not only related to sustained hypertension, but also factors that cause sustained hypertension. In this sense, further research aimed at replicating the present findings should use longitudinal designs instead of cross-sectional ones, and test whether high levels of trait anxiety, trait depression and stress predict later incidence of sustained hypertension.

The final sample used in this study is fairly small in size, especially as there are both males and females and the range of age is between 38 and 79 years. Ideally, a replication should be made using a larger number of participants. In fact, for some comparisons, it may be that this study had low statistical power, as the two participant groups were relatively small. *Post hoc* analysis of statistical power revealed that, considering an α=0.05 (one-tailed), statistical power indices were 0.34 for the trait anger measure derived from the STAXI-2, and 0.20 for the trait anger measure derived from the NEO PI-R. This means that this study had a low probability to yield a significant effect for trait anger measures, that is, a low probability to reject the null hypothesis that the two population means on trait anger are equal for sustained hypertensives and normotensives. Therefore, it may be that the absence of significant differences between sustained hypertensives and normotensives on trait anger in this study does not actually represent a true absence of differences. On the other hand, data from the statistical power analysis indicated that further studies should recruit between 55 and 129 participants to have a probability of 80% of correctly rejecting the null hypothesis of absence of trait anger differences between sustained hypertensives and normotensives for the trait anger measures derived from the STAXI-2 and NEO PI-R, respectively.

Some doubts could be cast on the use of the 'snowball' technique for participant recruiting. Given that participants were recruited among friends and relatives of Psychology students, the initial participant sample could not be representative of the Spanish adult population. However, mean scores and standard deviations for trait anger, trait anxiety and trait depression measures in male and female participants were roughly similar to those of the Spanish normative samples[22,25,27] (unfortunately, there are no Spanish normative data available nowadays for the stress measure). Thus, in terms of Cohen's *d* effect size statistic, the magnitudes of the differences between the mean scores of this study's initial sample and the Spanish normative samples on the five personality measures ranged between 0.02 and 0.26, with a mean *d* of 0.12. Moreover, in 8 out of the 10 comparisons, those magnitudes were lower than the conventional value for a small effect size (d=0.20).

Although it seems quite probable that the vast majority, or even all, of the sustained hypertensive participants of this study had a diagnosis of essential hypertension, participants were not examined for the presence of secondary hypertension. Therefore, further studies should carefully exclude participants with secondary hypertension.

Several studies suggest that knowledge of hypertension status may influence the relationship between personality and hypertension.[32–34] Thus, the positive associations of trait depression and trait anxiety with hypertension may reflect the negative psychological effects of being diagnosed or labeled as hypertensive or, alternatively, a selection bias, as individuals who tend to experience negative affect are more likely to visit physicians and, therefore, could be more likely to have their BP measured and to be diagnosed as having hypertension. However, studies supporting these two explanations are not free of problems. First, most of the studies have only considered clinic BP measures and, therefore, were not able to detect and control the potential presence of participants with isolated clinic hypertension. Second, most of the studies did not measure personality characteristics (see Irvine *et al.*'s study[32] for an exception); rather, they assessed emotional symptoms or perceived psychological well-being, which, unlike measures of personality, are expected to fluctuate. Moreover, there are also studies that have failed to support the idea that labeling persons as hypertensive is necessarily followed by negative psychological consequences,[35] including one with prospective design.[36] However, the two explanations mentioned above are plausible and, ideally, future research should compare normotensives and hypertensives selected from a sample of participants who are not aware of their BP status.

Finally, as 85.7% of hypertensives in this study were on antihypertensive medication, it may be that high levels of emotional personality traits found in the hypertensive group were due to the effects of that medication. Although there are some studies that have found that some antihypertensive drugs have negative psychological effects,[37] a meta-analysis of clinical trials has reported that most of the studies have found a decrease of distressing psychological symptoms and an increase of psychological well-being after drug intake.[38] These positive psychological effects seem to be associated with decreases in BP, and psychological well-being rose more in hypertensive patients whose BP is controlled by the antihypertensive medication than in noncontrolled hypertensive patients. However, even noncontrolled hypertensive patients on antihypertensive medication show significant increases in psychological well-being.[39] On the other hand, most of the studies on the psychological effects of antihypertensive medications did not measure personality characteristics; rather, they assessed the mood or general psychological well-being. Nonetheless, although it is not very likely, we cannot exclude the possibility that, in our study, antihypertensive medication intake could influence the levels of trait anxiety and trait depression. Therefore, further research should control this variable, for example, by comparing normotensives with hypertensives on antihypertensive medication and hypertensives not receiving any antihypertensive drug.

Nonetheless, in spite of the limitations, the findings of this study lend additional support to the association between psychological factors, especially personality factors, and hypertension. Furthermore, to our knowledge, this is the first study reporting an association between trait depression and hypertension, as previous research linking depression and hypertension had examined the role of depressive symptomatology, but not of trait depression. On the other hand, the results of this study underscore the need to define hypertension on the basis of both clinic and home/ambulatory BP measurements and to simultaneously evaluate all relevant negative emotional constructs, when conducting research on psychological factors in hypertension.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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