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Preliminary validation of the Norwegian version of misophonia questionnaire (MQ-NOR)

Erik-Aleksander Larsen^{a,b}, Tine Hovland^{a*}, Guri Engernes Nielsen^{a,c} and Linda Larsen^d 

^aDepartment of Special Needs Education, University of Oslo, Oslo, Norway; ^bVestfold Hearing and Communication [Vestfold Hørsel og Kommunikasjon], Stokke, Norway; ^cHEAR [HØR] Clinic, Oslo, Norway; ^dDivision of Mental & Physical Health, Norwegian Institute of Public Health, Oslo, Norway

ABSTRACT

Objective: To perform a psychometric validation of a Norwegian version of the Misophonia Questionnaire (MQ-NOR) and to test the link between the personality trait neuroticism and misophonia assessed with the MQ-NOR.

Design: Participants completed online versions of the MQ-NOR on two occasions about two weeks apart and the neuroticism scale from BFI-20.

Study sample: Two-hundred and twenty-seven (T1) and 173 (T2) participants with self-reported misophonia.

Results: The MQ-NOR was found to comprise two factors: Symptom Scale and Emotions and Behaviours Scale. Overall, the MQ-NOR evidenced good internal consistency and test-retest reliability. Regression analyses supported a positive relationship between misophonia and neuroticism that was moderated by participant age, but not gender.

Conclusion: The MQ-NOR demonstrates good psychometric properties, but until more extensively validated, it is cautiously recommended for use by clinicians in Norway to assessing misophonia. Future validation studies should be carried out.

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Misophonia questionnaire; misophonia; test-retest validation; neuroticism; Norwegian


There are many definitions of misophonia in the literature. Jastreboff and Jastreboff (2015) defined misophonia “as an abnormally strong reaction to a sound with a specific pattern and meaning to a given subject. The physical characteristics of the sound are secondary” (p. 376). A recent consensus definition was reached to aid empirical investigations, describing misophonia as a disorder related to decreased sound tolerance that evokes strong negative emotional, physical, and behavioural responses to sounds that do not bother people normally. It is the specific pattern or meaning rather than the loudness of sound that appears to be the problem, and the trigger sounds are often elicited by another individual and often produced by the body (e.g. eating or chewing sounds). Individuals with misophonia may find it difficult to distract themselves from the trigger sound and may experience impaired social, occupational, or academic functioning. Misophonia symptoms and severity vary between individuals, however, it commonly develops in childhood or early adolescence (Swedo et al. 2021).

The consensus definition of misophonia does not specify the aetiology, relation with psychological conditions or whether misophonia should be considered a psychiatric condition due to a paucity of empirical evidence on these topics (Swedo et al. 2021). However, some studies support an underlying neurobiological mechanism with evidence from functional magnetic

resonance imaging of abnormal functional connectivity of the anterior insula (Kumar et al. 2017, 2021; Schröder et al. 2019) and a significantly smaller mean peak amplitude of the N1 event-related brain potential component during an auditory odd-ball task, suggesting a neurobiological deficit reflecting either impaired processing or perception of auditory information (Schröder et al. 2014). Others have explored misophonia in relation to neuroticism due to a similarity in characteristics, that is, the frequent and intense negative emotional reactions to trigger sounds in misophonia and to stressors in individuals high in the personality trait neuroticism (Cassillo-Robbins et al. 2020; Widiger 2009). For instance, one study reports preliminary findings of above average scores on neuroticism by individuals with suspected misophonia (Jager et al. 2020), while others report significant correlations between neuroticism and symptoms of misophonia in university students (Daniels, Rodriguez, and Zabelina 2020), an adult transdiagnostic sample (Cassillo-Robbins et al. 2020), and a clinical sample of non-psychotic psychiatric outpatients, although in this study, neuroticism was not a significant predictor of misophonia (Çolak et al. 2021). Further research is needed to elucidate the relationship between misophonia and neuroticism, but current research suggests that higher neuroticism is a risk factor for misophonia (Cassillo-Robbins et al. 2020). The different foci within misophonia

CONTACT Erik-Aleksander Larsen  erik.aleksander@vestfoldhorsel.no  Frederik Stangs Gate 1, 3160 Stokke, Norway; Tine Hovland 
audiopedagoghovland@gmail.com  Postboks 45 Linderud, 0517 Oslo, Norway

*Current address: Linderud Educational Audiology Centre – Tinnitus and Hyperacusis Clinic, Oslo, Norway

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research serve to underscore that misophonia should be studied as a condition within several scientific disciplines such as audiology, psychology, and neuroscience (Swedo et al. 2021).

Misophonia assessments in a Cross-Cultural perspective

Irrespective of scientific discipline, it is important to have available valid and reliable measures to uncover the background, resulting emotions and behaviours, and degree and severity of misophonia. There are several misophonia questionnaires available including the Misophonia Questionnaire (MQ; Wu et al. 2014), the Amsterdam Misophonia Scale (A-Miso-S; Naylor et al. 2021), MisoQuest (Siepsiak, Śliwerski, and Łukasz Dragan 2020), and the Duke Misophonia Questionnaire (Rosenthal et al. 2021). The MQ (Wu et al. 2014) was the only misophonia questionnaire that had preliminary psychometric data when the present study was initiated and therefore the focus of our study. Notwithstanding the MQ being a relatively new measure, several studies have already used it to detect and map misophonia due to individual differences in symptoms, and emotions and behaviours. In general, studies report good internal consistencies with Cronbach's alphas ranging from .75 to .90 across different nationalities and populations (e.g. Zhou, Wu, and Storch 2017; McErlean and Banissy 2018; Daniels, Rodriguez, and Zabelina 2020; Honarmand et al. 2019). The MQ has also been utilised to report treatment effects in at least one study (McGuire, Wu, and Storch 2015). Importantly, the original study by Wu et al. (2014) detailing the development and validation of the MQ did not test for the stability of the measure over time and to our knowledge, no other study has evaluated this. This warrants an investigation of the test-retest validity the MQ.

Cross-cultural adaptations of questionnaires have clear advantages (e.g. time and cost savings) over developing new questionnaires (Beaton et al. 2000) and additionally, by adapting an already validated questionnaire into a new language, it more easily enables comparisons of results from different studies. A guideline specifically developed for adapting questionnaires within the field of audiology was recently developed with the aim of proposing a good practice guide on the translation process and encouraging transparency in the process by publishing the details of the process (Hall et al. 2018). The procedure proposed by Hall et al. (2018) is based on a synthesis of existing guidelines and involves a series of (six) steps involving preparation, translation from source language to target language, back-translation, evaluation by a cross-disciplinary expert team, pilot testing and final evaluation and completion of the adapted questionnaire. The process may thus be described as well-justified in addition to being particularly thorough and it therefore used in the present study.

The current study

The current study addressed a need by pedagogical hearing therapists, and clinicians and researchers in Norway to have a self-report measure available for assessing the background, resulting emotions and behaviours, and degree and severity of misophonia. The tradition in Norway is for technical clinicians working with individuals with (suspected) misophonia to follow Tinnitus Retraining Therapy (TRT) protocols (Jastreboff, 2000), even if the evidence for this approach is not supported. Nonetheless, other audiological conditions may be differentiated by using audiological evaluations (Ferrer-Torres and Giménez-Llort 2022), but the preferred is to use a self-report questionnaire

to assess misophonia. To the best of our knowledge, those working with individuals with (suspected) misophonia in Norway have no validated misophonia questionnaire available. Thus, the aim of the present study was to adapt the MQ into Norwegian (i.e. MQ-NOR) using Hall and colleagues' approach (Hall et al. 2018), before submitting the MQ-NOR for a pre-validation; investigating the factor structure, internal consistency, and the test-retest reliability. This is the first ever evaluation of the test-retest reliability of the MQ and provides a much-needed tool for assessing misophonia in Norway. Further, given the demonstrated link between misophonia and neuroticism and research interest in this relationship at the time of our study (e.g. Cassiello-Robbins et al. 2020; Daniels, Rodriguez, and Zabelina 2020), this will be tentatively explored in our Norwegian sample of individuals with misophonia to provide even further evidence.

Materials and methods

Procedure and participants

Data were collected through an online survey and participants were recruited through five audiology clinics and via social media (e.g. Facebook groups). To be able to participate in the study, participants had to be between 18–67 years and have (or suspect to have) a complaint of misophonia. A detailed description of the experience and symptoms of misophonia was included in the participant study information, to ensure uniformity in the understanding of the term (i.e. “Do you feel frustration or anger when someone else eats, breathes or makes other repetitive sounds? Do you avoid meals with friends or family or lose concentration when someone else types on a keyboard?”). The data were collected between February and March 2021. Participants were asked to complete the survey on two separate occasions about two weeks apart (T1 and T2). The study received approval from the Norwegian centre for research data (Norsk senter for forskningsdata; NSD).

A total of 227 participants (84.1% female) completed the survey at T1 and 173 (83.2% female) completed the survey at T2. The average age was 37.7 years ($SD=11.6$). The average age for females was 37.5 ($SD=11.3$) and for males 39.1 ($SD=13.2$). Twenty-six participants receiving treatment for misophonia at either T1 and/or T2 were excluded from the test-retest analysis to avoid any confounding treatment effects.

Questionnaire translation

The step-by-step process proposed by Hall et al. (2018) was used to adapt the MQ (Wu et al. 2014) into Norwegian. In the preparation phase, permission was received from the developers of the MQ for the adaption of the questionnaire into Norwegian. In the next step, two forward translations were produced, one by a professional translator and one by a pedagogical hearing therapist. An external reviewer, who is also a pedagogical hearing therapist with expertise in misophonia, then consolidated these translations. In the back-translation step, a third translator, a Norwegian-English bilingual with clinical experience in pedagogical hearing therapy, performed a back-translation of the consolidated questionnaire. In the next step, the back- and consolidated-forward translations were compared to the original MQ and any discrepancies were discussed and resolved by a review committee comprising the study authors. Finally, in the last two steps, four individuals with self-reported misophonia test-piloted the Norwegian adaptation and feedback on the last

item (i.e. misophonia severity) resulted in minor adjustment to the wording of the response option. The pilot testers then approved the adjustment. See [Supplementary Appendix A and A1](#) for further details and the translation protocol.

Measures

Participants completed a Norwegian version (MQ-NOR) of the Misophonia Questionnaire (Wu et al. 2014). Items on the Misophonia Symptom Scale are rated on scale from *Not at all true* (0) to *Always true* (4), while items on the Misophonia Emotions and Behaviours Scale are rated on a scale from *Never* (0) to *Always* (4). The two scales are summed to get the Total Score Scale (possible score range: 0–68). The single item Misophonia Severity Scale is originally rated on a scale from *Minimal* (1) to *Very severe* (15), with scores of 7 or higher corresponding to clinically significant symptoms (Wu et al. 2014), but we allowed participants to indicate if they thought they were *not sound sensitive* (0). Participants also completed the Neuroticism Scale from the Big Five Inventory 20 (BFI-20), a short version of BFI-44 (Engvik and Clausen 2011). The Neuroticism Scale is comprised of four statements (e.g. Is relaxed, handles stress well; I worry a lot) rated on a scale from *Does not fit* (1) to *Fits perfectly* (7). After reverse scoring items, an average score is calculated with values close to 7 reflecting a high degree of neuroticism. Internal consistency with Cronbach's alpha was $\alpha = .77$.

Statistical analyses

The factor structure of the MQ-NOR was investigated using exploratory factor analysis with an oblique factor rotation. The cut-off for factor loadings was set at 0.30. Factor extraction was determined by parallel analysis, inspection of the scree plot and eigenvalues > 1 (Kaiser 1960). The internal consistency of MQ-NOR was assessed with Cronbach's alpha using the following cut-offs: $< .60$ unacceptable; $.60$ – $.69$ minimally reliable; $.70$ – $.79$ reliable; $.80$ – $.90$ highly reliable and $> .90$ very highly acceptable (Cohen et al., 2017). Test-retest reliability was investigated by examining (1) the exact agreement between items at T1 and T2, (2) ≤ 1 response grade difference between T1 and T2, and (3) Cohen's weighted kappa for categorical variables (i.e. individual questionnaire items) and Intra Class Correlations (ICCs) for numerical variables (i.e. MQ-NOR scales) using a two-way mixed model with absolute agreement. Cohen's weighted kappa criteria were: $.21$ – $.40$ fair; $.41$ – $.60$ moderate; $.61$ – $.80$ substantial; and $\geq .81$ almost perfect agreement (McHugh 2012), while ICCs $< .50$ was considered poor; $.50$ – $.75$ moderate; $.75$ – $.90$ good; and $> .90$ excellent (Koo & Li, 2016). Finally, ordinary least squares (OLS) regression analyses were used to examine the relationship between the misophonia scales and neuroticism. The statistical analyses were performed using IBM SPSS (Version 27) and Jamovi (Version 1.6.15.0).

Results

Descriptive statistics

The sounds that participants were the most sensitive to (i.e. rated *Often true* or *Always true*) were people eating (77.3%) followed by nasal sounds (74.1%). Participants were the least sensitive to consonant/vowel sounds (14.1%). The emotional or behavioural responses that participants engaged in most often (i.e. rated

Often or *Always*) were becoming annoyed (83.2%) followed by leaving the environment (56.3%), while becoming sad and depressed (16.3%) and physically aggressive (3.5%) were the least experienced emotional responses. Descriptive statistics for individual items are provided in [Supplementary Appendix B](#) and [Supplementary Appendix C](#) presents the MQ-NOR in its entirety.

Bivariate correlations showed that the Misophonia Total Score Scale and the Emotions and Behaviours Scale were significantly and strongly associated with the Severity Scale ($r = .67$ and $r = .62$, respectively, $ps < .001$), while the association between the Misophonia Symptom Scale and the Severity Scale was moderate ($r = .34$, $p < .001$).

Factor analyses

Prior to performing the exploratory factor analyses investigating the underlying structure of items on the MQ-NOR, Kaiser-Mayer-Olkin (KMO) and Bartlett's test of sphericity were examined to ensure the quality of the correlation matrix and sampling adequacy. KMO was acceptable (KMO = 0.87), and Bartlett's test of sphericity was significant, $X^2(136) = 1675$, $p < .001$, suggesting that the data were suitable for factor analysis. Results showed that a two-factor solution was the better fit to the data and together the factors explained 42.13% of the variance. Two items ("People Eating" and "Nasal Sounds") cross-loaded, but as "Nasal Sounds" loaded more strongly on Factor 2 it was included in this factor, while "People Eating" loaded equally on the two factors. Despite this it was deemed more appropriate to include this item in Factor 2 akin to Wu et al. (2014) rather than exclude the item as it is a particularly salient symptom for patients with misophonia (see [Table 1](#)).

Internal consistency

Cronbach's alpha for the Misophonia Symptom Scale was $\alpha = .81$ and for the Misophonia Emotions and Behaviours Scale it was $\alpha = .88$. The internal consistency of each scale remained (or was marginally lower) if an item was dropped from the scale. Cronbach's alpha for the Total Score Scale was $\alpha = .88$, which was largely unchanged if an item was deleted.

Table 1. Results from the exploratory factor analysis.

MQ items	Factor loading		Uniqueness
	1	2	
<i>Misophonia Symptom Scale</i>			
1. People Eating	.39	.39	.59
2. Repetitive Tapping		.75	.47
3. Rustling		.73	.51
4. Nasal Sounds	.32	.53	.49
5. Throat Sounds		.62	.51
6. Consonants/Vowels		.44	.80
7. Environmental Sounds		.47	.77
<i>Misophonia Emotions and Behaviours Scale</i>			
1. Leave Environment	.69		.47
2. Avoid Environment	.65		.53
3. Cover Ears	.50		.75
4. Anxious/Distress	.60		.63
5. Sad/Depressed	.64		.62
6. Annoyed	.70		.39
7. Violent Thoughts	.76		.48
8. Angry	.86		.28
9. Physically Aggressive	.55		.74
10. Verbally Aggressive	.55		.68
Eigenvalue	5.52	1.50	

Table 2. Test-retest agreement for individual items from the MQ-NOR ($n = 147$).

Items	Exact agreement N (%)	≤ 1 grade difference in agreement N (%)	Cohen's Weighted kappa
<i>Symptoms</i>			
1. People Eating	112 (76.2)	146 (99.3)	.76
2. Repetitive Tapping	98 (66.7)	139 (94.6)	.66
3. Rustling	84 (57.1)	139 (94.6)	.62
4. Nasal Sounds	87 (59.2)	139 (94.6)	.59
5. Throat Sounds	81 (55.1)	140 (95.3)	.59
6. Consonants/Vowels	77 (52.4)	141 (95.9)	.58
7. Environmental Sounds	82 (55.8)	137 (93.2)	.65
<i>Emotions and Behaviours</i>			
1. Leave Environment	93 (63.3)	146 (99.3)	.60
2. Avoid Environment	88 (59.9)	139 (94.6)	.63
3. Cover Ears	92 (62.6)	138 (93.9)	.59
4. Anxious/Distress	75 (51.0)	126 (85.7)	.57
5. Sad/Depressed	90 (61.2)	138 (93.9)	.60
6. Annoyed	94 (63.9)	144 (97.9)	.60
7. Violent Thoughts	87 (59.2)	138 (93.9)	.62
8. Angry	82 (55.8)	140 (95.3)	.60
9. Physically Aggressive	118 (80.3)	145 (98.7)	.65
10. Verbally Aggressive	82 (55.8)	140 (95.3)	.56

Participants who were in treatment at T1 and/or T2 ($n = 26$) were excluded.

Table 3. Descriptive statistics and Intra-Class Correlations (ICCs) assessing the test-retest reliability for the respective scales of the MQ-NOR ($N = 147$).

MQ-NOR Scale	Test (T1) <i>M</i> (<i>SD</i>)	Re-test (T2) <i>M</i> (<i>SD</i>)	ICC
Symptom Scale (/28)	17.58 (5.64)	17.32 (5.30)	.88
Emotions and Behaviours Scale (/40)	17.37 (7.51)	16.72 (7.11)	.90
Total Score Scale (/68)	34.95 (11.45)	34.04 (10.73)	.92
Severity Scale (/15)	6.06 (2.63)	5.93 (2.62)	.77

Participants who were in treatment at T1 and/or T2 ($n = 26$) were excluded.
ICC: Intra-Class Correlation; *M*: Mean; *SD*: Standard deviation.

Test-retest reliability

The agreement for individual items on the Misophonia Symptom Scale and the Emotions and Behaviours Scale was generally good when inspecting the exact agreement and ≤ 1 grade difference agreement. Weighted kappas were in the high moderate to substantial range with values ranging from .56 (Verbally Aggressive) to .76 (People Eating) (see Table 2). ICCs were good to excellent with ICCs ranging from .77 (Severity Scale) to .92 (Total Score Scale) (see Table 3).

Regression analyses

Neuroticism showed statistically significant relation with the Symptom Scale, $\beta = .214$; $p = .001$, Emotions and Behaviours Scale, $\beta = .356$; $p < .001$ and Severity Scale, $\beta = .252$; $p < .001$. This suggests that participants more plagued by misophonia also reported a higher level of neuroticism. Further, results showed that age was a significant moderator of the relationship between neuroticism and scores on the Emotions and Behaviours Scale, $\beta = .613$; $p = .026$, which suggest a stronger association in older rather than younger participants. The age by neuroticism interaction effect on misophonia symptoms and severity, respectively, did not reach statistical significance, nor did any of the gender by neuroticism interaction effects.

Discussion

The purpose of this study was to perform a pre-validation of the MQ-NOR, a Norwegian translation of the MQ (Wu et al. 2014), and to tentatively explore the association between the personality

trait neuroticism and misophonia using our Norwegian sample. The MQ-NOR is the first ever validated Norwegian misophonia questionnaire and will be a valuable tool for audiologists, pedagogical hearing therapists and other professionals working with individuals with misophonia in Norway.

When Wu and colleagues developed the MQ, they found that three factors best described the questionnaire; the Symptom Scale, the Emotions and Behaviours Scale and the Total Score Scale (sum of other two scales; Wu et al. 2014). However, this finding was not replicated in our study, which found only two factors as did an Iranian validation study (Honarmand et al. 2019). Items clearly loaded on one of two factors except for two items (i.e. People eating and Nasal sounds) that had loadings exceeding the cut-off of .30 on both factors. It was decided to include both items in the Symptom Scale as both are commonly reported (i.e. salient misophonia symptoms; Swedo et al. 2021) and thus, despite the difference in the number of factors best describing the structure of the MQ, it is noted that each of our factors comprise the same items as Wu's first two factors. Interestingly, Wu's third factor is the Total Score Scale (i.e. the sum of the Symptom Scale and Emotions and Behaviours Scale), which has an eigenvalue greater than one even though several items have generally low factor loadings. Even if the present study did not find statistical evidence for a third factor (i.e. a Total Score Scale), it makes intuitive sense to have a Total Score Scale as an index of severity, breadth of trigger sounds and reactions. Regarding MQ-NOR inter-scale correlations, we found similarly to Wu et al. (2014) a significant and strong association between the Total Score Scale and the Severity Scale, something that indeed supports the utility of the Severity Scale as an index of severity even if it has not been validated against an (objective) alternative measure of severity and remains purely adapted from the NIMH Obsessive-Compulsive Scale (Murphy, Pickar, and Alterman 1982) as described by Wu et al. (2014). This therefore presents an avenue for future research to address.

Further, our results demonstrate high internal consistency with Cronbach's alpha above .80 for the Symptom Scale, Emotions and Behaviours Scale and Total Score Scale, respectively. This is reassuring and in accordance with other studies also reporting good internal consistency statistics for the MQ (Daniels, Rodriguez, and Zabelina 2020; McErlean and Banissy 2018; Wu et al. 2014; Zhou, Wu, and Storch 2017). Finally, our

test-retest analyses revealed at the more descriptive level that the mean exact agreement across items on the Symptom Scale and Emotions and Behaviours Scale was 60.9% (i.e. 17 items by 147 participants). Further, for all items, more than 90% of participants had ≤ 1 grade difference between scores at T1 and T2, that is, there was either no change in scores or only one grade difference from for example, *Not at all true* (0) to *Rarely true* (1). Based on the statistical test-retest analyses, indices with Cohen's weighted kappa and ICCs supported the stability of participants' responses over a period of 2–3 weeks. This is the first time the test-retest reliability of the MQ has been investigated with results indicating that the MQ-NOR may be reliably used over time, however, further investigations of the test-retest reliability of the MQ using both clinical and non-clinical populations are strongly encouraged.

Results from our supplementary regression analyses confirmed our hypothesis of a positive relationship between misophonia and neuroticism. These findings are in line with previous research (e.g. Çolak et al. 2021) and now demonstrates this relationship in a Norwegian sample of individuals with a complaint of misophonia. The moderation analyses revealed a stronger relationship between neuroticism and misophonia emotion and behaviour reactions in older participants than younger participants. A possible explanation for this might be related to the idea that misophonia trigger sounds tend to generalise over time, similar to a conditioned reflex (Edelstein et al. 2013). In adulthood there may also be an increased awareness of the condition, which is often reported as a hidden and shameful condition to live with. Thus, trigger reactions might promote more worry/nervousness and particularly reduce the ability to handle stress for those higher on neurotic personality traits, which in turn might exacerbate the experience of misophonia in a system where misophonia and neurotic traits in essence feed into each other over time. Taken together, our findings add to our understanding of the relationship between misophonia, a condition within decreased sound tolerance, and personality by demonstrating the importance of patients' age on this relationship, which has previously been shown in another related condition, namely, noise sensitivity where both age and gender was found to be important in the relationship with personality (Shepherd et al. 2015).

Strengths and limitations

A clear strength of our study is the rigorous cross-cultural adaptation of the MQ into Norwegian using the guidelines proposed by Hall et al. (2018). Another methodological strength is our test-retest design and extensive test-retest analyses. However, our study has some limitations that should be mentioned. The proportion of males to females was unequal at around 1:5. While this is regrettable, it is often the case and in the original MQ study by Wu and colleagues (2014), a similar proportion of males to females was found. This may indicate that the population with a complaint of misophonia is higher among women than it is among men. Further, the participants were recruited via clinics and online fora, and the present study relied on participants who were recruited online to self-report a complaint misophonia. It is thus not entirely clear if all participants in fact have misophonia or whether they may have confused this with sound over-responsivity generally, for example. But given the detailed description of misophonia in the study information to participants, we have good reason to believe in the participants' self-report. This was also confirmed in the rather high proportion of the sample (i.e. 48.9%) who meet cut-off for clinically significant misophonia

symptoms. Finally, the present study did not include individuals without misophonia nor were other misophonia questionnaires included (as none were validated at the time), something that prevented a more extensive validation of the MQ-NOR. We strongly encourage future studies to address these issues and additionally, using clinical samples in this endeavour.

Conclusion

The present study has demonstrated, using a sample of individuals with self-reported misophonia complaints, that the MQ-NOR has adequate psychometric properties in terms of factor structure, internal consistency, and test-retest reliability. However, until the MQ-NOR has undergone more extensive validation, it should be cautiously implemented as a measurement tool for misophonia in Norwegian clinics. Future studies should focus on the psychometric validity of MQ-NOR using clinical samples and it would be of interest to probe the personality trait of neuroticism as a risk factor for misophonia.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Linda Larsen  <http://orcid.org/0000-0002-6910-4946>

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