A Quantitative Study Investigating the Relationship between Autonomous Sensory Meridian Response (ASMR), Misophonia and Mindfulness.

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ABSTRACT

Autonomous Sensory Meridian Response (ASMR) is a sensory phenomenon which has received growing attention in recent years. Linked to an array of improvements in psychological wellbeing, ASMR holds potential therapeutic benefits. Previous research has drawn an association between ASMR and mindfulness, and a growing body of research links ASMR to the experience of misophonia. Misophonia is characterised by a disproportionate aversive response to certain sounds. The current study investigated the relationship between ASMR, misophonia and mindfulness. Furthermore, the current study looked to investigate specific triggers of ASMR and misophonic responses. 248 participants completed an online study, measuring state and trait ASMR, misophonia and mindfulness, through questionnaires and sensory-emotional responses to a series of 7 audio-clips featuring popular ASMR and misophonia triggers. Data was analysed using Pearson's Correlation Coefficient, significant positive correlations were found between ASMR, misophonia and the Observing subscale of the FFMQ-15 mindfulness measure. Additionally, significant negative correlations were found between misophonia and the Non-Judging of Inner Experience and Non-Reactivity to Inner Experience subscales of the FFMQ-15. A series of repeated-measures ANOVA's and further post-hoc corrected simple contrasts found that whispering sounds were the strongest trigger of ASMR responses, whilst eating noises were the strongest trigger of aversive responses.

KEY WORDS:	**ASMR**	**MISOPHONIA**	**MINDFULNESS**	**THERAPEUTIC BENEFITS**	**SENSORY-EMOTIONAL TINGLES**

Introduction

Autonomous Sensory Meridian Response (ASMR) is a sensory phenomenon, described by those who experience it as a deeply relaxing and euphoric, involuntary experience (Lochte et al., 2018; Roberts et al., 2018). It is characterised by a pleasant, static-like tingling sensation which typically originates on the scalp, neck or shoulders and can travel down the spine to the body's peripheries as the intensity of tingles increases (Fredborg et al., 2018; Barratt and Davis, 2015). Colloquially referred to as 'brain orgasms' or 'brain tingles', interest in ASMR has boomed in recent years. ASMR is a naturally occurring, calming, sensory experience (Cash et al., 2018). Triggering stimuli are commonly sought out by those who experience it through the use of popular YouTube ASMR channels dedicated to providing the 'ultimate tingles'. ASMR advocates report a fascinating variety of positive reasons for utilising ASMR videos (Barratt and Davis, 2015). Although ASMR is not universally experienced, as such an accessible at-home tool with a great array of anecdotal links to improved psychological wellbeing, ASMR holds potential to be explored for its therapeutic benefits. ASMR, however, remains a relatively under-researched phenomenon within the scientific community, with a small but growing, body of research into the mechanisms behind the experience. If we are to utilise ASMR in a therapeutic manner, it is crucial to further this enquiry.

The uplifting effects of ASMR on emotion and wellbeing in those who experience ASMR have recently received increasing academic attention. An exploratory study by Barratt and Davis (2015) highlighted that 80% of ASMR participants report ASMR to have positive mood-altering results, with specific uses of ASMR stimuli including relaxation, aiding sleep and reducing stress. Interestingly, the study found that participants rating higher on the Becks Depression Inventory displayed a significantly larger increase in positive emotion than those without depression. Furthermore, individuals with chronic pain were reported to experience a significant decrease in pain for hours following an ASMR experience. In support, findings by Poerio et al. (2018) revealed that following viewing ASMR videos, ASMR participants, in comparison to non-ASMR participants, showed an increase in positive affect; calmness and excitement, and a decrease in negative affect; stress and sadness.

Whilst the majority of current research presents ASMR as an emotionally pleasant experience, findings by Roberts et al. (2018) present a mixed result; a minority of ASMR participants describing ASMR as a 'strange' and occasionally 'unpleasant' feeling requiring cognitive effort to ensure pleasure. This ability to engage with and adjust one's reaction to ASMR is a curious finding. It is further supported by Fredborg et al. (2018) who highlight the ability to control the intensity and duration of tingles as a defining characteristic of ASMR, differentiating ASMR from the frequently compared sensory experience of synaesthesia (Barratt and Davis, 2015; Cash et al., 2018). An additional defining difference between ASMR and synaesthesia is that ASMR triggers tend to elicit the same reaction across different people, whereas responses to synesthetic triggers vary (Poerio, 2016). The current study aims to investigate ASMR in detail, to assess whether ASMR individuals, in comparison to non-ASMR individuals, provide ASMR consistent responses to all ASMR triggering stimuli.

Influenced by the propensity of ASMR experiencing individuals to focus on positive affective and physiological sensations, with attentional control of the nature of the tingles, a growing body of research draws similarities between ASMR and

mindfulness. Mindfulness can be defined as ‘paying attention, in a particular way; on purpose, in the present moment…non-judgementally’ (Kabat-Zinn, 2003:4). Mindfulness techniques are known to have an extensive range of positive effects on mental and physiological well-being, from reduced stress, to improvements in sleep and chronic pain (Gu et al., 2015). Bishop et al., (2004) propose that mindfulness functions through two mechanisms; self-regulation of attention and orientation to experience. Barratt and Davis (2015) posit that the positive effects of ASMR may be attributed to the engagement with ASMR material being a form of mindfulness practice. Fredborg et al. (2018) strengthened this link, demonstrating that ASMR individuals rate significantly higher on the Toronto Mindfulness Scale (TMS) in comparison to non-ASMR controls. The authors concluded that mindfulness attributes may, in part, elucidate the sensory-emotional experience of ASMR. Consequently, they hypothesise that mindfulness training could potentially amplify the experience of ASMR and subsequently heighten the positive effects of ASMR on wellbeing. This is an interesting line of discussion, which, with greater understanding of the mechanisms associated with ASMR, may be utilised in enhancing ASMR’s potential therapeutic benefits. The current study aims to further illuminate the relationship between ASMR and mindfulness.

Given the positive effects of ASMR, it is necessary to understand the triggers. Barratt and Davis’ (2015) study identifies several common audio-visual triggers featured in ASMR-stimuli. These comprise interpersonal triggers including whispering, close personal attention (e.g. themed role plays) and more abstract triggers such as crisp noises, slow and expert movements, tapping noises and mouth sounds (Poerio et al., 2018). Research highlights whispering as the strongest trigger (Barratt and Davis, 2015; McErlean and Banissy, 2017). ASMRtist’s (the name given to individuals who produce ASMR-stimuli) utilise sensitive microphones, often ‘binaurally’ recorded, which pick up the minutest of sounds in three dimensions, heightening the experience (Bennett, 2016; Barratt et al., 2017). Existing research suggests different triggers stimulate responses in different body parts, including gendered experiences of triggers, such as female vs male voices, eliciting differing locations of tingles (Barratt and Davis, 2015). This suggests a tie between ASMR and our social knowledge. According to Smith and Snider (2019), ASMR is an experience embedded within social context.

ASMR as a social experience is further supported by a variety of recent findings. Poerio et al.s’ (2018) study highlights that ASMR provokes an elevation in feelings of connectedness to others. Poerio et al. (2018) hypothesise that due to the interpersonal nature often depicted in ASMR triggering stimuli, ASMR may be reflective of a form of social grooming, prompting the positive affective and physiological responses characterised by ASMR. This social nature is further supported by McErlean and Banissys’ (2017) research into the personality and empathetic traits of those who experience ASMR. In addition to ASMR participants rating significantly higher on Openness to Experience on the Big Five Personality Inventory, which was reinforced by Fredborg et al. (2017), ASMR respondents were shown to have higher levels of empathetic concern than controls. Empathetic concern refers to an individual’s tendency to show compassion and consideration towards others (Davis, 1983). Interestingly, a study by Lochte et al. (2018) into the neurobiological basis of ASMR, which utilised fMRI to observe brain activity during ASMR activation (‘tingling’) in comparison to non-activating moments, found significant activation of brain areas associated with social bonding and empathy.

These examples give weight to the argument that ASMR may be linked to social mechanisms, which may mirror those utilised in interpersonal and therapeutic relationships.

Enhancing the argument of the potential therapeutic benefits of ASMR for ASMR experiencing individuals, a recent study into the mechanisms of ASMR revealed physiological differences between ASMR and non-ASMR participants during exposure to ASMR triggering stimuli. Poerio et al. (2018) found that ASMR participants exhibited a reduction in heart rate and an increase in skin conductance levels compared to controls, suggesting that ASMR involves a combination of relaxing yet arousing physiological states. This response reflects the physiological associations of emotions recognised by ASMR experiencers following ASMR-stimuli exposure; excitement and calmness, with a decrease in stress. Poerio et al. (2018) compare the level of reduction in heart rate observed during exposure to ASMR to those seen in alternative therapies such as music-based stress reduction and mindfulness/acceptance-based interventions.

Whilst ASMR is commonly described as enjoyable and calming, some individuals find certain sounds featured in ASMR videos unpleasant and distressing (McErlean and Banissy, 2018). A growing body of research links ASMR to the experience of misophonia, an extreme sensitivity to sound. Misophonia literally translates to ‘hatred of sound’ (Kovacevich and Huron, 2018), with common triggers including human generated noises such as eating and breathing, or alternative noises such as keyboard tapping (Rouw and Erfanian, 2018). Similarly to ASMR, misophonia typically begins in childhood (Palumbo et al., 2018), and is characterised by a disproportionate aversive response, such as intense feelings of disgust, anger, anxiety or avoidance towards the source of the sound (Wu et al., 2014; Edelstein et al., 2013). The negative affective response of misophonia has been validated through studies of misophonic individuals which reveal a physiological autonomic response characterised by increased skin conductance levels (Edelstein et al., 2013) and increased heart rate (Kumar et al., 2017) when exposed to triggers.

Whilst misophonia is not currently a listed disorder in the DSM-5 or ICD-11, it is reported that the syndrome can result in severe impairment of daily functioning (Brout et al., 2018). Studies have shown that in comparison to controls, a higher proportion of ASMR individuals also report experiencing misophonia (Barratt and Davis, 2015; McErlean and Banissy, 2018). Furthermore, a large-scale study by Rouw and Erfanian (2018) revealed 49% of participants who experience misophonia also report experiencing ASMR. These findings imply that ASMR and misophonia may represent two ends of the sound sensitivity spectrum; ASMR producing a pleasurable tingle sensation accompanied by positive affect, and misophonia eliciting a negative physical and emotional reaction. Consequently, if we are to utilise ASMR for its therapeutic benefits, it is crucial to thoroughly understand its relationship with misophonia.

An interesting implication for ASMR and misophonia research links to literature differentiating between types of sensory-emotional tingles/chills. Maruskin et al. (2012), investigating ‘the chills’ as a psychological construct, drew interesting conclusions regarding differences between the experience of two sensory concepts; ‘goosetingles’ (goosebumps and tingles), and ‘coldshivers’ (coldness and shivers). The extensive study deduced that ‘goosetingles’ elicit positive affect, such as awe and enjoyment, and are associated with approach-related stimuli. Conversely,

'coldshivers' elicit negative affect, such as disgust and fear, and are associated with avoidance-related stimuli. Maruskin et al. (2012) define approach-stimuli as stimuli that individuals are motivated to engage with, whereas avoidance-related stimuli motivate individuals to move away. The current study will aim to investigate whether ASMR is consistent with tingles and approach-related motivations and conversely, if misophonic responses are consistent with coldshivers and avoidance-related motivations.

Existing research into the relationships between ASMR and misophonia has assessed the relationship between the two constructs from a binary perspective. Barrett and Davis (2015) study of ASMR, asked participants to self-report whether they recognised experiencing misophonia. Similarly, in Rouw and Erfanian's (2018) study of misophonia, participants were asked to self-report whether they experience ASMR. Furthermore, McErlean and Banissy's (2018) recent work found increased misophonia in individuals who self-reported experiencing ASMR, however only participant's levels of misophonia was measured in the study. Consequently, current literature has only a limited understanding of the degree of the relationship between ASMR and misophonia. The current study will therefore aim to investigate this relationship in greater depth, utilising independent measures for both ASMR and misophonia, as two concepts which may exist on a continuum.

Current literature regarding the best therapeutic treatment for misophonia provides no clear picture. A wide range of appropriate treatments are proposed, including tittinus retraining therapy (TRT), psychoeducation, acceptance-based therapy and CBT (Palumbo et al., 2018; Rouw and Erfanian, 2018). The most commonly cited treatment, TRT, is criticised for its tendency to promote the masking of sounds, which can encourage avoidance behaviours. A recent case study by Schneider and Arch (2017), however, revealed promising findings. Schneider and Arch (2017) successfully treated a young man who presented with misophonia, triggered by eating noises, which provoked severe anger and avoidance and was subsequently impairing daily functioning. Through 10 therapy sessions, Schneider and Arch (2017) utilised mindfulness and acceptance-based components derived from dialectical behaviour therapy and acceptance and commitment therapy. The authors report a focus on mindful, acceptance and non-judgementalness strategies. The use of mindfulness in the successful treatment of misophonia implies an increase in mindfulness skills may result in a decrease in misophonic symptoms, suggesting there may be some relationship between the two concepts. The current study aims to assess this.

Several measures exist for the construct of mindfulness, with a limited number of measures for ASMR and misophonia. The present study will measure mindfulness from a multifaceted, trait-based perspective, utilising the Five Factor Mindfulness Questionnaire-15 (FFMQ-15), a shorter version of the FFMQ-39, to reduce participant burden (Baer et al., 2012). The FFMQ is a comprehensive measure of mindfulness, derived from the incorporation of five independent mindfulness measures (Park et al., 2013; Gu et al., 2016). ASMR will be measured from both a trait and state perspective, utilising the ASMR Checklist to measure trait ASMR (Fredborg et al., 2017), and a series of post ASMR-stimuli questions to measure state ASMR (Hostler et al., 2018). Misophonia will be measured via the Misophonia Questionnaire, an extensive measure of misophonia triggers, affect and associated behaviours (Wu et al., 2014).

The current study aims to firstly investigate the relationship between ASMR, misophonia and mindfulness. Secondly, considering the existing research on ASMR, to investigate whether those who report having ASMR provide ASMR consistent responses for all ASMR triggering audio clips in comparison to non-ASMR individuals, based on sensations and emotions experienced. Thirdly, the current study aims to establish which types of audio stimuli trigger ASMR responses and which trigger misophonic responses.

Research questions:

1. Do people who experience ASMR also experience misophonia and rate higher on mindfulness? Based on existing research it is hypothesised that people who experience ASMR will experience elevated levels of misophonia (McEarlean and Banissy, 2018) and will rate higher on mindfulness scores than non-ASMR individuals (Fredborg et al., 2018)
2. Do people who report having ASMR give ASMR consistent responses overall for all ASMR audio clips? Based on existing literature it is hypothesised that ASMR individuals will report higher levels of interpersonal connectedness, tingling sensations and positive emotions, e.g. calmness, overall for all ASMR triggering audio clips than non-ASMR individuals (Poerio et al., 2018)
3. Which types of audio stimuli (e.g. whispering, tapping, mouth sounds) trigger ASMR and which trigger misophonic responses (based on emotions experienced, types of tingling, engaged/avoidant responses)?

Method

Design

A within-subject design was used for this experiment. Participants completed the FFMQ-15 (Baer et al., 2012), modified versions of the ASMR Checklist (B. Fredborg et al., 2017) and the Misophonia Questionnaire (MQ) (Wu et al., 2014). For the main research activity, participants listened to seven audio clips and answered a series of Post Audio Clip Questions (Appendix 6). There were no control groups and no further conditions.

Ethical Considerations

Prior to gathering data, the project proposal was reviewed by the Psychology ethics committee at Manchester Metropolitan University (MMU) and approval obtained (Appendix 1). Participants provided informed consent via consent form (Appendix 2) and anonymity was maintained throughout. No personal identifiable data was collected during the study and participants right to withdraw was highlighted. Participants were advised not to participate in the study if they have a diagnosed condition causing severe reactions to certain sounds (e.g. misophonia). Participants were fully briefed via the participant information sheet (Appendix 3) prior to participation and debriefed upon completion (Appendix 4). All data was stored anonymously and securely.

Participants

A volunteer sample of $N = 432$ participants was recruited from the ASMR community (via Reddit – r/asmr) and the normal population (via MMU participation pool). $N = 75$ participants data was removed due to providing no responses to the questions, and

N = 109 were removed due to responding to less than 5 audio clips and the questionnaires and so were considered incomplete. N = 4 were kept in and classed as ASMR due to video responses (tingles, emotions), final sample was *N* = 248. *N* = 220 ASMR and *N* = 28 Non-ASMR participants were recruited. Participants were between the ages of 18 and 56 (*M* = 26.76, *SD* = 7.62). The sample consisted of Male *N* = 132, Female *N* = 112, Non-Binary *N* = 3, Prefer to self-describe *N* = 1.

Materials

FFMQ-15: 15-item Five-Facet Mindfulness Questionnaire – A 15-item measure was utilised to measure mindfulness (Baer et al., 2012) (Appendix 5). It includes five facets of mindfulness: Observing, Describing, Acting with Awareness, Non-Judging of Inner Experience, and Non-Reactivity to Inner Experience. Participants indicated on a 5-point Likert scale how well each of the fifteen semantically labelled statements applied to them. E.g. 'I pay attention to sensations, such as the wind in my hair or sun on my face' 1 = Never or very rarely true, 5 = Very often or always true. Higher score = higher level of mindfulness. Certain items were reverse scored and the scale totalled (see Appendix 5). The scale holds good internal consistency, Cronbach's alpha value ranging from (α = .80) to (α = .85) (Baer et al., 2012; Gu et al., 2016).

Audio Clips - Participants listened to a series of audio clips (seven clips, one-minute each). Audio only was used to reduce confounding variables related to visuals. The clips consisted of a variety of popular ASMR and misophonic trigger sounds from seven categories (whispering, lip smacking, eating, tapping, water, crinkling) and control (white noise). Audio clips were curated by the researcher from popular YouTube videos created by ASMRtists (e.g. GentleWhisperingASMR), excluding the control sound - white noise. Fourteen, one-minute clips were generated; each category contained two audio clips, of which participants were evenly, randomly allocated to one of the conditions. By testing two clips for each of the seven categories, the aim was to provide a more generalisable picture of the existence of ASMR/misophonia triggers between categories. The audio clips were both potential ASMR triggers and misophonia triggers, divided into human generated noises (whispering, lip smacking, eating sounds) and object generated sounds (tapping, water sounds, crinkling sounds, white noise). All sounds were sounds that participants would encounter in everyday life e.g. eating sounds. See https://www.youtube.com/channel/UCDPyUD2SNy2a76EeRtKrFPQ for all clips.

Post Audio Clip Questions – Following each audio clip, participants completed a series of questions (Appendix 6) to measure their emotional and sensory responses. These questions provide indications of state ASMR. The questions assessed the nature of the sensation, the frequency, intensity and the duration of the sensation, the emotional response and the level engaged/avoidance, compared to prior to exposure to the audio-clip (see Appendix 6 for all questions). E.g. 'Did you experience either of the following sensations whilst listening to the previous audio clip? a) Tingling, b) Chills or c) Neither'; E.g. 'Please indicate on the below sliding scale, how do you feel now compared to before you listened to the audio clip with regards to the following emotions: Calm' 1 = Much less to 7 = Much more (4 = No change). These questions were adapted from Hostler et al.'s (2018) recommended criteria for measuring ASMR via Likert style responses. Measures of 'connectedness to others' and 'engagement/avoidance' were included.

ASMR Checklist – The ASMR Checklist (Appendix 7) was adapted from Fredborg et al.'s (2017) checklist. The checklist provided participants with a definition of ASMR and asked participants to rate whether they experience ASMR – 'Yes' or 'No'. If participants answered 'Yes' they were asked a series of questions regarding their experiences of ASMR. Participants indicated the intensity of their responses to sixteen triggers that commonly prompt ASMR, on a 7-point Likert scale, E.g. 'Whispering', 0 = No Tingles, 3 = Moderately Intense, 6 = Most Intense or 7 = Unknown. Participants disclosed the speed of onset of tingling sensations following exposure to those triggers, E.g. '0-10 seconds' after exposure. Additionally, participants were asked about the frequency in which they use ASMR videos/audios, their emotional response to ASMR, their physiological response to ASMR and to disclose their age at their first experience of ASMR (see Appendix 7). The ASMR checklist holds good internal consistency, Cronbach's alpha (α = .81) (Fredborg et al., 2018).

Misophonia Questionnaire – The MQ (Appendix 8) was adapted from Wu et al.'s (2014) MQ. A definition of misophonia was provided. The MQ is divided into three sections. Firstly, the Misophonia Symptom Scale measures the presence of seven specific sound sensitivities in comparison to other people – E.g. 'In comparison to other people, I am sensitive to the sound of: people eating'. Secondly, the Misophonia Emotions and Behaviours Scale, measures nine emotional and behavioural reactions associated with misophonia – E.g. 'Once you are aware of the sound(s), because of the sound(s), how often do you: become annoyed?'. For both the symptoms and emotional/behavioural reactions sections, participants indicated on a Likert scale how well each of the labelled statements applied to them, 0= Not at all true 4 = Always true. Participants were then asked to indicate their level of physical response associated with misophonia triggers out of thirteen levels – E.g. 'I feel some physical sensation but can often/always ignore it.' The last section, the Misophonia Severity Scale, asked participants to indicate their level sound sensitivity on a scale from 1 to 15, ranging from 'minimal' to 'very severe', respectively, with a score greater than or equal to 7 indicating clinically significant symptoms (Wu et al., 2014). The Misophonia checklist holds good internal consistency, Cronbach's alpha (α = .89).

Procedure

Participants received the questionnaire in link form via the platform within which the survey was shared. Upon following the link to the online study via Qualtrics, participants were provided with a participant information sheet (Appendix 3) and consent form (Appendix 2), which was read and completed prior to participating in the study. The participant information sheet provided details of the study and informed participants that the study was an 'investigation into mindfulness and emotional reactions to different sounds'. Participants were informed that they were able to skip any of the audio clips during participation, should they wish to do so. Participants were advised to use a set of headphones during the study.

Once consent was obtained, participants provided their age, gender and completed the FFMQ-15 (Baer et al., 2012) (Appendix 5). Participants were then shown the following message '*You are about to be shown a series of short audio clips. Each clip is only 1 minute long, please pay attention and listen to the sounds in the clip. You are free to withdraw from the experiment at any time by closing the web browser. PLEASE PUT YOUR HEADPHONES ON NOW'.* For the main research

activity, participants listened to a series of short audio clips. Following each audio clip, participants answered a series of questions (Appendix 6). Once the participant had listened to the whole series of audio clips, participants were provided with a definition of ASMR (Appendix 7) and asked whether they recognise experiencing the phenomenon. If participants responded yes, they completed a measure of ASMR (Appendix 7). All participants were then provided with a definition of misophonia and completed the MQ (Appendix 8). The ASMR checklist and MQ were provided after the audio clip series to prevent participant response bias to the post-audio questions. The participants were then thanked for their participation and fully debriefed (Appendix 4). Upon collection all data was stored securely and anonymously.

Results

Preparation of data

Data was input into SPSS v.24.0. Incomplete responses were removed. Post-Audio Questions (Appendix 6) data for each audio clip was merged to create one set of scores for each category, i.e. Crinkle 1 and Crinkle 2 scores were merged to create one Crinkle category for the Post-Audio Questions. Any system missing data for the frequency/sensation ratings was replaced with neutral scores to allow for analysis – Frequency = 1, Intensity = 0. Questions 3, 4, 7, 8, 9, 13 and 14 of the FFMQ-15 were reversed scored accordingly. Total scores were generated for the FFMQ-15, the MQ (sections 1 and 2 summed), the mean score for the ASMR Checklist and the FFMQ-15 subscales; Observing, Describing, Acting with Awareness, Non-Judging of Inner Experience and Non-Reactivity to Inner Experience (see Appendix 5 for breakdown of questions into subscales).

Analysis

An alpha level of 0.5 was used for all statistical tests.

Research Question 1**:** *Do people who experience ASMR also experience misophonia and rate higher on mindfulness? Based on existing research it is hypothesised that people who experience ASMR will experience elevated levels of misophonia (McErlean and Banissy, 2018) and will rate higher on mindfulness scores than non-ASMR individuals (Fredborg et al., 2018).*

Due to only a small number of responses from non-ASMR respondents, $N = 28$, it was concluded there were not enough non-ASMR participants to perform a comparison with ASMR participants as originally proposed in research questions one and two. Consequently, non-ASMR respondents were excluded from analysis, $N = 28$. The following analysis will therefore address research questions one and three, from a within participants perspective based on the data set of, $N = 220$, ASMR participants. The data was pre-screened for normality and met the assumptions for parametric testing.

The mean ASMR Checklist score, the total MQ score, the total scores for the FFMQ-15 (labelled ‘Mindfulness’ in Table 1) and the FFMQ-15 subscales were analysed using Pearson’s Correlation Coefficient. $N = 7$ participants were excluded from this analysis as they did not complete the ASMR checklist, $N = 213$. Participants were filtered accordingly, ASMR mean score>0.

Pearson's correlations were calculated for the variables; FFMQ-15 and MQ totals, ASMR mean and FFMQ-15 subscales (see Table 1). As shown in Table 1, a significant weak positive correlation was found between ASMR and Misophonia, r(211) = .149, *p* = .015 Additionally, both ASMR, r(211) = .163, *p* = .009 and Misophonia, r(211) = .136, *p* = .024 had a significant weak positive correlation with the Observing subscale (FFMQ-15). Furthermore, a significant weak negative correlation was observed between Misophonia and the Non-Judging of Inner Experience subscale (FFMQ-15), r(211) = -.140, *p* = .021 and the Non-Reactivity to Inner Experience subscale (FFMQ-15), r(211) = -.160, *p* = .010.

Table 1

Correlations Among Study Variables

	Totals			FFMQ-15 Subscales				
Variable	ASMR	Misophonia	Mindfulness	Observe	Describe	ActAware	NonJudge	NonReact
ASMR		.149*	.004	.163**	-.021	-.018	-.072	-.026
Misophonia			-.098	.136*	-.068	-.023	-.140*	-.160**
Mindfulness				.376**	.580**	.647**	.628**	.542**
Observe					.116*	.120*	-.136*	.008
Describe						.203**	.172**	.091
ActAware							.356**	.159*
NonJudge								.264**
NonReact								

Note: i)* indicates *p* < .05; ** indicates *p* < .01. ii) FFMQ-15 Subscale Labels: Observe = Observing, Describe = Describing, ActAware = Acting with Awareness, NonJudge = Non-Judging of Inner Experience, NonReact = Non-Reactivity to Inner Experience

In sum, hypothesis one was supported by the findings. The results demonstrate that a stronger tendency to experience ASMR was correlated with a higher level of misophonia. Additionally, a stronger tendency to experience ASMR was correlated with a higher level of mindfulness, but only within the Observing subscale. Furthermore, a stronger tendency to experience misophonia was correlated with a higher score on the Observing mindfulness subscale, and lower scores on the Non-Judging of Inner Experience and Non-Reactivity to Inner Experience mindfulness subscales.

Research Question 3: *Which types of audio stimuli (e.g. whispering, tapping, mouth sounds) trigger ASMR and which trigger misophonic responses (based on emotions experienced, types of tingling, engaged/avoidant responses)?*

An exploratory analysis was performed on the Post-Audio Questions data, *N* = 220 ASMR participants, through fourteen repeated-measures ANOVA's and further post-hoc Bonferroni-corrected simple contrasts. Audio clip type (trigger type) was the IV; seven levels (control, crinkling, eating, tapping, whispering, water and lip smacking). The DV's were sensations (frequency/intensity/sensation type) and emotions experienced. Descriptive statistics for the sensations experienced in all conditions are displayed in Table 2. A means plot to show the most significant changes in

emotion following the most triggering audio clips is shown in Figure 1. This exploratory analysis provided a vast number of findings; consequently, due to the scope of this paper the most significant and relevant findings in relation to research question three will be reported in full.

Table 2

The Means and Standard Deviation for Sensations Experienced During Each Audio Clip

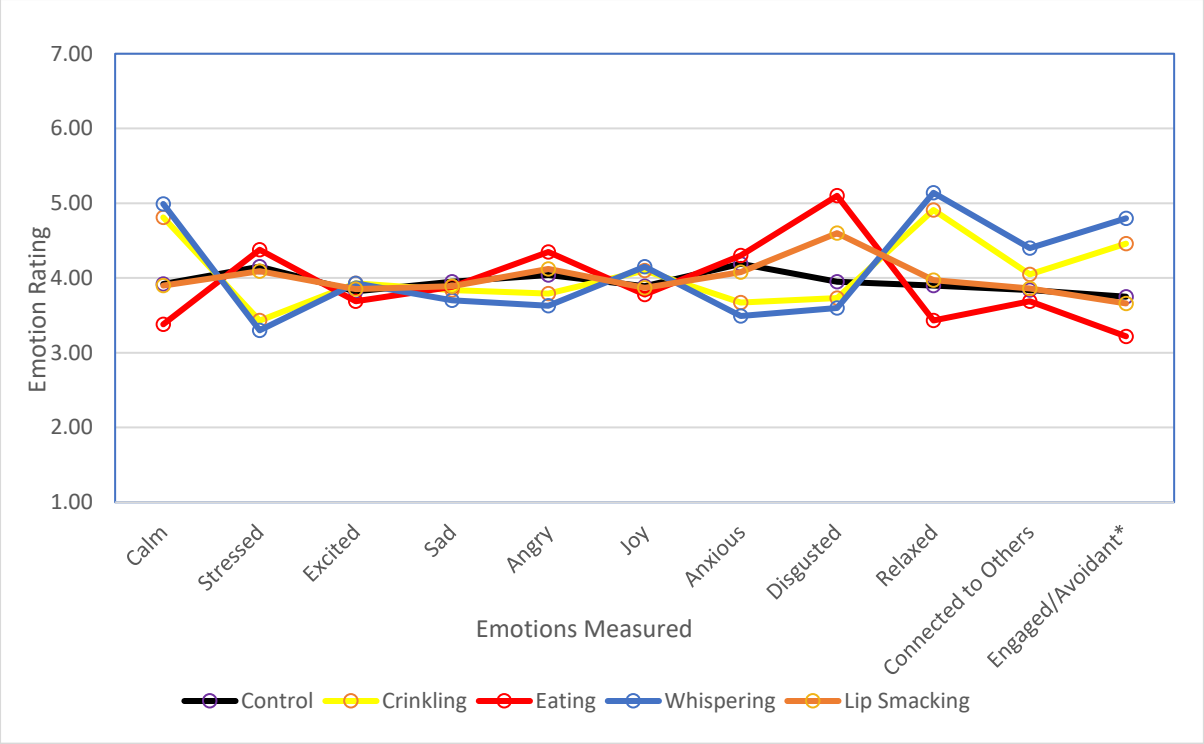
	Frequency		Intensity		Type of Sensation % Split		
Audio Clip	*M*	*SD*	*M*	*SD*	% Tingling	% Cold Chills	*N*
Control	1.64	1.57	0.57	1.42	64.40%	35.60%	45
Crinkling	2.65	1.94	1.72	2.08	88.60%	11.40%	114
Eating	2.09	1.77	1.24	1.96	70.60%	29.40%	85
Tapping	2.94	1.93	2.10	2.06	87.40%	12.60%	143
Whispering	3.60	2.13	2.77	2.26	89.20%	10.80%	167
Water	2.28	1.76	1.25	1.70	94.00%	6.00%	100
LipSmacking	2.70	2.02	1.87	2.17	76.40%	23.60%	123

Note: i) *M*= Mean; *SD*= Standard Deviations; *N*= Number of Participants. ii) Frequency: 1 = None of the time to 7 = All of the time iii) Intensity: 1 = Very mild to 7 = Very intense

The Greenhouse-Geisser correction was applied to all the results within this section.

Frequency and Intensity of sensations: results showed that there was a significant overall difference between conditions (trigger type) with regards to frequency of sensations, ($F(5,1191) = 34.28$, $p < .001$) and intensity of sensations, ($F(5,1178) = 38.73$, $p < .001$). Pairwise comparisons revealed the whispering condition to cause the most frequent ($M_{diff} = 1.97$, $p < .001$), CI(95%)1.44-2.50) and intense ($M_{diff} = 2.2$, $p < .001$), CI(95%) 1.67 – 2.73) triggering of sensations. Of those who were triggered by the whispering condition, $N = 167$ (see table 2), 89.20% experienced tingles and 10.8% experienced cold chills.

Conversely, eating sounds were found to trigger greatest proportion of cold chills, 29.40% cold chills and 70.60% tingles, $N = 85$ followed by lip smacking, 23.60% cold chills and 76.40% tingles, $N = 123$. Pairwise comparisons revealed significant mean differences between the control and the eating sounds with regards to frequency of sensations, $p = .029$, and intensity of sensations, $p < .001$. Mean differences between lip smacking and the control were significant, $p < .001$, with regards to frequency and intensity of sensations.



Note: i) Emotions: 1 = Much Less to 7 = Much More (4 = No Change). ii) Engaged/Avoidant*: 1 = Avoidant to 7 = Engaged (4 = Neutral)

Figure 1: Means plot showing changes in emotions following listening to the most triggering audio clips.

The repeated measures ANOVA's revealed significant overall differences between conditions (trigger type) with regards to all emotions, $p < .001$. However, the emotions of joy, excitement, anxiousness, anger and sadness will not be reported as the differences were minimal. Full descriptive statistics for changes in emotions following each audio clip are reported in APA style in Appendix 9.

As depicted in Figure 1, the whispering condition produced the largest reported increase in positive emotions in comparison to the control. Pairwise comparisons showed that following the whispering condition, participants felt significantly more calm *(M* = 4.99*, SD* = 1.11*)* (*M*diff = 1.11, $p < .001$), CI(95%) 0.70-1.44), relaxed *(M* = 5.14, *SD* = 1.21*)* (*M*diff = 1.2, $p < .001$), CI(95%) 0.84-1.63), connected to others *(M* = 4.40, *SD* = 0.84*)* (*M*diff = 0.56, $p < .001$), CI(95%) 0.33-0.79), engaged *(M* = 4.80, *SD* = 1.057*)* (*M*diff = 1.06, $p < .001$), CI(95%) 0.75-1.36 and less stressed *(M* = 3.30, *SD* = 1.07 (*M*diff = -0.845, $p < .001$), CI(95%) -1.16 - -0.53).

The crinkling condition produced the second largest increase in positive emotions, with participants reporting that they felt significantly more relaxed (*M* = 4.91*, SD* = 1.03*)* (*M*diff = 1.01, $p < .001$, CI(95%) 0.67-1.35), calm (*M* = 4.81*, SD* = 0.94) (*M*diff = 0.89, $p < .001$, CI(95%) 0.58-1.21) and less stressed *(M* = 3.43, *SD* = 0.90*)* (*M*diff = -0.714, $p < .001$, CI(95%) -0.99- -0.44) following listening to the audio stimuli.

Conversely, as depicted in Figure 1, the eating condition produced the largest reported increase in negative emotions in comparison to the control. Participants reported that following exposure to the audio stimuli they felt significantly more

disgusted *(M* = 5.10, *SD* = 1.32*)* (*M*diff = 1.14, *p* < .001), CI(95%) 0.82-1.47) and avoidant *(M* = 3.22*, SD* = 1.29*)* (*M*diff = -0.532, *p* < .001, CI(95%) -0.87- -0.194).

Additionally, following the lip smacking condition participants reported a small but significant increase in feelings of disgust, *(M* = 4.60, *SD* = 1.25*)* (*M*diff = 0.650, *p* < .001, CI(95%) 0.34-0.96).

Discussion

Due to an insufficient number of respondents within the non-ASMR control group, the current study tested hypothesis one from a within-participants perspective based on *N* = 213 ASMR participants. Hypothesis one proposed that people who experience ASMR will experience elevated levels of misophonia (McErlean and Banissy, 2018) and will rate higher on mindfulness scores than non-ASMR individuals (Fredborg et al., 2018). Weak but significant correlations were found between all variables measured. The findings support hypothesis one, indicating that a stronger tendency to experience ASMR is related to a higher level of misophonia. These findings are consistent with existing research (McErlean and Banissy, 2018; Rouw and Erfanian, 2018; Barratt and Davis, 2015). Furthermore, the findings address gaps in the current literature regarding ASMR and misophonia as experiences which exist on a continuum.

Additionally, the results showed that a stronger tendency to experience ASMR was significantly correlated with a higher level of mindfulness, but only within the Observing subscale. Again, the relationship between ASMR and mindfulness is supportive of existing research (Fredborg et al., 2018). However, the findings are not as strong as hypothesised, with a weak positive correlation only within the Observing subscale. Baer et al. (2006) describe the Observing subscale as measuring the 'quality of noticing or attending to experience'. This may explain the correlation with ASMR, as existing literature likens mechanisms associated with ASMR such as the observing of psychological and physiological sensations, to the practice of mindfulness (Fredborg et al., 2018; Barratt and Davis, 2015). Interestingly, the Observing subscale is positively correlated with openness (Baer et al., 2006), which has also been found to be strongly linked with ASMR (McErlean and Banissy, 2017; Fredborg et al., 2017).

Furthermore, the findings suggest that a higher level of misophonia is related to a higher score on the Observing mindfulness subscale and lower scores on the Non-Judging of Inner Experience subscale and Non-Reactivity to Inner Experience mindfulness subscales. The weak positive correlation with the Observing subscale may relate to the tendency of misophonic individuals to notice and attend to noises which trigger an adverse reaction. Severity of misophonic reactions are commonly reported to increase over time (Rouw and Erfanian, 2018), which is likely linked to increased observation of the aversive triggers. Moreover, the weak negative correlation between misophonia and the Non-Judging of Inner Experience and Non-Reactivity to Inner Experience subscales is fitting with the explanation that individuals with higher levels of misophonia are more likely to judge their inner experience (i.e. negative feelings towards the source of the triggering sound) and impulsively react to the experience (i.e. angry outburst or avoidance) (Baer et al., 2006). This is supportive of existing research into the behavioural representations of misophonia (Wu et al., 2014).

The findings from research question one have several real-world implications. Firstly, the positive correlation between ASMR and misophonia confirms the need for further research into the potential therapeutic benefits of ASMR to consider the relationship between the two experiences. Furthermore, the findings suggest that in addition to utilising mindfulness training to enhance the experience of ASMR as proposed by Fredborg et al. (2018), mindfulness training may also be utilised to reduce misophonic reactions. Specifically, a focus on enhancing Non-Judging of Inner Experience and Non-Reactivity to Inner Experience mindfulness skills may potentially reduce misophonic reactions. This supports the findings of Schneider and Arch (2017) in their successful treatment of misophonia, utilising mindfulness and non-judgementalness strategies.

As previously mentioned, due to an insufficient number of non-ASMR controls, research question two was not addressed by this study. Research question two hypothesised, based on existing literature, that ASMR individuals will report higher levels of interpersonal connectedness, tingling sensations and positive emotions, e.g. calmness, overall for all ASMR triggering audio clips than non-ASMR individuals (Poerio et al., 2018). Future studies may look to test this hypothesis.

The following line of discussion will address the exploratory findings of research question three. Research question three asked which types of audio stimuli (e.g. whispering, tapping, mouth sounds) trigger ASMR and which trigger misophonic responses (based on emotions experienced, types of tingling, engaged/avoidant responses). The findings indicated that the whispering condition was the strongest trigger of ASMR. Participants reported that the whispering condition triggered the most frequent and intense tingles, eliciting increases in positive affect; namely, calmness, relaxation, connectedness to others, engagement and reduction in stress. These findings are consistent with existing research (Barratt and Davis, 2015; McErlean and Banissy, 2017). The findings the ASMR response prompting feelings of increased connectedness to others and engagement (approach-related) are particularly interesting and support the findings of Poerio et al. (2018) and Maruskin et al. (2012). The crinkling audio condition was found to elicit the second largest increase in positive affect.

Conversely, the eating sounds condition was found to evoke the strongest responses consistent with a misophonic reaction. These include a higher proportion of cold shivers in comparison to the other conditions, increased feelings of disgust and avoidance. These findings are consistent with existing research which proposes that eating sounds are the most divisive of ASMR triggers (Barratt and Davis, 2015) and Maruskin et al.'s (2012) suggestion of cold shivers being representative of an aversive reaction. Interestingly, the eating condition did not evoke significant increases stress or anxiety or reduce feelings of connectedness to others.

The findings of research question three enhance the argument for the positive impact of ASMR triggers on the psychological wellbeing of those who experience ASMR, with whispering proving a particularly effective trigger. The current findings suggest that future studies assessing the therapeutic benefits of ASMR should avoid using eating and lip smacking audio stimuli due to the aversive affective reactions that they can elicit.

The current study has several strengths. Firstly, through use of independent measures of ASMR and misophonia the findings have enhanced understanding of

the relationship between ASMR and misophonia, which was previously understood from a limited, binary perspective. Secondly, the study highlights links between ASMR, misophonia and mindfulness, revealing important considerations for future research into the therapeutic benefits of ASMR which may be enhanced by mindfulness training. Furthermore, the results indicate particularly effective ASMR triggers, and triggers which may evoke a misophonic reaction.

A key limitation of the study is the lack of non-ASMR control group. Future studies may look to confirm the findings of the current study, comparing ASMR individuals to non-ASMR individuals. Furthermore, the current study was reliant on self-report measures, the results of which are vulnerable to demand characteristics. Additionally, as participants were recruited via an ASMR forum, there is a chance that expectancy effects influenced participants responses. However, the head researcher designed the study with this implication in mind. Participants were informed that the study was an 'investigation into mindfulness and emotional reactions to different sounds' and participants were asked to provide their sensory and emotional responses to all seven audio clips prior to the introduction of the ASMR checklist and misophonia questionnaire. Furthermore, both state and trait measures of ASMR were utilised to influence findings.

It is important to note that the current study has not assessed the reactions of individuals with clinically diagnosed misophonia. The measure of misophonia was utilised to indicate aversive sound sensitivity and findings should therefore be interpreted as an investigation of associations.

Future studies may look to assess the impact of mindfulness training on the experience of ASMR, and associated enhanced wellbeing, utilising both state/trait self-report and physiological measures of ASMR, pre and post mindfulness training. This study could also assess the impact of mindfulness training on ASMR individuals with a tendency to experience misophonia, with measures of misophonia taken both pre and post mindfulness training.

The current study utilised social media (Reddit) and the MMU Participant Pool as forms of opportunity sampling. Whilst the use of social media allows for a wide reach of geographically located individuals, it limits generalisability to those who utilise social media, specifically the r/ASMR forum. The current findings are, therefore, limited to those who frequently engage with social media and likely already utilise ASMR stimuli. Further research addressing ASMR and misophonia within the general population may provide insight into the prevalence of the two sensory phenomenon's and provide an interesting comparison to the current findings.

In summary, the findings of the current study have added to existing research by highlighting a relationship between ASMR, misophonia and mindfulness. Furthermore, whispering was found to be a particularly effective trigger of ASMR consistent reactions, whilst eating sounds elicited an aversive sensory-emotional response.

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