Autonomous Sensory Meridian Response self-reporters showed higher scores for cognitive reappraisal as an emotion regulation strategy

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Abstract

Background: Autonomous Sensory Meridian Response (ASMR) describes the experience of a pleasant tingling sensation along the back of the head, accompanied with a feeling of well-being and relaxation, in response to specific audio-visual stimuli, such as whispers, soft sounds, and personal attention. Previous works have assessed individual variations in personality traits associated with ASMR, but no research to date has explored differences in emotion regulation associated with ASMR. This omission occurred even when ASMR, a sensory-emotional experience, has been proposed to be located in a sound sensitivity spectrum as the opposite end of misophonia, a phenomenon associated with difficulties regulating emotions. The present work aimed to assess group differences between ASMR self-reporters and non-ASMR controls associated with emotion regulation strategies.

Methods: We used the validated Spanish version of the Emotion Regulation Questionnaire to assess individual differences in the use of cognitive reappraisal and expressive suppression.

Results: Our results showed that participants who experience ASMR had higher scores in the cognitive reappraisal subscale of the emotion regulation questionnaire than the non-ASMR group.

Conclusions: Individuals who experience ASMR reported higher use of cognitive reevaluation of emotionally arousing situations, suggesting more effectiveness in regulating emotions. Our finding further elucidates individual differences related to this experience, supporting that ASMR is a real psychophysiological phenomenon associated with other psychological constructs and has remarkable consequences in affective/emotional dimensions and general well-being.

1 Introduction

Autonomous Sensory Meridian Response (ASMR) describes the experience of a pleasant tingling sensation along the back of the head and neck region, at times spreading to other areas of the body, in response to specific visual and auditory stimuli (Barratt & Davis, 2015). Usually, ASMR is triggered by whispers, soft sounds made with the fingers on a surface, and personal attention from someone with an affectionate disposition (Barratt, Spence, & Davis, 2017; Fredborg, Clark, & Smith, 2017; Poerio, Blakey, Hostler, & Veltri, 2018).

This non-scientific term "ASMR" was coined just in 2010 (del Campo & Kehle, 2016; Morris, 2018). During the last decade, social networks have made it possible to publicize this phenomenon and quickly disseminate different personal reports on this experience, along with the creation of videos ("ASMR videos") that simulate or accentuate the stimuli to trigger the sensation in people who watch/listen to them (del Campo & Kehle, 2016). Anecdotal accounts and early research have shown that ASMR seems to be experienced by only part of the population, and therefore some individuals do not experience it (Barratt & Davis, 2015; del Campo & Kehle, 2016). There are no studies to date about the prevalence of ASMR-capability in the general population; however, some studies have offered some estimates suggesting the phenomenon is widespread (Poerio, 2016; Roberts, Beath, & Boag, 2020). ASMR's popularity on the internet supports how prevalent this phenomenon might be (Figure S.1).

Scientific investigation about this experience started even more recently, with the first peer-reviewed paper on the topic published in 2015 (Barratt & Davis, 2015). Since then, there has been a growing interest in deciphering this phenomenon's underlying psychological and biological basis (Figure S.2).

Some previous works have assessed individual variations in personality traits associated with ASMR. These works have shown that, compared with non-ASMR controls, ASMR self-reporters scored higher on openness to experience (Fredborg et al., 2017; McErlean & Banissy, 2017), which is associated with curiosity about the world around them and propensity to have vivid fantasies or daydreams (John, Naumann, & Soto, 2008). In line with these results, other works have shown ASMR self-reporters score higher on Fantasizing (McErlean & Banissy, 2017), reflecting an ability to immerse oneself in a fictional reality (Davis, 1983). They also produced higher scores on the Curiosity subscale of the Toronto Mindfulness Scale (TMS), suggesting a greater interest in and openness to their own conscious experiences (Fredborg, Clark, & Smith, 2018). Individuals with ASMR also showed higher scores on neuroticism, associated with increased self-consciousness (Fredborg et al., 2017). Finally, ASMR self-reporters have shown to score higher on absorption (McErlean & Osborne-Ford, 2020; Roberts, Beath, & Boag, 2019), which is the ability to get deeply immersed with the current experience accompanied by loss of

91   reflective awareness, and it has been previously linked to imagery, daydreaming, and openness to
92   experience (Glisky, Tataryn, Tobias, Kihlstrom, & McConkey, 1991). All these results together
93   suggest that an increased tendency to have openness to conscious experience, fantasize, and
94   imaginatively transposing oneself into a virtual reality may be a key feature of ASMR
95   responders.

96   Despite the notorious and growing interest in the subject, no research has explored the individual
97   variations of emotional-related traits associated with ASMR, excepting some works assessing the
98   relation between empathy and ASMR (McErlean & Banissy, 2017; Poerio et al., 2018). The lack
99   of studies directly evaluating emotional-related traits has occurred even when the literature is
100 continuously emphasizing that ASMR is a sensory-emotional experience rather than just a
101 sensory one (Fredborg et al., 2018; Smith, Fredborg, & Kornelsen, 2019; Smith, Fredborg, &
102 Kornelsen, 2017).

103 Previous works have revealed the emotional dimension of ASMR by evaluating self-report
104 measures, neuroimaging, and physiology. For instance, according to the first study on the topic,
105 80% of the participants reported watching ASMR videos because it positively affects their mood,
106 usually accompanied by a pleasant feeling of well-being and relaxation (Barratt & Davis, 2015).
107 With regard to the neuroimaging approach, activation in regions related to emotional arousal
108 (dorsal anterior cingulate cortex, insula, and inferior frontal gyrus) has been shown using fMRI
109 during tingling sensations (Lochte, Guillory, Richard, & Kelley, 2018). Another study measured
110 physiological responses comparing ASMR self-reporters and non-ASMR controls while
111 watching ASMR videos. The results showed a significant reduction in heart rate and increased
112 skin conductance levels in ASMR self-reporters compared with non-ASMR controls suggesting
113 that ASMR is a complex emotional experience blending different emotional components such as
114 relaxation and arousal (Poerio et al., 2018).

115 In line with these previous studies supporting ASMR as an emotional experience, ASMR has
116 also been suggested to be related to another underreported condition known as misophonia,
117 where familiar repetitive sounds, mostly sound produced by humans such as chewing and
118 sniffing, may trigger negative physiological, emotional, and behavioral responses (Roberts et al.,
119 2019; Rouw & Erfanian, 2018).

120 Previous works have suggested that misophonia and ASMR might represent two ends of the
121 same spectrum of sound sensitivity where human-generated sounds elicit pleasurable tingling
122 sensation in case of ASMR and negative physical and emotional responses in case of misophonia
123 (Barratt & Davis, 2015; McErlean & Banissy, 2018).

124 Previous works have shown that individual variations in the severity of misophonia symptoms
125 positively correlate with emotional regulation difficulties (Cassiello-Robbins et al., 2020).
126 Neuroimaging approaches to misophonia revealed abnormal functional connectivity between the

127 anterior insular cortex (a hub of the salience network critical for interoception and emotion
128 processing) and brain regions responsible for the regulation of emotions (Kumar et al., 2017).

129 It is interesting to note that even when misophonia and ASMR have been proposed as opposite
130 poles on the same spectrum, they also have been reported to overlap and co-occur in the same
131 individuals, but the experience may depend on the trigger stimuli or context (Roberts et al., 2019;
132 Rouw & Erfanian, 2018).

133 ASMR has also been widely associated with another related sensory-emotional phenomenon
134 known as frisson or music chills (del Campo & Kehle, 2016). Frisson is a chill down the spine
135 sensation that occurs while engaged in enjoyable music and other emotional experiences and is
136 generally described as a pleasant sensation with an emotional load; Tears, gooseflesh, or
137 piloerection could accompany it (Harrison & Loui, 2014). Neuroimaging studies have shown that
138 brain activation during ASMR showed similarities to patterns previously observed in music
139 chills, associated with the striatal reward pathway and emotional arousal regions (Lochte et al.,
140 2018; Salimpoor, Benovoy, Larcher, Dagher, & Zatorre, 2011). These similarities can also be
141 found in electrophysiological measures, in which both phenomena elicit an increase in skin
142 conductance (Poerio et al., 2018; Salimpoor et al., 2011).

143 Nonetheless, essential differences have been observed between these phenomena involving
144 activation of the medial prefrontal cortex (mPFC). This region showed increased activation
145 during ASMR tingling sensation, which has not been observed for music chills (Lochte et al.,
146 2018). Activation of mPFC has been associated with higher scores in empathy and emotional
147 regulation capabilities (Esménio et al., 2019; Tang, Tang, & Posner, 2016), especially for
148 reappraisal (Nelson, Fitzgerald, Klumpp, Shankman, & Phan, 2015). In line with this, previous
149 research has shown that ASMR self-reporters have higher Empathic Concern levels (McErlean &
150 Banissy, 2017). This trait has been previously associated with higher scores in cognitive
151 reappraisal (Laghi, Lonigro, Pallini, & Baiocco, 2018; Lockwood, Seara-Cardoso, & Viding,
152 2014)

153 Taking this evidence into account, it would be logical to assume that the ability to feel ASMR
154 could be associated with differences in some facet of emotional regulation, for instance, the
155 regulation strategy deployed (suppression or reappraisal). However, there is no evidence about
156 ASMR/non-ASMR group differences related to the emotional regulation abilities to date.

157 Individual differences in emotion regulation mechanisms can be investigated by studying the
158 most common strategies: suppression and reappraisal (Gross & John, 2003). Suppression is a
159 form of response modulation in which the ongoing emotion-expressive behavior becomes
160 inhibited. Reappraisal involves a cognitive reevaluation of the emotionally arousing situation to
161 alter its emotional impact. Research on this topic has shown that using reappraisal is more
162 effective and related positively to well-being, whereas using suppression is negatively related

163 (Gross & John, 2003; Morawetz, Alexandrowicz, & Heekeren, 2017). Previous studies
164 demonstrated an association between reappraisal use and personality traits such as neuroticism
165 and openness to experience (Morawetz et al., 2017; Wang, Shi, & Li, 2009). These same traits
166 have also been strongly associated with people who experience ASMR (Fredborg et al., 2017;
167 McErlean & Banissy, 2017).

168 The present work aims to assess group differences between ASMR self-reporters and non-ASMR
169 groups associated with emotional regulation strategies. We hypothesized that people who
170 experience ASMR, in the same way they seek to listen/watch ASMR stimuli to improve their
171 positive affect and well-being, use an emotional regulation strategy that better provides
172 effectiveness regarding well-being in different situations. We predicted that being the opposite
173 extreme of misophonia (which is a condition related to difficulties in emotional regulation),
174 people who experience ASMR will show greater cognitive reappraisal use than non-ASMR self-
175 reported controls. This strategy has been positively associated with well-being and used by
176 people who share personality traits common to ASMR groups. Finally, this prediction is also
177 supported by the ASMR self-reporters' known capabilities regarding fantasy/absorption, which
178 could facilitate the propensity to change the way they think about emotional situations.

179 We used the validated Spanish version of the Emotion Regulation Questionnaire (Cabello,
180 Salguero, Fernández-Berrocal, & Gross, 2013) to assess individual differences in the use of
181 cognitive reappraisal and expressive suppression in ASMR self-reporters and non-ASMR
182 controls.

183 This is the first study to examine whether ASMR self-reporters show differences associated with
184 emotional regulation strategies compared with non-ASMR controls. Therefore, this work further
185 elucidates individual differences related to this phenomenon and its remarkable consequences in
186 affective/emotional dimensions and well-being.

187 ## 2 Materials & Methods
188 ## 2.1 Participants
189

190 The total number of participants who answered the online survey was 177. From this total, only
191 69 reported not experiencing ASMR. One of these 69 participants answered the same response to
192 all of the questions in the cognitive reappraisal and expressive suppression subscales. Due to this
193 pattern of responses, we decided to exclude this participant's data from further analysis. Our
194 sample consisted of 108 participants who report to experience ASMR and 68 participants who do
195 not report to experience ASMR. All participants were native Spanish speakers. The matched
196 samples' nationalities were mostly Chilean; 167 Chilean, 2 Argentinian, 3 Spanish, 2
197 Venezuelan, 1 Mexican, and 1 Peruvian.

198 Due to the high proportion of participants who reported experiencing ASMR, we took a random
199 subsample of 68 participants from 108 who declared experiencing ASMR to attain similar
200 sample sizes. The matched samples consisted of 136 volunteers; 68 participants in the ASMR
201 group (51 female, mean age =22.40, $SD = 3.32$) and 68 participants in the non-ASMR group (52
202 female, mean age =23.81, $SD = 5.51$). Groups did not differ in age ($t(134) = 1.81$, $p = .07$) nor in
203 the proportion of male to female participants ($\chi^2 (1) < 0.01$, $p = 1$). Analysis with the total
204 sample of the participants can be found in the supplementary materials. The participants were not
205 rewarded for participating in this study.

206

207 2.2 Procedure
208

209 Participants were recruited by an online invitation to participate in the present work. This
210 invitation was spread through social media, specifically through Instagram and Facebook, posted
211 in ASMR groups and also in groups non-related to ASMR (e.g., University students groups on
212 Facebook). The invitation explained the study without giving away information related to
213 ASMR to avoid bias towards people who might know and were interested exclusively in ASMR.

214 Participants were asked to complete a survey hosted in Google forms. This online survey
215 included questions about personal information (age and gender) followed by the Spanish version
216 of the Emotion Regulation Questionnaire (Cabello et al., 2013). Then, they were provided with
217 the Spanish version of the ASMR-15 Score questionnaire (Roberts et al., 2019).

218 Afterward, participants were asked if they knew what Autonomous Sensory Meridian Response
219 is. Regardless of the answer, they then were provided with a description and question about
220 experiencing ASMR. Specifically, participants were provided with the following statement:
221 "ASMR is defined as a pleasant sensation of 'tingles' across the back of the head and neck in
222 response to specific visual and auditory stimuli." Then, participants were asked to answer the
223 following question, "would you defined yourself as someone who experiences ASMR?" with a
224 Yes or No response. We divided the ASMR self-reporters and non-ASMR groups based on this
225 response. Additionally, we further asked the ASMR group to provide their favorite ASMR video
226 link/channel and answer some additional questions about the frequency of watching ASMR
227 videos/content and the main reason for watching them if that was the case (see supplementary
228 material).

229 The protocol was approved by the Ethics Committee of Pontificia Universidad Católica de Chile
230 (approval reference number: 190325015). All participants gave electronic informed consent
231 following the Declaration of Helsinki. This study was conducted online, and participants
232 completed the questionnaires in their own time in one sitting.

233

2.3 Materials

235

Emotion Regulation Questionnaire (ERQ)

237 The ERQ is a self-report questionnaire that consists of 10-items assessing two different
238 regulation strategies. The first one is called cognitive reappraisal based on six items, and the
239 second one is called expressive suppression based on four items. Cognitive reappraisal focuses
240 on the person's attempts to change the emotional impact by changing how they think of the
241 situation. Expressive suppression focuses on the person's attempts to hide or inhibit the
242 expression of their emotions. The instruction was: "We would like to ask you some questions
243 about your emotional life, in particular, how you control (that is, regulate and manage) your
244 emotions. We are interested in two main aspects: on the one hand, your emotional experience, or
245 how you feel the emotions; and on the other hand, the emotional expression or how you show
246 emotions in the way you talk or behave. Although some of the following questions may seem
247 similar, they differ in quite important ways. Please answer how much you agree or disagree with
248 each of the questions below using the following response scale". Both subscales are measured
249 with simple questions answered on a Likert scale ranging from 1 (totally disagree) to 7 (totally
250 agree). The higher scores signify more usage of the strategy they are referring to in that specific
251 question. In this case, the questionnaire used was the Spanish adaptation of the ERQ, which has
252 been translated and validated for Spanish-speaking users, showing good internal consistency for
253 both subscales; expressive suppression (Cronbach's alpha = 0.75) and cognitive reappraisal
254 (Cronbach's alpha = 0.79) (Cabello et al., 2013). This questionnaire's internal consistency
255 calculated from data of the present study is similar to those reported in Cabello et al., 2013, with
256 a Cronbach's alpha = 0.76 for cognitive reappraisal and Cronbach's alpha = 0.78 for expressive
257 suppression.

258 **ASMR-15 SCORE**

259

260 The ASMR-15 is a multidimensional self-report measure of ASMR propensity that consists of
261 15-items assessing four different characteristics of the phenomenon; sensation, relaxation, affect,
262 and altered consciousness (Roberts et al., 2019). "Sensation" describes aspects of the location
263 and physical sensation. "Relaxation" involves changes in arousal associated with calm and
264 relaxation. "Affect" describes aspects of emotional experience. Finally, "Altered Consciousness"
265 is associated with shifts in perception and awareness. In this questionnaire, five items are related
266 to sensation, three related to relaxation, four related to altered consciousness state as a result of
267 the ASMR experience, and three others are related to affect, specifically to changes in emotional
268 states. Participants answer with a Likert scale ranging from 1 (totally disagree) to 5 (totally
269 agree), where higher scores indicate a greater tendency to experience ASMR. We used this scale

270   as a global corroboration that the selection of groups based on self-report was different on the
271   different dimensions of the phenomenon.
272   The scale has a brief introduction: "This survey is looking at how certain stimuli affect you.
273   Some individuals experience intense physical and emotional responses upon hearing particular
274   sounds. These sensations and feelings can be pleasant or unpleasant. Sounds such as whispering,
275   crackling, tapping, or scratching may produce particular experiences described below. Using the
276   scale, please indicate your level of agreement with each statement, upon hearing any of these, or
277   similar sounds. When I hear certain sounds, such as whispering, crinkling, tapping...".
278   For this questionnaire, our research group translated the original instrument to a Spanish version,
279   which showed good levels of internal consistency in the four subscales. The sensation subscale
280   had a Cronbach's alpha = 0.81, the relaxation subscale had a Cronbach's alpha = 0.88, the affect
281   subscale had a Cronbach's alpha = 0.80, and the altered consciousness subscale had a
282   Cronbach's alpha = 0.83. The total score (the mean of the 15 items) had a Cronbach's alpha =
283   0.90.
284
285

286   **2.4 Statistics**
287

288   All the data analysis, processing, basic descriptive statistics, testing of assumptions, and
289   comparison between means were performed using the R and RStudio software (Allaire, 2012).
290   Reliability analysis of the subscales of the ERQ and ASMR-15 was made with the psych
291   package (Revelle & Revelle, 2015) and plots with the ggplot2 package (Valero-Mora, 2010).

292   To match the sample sizes between the ASMR and non-ASMR groups we randomly selected a
293   subsample from the group with more participants, equal to the number of participants of the
294   group with fewer participants. We repeated this procedure 1000 times to corroborate the
295   replicability of the effect. To test if the ASMR and non-ASMR groups differ in age or male to
296   female participants, we performed a t-test and a chi-square test, respectively. Subsequently, we
297   used the Cronbach alpha coefficient to measure the internal consistency of the subscales of the
298   ERQ and the ASMR-15. All of the comparisons between the ASMR and non-ASMR groups
299   were performed with independent sample t-tests.

300   **3 Results**
301

302   Our main aim was to assess whether ASMR self-reporters show differences in emotional
303   regulation strategies compared to the non-ASMR group. We performed individual comparisons
304   between each of the subscales of the questionnaire. To maintain the experiment-wise error rate to
305   5%, we set an alpha value of 2.5% (a significant p-value of .025).

306   **Normality and homogeneity of variance**

307   To test the assumptions of normality and homogeneity of variance, we use the Shapiro-Wilk and
308   Levene tests, respectively. In the Expressive suppression subscale, data from the ASMR group
309   (W =0.98, p = .41), and data from the non-ASMR (W =0.97, p = .07) showed a normal
310   distribution. In the Cognitive reappraisal subscale, both the ASMR group (W =0.97, p = .11) and
311   the non-ASMR group (W =0.98, p = .37) showed a normal distribution. The variance between
312   the ASMR and non-ASMR groups were similar in both the Expressive Suppression subscale
313   ($F(1,134) = 2.31$, p = .13) and in the Cognitive Reappraisal subscale ($F(1,134) = 0.11$, p = .76).
314   In neither group, participants with z scores bigger than 3 or lesser than -3 were detected;
315   accordingly, we didn't reject any case (Tabachnick & Fidell, 2013).

316   As the data followed a normal distribution and had equal variances, we used an independent t-
317   test to compare groups. We applied a one-tailed t-test for the cognitive reappraisal subscale, as
318   we predicted higher scores for the ASMR group. We used a two-tailed t-test for the expressive
319   suppression subscale because we had no directional prediction for group differences.

320   ASMR group differences in the Emotion Regulation Questionnaire (ERQ)

321   The ASMR group showed significantly higher scores in the cognitive reappraisal subscale than
322   the non-ASMR group ($t(134) = 2.53$, p < .01, Cohen's d = 0.43) (see *Table 1*). There were no
323   significant differences between ASMR and non-ASMR groups for the expressive suppression
324   subscale ($t(134) = -0.84$, p = .40). These results can be observed in *Figure 1*.

325   We also performed the same analysis using all the sample and, after including the gender of the
326   participants as a predictor, obtaining similar results (see supplementary material)

327   Table 1: **ASMR and Non-ASMR scores in the Emotion Regulation Questionnaire.**

328   Figure 1: **Plot of ASMR and Non-ASMR scores in the Emotion Regulation Questionnaire.**
329   Box-plot shows the scores of the two Emotional Regulation Questionnaire' subscales for the
330   ASMR (n = 68) and non-ASMR (n = 68) groups. Jittered points are individual subjects.

331   Replicability of the effect using multiple random sub-samples.

332   As our main analysis was performed on a subsample of 68 participants of the total sample who
333   reported to experience ASMR (108 participants), we wanted to test the replicability and
334   robustness of our effect by using multiple random sub-samples. Specifically, we repeated 1000
335   times the procedure of randomly choose subsamples, each of 68 participants of the total of 108
336   participants who reported experiencing ASMR. We compared each subsample with the 68
337   participants who reported not experiencing ASMR. Of these 1000 randomly chosen subsamples,
338   we found that the ASMR group had significantly higher scores in the cognitive reappraisal
339   subscale 84.60% of the time, binomial 95% CI [82.18%, 86.75%]. Regarding the expressive
340   suppression subscale, we found no significant differences in 97.90% of the subsamples, binomial

341 95% CI [96.75%, 98.66%]. In a high percentage of subsamples, we found results similar to those
342 from our main analysis, supporting the replicability of the effect in different subsamples of our
343 data.

344 **Differences in ERQ scores using ASMR self-reporters who sought out ASMR videos.**

345 Given that group selection was based on self-report over the internet after a brief description of
346 the phenomenon, naïve people may confound the experience (for instance, with frisson) and
347 erroneously report themselves as ASMR experiencers. In order to have a more accurate selection
348 of participants who experience ASMR we performed the same analysis as before, but only with
349 the subjects who report to experience ASMR and also sought ASMR videos before. This new
350 subsample was composed of 58 participants (45 female, mean age = 22.59, SD = 3.08). We
351 compared this new subsample with the 68 participants who reported not experiencing ASMR.
352 Groups did not differ in age (t(124) = 1.50, p = .13) nor in the proportion of male to female
353 participants (χ^2 (1) = 0.09, p = .76).
354 In the cognitive reappraisal subscale, the ASMR self-reporters who have watched ASMR videos
355 had marginally significant higher scores than non-ASMR subjects (t(124) = 1.66, p =.05,
356 Cohen's d =0.30), with the ASMR group scoring 4.53 (SD = 1.12) and the non-ASMR group
357 scoring 4.20 (SD = 1.16). In the expressive suppression subscale there were no significant
358 differences between groups (t(124) = -0.77, p =.44).
359

360 **ASMR-15 Score group differences**

361
362 We used the ASMR-15 Scale as a global corroboration that the selection of groups based on self-
363 report was different on several dimensions of the phenomenon. This analysis may help to
364 confirm that participants who self-report to experience ASMR actually had felt it. Using the
365 same sample from our main analysis, we wanted to test if participants who self-report to
366 experience ASMR had higher scores in the four subscales of the ASMR-15, comparing with
367 participants who do not report to experience ASMR.
368 Compared to the non ASMR group, the ASMR group had significantly higher scores in sensation
369 (t(134) = 6.03, p < .001, Cohen's d = 1.03), relaxation (t(134) =5.20, p < .001, Cohen's d =
370 0.89), affect (t(134) = 5.08, p < .001, Cohen's d =0.87) and in altered consciousness (t(134)
371 =3.59, p < .001, Cohen's d =0.62). Additionally, using the ASMR-15 total score (the mean of the
372 15 items), the ASMR group had significantly higher scores than the non ASMR group (t(134) =
373 6.51, p < .001, Cohen's d = 1.12). These results indicate that participants who self-report as
374 ASMR experiencers, also scores higher in different dimensions involved in experiencing ASMR,
375 providing further support to the group selection. Descriptive values of the subscales can be found
376 in the supplementary material.

377 **4 Discussion**
378

379 The present study investigated group differences between ASMR self-reporters and non-ASMR
380 groups associated with emotional regulation strategies. We predicted that people who experience

381   ASMR would show more significant use of cognitive reappraisal compared with non-ASMR
382   self-reported controls. Our results confirmed our prediction, showing with a moderate effect size
383   that participants who experience ASMR had higher scores in the cognitive reappraisal subscale
384   of the emotion regulation questionnaire than the non-ASMR group. This finding suggests that the
385   ASMR group uses cognitive reevaluation of the emotionally arousing situation to alter its
386   emotional impact to a greater extent than the non-ASMR group. On the other hand, both groups
387   showed similar scores in the other subscale of the same questionnaire, suggesting no group
388   differences for the use of inhibition of emotion-expressive behavior.

389   Our finding supports the notion that ASMR is closely associated with emotional behavior rather
390   than merely a sensory response. As we mentioned before, a growing body of studies has
391   explored how ASMR elicits emotional arousal, which can be observed at different levels, such as
392   psychological/behavioral (Barratt & Davis, 2015), hemodynamical (Lochte et al., 2018), and
393   electrophysiological (Fredborg, Champagne-Jorgensen, Desroches, & Smith, 2021; Poerio et al.,
394   2018). We now show that this phenomenon is also associated with strategies that allow us to
395   control (regulate and manage) emotions when facing emotionally arousing situations. The higher
396   use of the reappraisal strategy in people who experience ASMR is especially interesting given
397   that reappraisal has been shown to be more effective to regulate emotions and related positively
398   to well-being (Gross & John, 2003; Morawetz et al., 2017). This contrasts with what has been
399   shown for misophonia, suggested to be the opposite pole of ASMR, in which people have
400   noticeable difficulties regulating emotions (Cassiello-Robbins et al., 2020).

401   We can speculate that the individual variations on reappraisal preferences might be associated
402   with connectivity of brain networks associated with reappraisal, involving the orbitofrontal
403   cortex selectively (Kanske, Heissler, Schönfelder, Bongers, & Wessa, 2011). Studies in resting-
404   state functional connectivity have reported that people who experience ASMR show the
405   recruitment of the orbitofrontal cortex by sensory-motor networks, suggesting this is one neural
406   substrate of ASMR's underlying emotional aspect. However, the differences reported in the
407   present study may also be mediated by personality traits that have been independently related to
408   ASMR and emotional regulation, such as neuroticism and openness to experience (Fredborg et
409   al., 2017; McErlean & Banissy, 2017; Morawetz et al., 2017; Wang et al., 2009). As we did not
410   measure these traits in our sample, future investigations may explore the specific relations
411   between ASMR, personality traits, and emotional regulation.

412   While we showed that ASMR self-reporters obtained higher cognitive reappraisal scores, our
413   study cannot shed light on the mechanisms responsible for this association. Follow-up studies
414   should specify the relationship between experiencing ASMR and cognitive reappraisal strategies
415   to regulate one's emotional states. We hypothesize that the higher tendency of ASMR self-
416   reporters to deploy cognitive reappraisal strategies is mediated by their capacity to be able to
417   immerse themselves in different types of experiences (McErlean & Banissy, 2017; Roberts et al.,

418 2019), a capacity that might give them greater flexibility to change the way they think about and
419 re-appraise emotional situations. If this hypothesis is correct, constructs related to the capacity to
420 be absorbed by imagery, such as fantasizing capabilities and daydreaming (Fox, Nijeboer,
421 Solomonova, Domhoff, & Christoff, 2013; Glisky et al., 1991), should mediate the relationship
422 between ASMR and cognitive reappraisal.

423 In the present study, we also found that almost half of the ASMR sample (46%) watch/listen to
424 ASMR videos at least once a week (Figure S.4) which is in line with the reports of previous
425 works, as in the case of Poerio et al., (2018) where 51% reported watching videos daily or
426 several times a week. This evidence suggests that a large proportion of the individuals who
427 watched ASMR videos for the first time watch ASMR content again in a recurrent manner.
428 Regarding the main motivations for watching ASMR videos, we found that relaxation was the
429 most frequent reason for ASMR self-reporters followed by sleep induction (Figure S.5), which
430 has been previously reported for people who experience ASMR (Barratt & Davis, 2015).
431 Interestingly, in our study, the people who do not experience ASMR and have watched ASMR
432 videos also reported relaxation as the main motivation for watching ASMR content. This result
433 may suggest that ASMR content may have the potential to help people to deal with anxiety
434 regardless of whether they experience the tingles or not. However, previous works have shown
435 this positive effect may occur only for individuals who experience ASMR (Poerio et al., 2018).
436 Regarding the positive effect in sleep induction, ASMR triggers have been used to induce sleep
437 in general population (Lee, Song, Shin, & Lee, 2019). The main findings of the present study
438 constitute a starting point to continue investigating on the underlying mechanism mediating the
439 association between ASMR and emotional regulation, which in the future could also open the
440 possibility to use ASMR videos/triggers as tools to promote emotion regulation strategies in
441 general population.

442 We also used a multiple regression with gender as the first predictor and showed that gender did
443 not play an essential role in our main finding (see supplementary material). This result suggests
444 that individuals who experience ASMR report higher scores on cognitive reappraisal regardless
445 of their gender. Nonetheless, we had a limited capacity to assess the indirect effect of gender on
446 the results due to the sample was composed mostly of women (in the ASMR and non-ASMR,
447 women made 75.36% of each group). This unbalance is a limitation of the present study reducing
448 our capacity to reach a more informed conclusion about the potential gender effects. Curiously,
449 this more extensive representation of women seems common in other ASMR studies with self-
450 reporting subjects. In a study by McErlean and Banissy (2017), the percentage of women in the
451 ASMR group was 69.88% and 80% in the non-ASMR group; in McErlean and Banissy (2018),
452 the percentage of women was 62.5% in the ASMR group and 72.47% in the non-ASMR group.
453 Finally, in the study by McErlean and Osborne-Ford (2020), the percentage of women was
454 74.19% in both groups. We believe that future studies on ASMR need to explore this tendency

455 and also balance the proportion of female/male participants to precisely determine gender effects
456 and potential gender differences in the experience of ASMR.

457 Finally, another limitation of the present study is related to the group selection's validity based
458 on self-report over the internet. We grouped based on a YES/NO question widely used in
459 previous studies (Barratt & Davis, 2015; J. McErlean & Banissy, 2018; Poerio et al., 2018;
460 Valtakari, Hooge, Benjamins, & Keizer, 2019). However, our description of the phenomenon
461 was not very detailed (for instance, we did not provide examples of the triggers), potentially
462 generating people confounding with other experiences, such as frisson. We then used
463 complementary methods to corroborate that people who reported to experience ASMR actually
464 did. We used the ASMR-15 scale, which has demonstrated effectiveness to measure the ASMR
465 propensity in multiple dimensions of the phenomenon (Roberts et al., 2019), and also performed
466 an additional analysis with only the people who sought ASMR videos. These results provided
467 reliability to our group selection; however, this is still a big challenge to all ASMR studies
468 performed over the internet. Some other methods have been used to ensure group selection is
469 performed adequately (see ASMR checklist in Fredborg et al., 2017).

5 Conclusions

470 **5 Conclusions**
471

472 This is the first study that examines whether ASMR self-reporters show differences associated
473 with emotional regulation strategies compared with non-ASMR controls. We showed that people
474 who experience ASMR use the cognitive reappraisal strategy to a greater extent than non-ASMR
475 people, suggesting more effectiveness in regulating emotions. The relevance of this finding relies
476 on the fact that emotion regulation is fundamental for well-being, and this relationship between
477 ASMR and emotional regulation may open the way to future research exploring the causal
478 relationship between these features and also opening the possibility to use ASMR videos/triggers
479 as tools to promote emotion regulation strategies, similar to how it is used to induce sleep (Lee et
480 al., 2019).

481 Finally, our finding further elucidates individual differences related to this experience,
482 supporting that ASMR is a real psychophysiological phenomenon associated with other
483 psychological constructs and has remarkable consequences in affective/emotional dimensions
484 and general well-being.

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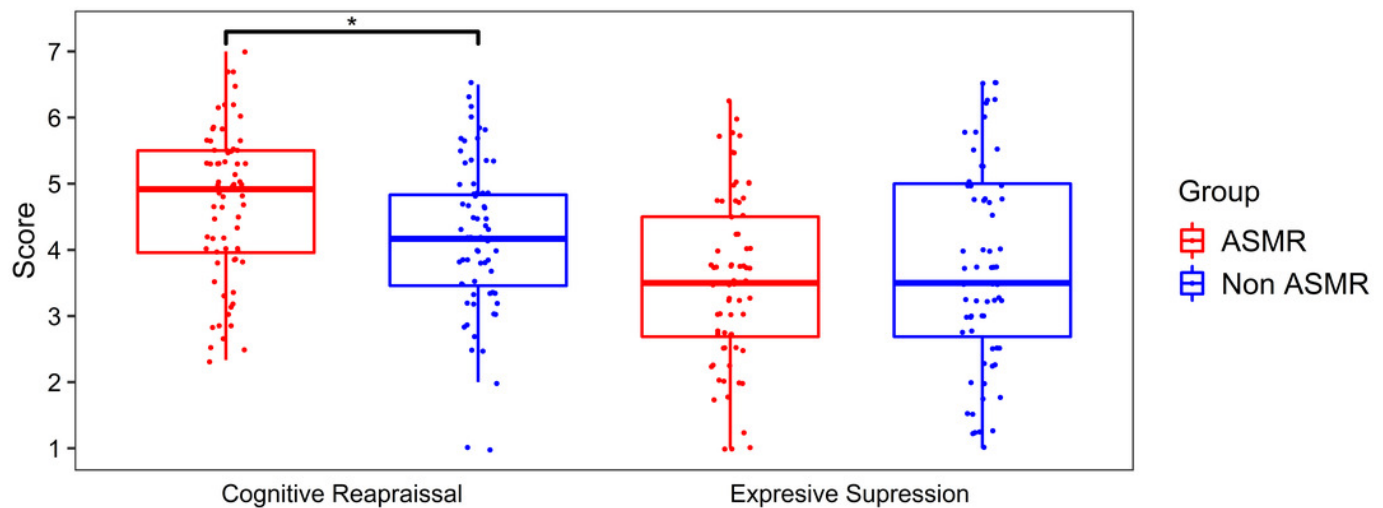
607

Figure 1

Plot of ASMR and Non-ASMR scores in the Emotion Regulation Questionnaire.

Box-plot shows the scores of the two Emotional Regulation Questionnaire' subscales for the ASMR (n = 68) and non-ASMR (n = 68) groups. Jittered points are individual subjects.

ASMR and Non-ASMR scores in the Emotion Regulation Questionnaire.

1   Table 1: **ASMR and Non ASMR scores in the Emotion Regulation Questionnaire.**

	Group					
Scale	ASMR			Non ASMR		
	Mean	Median	SD	Mean	Median	SD
Cognitive Reappraisal	4.69	4.92	1.14	4.19	4.17	1.16
Expressive Suppression	3.53	3.50	1.28	3.73	3.5	1.51