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Alexithymia: A Facet of Uncontrolled Hypertension

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Abstract

Introduction

Proper control of blood pressure reduces the risk of developing cardiovascular and cerebrovascular complications in hypertensive people. However, this control remains mostly unsatisfactory.

Although alexithymia has been associated with essential hypertension, no study has analysed the relationship between alexithymia and blood pressure control in drug-treated hypertension.

This research aimed to analyse the presence and the characteristics of this relationship, considering both the pharmacological treatment and the achievement of adequate maintenance of blood pressure in a physiological range.

Method

One thousand two hundred and forty-one people participated in the study. Eight hundred and ten were hypertensive patients, and four hundred and thirty-one were normotensive people. The Toronto Alexithymia Scale-20 was used to assess alexithymia.

Results

Results show that hypertensive people are more alexithymic than normotensive people. According to the presence of pharmacological treatment, treated hypertensive patients are more alexithymic than normotensive and not treated hypertensive patients. Considering the blood pressure control associated with the drug-therapy, people with uncontrolled hypertension are more alexithymic than normotensive and untreated hypertensive people.

Conclusions

These findings confirm a relationship between alexithymia and essential arterial hypertension, but they also highlight that alexithymia appears to be associated with higher severity of hypertension. Alexithymia could be a facet of uncontrolled hypertension.

Keywords: Essential Hypertension, Alexithymia, Drug Treatment of Hypertension, Uncontrolled Hypertension

1. Introduction

High blood pressure (or hypertension) is a global public health problem, and it represents the indirect cause of 7.5 million of deaths (12.8% of total deaths) (World Health Organization, WHO, 2013). Hypertension is correlated independently and linearly with an increased risk of developing cardiovascular and cerebrovascular complications (Britton, Gazziano, & Djoussé, 2009; Iadecola & Davisson, 2008; Lewington et al., 2003; Meissner, 2016). Some studies have evidenced a progressive and linear increase of cardiovascular disease for each rise of 20/10 mmHg of blood pressure, starting from the value of 115/75 mmHg (Lewington et al., 2003).

Proper control of blood pressure reduces the risk of developing heart and cerebrovascular diseases (Go et al., 2014). Conversely, insufficient control of blood pressure contributes to increased risk of developing myocardial infarction, cerebral stroke, heart failure and other diseases (Bramlage et al., 2010; Chobanian, 2009; Prugger et al., 2011).

Essential hypertension has a multifactorial aetiology, and many studies have highlighted the influence of psychological factors both in the general increase of blood pressure and in the possible development and maintenance of hypertension. Specifically, the role of anger (Shehata, 2010), anxiety and depression (Rafanelli, Offidani, Gostoli, & Roncuzzi, 2012; Rubio-Guerra et al., 2013), acute stress (e.g., traumatic life events), negative emotions (Spruil, 2010) and type D personality (Grande, Romppel, & Barth, 2012) are well known.

Among the psychological dimensions investigated in connection to hypertension, there is also alexithymia (Grabe et al., 2010; Jula, Salminen, & Saarijarvi, 1999; Todarello, Taylor, Parker, & Fanelli, 1995).

Alexithymia is a multidimensional and transdiagnostic construct characterised by difficulties in identifying and describing feelings, in distinguishing between feelings and bodily sensation of emotional arousal, and by an external oriented style of thinking (Taylor, Bagby, & Parker, 1997).

The prevalence of alexithymia ranges between 7.1% (Joukamaa et al., 2003), 10% (Franz et al., 2008) and 12.8% (Salminen et al., 1999) in the general population. High levels of alexithymia have been highlighted in different psychological disorders, such as depression (Li, Zhang, Guo, & Zhang, 2015), anxiety (Frewen, Dozois, Neufeld, & Lanius, 2008), somatoform disorders (Melin, Thuleius, & Persson, 2010), substance addiction (Coriale et al., 2012), eating disorders (Miyake et al., 2012), abuse of alcohol and drugs (Helmers & Mente, 1999) and incorrect eating habits (Casagrande, Boncompagni, Forte, Guarino & Favieri, 2019). Alexithymia was also considered a risk factor for cardiovascular mortality (Tolmunen et al., 2010), and it is associated with low drug therapy adherence (Axelsson et al., 2009).

Many studies have highlighted an association between hypertension and alexithymia; some authors have reported a more significant association (Jula et al., 1999; Todarello et al., 1995); while others have shown less robust effects (Chachaj et al., 2009; Hanninen et al., 2011) and others have not confirmed this relationship (Linden, Lenz, & Stossel, 1996; McCubbin et al., 2013). However, the nature of this association and how much alexithymia is linked to the severity of hypertension are not clear (Gage & Egan, 1984). To our knowledge, no study has analysed the relationship between alexithymia and blood pressure control in hypertension, considering drug therapy.

This study aims to examine the association between hypertension, alexithymia and blood pressure control in a sample of Italian adults not affected by other medical or psychological diseases.

For these aims, three different subsections with different objectives have been planned:

1. To confirm the association between hypertension and alexithymia as reported in other studies (Jula et al., 1999; Todarello et al., 1995) (subsection 1);

2. To investigate whether the presence or absence of antihypertensive pharmacological treatment is differently related to alexithymia (subsection 2);

3. To examine the association between alexithymia and uncontrolled hypertension, in treated hypertensive patients (subsection 3), specifically to understand whether the lack of control of blood pressure can be associated with higher levels of alexithymia.

In general, we expect that alexithymic characteristics are associated with hypertension, particularly considering severe hypertension conditions, such as the uncontrolled condition.

2. Method

2.1. Participants

One thousand two hundred and forty-one people participated in the study; they were recruited at the First Medical Clinic of the Policlinico Umberto I of the University of Rome "Sapienza" between 2014 and 2017. Hypertensive patients were selected at the Hypertension Centre, and the control group was recruited from the Geriatric dental surgery, within the same Medical Clinic. A cardiologist provided information on drug treatment (number of drugs assumed).

In accordance with European guidelines for the diagnosis and treatment of arterial hypertension (Mancia et al., 2013; Williams et al., 2018), the participants were divided into two groups: hypertensive (N= 810 [376 Male, 434 Female]; Age= 60.08 years; SD= 11.15) who had a Systolic/Diastolic blood pressure equal to or higher than 140/90 mmHg or were under drug treatment for hypertension; normotensive (N= 431 [158 Male, 273 Female]; Age= 51.54 years; SD= 10.17) who presented Systolic/Diastolic blood pressure values lower than 140/90 mmHg (subsection 1).

Subsequently (subsection 2), hypertensive patients were subdivided, considering drug therapy, into two subgroups: Hypertensive patients under drug treatment (N= 545; [255 Male, 290 Female]; Age= 62.28; SD= 10.88) and Untreated Hypertensive patients (N= 265 [121 Male, 144 Female]; Age= 55.55; SD= 10.33). Finally (subsection 3), the participants who were classified under pharmacological treatment were further subdivided into: patients with Controlled Hypertension (those who presented a blood pressure lower than 140/90 mmHg) (N= 209; Age= 62.00; SD= 10.81), and patients with Uncontrolled Hypertension (N= 336; Age= 62.46; SD= 10.93) if they had a Systolic/Diastolic blood pressure equal to or higher than 140/90 mmHg.

Inclusion criteria were: aged over 40 years, being native Italian speakers and, only for the hypertensive patients, receiving a diagnosis of essential hypertension by a cardiologist. Participants

who presented chronic conditions such as cancer, diabetes, cardiac or neurological and psychiatric disorders were excluded from the study. Participants were also not included in the research when they present a Systolic/Diastolic blood pressure equal or higher than 140/90 mmHg and they were taking a drug therapy consisting of at least three classes of drugs, one of which was represented by a diuretic, since this typology of hypertensive patients is considered drug-resistant (Sheppard, Martin, & McManus, 2017).

Figure 1 reports the exclusion criteria of participants.

2.2. Assessment tools

2.2.1. Physiological measures

Systolic (SBP) and Diastolic blood pressure (DBP) and Heart Rate were recorded by using an automatic electronic sphygmomanometer validated for self-measurement ("Personal Check" PIC) (Germanò et al., 2010).

Blood pressure measurement was performed according to the European guidelines criteria (Mancia et al., 2013). Blood pressure has been categorized as optimal (SBP lower than 120 mmHg and DBP lower than 80 mmHg), normal (SBP equal to 120-129 mmHg and DBP lower than 85 mmHg), high normal (SBP equal to 130-139 mmHg or DBP equal to 85-89 mmHg), grade I hypertension (SBP equal to 140-159 mmHg or DBP equal to 90-99 mmHg), grade II hypertension (SBP equal to 160-179 mmHg or DBP equal to 100-109 mmHg) and grade III hypertension (SBP equal to or higher than 180 mmHg or DBP equal to or higher than 110 mmHg).

After a 5-minute rest in which participants were seated on a comfortable chair with their backs resting on their backrests, they were required to keep silent, and consequently, the three recommended measurements were carried out on the non-dominant arm, at about 2 minutes from each other.

For subsequent analyses, the mean value of both SBP and DBP was considered. Furthermore, the Mean Arterial Pressure (MAP) was computed; this is defined as the mean blood pressure in a patient's arteries during one cardiac cycle. It is considered an indicator of perfusion to vital organs

and it can be estimated by using the formula: MAP= [SBP + 2(DBP)]/3. Finally, Heart Rate (HR) was also recorded.

A balance and a meter were used to measure the weight and height of the participants. Weight and height were used to calculate the Body Mass Index (BMI), an indirect estimate of the individual's body fatness. BMI was obtained by dividing weight (in kilograms) by height (in metres squared) (NCD Risk Factor Collaboration, 2016).

2.2.2. Socio-demographic and anamnestic information

Demographic data (age, gender, marital status, years of education), lifestyles (smoking, alcohol consumption), medical and psychiatric information were collected for each patient by face-to-face interview. A questionnaire on compliance with the pharmacological treatment (3-point Likert scale) was included in the interview in the first part of the research (2014-2015), subsequently (2016-2017) this was replaced by a short questionnaire composed of four items with a dichotomous answer (yes/no), with the aim to investigate adequate adherence to drug therapy.

2.2.3. 20-item Toronto Alexithymia Scale (TAS-20)

TAS-20 (Bagby, Parker, Taylor, 1994; Italian validation: Bressi et al., 1996) is a self-report questionnaire that allows evaluating alexithymia. It includes 20 items on a 5-point Likert scale (1= strongly disagree, 5= strongly agree). The test also permits assessing the three different facets of alexithymia: Difficulty Identifying Feelings (DIF); Difficulty Describing Feelings (DDF); Externally Oriented Thinking (EOT). The scores range from 20 to 100 and proved both categorical and continuous information. In categorical classification, three different levels of alexithymia are considered: non-alexithymic (scores below 51); moderately alexithymic (scores between 51 and 60); alexithymic (scores above 60).

2.3. Procedure

The research was conducted according to the Declaration of Helsinki and approved by the Local Ethics Committee. Following the signing of the informed consent, the participants were subjected to blood pressure recordings; after this recording, weight and height were measured. Then, the

participants were submitted to the socio-demographic and anamnestic interview, and they completed the TAS-20. After this procedure, hypertensive patients were visited by a cardiologist, who carried out the diagnosis. The whole procedure, lasting 40 minutes, took place in a quiet environment with a comfortable temperature.

2.4. Statistical analysis

Raw scores of the two adherence scales were transformed into z scores.

To assess the presence of differences between groups, one-way analyses of variance (ANOVAs) were carried out considering the Group as the independent variable and the adherence to drug treatment, the average number of drugs taken, the different socio-demographic and physiological dimensions, and the lifestyles as dependent variables. If significant differences were found for more influential variables (age, gender, years of education and BMI), these were included in the covariance analyses (ANCOVAs) for the analyses of alexithymia, considering as outcomes the total score on the TAS-20 and its subscales (Difficulty Identifying Feelings, Difficulty Describing Feelings, Externally-Oriented Thinking). Moreover, to compare the percentage of alexithymic and non-alexithymic individuals in the different groups, the χ^2 test was used

In the subsections with more than two groups, the differences between groups were tested with planned comparisons that contrasted the means between the three (subsection 2: normotensive, untreated hypertensive, treated hypertensive) and four (subsection 3: normotensive, untreated hypertensive, controlled hypertensive and uncontrolled hypertensive) groups.

Using G-Power software (Faul et al., 2009), a sensitivity analysis was carried out to compute the effect size associated with a power equal to 0.80 according to the sample size of the study. The expected effect sizes expressed in partial eta squared were of 0.005 (subsection 1), 0.006 (subsection 2), 0.008 (subsection 3).

For all the statistical analyses, the level of significance was accepted at $p < 0.05$.

To reduce the risk of a Type 1 error, a Bonferroni's correction was applied in the subgroups analysis. A $p < 0.02$ was accepted in the second and third subsections.

Statistical analyses were performed through the Statistica Software v.10.0.

3. Results

The global sample has been differently separated according to the different types of analyses suitable to answer the research questions. The results have been reported in different subsections, each addressing one type of analysis. Table 1 shows the descriptive statistics.

3.1. Subsection one: Assessment of the association between hypertension and alexithymia

Table 2 shows the differences between groups in demographics (age, gender, years of education, BMI), lifestyles and physiological variables.

Alexithymia

The χ^2 test shows a different Alexithymic/Non-Alexithymic ratio in the two groups (χ^2 = 10.6; p< 0.002). Specifically, there was a higher percentage of alexithymic people in the hypertensive group compared to the normotensive group (16.4%. 11.4%).

ANOVAs performed on the TAS-20 scores showed a significant difference between the groups in the overall score of Alexithymia ($F_{1,1239}$= 28.76; p< 0.0001; $p\eta^2$= 0.02), the Difficulty Identifying Feelings ($F_{1,1239}$= 19.68; p< 0.0001 $p\eta^2$= 0.01), the Difficulty Describing Feelings ($F_{1,1239}$= 11.77; p< 0.001; $p\eta^2$= 0.01) and the Externally Oriented Thinking ($F_{1,1239}$=16.50; p< 0.0001; $p\eta^2$= 0.01).

Since age, years of education and BMI were significantly different between groups, they were introduced as covariates in the analyses.

ANCOVAs performed on the TAS-20 scores confirmed significant differences between groups in both the overall score of Alexithymia (49.01 vs. 45.08; $F_{1,1235}$= 3.92; p= 0.05; $p\eta^2$= 0.003) and the Difficulty Identifying Feelings (16.28 vs. 14.47; $F_{1,1235}$= 5.40; p= 0.02 $p\eta^2$= 0.004). Conversely, Difficulty Describing Feelings ($F_{1,1235}$= 1.06; p= 0.30) and Externally Oriented Thinking ($F_{1,1235}$< 1; p= 0.46) were no longer significantly different (see Table 2).

3.2. Subsection two: Assessing alexithymia in people with untreated hypertension and under drug treatment hypertension

Table 3 shows the differences between groups in demographics (age, gender, years of education, BMI), lifestyle and physiological variables.

Alexithymia

The χ^2 test showed a higher presence of alexithymic individuals in the treated hypertensive group compared to both the normotensive group (χ^2= 16.21; p< 0.001; 18.5% vs. 11.4%) and the untreated hypertensive group (χ^2= 8.08; p< 0.01; 18.5% vs. 12.1%), while there were no significant differences in the number of alexithymic people between normotensive and untreated hypertensive groups (χ^2< 1; p= 0.59).

ANOVAs performed on the TAS-20 scores showed a significant difference between the groups in the overall score of Alexithymia ($F_{1,1238}$= 22.77; p< 0.0001; $p\eta^2$= 0.03), the Difficulty Identifying Feelings ($F_{1,1238}$= 13.29; p< 0.0001 $p\eta^2$= 0.02), the Difficulty Describing Feelings ($F_{1,1238}$= 8.28; p< 0.001; $p\eta^2$= 0.01) and the Externally Oriented Thinking ($F_{1,1238}$=17.96; p< 0.0001; $p\eta^2$= 0.03).

Since age, years of education and BMI were significantly different between groups, they were introduced as covariates in the analysis considering alexithymia.

The ANCOVAs on the TAS-20 scores showed significant differences between the groups in Difficulty Identifying Feelings ($F_{2,1234}$= 3.31; p= 0.04; $p\eta^2$= 0.01) with higher scores in the treated hypertensive group than the normotensive group ($F_{1,1234}$= 6.61; p= 0.001; $p\eta^2$= 0.01); a significant difference was also confirmed for Externally Oriented Thought ($F_{2,1234}$= 3.89; p= 0.02; $p\eta^2$= 0.01) with higher scores in the treated hypertensive group than both the untreated hypertensive ($F_{1,1234}$= 7.25; p= 0.007; $p\eta^2$= 0.01) and the normotensive ($F_{1,1234}$= 3.54; p= 0.06; $p\eta^2$= 0.003) groups. Difficulty Describing Feelings did not show significant differences (F< 1; p= 0.48). Finally, the TAS-20 total score was different between groups ($F_{2,1234}$= 3.88; p= 0.02; $p\eta^2$= 0.01), the treated hypertensive group had higher scores than both normotensive ($F_{1,1234}$= 7.05; p= 0.008; $p\eta^2$= 0.01) and untreated hypertensive ($F_{1,1234}$= 3.84; p= 0.05; $p\eta^2$= 0.003) groups (Figure 2). Considering the Bonferroni's correction, there were not substantial changes in the results.

3.3. Subsection three: Assessing alexithymia in people with uncontrolled hypertension

Table 4 shows the differences between groups in demographics age, gender, years of education, BMI, lifestyles and physiological variables.

Adherence

The ANCOVA performed on the adherence of the two pharmacologically treated groups (uncontrolled hypertensive and controlled hypertensive) did not show significant differences ($F_{1,539}$= 2.56; p= 0.11), although the average scores of adherence were marginally higher in controlled hypertensive individuals (see Table 2).

An ANOVA conducted considering the classification of alexithymia as the independent variable (alexithymic, non-alexithymic, moderately alexithymic) and adherence to pharmacological treatment as the dependent variable showed no significant differences ($F_{2,539}$= 1.92; p= 0.15); the correlational analysis between TAS-20 scores and adherence scores did not show any relations between these variables (r= -0.06; p= 0.16).

Alexithymia

The X^2 analysis showed a higher percentage of alexithymic people in the controlled hypertensive group than both untreated hypertensive (X^2= 7.17; p< 0.01; 20.1% vs. 12.1%) and normotensive (X^2= 12.71; p< 0.001; 20.1% vs. 11.4%) groups, but not compared to the uncontrolled hypertensive group (X^2< 1; p= 0.64; 20.1 vs. 17.6). The latter group show significant differences compared to both untreated hypertensive (X^2= 5.96 p= 0.01; 17.6% vs. 12.1%) and normotensive (X^2= 11.62; p< 0.001; 17.6% vs. 11.4%).

ANOVAs performed on the TAS-20 scores showed a significant difference between the groups in the overall score of Alexithymia ($F_{1,1237}$= 15.49; p< 0.0001; $p\eta^2$= 0.04), the Difficulty Identifying Feelings ($F_{1,1237}$= 9.61; p< 0.0001 $p\eta^2$= 0.02), the Difficulty Describing Feelings ($F_{1,1237}$= 5.52; p< 0.001; $p\eta^2$= 0.01) and the Externally Oriented Thinking ($F_{1,1237}$=11.98; p< 0.0001; $p\eta^2$= 0.03).

Since age, years of education and BMI were significantly different between groups, they were introduced as covariates in the analysis considering alexithymia.

The ANCOVAs on the TAS-20 scores showed significant differences in both Difficulty Identifying Feelings ($F_{3,1233}$= 2.56; p= 0.05; $p\eta^2$= 0.01) and Externally Oriented Thought ($F_{3,1233}$= 2.63; p= 0.05; $p\eta^2$= 0.01), while no significant differences were evident in the Difficulty Describing Feelings (F< 1; p= 0.68).

Regarding the Difficulty Identifying Feelings, the uncontrolled hypertensive group presents higher scores than the normotensive group ($F_{1,1233}$= 7.67; p= 0.006; $p\eta^2$= 0.01); concerning Externally Oriented Thought, the uncontrolled hypertensive group differs from untreated hypertensive ($F_{1,1233}$= 6.74; p= 0.009; $p\eta^2$= 0.01) and normotensive ($F_{1,1233}$= 3.38; p= 0.06; $p\eta^2$= 0.003) groups (see Figure 3).

The TAS-20 total score showed a significant difference ($F_{3,1233}$= 2.81; p= 0.03; $p\eta^2$= 0.01), in this case the uncontrolled hypertensive differed from normotensive ($F_{1,1233}$= 7.57; p= 0.006; $p\eta^2$= 0.01) and untreated hypertensive groups ($F_{1,1233}$= 4.51; p= 0.03; $p\eta^2$= 0.004), but not from controlled hypertensive (F< 1; p= 0.41) group (see Figure 3). Considering the Bonferroni's correction, there were no substantial changes in the results.

4. Discussion

The transdiagnostic construct of alexithymia has often been associated with both personality (Grande et al., 2012) and mood characteristics (Rafanelli et al., 2012; Rubio-Guerra et al., 2013). Moreover, alexithymia has often been associated with dysfunctional physiological aspects, leading to medical diseases (Asi Karakas et al., 2016; Panayiotou, 2018).

Many studies have highlighted a strong association between alexithymia and hypertension (Hanninen et al., 2011; Chachaj et al., 2009; Grabe et al., 2010; Jula et al., 1999; Niiranen et al., 2006; Todarello et al., 1995). However, to our knowledge, there are no studies that investigated alexithymia referring to all aspects of essential hypertension and, specifically, no study has investigated pharmacological treatment or have compared patients under drug treatment with untreated patients.

For these reasons, the primary aim of this study was to investigate the link between alexithymia and hypertension, considering drug treatment. This goal has been pursued through a step-by-step approach aimed to highlight the actual weakness of information, too generic, on this topic and to focus on different aspects of hypertension gradually.

The first subsection confirms well-known findings (i.e., Jula et al., 1999; Todarello et al., 1995). There is a higher presence of alexithymia in individuals with essential hypertension compared with normotensive people. Our findings confirmed this association, also controlling the results for BMI, years of education, gender and age and excluding people with other medical and psychological diseases.

The overall percentages of Hypertension (65%) and Alexithymia (15%) highlighted in this study are in line with those found in the general population (Franz et al., 2008; Tocci et al., 2015). However, the percentage of alexithymic persons in the group of hypertensive patients is much lower than that reported by other authors (Jula et al., 1999; Todarello et al., 1995) that found a percentage higher than 50%. In our study, the percentage found is significantly lower (16.4%). These differences may depend on some methodological aspects. For example, despite the well-known relationships of age with both alexithymia (Salminen et al., 1999) and blood pressure (Lewington, 2002), age was not considered in the data analysis of other studies. Moreover, in Todarello et al.'s study (1995), hypertensive patients were older compared to the other groups (mean age of hypertensive patients= 52.5 years; psychiatric patients: 39.0 years; control subjects: 40.8 years). On the other hand, Jula and co-workers (1999) assessed alexithymia using the TAS-26 (Taylor, Ryan, & Bagby, 1985; Taylor et al., 1988) that presents some psychometric limitations compared to the TAS-20 (Bagby et al., 1994).

Nevertheless, our findings confirm the presence of higher emotional dysregulation in hypertensive patients. Hypertensive people show more difficulty in identifying feelings and distinguishing them from somatic sensations. So, these primary analyses suggested that alexithymia could be considered an additional and general risk factor for essential hypertension, as expressed in previous literature

(Grabe et al., 2009), although it must be emphasised that the present study only highlights an association between alexithymia and hypertension and does not allow establishing a causal relationship.

The second subsection focused on a classification that considered pharmacological treatment. This aspect has a significant impact on the quality of life (Lauziére et al., 2013; Schmidt, Bramlage, Limberg, & Kreutz, 2008; Souza, Borges, & Moreira, 2016) and it is usually associated with higher severity of hypertension (Whelton et al., 2017).

In most cases, hypertension does not present manifest symptomatology. For this reason, hypertension is known as the "silent killer", and it is estimated that in the general population there is a variable percentage of hypertensive individuals who do not know their condition and, consequently, they do not receive any treatment to control their blood pressure (Tocci et al., 2015). Untreated hypertensive people would seem to present emotional dysregulation (Jula et al., 1999). However, no studies have considered alexithymia in people with drug-treated hypertension.

In general, our results highlighted a percentage of 32.71% untreated hypertensive participants. This percentage is in line with a previous Italian study (Tocci et al., 2015). Untreated hypertension is a significant risk factor for the development of cardiovascular disorders due to its association with higher risk behaviours (Whelton et al., 2017). Our findings confirm this hypothesis. Untreated hypertensive patients show more problematic dimensions as indicated by both physiological (blood pressure indices) and lifestyles (alcohol and cigarette smoking) (Niiranen et al., 2006; Virdis et al., 2010; Whelton et al., 2017). Moreover, they are younger than treated hypertensive patients; this result could be due to the absence of the hypertensive symptomatology; in fact, hypertension is often silent, and consequently, blood pressure control is rarely performed at a younger age (Sawicka et al., 2011).

However, this physiological and behavioural trend would seem to be dissociated from the tendency of emotional dysregulation, as expressed by a higher percentage of alexithymic in treated hypertensive groups (18.5%).

The results showed that among the populations considered, hypertensive patients under pharmacological treatment present higher alexithymic characteristics than the other groups. They appear more unable to distinguish their feelings from somatic sensations and show a restricted imaginative process characterised by outwardly directed cognitive style (Taylor et al., 1999).

These findings provided us further information compared to that observed in the previous studies; alexithymia, independently from other factors, such as BMI, age, gender and years of education, appears to be associated more closely with drugs treated hypertension, i.e. more severe hypertension. These results allow a higher knowledge on this topic.

Therefore, our findings seem to highlight that emotional dysregulation is not associated by itself with higher blood pressure, as evidenced by previous studies (e.g., Todarello et al., 1995), but rather by more severe hypertension requiring pharmacological treatment.

The last subsection was aimed to clarify the role of alexithymia in maintaining optimal blood pressure control during pharmacological therapy, which is essential to minimise cardiovascular risks (Flack et al., 2018; Go et al., 2014). It is well known that some people present failure to control blood pressure; this condition is called uncontrolled hypertension (Sheppard et al., 2017). It is associated with patients' reduced compliance, incorrect lifestyles, inadequate drug therapy or real drug resistance (Jankowska-Polanska et al., 2017; Whelton et al., 2017).

Previous studies have investigated some psychological dimensions connected to the lack of control of blood pressure (Sanz et al., 2010); no study had ever investigated the relationship between uncontrolled hypertension and alexithymia. Furthermore, no study has ever considered a classification of hypertension under pharmacological treatment into two further divisions linked to the effectiveness of drug therapy. This distinction allowed us to highlight how the group with uncontrolled hypertension presented both a higher percentage of alexithymic and moderately alexithymic people and higher scores on the TAS-20 than the normotensive and untreated groups. The results show more difficulty in identifying feelings and more external oriented thought in the uncontrolled hypertensive group than the other groups.

On the one hand, this result confirms the hypothesis that the lack of blood pressure control is associated with some psychological characteristics of patients such as personality traits (Sanz et al., 2010) and coping strategies (Casagrande et al., 2019), on the other hand, it also highlights a relationship between alexithymia and higher severity of hypertension.

It is relevant to underline that in our sample uncontrolled hypertensive people do not show poor therapeutic adherence, even if they present unhealthier behaviours (Niiranen et al., 2006; Virdis et al., 2010; Whelton et al., 2017). Moreover, these results were obtained by controlling the variables most associated with both alexithymia and hypertension (age, BMI, years of education and gender).

In our opinion, the strength of this study is (a) the methodological organisation that has allowed focusing and analysing the various dimensions linked to hypertension, (b) to have controlled some variables, i.e. BMI, age, gender and years of education, commonly associated with both hypertension and alexithymia. BMI is positively associated with both a significant emotional dysregulation (Casagrande et al., 2019; Waldstein et al., 2002) and higher blood pressure levels (Brown et al., 2000; Shihab et al., 2002). Moreover, older age represents a known risk factor for hypertension (Sun, 2015), and it is positively associated with alexithymia (Mattila, Salminen, Nummi, & Joukamaa, 2006). Also, years of education seem to be associated with both hypertension (Chobanian et al., 2003) and alexithymia (Lane, Sechrest, & Riedel, 1998; Pasini, Delle Chiaie, Seripa, & Ciani, 1992; Salminen et al., 1999) indicating that there is an increased risk associated with a low education in both cases. Considering gender (for a review see Levant, Hall, Williams, & Hasan, 2009), some studies have reported a difference in the levels of alexithymia between males and females, with a higher percentage of alexithymia in the male population (Lane, Sechrest , & Riedel, 1998), while others, in line with our results, do not report significant differences (Pasini et al., 2002).

In the present study, analyses were carried out without and with the introduction of covariates (age, BMI, years of education). In the first case, the results were significant in all the subscales of TAS-20. After the adjustment for confounding variables, Difficulty Describing Feelings no longer

discriminates between groups, therefore this aspect of emotional regulation is strongly influenced by the modulating variables considered.

Another point of strength of this study is to have used rigorous inclusion criteria for excluding participants that presented important medical and psychological diseases, an aspect often not controlled by other studies (e.g., Todarello et al., 1995).

Moreover, the results of this study appear to be robust, considering that the effect sizes were similar to that expected in the sensitivity analysis.

Assuming that uncontrolled hypertension is to be placed at the most severe point of the hypertensive continuum (Iyer et al., 2010; Zhou et al., 2018), this study would seem to show that alexithymia represents a factor that should be considered in hypertensive patients, especially for severe hypertension. These results could depend on the association of alexithymia with poor therapeutic adherence (Lumley, Neely, & Burger, 2007); however, in our study, this association is not present. The physiological activations associated with emotions (e.g. increase in blood pressure, HR, body temperature, skin conductance) may mediate the role between hypertension and alexithymia. Alexithymic people, who experience but do not consciously process their emotions, could undergo an increase in the physiological activation resulting from an emotional event (Neumann et al., 2004). In the long run, this could affect the physiological self-regulation and be consequently associated with a higher autonomic activation leading to more elevated blood pressure, but our empirical evidence cannot confirm this hypothesis. To appropriately consider the relationship between alexithymia and autonomous nervous system activation, a longitudinal study would be necessary. Our results could also be verified from an applicative point of view since an intervention aimed at emotional regulation could lead to improvements in both hypertension (Mingarelli et al., 2006) and the individual response to pharmacological treatment.

Despite the promising results, this study has some limitations. Among these, we mention the use of two different scales of adherence in the course of data collection, which could have influenced the results obtained. Furthermore, failure to control other psychological variables related to

alexithymia, such as mood and anxiety, may have weakened the methodological implant. Another limitation could be linked to the fact that only the clinical measurement of blood pressure was used, and this did not allow to control some aspects of hypertension, such as masked hypertension and white coat hypertension (Hanninen et al., 2011). However, further studies may enable investigating these aspects by considering blood pressure monitoring for 24 hours.

One of the most critical limitations of the study is the lack of a specific analysis of drug treatment. It would be useful to consider the effect of different drugs on hypertension, and more importantly, try to analyse the nature of the relationship between drugs treatment and alexithymia in hypertensive individuals. Individuals with uncontrolled hypertension showed higher levels of alexithymia compared to normotensive people, but the role of the drugs could not be controlled. Controlling dose and type of medications could allow considering the possible modulation effects of treatment. To know the specific type and dose of the medications used to treat hypertension might let to understand better if the type of drug taken modulates certain emotional aspects in hypertensive patients.

In the present study, we chose to consider the European guidelines (Mancia et al., 2013; Williams et al., 2018) on which pharmacological therapy was based. It could be interesting to compare these results with other studies that analysed the relationship between hypertension and emotional regulation considering the ACC/AHA guidelines (Whelton et al., 2017), which changed the cut-off for the classification of hypertension, lowering the risk threshold.

Moreover, it would be interesting to consider how different severity levels of hypertension (Mancia et al., 2013; Williams et al., 2018) influence this relationship.

A future study could consider anxiety and arousal measures to support the findings from this study and the idea that hypertensive individuals could express their emotions through the physiological components. For example, it could be useful to consider the Heart Rate Variability measure that could be given more information about physiological activation (e.g., Forte et al., 2019).

From our point of view, the results of this study could have two possible implications. On the one hand, alexithymia could represent a risk factor associated with the increase in blood pressure. On the other hand, alexithymia could be a consequence of hypertension. Disentangling these two possibilities without longitudinal data is impossible. Therefore, it would be important to analyse this relationship in other studies.

5. Conclusion

In summary, this study highlighted a relationship between alexithymia and essential hypertension. We could hypothesise that hypertensive people are confused about their emotions. They also somatise emotions, minimise affective components and express their emotions through the physiological components because they cannot consciously process their emotions.

However, unlike previous studies that evidence a general relationship between alexithymia and hypertension, this study has found that this relationship is present to a higher extension in hypertensive patients that cannot maintain control of their blood pressure despite following pharmacological treatment. Thus, alexithymia would appear to be associated with higher severity of hypertension and should be considered a risk factor in the development and maintenance of hypertension, even under pharmacologically controlled conditions.

6. Acknowledgments

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7. Declaration of Interest Statement

The authors declare that the research was conducted in the absence of any financial or commercial relationship that could be a potential conflict of interest.

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Figure 1. Selection of the participants.

Figure 2. Means and SE of (a) the Total Score and (b) the three TAS-20 Subscales scores in the three Groups.

TH: Treated Hypertensive Group; UH: Untreated Hypertensive Group; NH: Normotensive Group; DIF: Difficulty Identifying Feelings; DDF: Difficulty Describing Feeling; EOT: External Oriented Thinking. [*Total Score: TH vs NH: p< 0.01; TH vs UH: p= 0.05]; [*DIF: TH vs NH: p< 0.002; *EOT: TH vs UH: p< 0.01; TH vs UH: p= 0.06].

Figure 3. Means and SE of (a) the Total Score and (b) the scores of the three TAS-20 Subscales in the four Groups.

NH: Normotensive Group; UH: Untreated Hypertension Group; CH: Controlled Hypertension Group; UCH: Uncontrolled Hypertension Group; DIF: Difficulty Identifying Feelings; DDF: Difficulty Describing Feeling; EOT: External Oriented Thinking. [*Total Score: UCH vs NH: p< 0.01; UCH vs UH: p<0.04] [*DIF: UCH vs NH: p< 0.01; *EOT: UCH vs UH: p< 0.01; UCH vs NH: p< 0.06].

Table 1. Frequencies of sociodemographic data of Normotensive and Hypertensive Groups.

			Hypertensive									
							Antihypertensive medication					
	Normotensive (N = 431)		Total Hypertensive (N=810)		Untreated Hypertension (N= 265)		Total Antihypertensive medication (N=545)		Controlled Hypertension (N= 209)		Uncontrolled Hypertension (N = 336)	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Male	158	36.7	376	46.4	121	45.7	255	46.8	97	46.4	158	47
Education Level*												
Primary School	36	8.4	78	9.6	16	6.0	63	11.6	20	9.6	43	12.8
Secondary I Grade School	51	11.8	170	21.8	62	23.4	122	22.4	46	22.0	76	22.6
Secondary II Grade School	214	49.7	415	50.5	136	51.3	260	47.7	105	50.2	155	46.1
Higher Education	130	31.1	148	18.1	51	19.2	100	18.3	38	18.2	62	18.5
Marital Status												
Widowed	15	3.5	70	8.6	16	6	54	9.9	20	9.6	34	10.1
Divorced	33	7.7	73	9	22	8.3	51	9.4	18	8.6	33	9.8
Single	43	10	71	8.8	27	10.2	44	8.1	19	9.1	25	7.4
Married	340	78.9	596	73.6	200	75.5	396	72.6	152	72.7	244	72.6
Working Status*												
Unemployed	13	3.0	17	2.1	9	3.4	8	1.5	2	1	6	1.8
Employed	296	68.7	346	42.7	153	57.7	193	35.4	77	36.8	116	34.5
Retired/homemaker	112	26.0	388	47.9	87	32.8	301	55.2	110	52.6	191	56.8
Lifestyles												
Current Smokers	42	9.7	148	18.3	65	24.5	83	15.2	33	15.8	50	14.9
Excessive Alcohol Consumption**	1	0.2	15	1.9	8	3.0	7	1.3	1	0.5	6	1.8
Cardiovascular diseases Familiarity												
Yes	129	29.9	460	56.8	134	50.6	326	59.8	133	63.6	193	57.4
No	302	70.1	350	43.2	131	49.4	219	40.2	76	36.4	143	42.6
TAS-20												
Alexithymic	49	11.4	133	16.4	32	12.1	101	18.5	42	20.1	59	17.6
Moderately Alexithymic	69	16.0	197	24.4	54	20.4	143	26.2	50	23.9	93	27.7
Non Alexithymic	313	72.6	480	59.2	179	67.5	301	55	117	56.0	183	54.5

*Missing Data: Worker [NH= 10 (2.3%); HP= 59 (7.3%)]. ** Excessive Alcohol Consumption >2 drinks and/or wine glasses per day.

Table 2. Mean and Standard Deviation of demographic, lifestyle and physiological variables, and TAS-20 scores in normotensive and hypertensive groups.

	Normotensive (N= 431)	Hypertensive (N= 810)	F	p
Age (years)	51.54 (10.17)	60.08 (11.15)	175.09	0.0001
Education (years)	13.45 (4.26)	12.17 (4.27)	23.92	0.0001
BMI (Kg/m2)	24.94 (3.74)	26.57 (4.19)	44.21	0.0001
Systolic BP (mmHg)	118.09 (10.65)	145.81 (20.19)	707.14	0.0001
Diastolic BP (mmHg)	75.23 (7.75)	90.59 (12.72)	524.31	0.0001
Heart Rate (beats per min)	72.58 (10.07)	72.84 (12.56)	28.29	0.0001
Mean Arterial BP (mmHg)	89.52 (7.92)	108.99 (13.31)	776.07	0.0001
Pharmacological Treatment (numbers)	NA	0.85 (0.84)	-	-
Smoking Cigarettes (number per die)	1.29 (3.92)	1.75 (5.25)	1.37	0.24
Drink or Wine (number of glasses per day)	0.16 (0.41)	0.28 (0.64)	6.39	0.01
TAS-20* (points)				
Difficulties Identifying Feelings	14.47 (6.40)	16.28 (6.54)	5.40*	0.02
Difficulties Describing Feelings	12.24 (4.27)	13.21 (4.63)	1.06*	0.30
External Oriented Thinking	18.36 (5.04)	19.52 (5.01)	< 1*	0.46
Total Score	45.08 (12.00)	49.01 (12.10)	3.92*	0.05

*Adjusted for covariates (BMI; ages; Years of education).

Table 3. Mean and Standard Deviation of demographic, lifestyle and physiological variables, and TAS-20 scores in Normotensive, Untreated and Treated Hypertensive groups.

	Normotensive (N= 431)	Untreated Hypertensive (N= 265)	Treated Hypertensive (N= 545)	F	p
Age (years)	51.54 (10.17)[a]	55.55 (10.32)[b]	62.29 (10.88)	129.19	0.0001
Education (years)	13.45 (4.26)[a]	12.48 (4.05)	12.03 (4.37)	12.88	0.0001
BMI (Kg/m2)	24.94 (3.74)[a]	25.75 (3.70)[b]	26.97 (4.36)	30.00	0.0001
Systolic BP (mmHg)	118.09 (10.65)[a]	149.18 (16.81)[b]	144.17 (21.47)	364.94	0.0001
Diastolic BP (mmHg)	75.23 (7.75)[a]	96.48 (10.69)[b]	87.73 (12.64)	346.01	0.0001
Heart Rate (beats per min)	72.58 (10.07)[a]	77.99 (12.12)[b]	70.25 (11.99)	21.21	0.0001
Mean Arterial BP (mmHg)	89.52 (7.92)[a]	114.01 (10.77)[b]	106.54 (13.74)	450.24	0.0001
Pharmacological Treatment (n°)	NA	NA	1.47 (0.67)	-	-
Smoking Cigarettes (n° per die)	1.29 (3.92)[c]	2.73 (6.57)[b]	1.36 (4.35)	7.81	0.001
Drink or Wine (n° of glasses per day)	0.16 (0.41)[a]	0.32 (0.74)	0.26 (0.59)	3.89	0.02
TAS-20* (points)					
Difficulties Identifying Feelings	14.47 (6.40)[d]	15.57 (6.64)	16.37 (6.47)	3.31*	0.04
Difficulties Describing Feelings	12.24 (4.27)	12.76 (4.53)	13.43 (4.67)	< 1*	0.48
External Oriented Thinking	18.36 (5.04)[d]	18.48 (4.92)[b]	20.03 (4.97)	3.89*	0.02
Total Score	45.08 (12.00)[d]	46.81 (11.49)[b]	50.10 (12.25)	3.88*	0.02

*Adjusted for covariates (BMI; ages; Years of education).
[a] Normotensive are different from both Untreated and Treated Hypertensive
[b] Untreated Hypertensive are different from Treated Hypertensive
[c] Normotensives are different from Untreated Hypertensive
[d] Normotensives are different from Treated Hypertensive

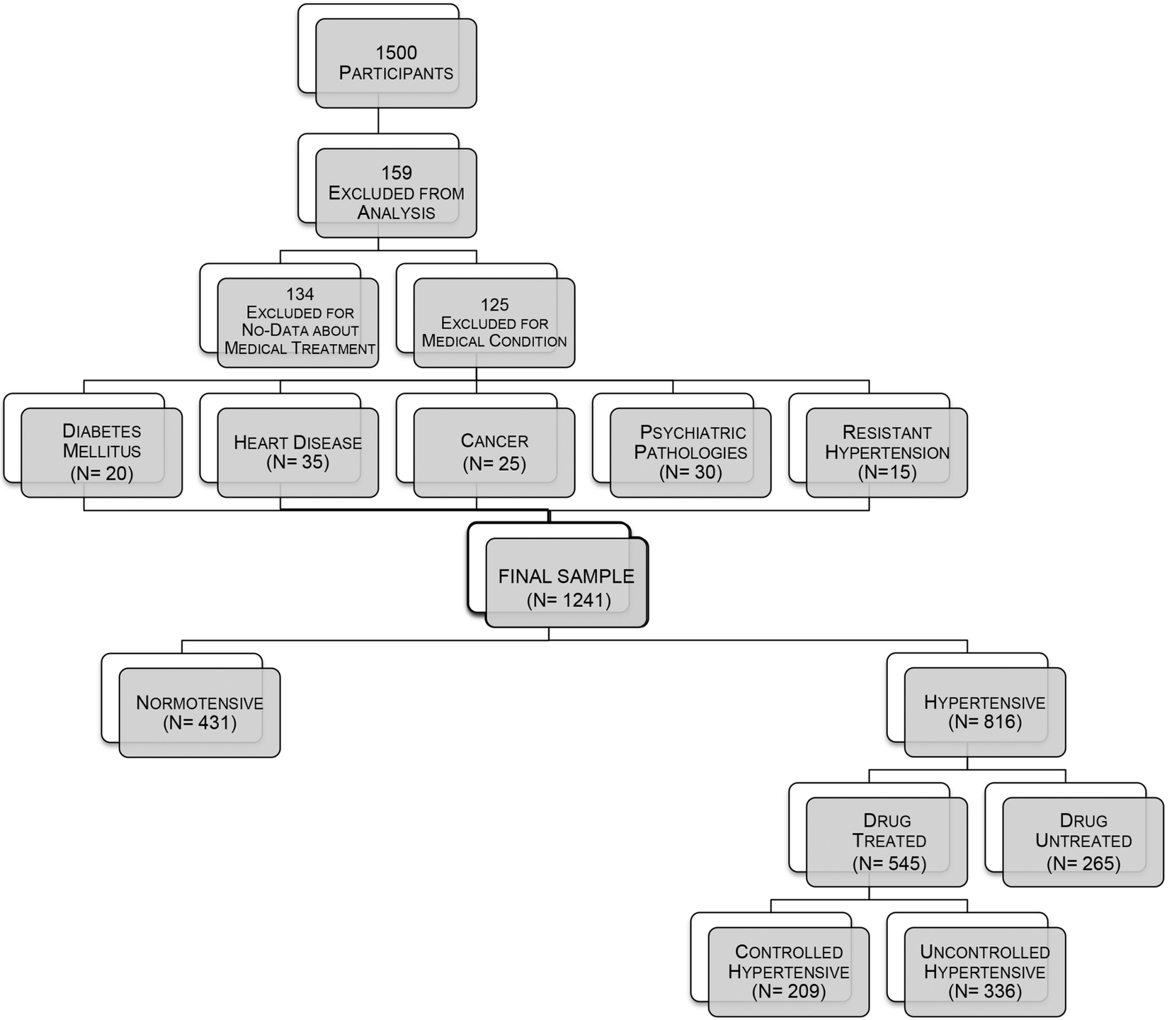
Table 4. Mean and Standard Deviation of demographic, lifestyle and physiological variables, and TAS-20 scores in Normotensive, Untreated, Controlled and Uncontrolled Hypertensive groups.

		Hypertensive				
	Normotensive (N= 431)	Untreated (N= 265)	Controlled (N= 209)	Uncontrolled (N= 336)	F	p
Age (years)	51.54 (10.17)[a]	55.55 (10.33)[b]	62.00 (10.82)	62.46 (10.93)	86.16	0 0001
Education (years)	13.45 (4.26)[a]	12.57 (3.86)	12.22 (4.00)	12.13 (4.28)	7.88	0.0001
BMI (Kg/m2)	24.94 (3.74)[a]	25.76 (3.70)[b]	26.83 (3.89)	27.05 (4.62)	20.11	0.0001
Systolic BP (mmHg)	118.09 (10.65)[a]	149.18 (16.81)[b]	125.36 (9.63)[c]	155.86 (18.25)	552.1	0.0001
Diastolic BP (mmHg)	75.23 (7.75)[a]	96.48 (10.69)[b]	79.62 (7.49)[c]	92.77 (12.58)	349.04	0.0001
Heart Rate (beats per min)	72.58 (10.07)[d]	77.99 (12.12)[b]	67.77 (10.58)[c]	72.69 (12.80)	18.70	0.0001
Mean Arterial BP (mmHg)	89.52 (7.92)[a]	114.01 (10.77)[e]	94.87 (6.79)[e]	113.80 (11.83)	588.2	0.0001
Pharmacological Treatment (numbers)	NA	NA	1.53 (0.69)[c]	1.45 (0.52)	2.34	0.13
Smoking Cigarettes (number per die)	1.29 (3.92)	2.73 (6.58)[f]	1.25 (4.33)	1.27 (4.38)	5.20	0.001
Drink or Wine (number of glasses per day)	0.16 (0.41)[a]	0.32 (0.74)[e]	0.19 (0.43)[c]	0.30 (0.67)	3.97	0.01
Adherence (z score)	NA	NA	0.20 (0.74)	0.07 (0.87)	1.74	0.19
TAS-20* (points)						
Difficulties Identifying Feelings	14.47 (6.40)[g]	15.57 (6.64)	16.25 (6.54)	16.86 (6.43)	2.62	0.05
Difficulties Describing Feelings	12.24 (4.27)	12.76 (4.53)	13.35 (4.87)	13.47 (4.54)	<1	0.70
External Oriented Thinking	18.36 (5.04)	18.48 (4.92)	19.94 (4.67)	20.09 (5.15)[h]	2.30	0.07
Total Score	45.08 (12.00)	46.81 (11.49)	49.54 (12.90)	50.43 (11.85)[h]	2.73	0.04

*Adjusted for covariates (BMI; ages; Years of education).
[a] Normotensive are different from Untreated, Controlled and Uncontrolled Hypertensive
[b] Untreated Hypertensive are different from Controlled and Uncontrolled Hypertensive
[c] Controlled Hypertensive are different from Uncontrolled Hypertensive
[d] Normotensives are different from Untreated and Controlled Hypertensive
[e] Untreated Hypertensive are different from Controlled Hypertensive
[f] Untreated Hypertensive are different from Normotensive, Controlled and Uncontrolled Hypertensive
[g] Normotensive are different from Uncontrolled Hypertensive
[h] Uncontrolled Hypertensive are different from Normotensive and Untreated Hypertensive.

Highlights

- Alexithymia appears to be related to Uncontrolled Hypertension
- Alexithymia is associated with failure in the therapeutic goals in hypertensive patients.
- Alexithymia seems to be associated with higher severity of Hypertension.


1500
PARTICIPANTS
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EXCLUDED FROM
ANALYSIS
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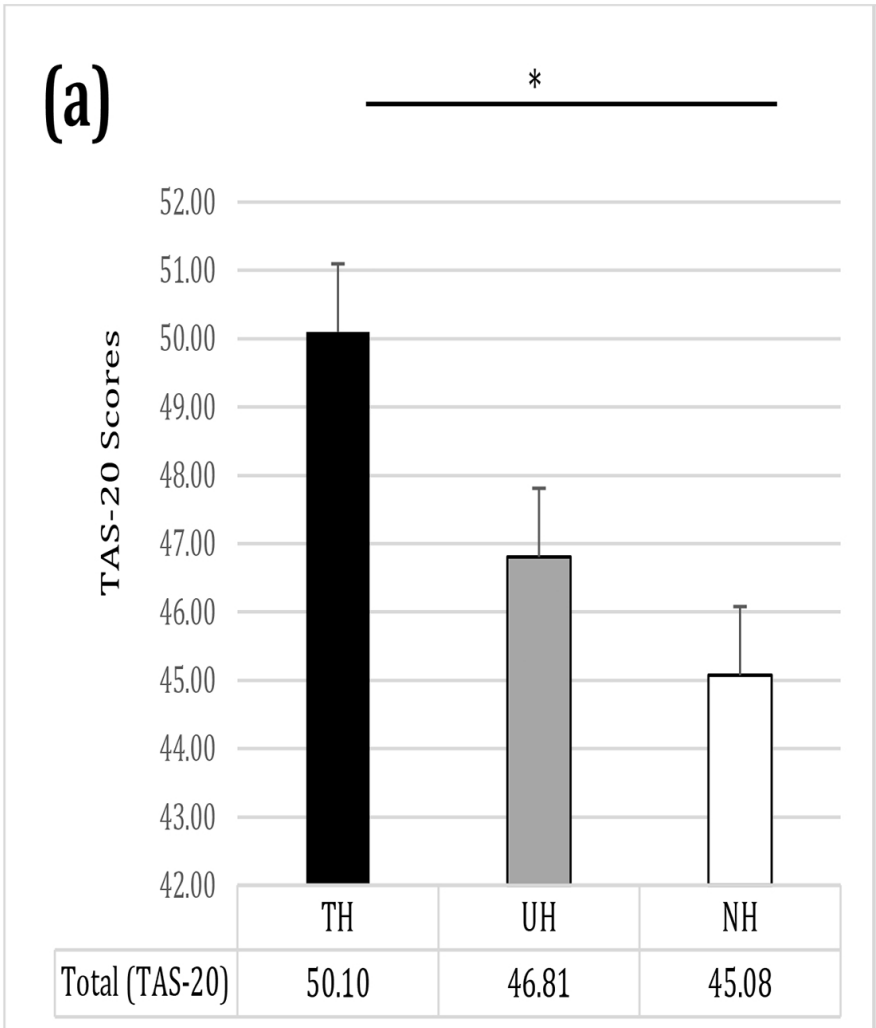
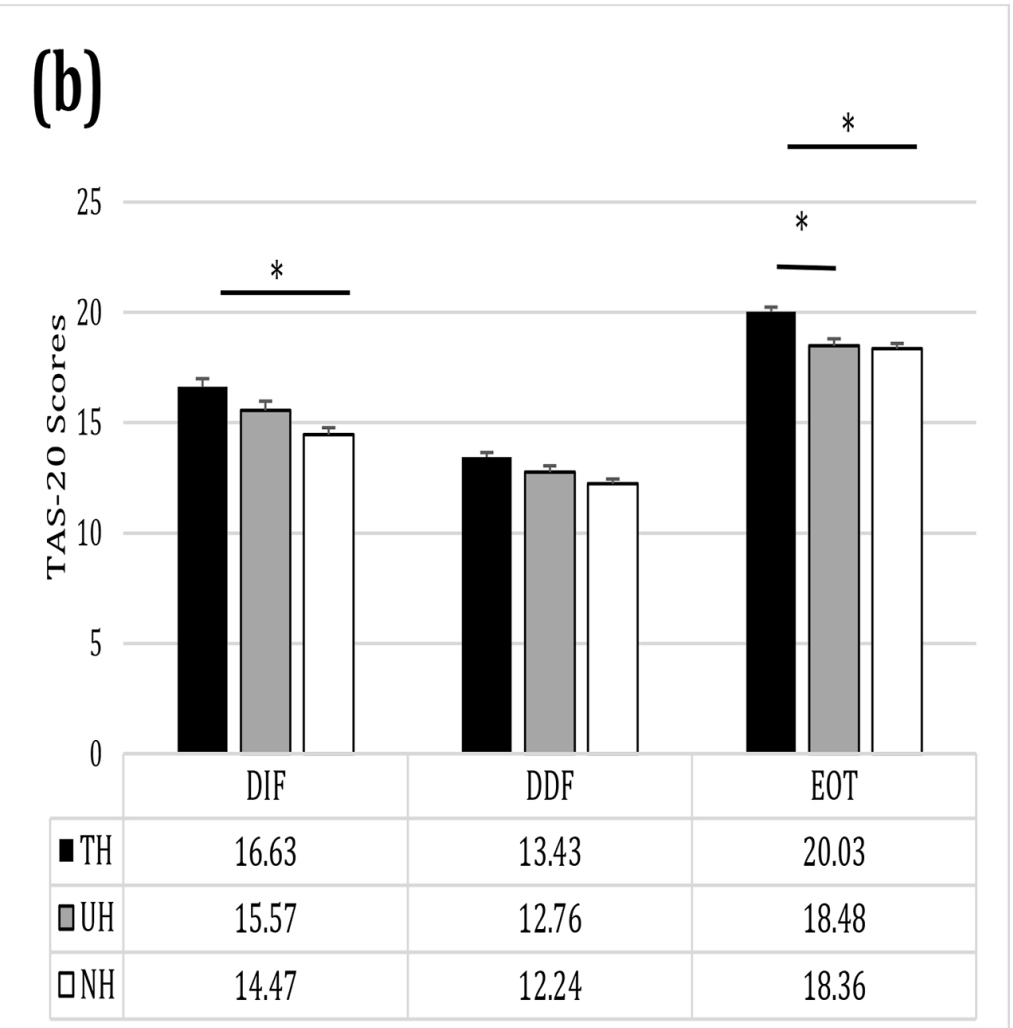
EXCLUDED FOR
NO-DATA ABOUT
MEDICAL TREATMENT
125
EXCLUDED FOR
MEDICAL CONDITION
DIABETES
MELLITUS
(N= 20)
HEART DISEASE
(N= 35)
CANCER
(N= 25)
PSYCHIATRIC
PATHOLOGIES
(N= 30)
RESISTANT
HYPERTENSION
(N=15)
FINAL SAMPLE
(N= 1241)
NORMOTENSIVE
(N= 431)
HYPERTENSIVE
(N= 816)
DRUG
TREATED
(N= 545)
DRUG
UNTREATED
(N= 265)
CONTROLLED
HYPERTENSIVE
(N= 209)
UNCONTROLLED
HYPERTENSIVE
(N= 336)

Figure 1


(a)
*
TAS-20 Scores
52.00
51.00
50.00
49.00
48.00
47.00
46.00
45.00
44.00
43.00
42.00
TH
UH
NH
Total (TAS-20)
50.10
46.81
45.08


(b)
*
*
*
TAS-20 Scores
25
20
15
10
5
0
DIF
DDF
EOT
TH
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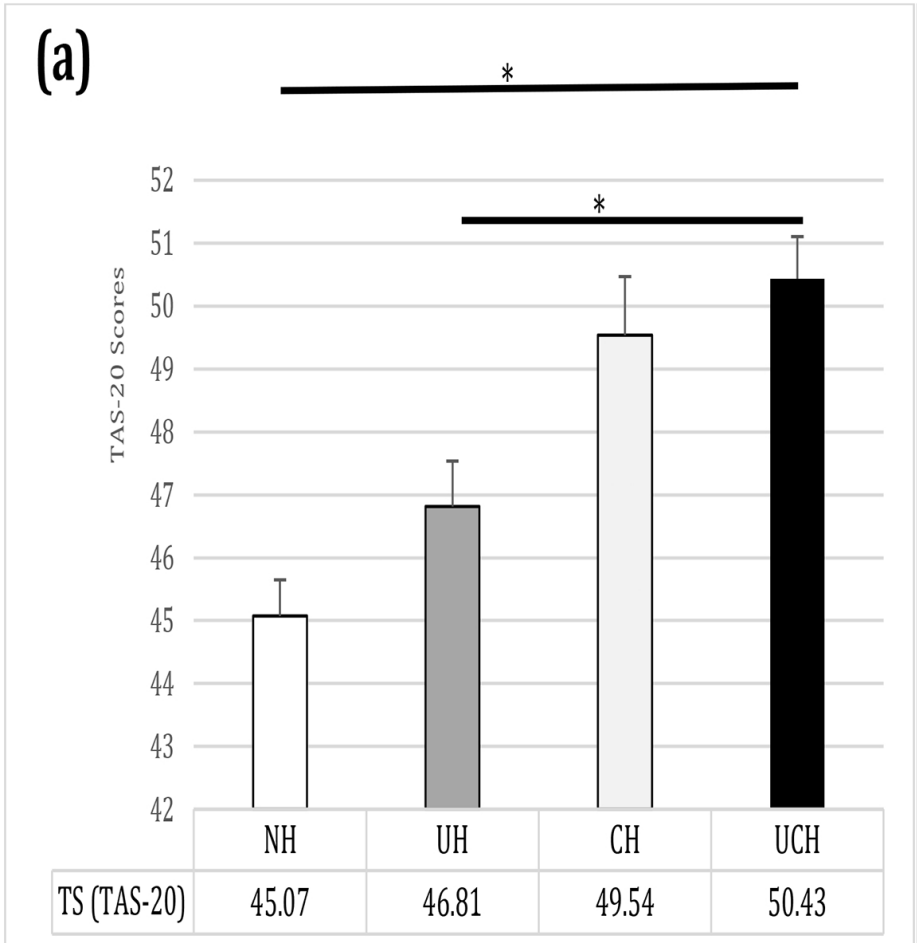
13.43
20.03
UH
15.57
12.76
18.48
NH
14.47
12.24
18.36

Figure 2


(a)
*
*
TAS-20 Scores
52
51
50
49
48
47
46
45
44
43
42
NH
UH
CH
UCH
TS (TAS-20)
45.07
46.81
49.54
50.43

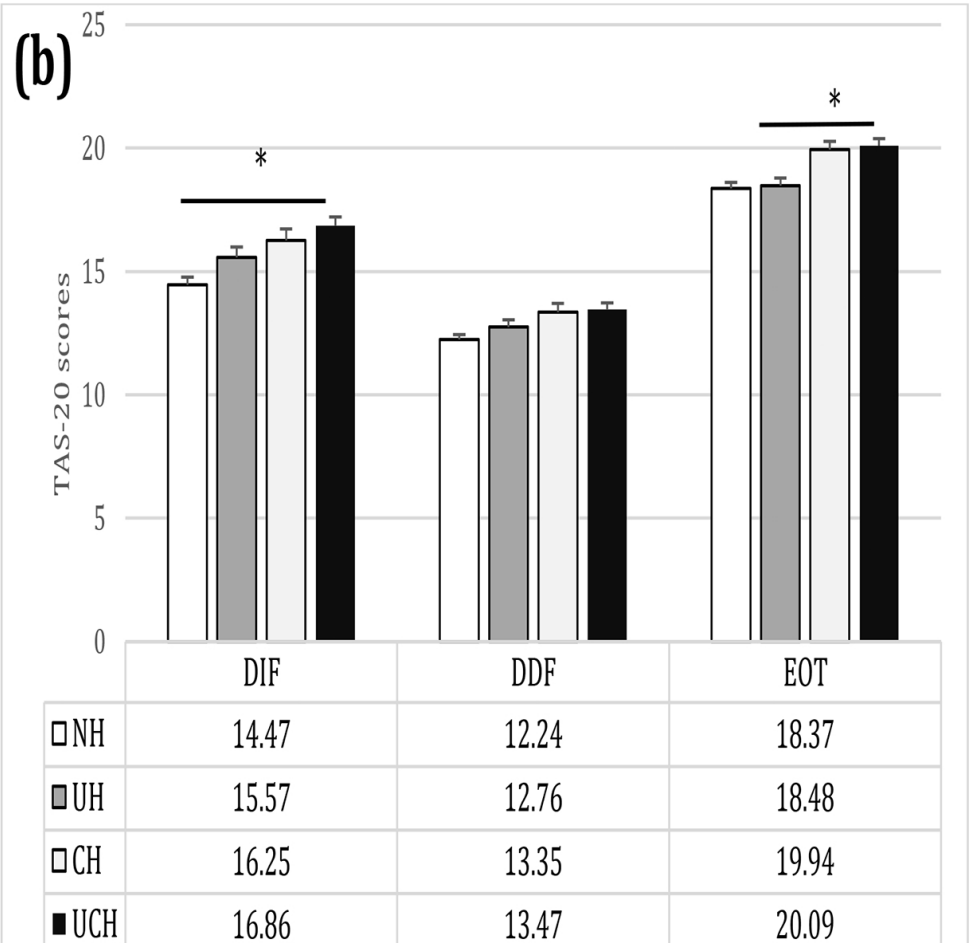

(b)
*
*
TAS-20 scores
25
20
15
10
5
0
DIF
DDF
EOT
NH
14.47
12.24
18.37
UH
15.57
12.76
18.48
CH
16.25
13.35
19.94
UCH
16.86
13.47
20.09

Figure 3