Research Paper

Structural Validity and Psychometric Properties of the Anger Rumination Scale in Spanish: An Analysis of Invariance by Gender, Age and Sample Type in A General Population and A Clinical Sample

Manuel González[1]*, Ignacio Ibáñez[2], Wenceslao Peñate[3], Rosario J. Marrero[4],

Axit Fumero[5], Laureano Lorenzo[6], Pilar Rascón[7]

ABSTRACT

Background: Depressive rumination is considered to be a transdiagnostic construct of multiple emotional disorders, however, the role of anger rumination is less known. **Methods:** We present the structural validity of the Anger Rumination Scale (ARS) in two samples: a general population of N = 536 individuals (M_{age} = 29.9, SD= 12.6) with 59.4% were women and a clinical sample of N = 95 individuals (M_{age} = 43.3, SD= 12.7) with 68% were women. **Results:** An exploratory factor analysis (EFA) isolated three factors that explained 53.7% of the variance after rotation; a confirmatory factor analysis (CFA) indicated a good fit of the data to a model composed of three factors, which we called 1) angry memories (AM) (α = .90), 2) analysis of past anger events (APA) (α = .88), and 3) thoughts of revenge (TR) (α = .76). A multigroup CFA showed that the structural validity of the ARS had metric invariance by gender, age group (i.e., younger than 25 years vs. or older than 25 years) and sample type (i.e., community vs. clinical sample). As regards incremental validity, once depressive rumination was controlled for, angry memories and analysis of past anger events predicted anxiety and depression symptoms. **Conclusions:** Results are discussed according to the studies reviewed. We suggest that anger rumination and depressive rumination are repetitive processes that should be taken into account when assessing anxiety and mood disorders.

[1]Departamento de Psicología Clínica, Psicobiologíaa y Metodología. Facultad de Psicología y Logopedia. Universidad de La Laguna. Tenerife
[2]Departamento de Psicología Clínica, Psicobiologíaa y Metodología. Facultad de Psicología y Logopedia. Universidad de La Laguna. Tenerife
[3]Departamento de Psicología Clínica, Psicobiologíaa y Metodología. Facultad de Psicología y Logopedia. Universidad de La Laguna. Tenerife
[4]Departamento de Psicología Clínica, Psicobiologíaa y Metodología. Facultad de Psicología y Logopedia. Instituto Universitario de Neurociencia (IUNE). Universidad de La Laguna. Tenerife
[5]Departamento de Psicología Clínica, Psicobiologíaa y Metodología. Facultad de Psicología y Logopedia. Instituto Universitario de Neurociencia (IUNE). Universidad de La Laguna. Tenerife
[6]Servicio de Psiquiatría del Hospital Universitario de Canarias. Tenerife. Canarias
[7]Unidad de Salud Mental de Valterra. Servicio Canario de la Salud. Lanzarote. Canarias
*Corresponding Author

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Repetitive negative thinking (RNT) is defined as "repetitive thinking about one or more negative topics that is experienced as difficult to control" (Ehring & Watkins, 2008, p. 193). Depressive rumination and anger rumination are associated to RNT (Besharat et al., 2013; Nolen-Hoeksema & Morrow, 1991; Sukhodolsky et al., 2001; Toro et al., 2020). These two rumination processes have some negative consequences, in particular: a) they exacerbate the psychopathologies, since they magnify and prolong negative affect, and b) they interfere with therapy because they limit the effectiveness of psychological interventions (McEvoy et al., 2018; Watkins & Roberts, 2020).

The Response Styles Theory postulates that depressive rumination is a response to negative affect (Watkins & Roberts, 2020) and defines it as a dispositional tendency to repetitively concentrate on the nature and implications of one's own negative feelings (Nolen-Hoeksema, 1991). Two types of rumination are distinguished: brooding and reflection (Treynor et al., 2003) (for a review, see, for example, González et al., 2017).

As regards anger rumination, the Multiple Systems Model of Angry Rumination defines it as "persevering thoughts about a personally significant event that […] leads to anger" (Denson, 2013, p. 1). These thoughts increase the level of anger and perceived loss of control and can also be accompanied by angry feelings or thoughts of revenge (Sukhodolsky et al., 2001) (for a review, see, for example, Denson, 2013).

Both theoretical models consider that depressive rumination and depressive symptoms as well as anger rumination and anger influence each other bidirectionally and recursively (Denson, 2013; Whisman et al., 2020).

Depressive rumination is considered to be a transdiagnostic construct of multiple emotional disorders (Johnson et al., 2016). However, the role of anger rumination is less known, as both constructs involve a pattern of repetitive negative thoughts that intensify and prolong negative affect. Although different, both are constructs related to anxiety and depression (Besharat et al., 2013; Denson, 2013; du Pont et al., 2018; Watkins & Roberts, 2020; Whisman et al., 2020).

Anger rumination is assessed with the Anger Rumination Scale (ARS; Sukhodolsky et al., 2001). This scale has been found to measure four factors that have been called 1) Angry Memories, 2) Understanding the Causes of Anger, 3) Angry Afterthoughts, and 4) Thoughts of Revenge. This structure has been replicated in several countries including Brazil, United Kingdom, Hong Kong, France, Spain, Australia-Spain, Turkey, Iran, and Colombia (Besharat, 2011; Magán et al., 2016; Maxwell et al., 2005; Ortega-Andrade et al., 2017; Ramos-Cejudo et al., 2017; Reynes et al., 2013, Satici, 2014; Sukhodolsky et al., 2001; Toro et al., 2020), with alpha coefficients ranging from .72 to .86 (Ramos-Cejudo et al., 2017; Sukhodolsky et al., 2001). As regards convergent validity, studies show that the four factors are related to the trait anger, depression, and anxiety (Magán et al., 2016; Ramos-Cejudo et al., 2017).

The studies reviewed suggest that the ARS has good structural validity. However, we consider that those studies have some shortcomings, in particular: 1) Although most studies

have focused on the relationship between anger rumination and aggression (Magán et al., 2016; Ortega-Andrade et al., 2017; Ramos-Cejudo et al., 2017; Toro et al., 2020), few studies have associated anger rumination with anxiety and depression symptoms, at least at the predictive level; 2) Very few studies included an analysis of factorial invariance by gender, age group and with a community sample vs. a clinical sample. An important question regarding the anger rumination constructs its accuracy to detect real differences between groups. Measurement invariance is considered important in assessments of cross-cultural populations because it is essential to compare scores between groups. In fact, measurement invariance addresses the key question of measuring latent constructs between multiple groups. The most usual measurement invariances are configuration invariance, metric invariance and scalar invariance (Kline, 2015; Putnick & Bornstein; 2016; Xu & Traceya, 2017); 3) We are not aware of any studies about the incremental validity of the factors of the ARS scale that explain whether the factors of the ARS contribute to the additional explanation of anxiety and depression symptoms after controlling for depressive rumination (brooding and reflection).

In the study 1) we analyzed the construct validity of the Anger Rumination Scale (ARS) using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA); 2) we explored convergent and discriminant validity with brooding, reflection, depression and anxiety; 3) we examined measurement invariance with a multigroup confirmatory factor analysis (MCFA) by gender and age group and in a community sample vs. a clinical sample; and 4) we calculated the incremental predictive validity to explain the variation in anxiety and depression after controlling for brooding and reflection.

METHOD
Participants
Community sample
This sample is from Tenerife Island (Canary Islands) was composed of 536 individuals from the general population with a mean age of 29.9 years (SD =12.6), an age range from 18 to 68 years and a mode of 21 years. Of these, 59.4% were women and 40.6% were men. As regards level of education, 5.6% had primary education, 45.6% had secondary education, 19.5% had short-cycle higher education degrees and 29.4% had bachelor's degrees. As regards their occupational status, 46.5% were students, 37.6% had a paid job, 12.2% were unemployed and 3.8% were retired. As regards civil status, 59.7% were single, 34.5% were married or cohabiting with a partner, 5.4% were divorced or separated and 0.3% were widowed. Finally, 24.2% of participants were from rural areas and 75.8% were from urban areas.

Clinical sample
This sample is from Lanzarote Island (Canary Islands) was composed 95 individuals with a mean age of 40.3 years (SD =12.6), an age range from 18 to 71 years and a mode of 43 years. Of these, 68% were women and 32% were men. As regards level of education, 43.3% had primary education, 11.9% had secondary education, 19.5% had short-cycle higher education degrees and 32.8% had bachelor's degrees. As regards their occupation, 40.3% were students, 26.8% had a paid job, 32.8% were unemployed and 3.8% were retired. As for civil status, 94.03% were single and 5.97% were married or cohabiting with a partner. Finally, 100% of the sample came from rural areas. Among participants, 53.8% had a diagnosis of probable depression, while 46.2% had moderate or mild symptoms of

depression. Moreover, 48.3% had anxiety and 51.7% had moderate or mild symptoms of anxiety. The clinical sample was selected by the authors L.L. and P. G., who are clinical psychologists. The research was approved by the Research Ethics Committee of Dr. Negrín University Hospital of Gran Canaria. The clinical sample was referred by the primary care physicians of the health centers to the Mental Health Unit. The inclusion criteria were being a male or female over 18 years of age and to present symptoms of anxiety and/or depression. Exclusion criteria were having psychotic episodes, addictive disorders, personality disorders or significant cognitive impairment.

As regards age group, N = 338 (53.9%) participants were under 25 years and N = 290 (46.1%) were over 25 years. No differences were found in gender (χ^2 = .15, df, p ≤ .694) or place of residence (χ^2 = .60, df, p ≤ .435).

Instruments

- **The Spanish adaptation (Magán et al., 2016) of the Anger Rumination Scale (ARS; Sukhodolsky et al., 2001).** The scale is composed of 19 items and assesses four factors: Thoughts of Revenge (4 items, α = .72), Angry Afterthoughts (6 items, α = .86), Angry Memories (5 items, α = .85), and Understanding the Causes of Anger (4 items, α = .77). It is responded on a Likert scale from 1 (almost never) to 4 (almost always). In this study, internal consistency was α = 94 and ω =.94 in the total scale, α=.88 and ω =.89 in analysis of past anger events, α = .90 and ω = .90 in angry memories and α = .76 and ω = .79 in thoughts of revenge.
- **The Depression, Anxiety and Stress Scales (DASS-21, Lovibond & Lovibond, 1995).** This instrument measures current symptoms of depression and anxiety. We used the short 21-item version and only the anxiety and depression scales. The Spanish version by Bados was used in this study. The total scale had an internal consistency of .95 and a test-retest reliability of .55 (Bados et al., 2005). The study shows the internal consistency α= .85 and ω = .86 for the anxiety scale and α= .90 and ω =.90 for the depression scale.
- **The Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991).** This is a 5-point scale made up of 10 items ranging from "strongly disagree" to "strongly agree". Internal consistency is α = α= .86 and ω = .86 for brooding and α = .78 and ω =.78 for reflection. The Spanish version by Hervás was used in this study (Hervás, 2008). In this study, internal consistency was .79 for brooding and .75 for reflection.

Procedure
In the community sample, a total of 15 students who were working on their final year dissertation were trained through role playing to administer questionnaires. They were asked to recruit a group of 8 to 10 adults over 18 years old from their close circle through snowball sampling (Thomson, 2002). Participants received an envelope with instructions on how to respond to each questionnaire and a contact telephone number; they gave their written informed consent. The research was approved by the Research Ethics and Animal Welfare Committee of the University of La Laguna, Spain.

Statistical analysis of the data
The statistical analyses were performed using JASP software, version 0.18.3.0. The construct validity of the Anger Rumination Scale (ARS) was calculated with an exploratory

factor analysis (EFA) using principal axis extraction and promax rotation and saturation greater than or equal to 0.30 and an eigenvalue $\geq$ 1. The Kaiser-Meyer-Olkin Index (KMO) and Bartlett's test of sphericity. The reliability of the ARS was calculated with an internal consistency analysis (Cronbach's alpha). We performed a confirmatory factor analysis (CFA) according to the number of factors extracted in the EFA, which we compared to at least three of the studies reviewed. The goodness of fit of the models was assessed with several fit indices such as the chi-square ($\chi 2$) statistic, in which lower values indicate better fit and the ratio between the $\chi 2$ and degrees of freedom ($\chi 2/df$) must be < 3 for an acceptable fit (Kline, 2015). We also used the comparative fit index (CFI) and the Tucker-Lewis Index (TLI). Specifically, it was considered that values $\geq$ .90 indicated acceptable fit and values $\geq$ .95 indicated good fit of the model. The standardized root means square residual (SRMR) and root mean square error of approximation (RMSEA) were also calculated to determine the fit of the model. RMSEA values < .06 and SRMR values < .08 were considered to indicate good fit of the model and RMSEA values between .06 and .08 were considered to indicate acceptable fit, with a 90% confidence interval (Hu & Bentler, 1998). We performed a multigroup confirmatory factor analysis (MCFA) by gender, age, and sample type (i.e., community sample vs. clinical sample).

We calculated zero-order and partial correlation coefficients (Pearson's r) to identify the relationships between the factors assessed by the ARS and the criterion variables anxiety, depression, brooding and reflection, as well as partial correlations with brooding and reflection as covariables. To determine the incremental validity of the ARS, we conducted multiple hierarchical regression analyses with anxiety and depression as dependent variables, and the factors of the ARS and brooding and reflection as independent variables. Brooding and reflection were entered in the first step and the ARS factors were entered in the second step. An evaluation in terms of the VIF and tolerance values specified by Kline (2015) suggested the absence of multicollinearity problems in the current study.

The multicollinearity assumption was evaluated with variance inflation factor (VIF) and tolerance values. In the current study, the VIF value was found to be 1.01 while the tolerance value was .98.

RESULTS

Structural validity I: exploratory factor analysis

We conducted an exploratory factor analysis (EFA) it is carried out on the matrix of polychromic correlations and ML (maximum likelihood) by extracting the main factors with promax rotation ant the principal axis factoring method. Kaiser-Meyer-Olkin Index (KMO = .954, p < .001, which is greater than .60, indicating sample adequacy, Bartlett's of sphericity test ($\chi 2$ $_{(171)}$ = 6358, p <.001). The number of factors was determined with Horn's parallel analysis (1969), which recommended retaining three factors with item loadings equal to or greater than .30. The three factors explained 53.7% of the variance after rotation. Table 1 shows item loadings on each factor and eigenvalues. The first factor was called angry memories (AM) and was composed of eight items. The second was called analysis of past anger events (APA) and included seven items; the third factor was called thoughts of revenge (TR) and was composed of four items. Of the four items of the factor Understanding the Causes of Anger, two loaded on APA: items 10 and 11. Items 12 and 16 loaded on the AM factor. Item 19 loaded on factors APA and TR but, given that the loading was higher on factor APA, it

was assigned to this factor. The correlation coefficients between AM and APA is .79, and AM with TR is .46, and between APA and TR is .48.

Table 1 Factor structure of the Anger Rumination Scale (ARS) for three factors

	Three factors			
	AM	APA	TR	h^2
1. I ruminate about my past anger experiences.	.59			.58
2. I ponder about the injustices that have been done to me.	.86			.41
3. I keep thinking about events that angered me for a long time.	.71			.36
4. I have long living fantasies of revenge after the conflict is over.			.78	.37
5. I think about certain events from a long time ago and they still make me angry.	.59			.40
6. I have difficulty forgiving people who have hurt me.			.30	.75
7. After an argument is over, I keep fighting with this person in my imagination.		.47		.59
8. Memories of being aggravated pop up into my mind before I fall asleep.		.53		.49
9. Whenever I experience anger, I keep thinking about it for a while.		.89		.32
10. I have had times when I could not stop being preoccupied with a particular conflict.		.74		.29
11. I analyze events that make me angry.		.55		.67
12. I think about the reasons people treat me badly.	.55			.56
13. I have day dreams and fantasies of violent nature.			.64	.57
14. II feel angry about certain things in my life.	.68			.47
15. When someone makes me angry I can't stop thinking about how to get back at this person.			.87	.24
16. When someone provokes me, I keep wondering why this should have happened to me.	.71			.46
17. Memories of even minor annoyances bother me for a while.	.53			.37
18. When something makes me angry, I turn this matter over and over again in my mind.		.72		.30
19. I re-enact the anger episode in my mind after it has happened.		.41	.34	.48
Eigenvalue	4.12	3.69	2.40	
% total variance	21.7	19.4	12.6	
% accumulated variance	21.7	41.1	53.7	

Note: AM = angry memories; APA = analysis of past anger events; TR = thoughts of revenge

Structural validity II: confirmatory factor analysis

We conducted a confirmatory factor analysis (CFA) comparing the following models: 1) two four-factor models – the Sudkholosky model or MSu (Sukhodolsky et al., 2001) and the Magan model or MMa (Magán et al., 2016) – and 2) the three-factor model yielded by the EFA of this study or MB. Table 2 shows the results. Of the two four-factor models, the MSu and the MMa met the goodness of fit criteria so they were considered adequate. The three-factor model (MB) of this study obtained the best fit indices, as shown by the χ^2/df ratio = 2.26, which was lower than 3 (Kline, 2015), and by the CFI, TLI, SRMR and RMSEA. The single-factor MB1 model has a significantly worse fit than the MB model ($\chi^2_{(3)}$ =1069, p <.001), χ^2/df = 7.03; CFI=.855).

Table 2 Goodness-of-fit indices of the three-factor model vs. competing models

	IF	χ^2	df	χ^2/df	CFI	TLI	SRMR	RMSEA	90%CI	p
MSu	4	527	128	4.11	.934	.921	.052	.071	.065-.077	.001
MMa	4	617	146	4.22	.929	.916	.053	.072	.066-.078	.001
MB	3	338	149	2.26	.941	.933	.051	.064	.058-.070	.001
MB1	1	1069	152	7.03	.855.	.837	.060	.099	.094-.105	.001

Note: IF = isolated factors; MSu = four-factor model (Sukhodolsky et al., 2001); MMa = four-factor model (Magán et al., 2016); MB = three-factor model in this study; MB1 = One factor model

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Structural validity III: analysis of invariance by gender, age group and sample type (community vs. clinical sample)

Table 3 shows the comparison between the MB basic model of this study in men and women. The women's model (MBw) and the men's model (MBm) obtained adequate fit indices. Both models showed differences with one another and with the MB basic model. Specifically, the fit indices ΔCFI and ΔTLI $\leq$ 0.01 and ΔRMSEA $\leq$ 0.015 (Kline, 2015) were adequate so there were no statistically significant differences between the total sample (MB) and the models for each gender. The correlation coefficients between AM and APA is .32, and AM with TR is .24, and between APA and TR is .27.

We used a multigroup CFA (MCFA) to assess the factor invariance of the MB model both by gender, age group and sample type (community vs. clinical sample). As usual, we worked with nested models, increasing the number of restrictions in each one. We compared the configural invariance model (i.e., equivalence in the model structures: number of factors and pattern of factor loadings) to the metric invariance model (i.e., equivalence of factor loadings). To test for strong invariance, an additional progressive restriction was added on the intercepts to verify whether the test was invariant or not at scalar level. Specifically, the aim was to check if the response profiles and the ARS structure were similar or not between the nested groups.

For this purpose, three types of invariances were evaluated: configural invariance, in which the number of factors, in this case one, and the patterns of factor loadings were freely estimated for both groups; metric invariance, in which the factor loadings were restricted to be equal; and scalar or strong metric invariance, in which the intercepts were also restricted to be equal. To assess whether these progressively more restrictive models differed from each other, the difference in Chi-square, as well as the comparative fit indices proposed by Millsap and Cham (2012) and Chen (2007) were used as criteria: values less than .010 in the CFI, .05 in the TLI and .015 in the RMSEA were considered as indicators of equivalence of the models.

Table 3 shows configural (MBc), metric (MBm) and scalar (MBs) invariance for gender and age group; incremental fit indices were below the established criteria (ΔCFI & ΔTLI $\leq$ 0.01 and ΔRMSEA $\leq$ 0.015) (Cheung & Rensvold, 2002) to support non-equivalence. We can therefore conclude that the structure of the ARS was similar in terms of gender and age group.

We performed a separate CFA for the community and the clinical sample, considering the basic model (MB). Table 3 shows that the fit indices were adequate for the community sample (MBco) and the clinical sample (MBcl). We therefore concluded that the structure of the ARS did not differ between the community and clinical sample. The MCFA showed metric invariance between both samples; ΔCFI $\leq$ -.003, ΔTLI $\leq$ -.002 and ΔRMSEA $\leq$ -.01 were lower than the recommended criteria of $\leq$ 0.01 and $\leq$ 0.015 (Cheung & Rensvold, 2002), which suggests invariance between samples.

In summary, these results demostraste that the structural validity of the Anger Rumination Scale remained invariance by gender, age group and sample type (community vs. clinical sample)[8].

Table 3 Confirmatory factor analysis (CFA) and multigroup confirmatory factor analysis (MCFA) by gender, age group and sample type (community vs. clinical) and goodness-of-fit indices for the ARS models contrasted

	IF	χ^2	df	χ^2/df	CFI	TLI	SRMR	RMSEA	MCON	ΔCFI	ΔTLI	ΔRMSEA	ΔSRMR
MB	3	338	149	2.26	.941	.933	.051	.064					
Gender													
MBw	3	356	149	2.38	.934	.924	.057	.070	MB-MBw	.007	.009	.006	.006
MBm	3	271	149	1.81	.930	.920	.057	.065	MB-MBm	.011	.007	.006	.001
									MBw-MBm	.004	.004	0	.005
Gender													
MBc		665	298	2.23	.929	.919	.058	.071					
MBm		684	314	2.17	.929	.922	.065	.069	MBc-MBm	.004	.001	0	.013
MBs		712	330	2.15	.926	.923	.063	.068	MBw-MBe	.002	.001	.001	.002
Age													
MB≤25		371	149	2.48	.931	.920	.052	.067					
MB≥25		432	149	2.89	.918	.906	.062	.082	MB≤25-MB≥25	.013	.014	.01	.015
MBagc		804	298	2.69	.924	.913	.057	.074					
MBagm		825	314	2.62	.923	.917	.064	.073	MBagc-MBagm	.001	.004	.007	.001
MBags		891	330	2.70	.916	.913	.063	.074	MBagm-MBags	.007	.004	.001	.001
Sample													
MBco		511	149	3.42	.931	.920	.052	.067					
MBcl		198	149*	1.32	.934	.922	.078	.077	MBco-MBcl	-.003	-.002	-.026	-.01
MBc		710	298	2.38	.931	.921	.055	.068					
MBmt		726	314	2.31	.931	.925	.059	.066	MBc-MBmt	0	-.004	-.004	.002
MBs		751	330	2.27	.929	.927	.057	.065	MBmt-MBs	.002	-.002	.002	.001

Note: * = p ≤ 004; IF = isolated factors, MCON= model contrasted; MB= three-factor model in this study; MBw = three-factor model-women; MBm = three-factor model-men; MBc = three-factor model-configural; MBm = three-factor model-metric; MBs= three-factor model-scalar; MBa = three-factor model-age; MBagc= three-factor model_age-configural; MBagm= three-factor model_age-metric; MBags = three-factor model_age-scalar; MBco= community sample three-factor model, MBcl = clinical sample three-factor model; χ^2 = chi-square; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation

Convergent and discriminant validity of the ARS: correlation analyses

Table 4 shows zero-order Pearson *r* correlation coefficients. Both AM and APA were correlated with depression, anxiety and brooding. They were also correlated with reflection, although with lower coefficients. Thoughts of revenge (TR) had coefficients greater than .30 with depression but were not correlated with reflection. The three anger rumination factors had higher correlations with brooding than with reflection.

As regards partial correlations, when brooding and reflection were controlled for, there were statistically significant differences between APA and anxiety (z = 2.41, p ≤ .01) and depression (z = 2.58, p ≤ .01) and also between AM and anxiety (z = 2.97, p ≤ .003) and depression (z = 2.00, p ≤ .04).

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[8] Differences in chi-square (χ^2) and degrees of freedom (df) in all the analyses were p ≤ .001, except between the community sample (MBco) and the clinical sample (MBcl), which were p ≤ .004.

Table 4 Correlation coefficients (zero order, above the diagonal, and partial, below the diagonal) between the ARS factors with state and trait anger, rumination, anxiety and depression

	AM	APA	TR	BRO	REF	AN	DE
AM		.78***	,57***	.43***	.28***	**.44*****	**.46*****
APA	.73***		,57***	.56***	.27***	**.47*****	**.53*****
TR	.53***	.54***		.27***	.05	.29***	.31***
BRO					.40***	.39***	.46***
REF						.27***	.26***
AN	**.32*****	**.32*****	.22***				.77***
DE	**.33*****	**.36*****	.23***			.72***	

Note: AM = angry memories; APA = analysis of past anger events; TR = thoughts of revenge; BRO = brooding; REF = reflection; AN = anxiety; DE = depression. In bold, coefficients with statistically significant z; * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Incremental validity of the ARS: regression analyses

The tolerance of the regression analysis was estimated to range from .42 to .75, and the VIF was estimated to range from 1.34 to 3.40, indicating no multicollinearity between the nine predictor variables. Table 5 shows the results of the regression analyses. When predicting anxiety symptoms, brooding and reflection contributed to 17% of the variance. Once they were controlled for, the two factors of the ARS predicted an additional 8%. In the prediction of depressive symptoms, only brooding explained 23% of the variance. Once it was controlled for, angry memories (AM) and analysis of past anger events (APA) predicted an additional 9% of the variance. Thoughts of revenge did not contribute to the prediction of anxiety or depression symptoms. Therefore, anxiety and depression shared brooding, angry memories, and analysis of past anger events. Thoughts of revenge did not explain anxiety or depression in a statistically significant way.

Table 5 Regression analysis between predictor variables (i.e., brooding, reflection, angry memories, analysis of past anger events; thoughts of revenge) and criterion variables (i.e., anxiety and depression)

CV	Model	PV	B	β	R^2	ΔR^2	SE B	t	p	95% CI	
										LL	UL
		Intercept	-5.64				1.29	-4.37	.001		
ANXIETY		BRO	.92	.34			.11	7.98	.001	.260	.431
	1	REF	.32	.13	.17		.10	3.08	.002	.048	.218
		Intercept	-8.69				1.34	-6.45	.001		
		AM	.32	.21			.10	3.05	.002	.074	.342
		APA	.23	.15			.09	2.34	.019	.024	.270
	2	TR	.04	.01	.26	.08	.15	.26	.795	-.081	.106
DEPRESSION		Intercept	-7.99				1.35	-5.90	.001		
		BRO	1.25	.44			.12	10.40	.001	.353	.518
	1	REF	.24	.09	.23		.11	2.12	.034	.006	.171
		Intercept	-11.21				1.39	-8.03	.001		
		AM	.52	.21			.11	4.77	.001	.183	.438
		APA	.133	.15			.10	1.27	.204	-.041	.194
	2	TR	-.00	.01	.32	.09	.15	-.03	.974	-.090	.087

Note. CV = Criterion Variables; PV= Predictors variables; R^2 = determination coefficient; CI = Confidence interval; LL = Lower limit; UL = Upper limit; AM = angry memories; APA = analysis of past anger events; TR = thoughts of revenge; BRO = brooding; REF = reflection.

DISCUSSION

In this study we analyzed the structural validity of the ARS in a general population sample and a clinical sample. We isolated three factors instead of the four factors isolated in the studies reviewed (Magán et al., 2016; Ortega-Andrade et al., 2017; Ramos-Cejudo et al., 2017; Sukhodolsky et al., 2001). This three-factor structure showed a higher fit in all the fit indices, with adequate values (CFI=.941 and TLI= .933), SRMR = .051, RMSEA = .064 (90% CI, .058 - .077) (Hu & Bentler, 1999) and a χ^2/df ratio = 2.26, that is, below 3 (Kline, 2015). The four-factor structure of the original authors (Sukhodolsky et al., 2001) and that of a Spanish sample (Magán et al., 2016) obtained adequate fit indices.

The analyses of measurement invariance by gender, age group (≤ 25 and ≥ 25 years) and sample type (community vs. clinical sample) showed a total configural, metric and scalar invariance for gender and age group that was consistent with a previous study of the ARS with four factors (Toro et al., 2020) and for the community vs. clinical sample. However, the three-factor structure of this study showed the greatest parsimony and was the most consistent and feasible one from a conceptual and methodological point of view.

We called the factors 1) angry memories (AM), 2) analysis of past anger events (APA) and 3) thoughts of revenge (TR). They had an internal consistency ranging between .81 and. 94, slightly higher than that found in the studies reviewed (Magán et al., 2016; Ramos-Cejudo et al., 2017; Sukhodolsky et al., 2001).

The four items related to understanding of causes were included in the factors angry memories (AM) and analysis of past anger events (APA). Specifically, items related to past verb tenses showed loadings on APA, for example, item 10, "I have had times when I could not stop being preoccupied with a particular conflict" and item 11 "I analyze events that make me angry". Items referring to subsequent thinking showed loadings on AM, such as item 12 "I think about the reasons people treat me badly" and item 16 "When someone provokes me, I keep wondering why this should have happened to me". These results suggest that individuals can reflect upon or analyze the causes of anger. It can be seen as a process of understanding an episode of anger, which is one of the first emotional regulation skills (Gratz & Roemer, 2004).

As regards convergent and discriminant validity, the three factors of the ARS had higher correlation coefficients with brooding, depression, and anxiety (Besharat et al., 2013; du Pont et al., 2018; Magán et al., 2016; Ortega-Andrade et al., 2017; Ramos-Cejudo et al., 2017; Sukhodolsky et al., 2001; Toro et al., 2020), and lower ones with reflection (McLaughlin & Nolen-Hoeksema, 2011).

As regards partial correlation, when we controlled for brooding and reflection, we found statistically significant differences between the correlation coefficients of both AM and APA factors with anxiety and depression. Specifically, the two factors of anger rumination seem to be a shared factor with anxiety and depression that may explain the comorbidity between these disorders (Watkins & Roberts, 2020). As regards incremental validity, angry memories and analysis of past anger events were the strongest predictors of each of the criterion variables – anxiety and depression. They represented between 10 and 12% of the variance explained by the final models, respectively. These results corroborate the criterion and discriminant validity of the ARS and suggest that it captures a unique variation in the

symptoms of anxiety and depression that cannot be attributed to their overlap with other negative thoughts such as depressive rumination with its two constructs: brooding and reflection.

As we pointed out, depressive rumination and depressive symptoms on one side and anger rumination and anger on the other side influence each other mutually in a bidirectional and recursive way (Denson, 2013; Whisman et al., 2020). In this regard, the Emotional Cascade Model argues that rumination and negative emotions worsen each other synergistically and progressively, which results in an aversive experience that rapidly intensifies over time (Selby & Joiner, 2013). In addition, the resulting negative affect is transferred to related experiences and thoughts, regardless of valence (Ryckman & Lambert, 2015). Thus, rumination may contribute to explain the overlap between the three main negative emotions such as trait anger, depression, and anxiety, as well as the high comorbidity between depression and anxiety disorders and dysfunctional anger (McLaughlin & Nolen-Hoeksema, 2011).

In this study we provide responses to some questions raised, specifically: a) the ARS has a multidimensional structure instead of the unidimensional structure suggested by some authors (Sukhodolsky et al., 2001); b) anger rumination and depressive rumination, which share repetitive negative thoughts such as brooding and reflection, are two constructs that are related to but different from anxiety and depression; c) the structural validity of the ARS is invariant by gender, age group and sample type (community vs. clinical sample); and d) results of the incremental validity analyses revealed that two subscales of the ARS – angry memories and analysis of past anger events – explained a significant variance in depression and anxiety symptoms that exceeded the variance explained by brooding and reflection. It can therefore be stated that the ARS is a useful tool to assess anger rumination. Moreover, given our results, anger rumination should be included in the assessment of anxiety and depression along with the constructs brooding and reflection. The reason is that, although anger or irritability are not considered a specific diagnostic entity, they can be found in several disorders such as post-traumatic stress, generalized anxiety, bipolar disorder, impulse control disorders and borderline personality disorder (DSM-5, APA, 2013).

It is important to note some limitations of this study. It was a cross-sectional study, so it would be desirable to conduct longitudinal studies to determine the temporal stability of the isolated factors. It would also be good to have a broader clinical sample and assess 1) cognitive processes such as trait worry and 2) positive and negative beliefs about anger and anger rumination as well as other psychopathological constructs such as social anxiety, obsessive-compulsive symptoms, post-traumatic stress symptoms, panic disorder and generalized anxiety.

These results have clinical implications, given that individuals with high levels of anger and consequently of anger rumination can benefit from interventions aimed at this cognitive style. Metacognitive therapy and cognitive-behavioral therapy focused on rumination have proven their effectiveness in the treatment of depressive rumination (Watkins, 2016; Wells et al., 2012).

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