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Quality of Life among Youth with Misophonia: The Role of Internalizing Symptoms and Pessimism

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Abstract
This study examined quality of life (QoL) in youth with misophonia compared to a general US youth sample and how misophonia-related variables (severity, number of triggers, responses), internalizing/externalizing symptoms, age and gender were associated with QoL among youth with misophonia. One-hundred and two children and adolescents ($M_{age} = 13.7$ [2.5]) with impairing misophonia symptoms completed self-report measures and clinical interviews. A comparison to a general US youth sample was conducted by dividing participants with misophonia into two age groups ($<$ or ≥ 14 years). Older youth with misophonia reported poorer QoL than youth from the general US population, while no statistically significant difference emerged for younger youth with misophonia. More internalizing symptoms, more pessimism, a greater number of misophonia triggers, and being older were significantly associated with poorer QoL among youth with misophonia, with each variable explaining unique variance. Hence, youth with misophonia – particularly adolescents – may have lower QoL compared to their peers, and internalizing symptoms and pessimism are most strongly correlated with poorer QoL. Future research should examine what contributes to poor QoL among youth with misophonia and their family members and potential remedies.

Keywords Misophonia · Sound sensitivity · Quality of life · Youth · Pessimism · Internalizing symptoms

Introduction

Misophonia is characterized by distressing emotional and physiological reactions to specific sound triggers and visual stimuli (Swedo et al., 2022). Triggers are often oral-nasal in nature (e.g., breathing, eating, lip smacking, sniffing, throat clearing, talking or humming) although there is a wide variety of triggers such as tapping, typing on a keyboard, pen clicking, and animal sounds as well as visual stimuli like leg swinging or knuckle cracking (Swedo et al., 2022). In response to these triggers, individuals with misophonia often experience intense emotional reactions such as anger, annoyance, irritation, disgust, shame, guilt, and physiological reactions (e.g., increase heart rate, sweating, muscle tension, and autonomic arousal (Swedo et al., 2022; Jager et al., 2020; Edelstein et al., 2013)). Behavioral responses to misophonic triggers can include verbal and physical aggression, assertively asking others to stop making noises, covering eyes and ears, crying, active avoidance of hearing triggers (e.g., walking away, listening to music), and mimicking trigger sounds, among others (Edelstein et al., 2013; Jager et al., 2020; Siepsiak et al., 2023). Misophonia is associated with functional impairment across family, social, academic and work domains (Brout et al., 2018; Swedo et al., 2022; Wu et al., 2014; Zhou et al., 2017).

Given this often disabling clinical profile, it seems as though individuals with misophonia would experience considerably poorer quality of life (QoL); however, investigations into the quality of life (QoL) in this population are limited, particularly among children and adolescents. QoL is a multidimensional concept that describes the overall

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well-being of an individual and the extent to which an individual can enjoy and is satisfied with their life (Endicott et al., 2006; Felce & Perry, 1995). Assessing QoL provides unique insight into an individual's perceived impact of illness and can be used as an additional metric to operationalize symptom severity as well as response to interventions in research and clinical settings. Outside of misophonia, QoL is consistently inversely correlated with the severity of mental health and somatic symptoms (Coluccia et al., 2017; Fernandes et al. 2023; Lack et al., 2009; Storch et al., 2018). Across mental health conditions such as obsessive–compulsive disorder (OCD; (Weidle et al., 2015)), chronic tic disorders (Storch et al., 2007), and internalizing disorders (Martinsen et al., 2016), QoL is lower relative to controls. Similarly, hearing conditions such as tinnitus or hyperacusis are associated with problems with sleep, attention, headache, stress, functioning and emotional well-being in youth (Kim et al., 2012; Myne & Kennedy, 2018; Potgieter et al., 2020; Tegg-Quinn et al., 2021). Youth with comorbid diagnoses experience worse QoL than those who have a single diagnosis (Johansson et al., 2013; Masellis et al., 2003), likely due to the cumulative burden coupled with each condition. Internalizing symptoms, which refer to internal responses that manifest in disorders such as depression and anxiety, are uniquely associated with QoL in adolescents, even when accounting for demographic and environmental factors (Salum et al., 2014). Similarly, externalizing symptoms, which refer to external behaviors that manifest in impulsivity, anger, aggression, have been found to be associated with QoL in both clinical (Lack et al., 2009) and medical samples (Jackson et al., 2014). Given the documented severity and associated impairment in misophonia, high rates of its co-occurrence with internalizing conditions (Guzick et al., 2023; Jager et al., 2020; Siepsiak et al., 2020a), which can develop as early as during childhood (Rinaldi & Simner, 2023), and the known effects of stress on physical and mental health (LeMoult et al., 2020; O'Connor et al., 2021; Stults-Kolehmainen & Sinha, 2014), it is conceivable that youth with misophonia may experience worse QoL than their non-misophonic peers.

Understanding QoL in youth with misophonia has potential clinical and policy implications. First, attenuated QoL may lead to health deterioration due to its association with decreased resilience (Anderson et al., 2020), increased depressive symptoms (Thabrew et al., 2018) and sleep deprivation (Paiva et al., 2015). Second, there is emerging evidence that supports the association between misophonia symptoms and self-destructive behaviors (i.e., self-harm, suicidal thinking). A recent study by Simner and Rinaldi (Simner & Rinaldi, 2023) found that adults with current misophonia symptoms reported poorer well-being than non-misophonic adults during their adolescence and early adulthood. Furthermore, in comparison to the non-misophonic control group, more female adults with current misophonia symptoms endorsed a history of self-harm and suicidal feelings at the age of 16, and a history of self-harm with intent to die and suicidal ideation at the age of 24 (Simner & Rinaldi, 2023). In another study by Siepsiak and colleagues (Siepsiak et al., 2023), adolescents with misophonia reported their engagement in self-harm behaviors (e.g., pinching, scratching skin) while hearing the triggers sounds and the associated results (e.g., bruises, scratches, bleeding). Given that self-harm and suicidality are associated with lower life satisfaction and well-being (Le et al., 2023), these findings highlight that youth with misophonia might be at risk of experiencing poor QoL or that they may be engaging in self-destructive behaviors due to poor QoL. Third, understanding QoL will provide further justification for developing and evaluating interventions and policies for this population, as well as provide guidance on domains that may be necessary to specifically target in treatment.

However, research on misophonia and its association with QoL is still in its infancy. In an adult study, Jager and colleagues (Jager et al., 2020) suggested that QoL is adversely impacted among individuals with misophonia. In an online, longitudinal survey, adults with misophonia reported lower QoL than the general population at baseline and at a 1-year follow-up, and the difference between reported QoL was prominent for emotional well-being and social functioning (Dibb & Golding, 2022). In a pediatric study, Rinaldi and colleagues (Rinaldi et al., 2022) examined QoL among 15 children with elevated misophonia symptoms and showed that these children had poorer health-related QoL and satisfaction with life than peers without elevated misophonia symptoms. In other work, misophonia severity was negatively associated with QoL in youth although QoL was not significantly different between misophonia and anxiety groups (Cervin et al., 2023; Guzick et al., 2023).

To extend this line of research in a novel way, the present study examined QoL in youth with misophonia by 1) recruiting a large sample size within the United States of America, and 2) investigating multiple variables associated with misophonia symptom severity (e.g., pessimism). Specifically, we had two aims. First, we examined whether youth with misophonia reported more impaired QoL compared to a general US youth sample. Given that a previous study by Rinaldi and colleagues (Rinaldi et al., 2022) found that children with misophonia reported poorer well-being on a brief, four-item QoL measure, which assesses well-being in major life domains (i.e., home, school, friends, and health) as well as based on our clinical experience, we hypothesized that QoL would be impaired in youth with misophonia compared to their peers without misophonia. To assess QoL in our sample, we utilized a QoL measure (Endicott et al., 2006) that assesses well-being across a broad range of life domains, including the aspects examined in Rinaldi

and colleagues' study (Rinaldi et al., 2022), and additional areas such as mood/feelings, play or free time, and energy level. Second, we examined whether different features of misophonia (severity, number of triggers, responses), co-occurring mental health symptoms and sociodemographic information were associated with QoL among youth with misophonia. Based on previous research in non-misophonic conditions (e.g., OCD, anxiety disorders), it was expected that misophonia symptom severity would be negatively related to QoL. We also predicted that internalizing and externalizing symptoms would each be uniquely associated with poorer QoL.

Method

Participants and Procedure

Youth with misophonia and their parents were recruited via social media, newsletters, listservs, clinician referrals, and other resources. First, 148 participants were screened through a phone call for basic eligibility requirements: 1) 8—17 years old, 2) proficiency in English, and 3) currently living in the United States (U.S). After this preliminary screening, 19 declined to participate, 3 were found to be ineligible (1 due to communication concerns (e.g., child could not comprehensively communicate misophonia-related concerns), and 2 lived outside of the U.S.), 13 were lost to follow up, and 1 did not schedule for other reasons.

Following the screening, 112 participants provided their assent/consent and completed the online screening questionnaires to confirm their eligibility. Youth with misophonia had to score ≥ 10 on the Amsterdam Misophonia Scale indicative of misophonia with moderate severity (A-MISO-S) (Schröder et al., 2013). Given that the A-MISO-S was originally developed for adults (Schröder et al., 2013), a trained assessor was present to clarify any questions and ensure participants could respond to the questions appropriately. After confirming eligibility, youth participants and their parents completed a series of online baseline questionnaires and virtual clinical interviews using a HIPAA compliant teleconferencing software. The clinical interview consisted of the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) (Sheehan et al., 2010) and the Misophonia Assessment Interview (MAI) (Lewin et al., 2021). The MINI-KID and the MAI were administered by trained assessors who held at least a bachelor's in psychology. The MINI-KID was administered to both the parents and youth, and was used to further characterize possible co-occurring disorders (e.g., depression, anxiety, ADHD), which is reported in Guzick et al. (2023). The MINI-KID was not used to ascertain misophonia symptoms.

Of the 112 who completed the above interviews, 5 (4%) were ineligible due to their misophonia symptoms being too mild (a score on A-MISO-S < 10), and 5 (4%) were unable to schedule visits. A total of 102 misophonia participants were included in the present analyses. The cut-off score of 10 on A-MISO-S was determined based on (Möllmann et al., 2023) and because scores 10 – 14 are considered to be moderate severity (Schröder et al., 2013). Participants were compensated $60 (i.e., $30 for the parent and $30 for the child) for completing the self-report questionnaires and clinical interviews.

Measures

Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (P-QLESQ) The P-QLESQ is a 15-item, self-report measure on a 5-point Likert scale, which ranges from 1 = *Very Poor* to 5 = *Very Good* and assesses quality of life in children and adolescents (Endicott et al., 2006). It has shown strong internal consistency, test–retest reliability, and concurrent validity in youth. Higher scores on P-QLESQ indicate better QoL. In the present study, the P-QLESQ was delivered as a child self-report and the internal consistency was very good (a = 0.90). Mean and standard deviation scores in a general US youth sample with a mean age of 15.5 years (SD = 1.07, 61.5% girls) have been reported (Anderson et al., 2020) and were used as a reference.

Misophonia Assessment Questionnaire (MAQ) The MAQ is a self-report measure that assesses impact/severity of misophonia (Dozier, 2015; Johnson & Dozier, 2013). The measure includes 21 items that comprise four scales: pessimism (e.g., "My response to certain triggers currently makes me feel helpless"), distress (e.g., "My sound issues currently make me unhappy"), interference (e.g., "My sound issues currently interfere with my social life") and non-recognition (Cervin et al., 2023). Each item is rated on a 4-point Likert scale from 0 = *not at all* to 3 = *almost all the time.* Reliability and validity properties are strong (Cervin et al., 2023). The four subscales were used to explore associations with QoL. The MAQ was used to further characterize the severity and presentation of misophonia. The internal consistency of each subscale was adequate in our sample: Pessimism, a = 0.89; Distress, a = 0.84; Interference, a = 0.86; Non-recognition, a = 0.75.

Misophonia Assessment Interview (MAI) The MAI is a clinician-administered semi-structured interview for children and adolescents that evaluates the overall impairment caused by misophonia (Cervin et al., 2023). This interview was administered to both the parent and youth simultaneously. This interview includes a list of 8 possible trigger categories (e.g., eating, breathing, nasal, tapping, environmental), including

an "other" category to capture other possible misophonic trigger categories, 7 possible emotional (e.g., anger, disgust, anxiety) and 4 behavioral (e.g., verbal aggression, physical aggression) responses. In the present study, this measure was used to create two misophonia variables: count of the number of triggers (out of 8 listed) and count of the number of responses (out of the 11 listed). Hence, the MAI was used to quantify the number of misophonia triggers and the number of misophonia responses, but not to assess impairment caused by misophonia nor determine eligibility. Psychometric properties of MAI have not been examined yet.

Youth Self-Report (YSR) YSR is a self-report questionnaire commonly used to assess externalizing and internalizing behaviors (Achenbach & Rescorla, 2001). It contains 112 items related to children's behaviors and is scored on 3-point Likert Scale with 0 = *Not True* to 2 = *Very True or Often True*. The internalizing and externalizing subscales were utilized in the present analyses. In the present study, we used raw scores of YSR self-ratings from the children and adolescents. Both subscales had high internal consistency (Internalizing, $\alpha = 0.90$; Externalizing: $\alpha = 0.78$).

Statistical analysis

P-QLESQ data from a general US youth sample (Anderson et al., 2020) were used as a reference group. The mean P-QLESQ score in the reference sample was 52.01 with a standard deviation of 10.39. To compare the mean in the misophonia group to the mean in the reference group, one-sample t-tests were used. Separate models for the full misophonia sample and for younger (< 14 years) and older (≥ 14 years) misophonia participants were also conducted. The separate age models were used since the general US youth sample had a higher mean age than the misophonia sample, with the older misophonia group largely mirroring the age of the general US sample (general sample, mean age = 15.50 [1.07]; older misophonia sample, mean age = 15.43 [1.18]). The mean age in the younger misophonia sample was 11.10 years (SD = 1.51).

Correlation analysis was used to examine zero-order associations between all variables (except gender) and QoL. Then, multiple linear regression analyses were used to examine unique associations between features of misophonia (severity across the domains of MAQ, number of triggers, responses on MAI), co-occurring mental health symptoms and sociodemographic information and QoL. For the gender variable, 69 participants identified as female, 29 participants as male, 2 participants as "other", 1 participant as a transgender male, and 1 participant as a transgender female. All participants identifying as female and transgender female were coded as female and the rest as non-female. Variables showing statistically significant associations with QoL after accounting for age and gender were analyzed in a final linear regression model that was followed-up by dominance analysis. In dominance analysis, all possible subsets of independent variables are tested in relation to the dependent variable (QoL) and the unique contribution of each independent variable to variance in the dependent variable is estimated (Azen & Budescu, 2003). All analyses were conducted in R Studio (version 2023.09.0) (R Core Team, 2020) and an alpha level of 0.05 was used as an indicator of statistical significance. Assumptions of the linear regressions were evaluated by graphically inspecting the residuals vs fits plot, the QQ plot, the Scale-Location plot and the Residuals vs Leverage plot.

Results

Demographic Characteristics

Demographic characteristics for both the representative US sample, as well as the misophonic group, can be found in Table 1.

QoL in Pediatric Misophonia Compared to a General US Youth Sample

A one sample t-test for the QoL scores in the full misophonia sample ($M = 50.28$, $SD = 8.37$) compared to the mean in the sample of general US youth ($M = 52.01$) showed that

Table 1 Demographic Characteristics of misophonia youth (current sample) and general US youth sample (Anderson et al., 2020)

	Misophonia Youth ($N = 102$)	General US Youth ($N = 3{,}222$) (Anderson et al., 2020)
Age, M (SD)	13.69 (2.5)	15.5 (1)
	%	%
Gender		
Male	28.4	38.5
Female	67.6	61.5
Other	1.96	
Transgender Female	0.98	
Transgender Male	0.98	
Race		
Black or African American	2.9	10.8
Asian	3.9	15.3
White	87.3	42.7
Other	5.9	31.2
Ethnicity		
Hispanic or Latino	5.9	31.8

No information on Transgender Female and Transgender Male was reported in (Anderson et al., 2020)

the misophonia sample had statistically significantly lower QoL (t[101] = -2.09, p = 0.04), but the difference was of a small magnitude (Cohen's d = 0.21). When age-specific analyses were conducted, the younger misophonia sample (M = 53.91, SD = 8.02) did not differ significantly from the general sample (t(Schröder et al., 2013) = 1.52, p = 0.14), but the older sample did (M = 47.84, SD = 7.74; t(Lijster et al., 2018) = -4.21, p < 0.001) and for the older sample the difference was of a moderate magnitude (Cohen's d = 0.54).

Explaining QoL in Youth with Misophonia

The distributions of all study variables are presented in Fig. 1 and their zero-order correlations are presented in Fig. 2. No correlation above 0.70 was present, limiting the risk of multicollinearity. Of note, age was positively correlated with MAQ pessimism, MAQ non-recognition, and internalizing symptoms. We ran several multiple linear regression models to identify variables contributing significantly to variance in QoL. A model with age and gender, showed that age (β = -0.26 [95%CI -0.07, -0.45], p < 0.01) but not gender (β = -0.15 [-0.34, 0.04], p = 0.12) was significantly associated with QoL. We then examined, still accounting for age and gender, the four MAQ scales. Results showed that the pessimism scale (β = -0.34 [-0.07, 0.61], p = 0.02) was the only scale significantly associated with QoL (other ps > 0.20). In a model with number of misophonia triggers and number of misophonia responses (i.e., the sum of emotional and physical responses endorsed on the MAI), again accounting for age and gender, only number of triggers (β = -0.23 [-0.05, -0.42], p = 0.02) was significantly associated with QoL. Last, we examined whether self-reported internalizing and externalizing symptoms were associated with QoL while accounting for age and gender: only internalizing symptoms was significantly associated with QoL (β = -0.64 [-0.44, -0.83], p < 0.001). Detailed results for all linear regression models can be found in Table 2. Graphical inspection of model plots showed no indications of violation of model assumptions.

After examining the subsets of variables above, we conducted a final model that included the variables showing

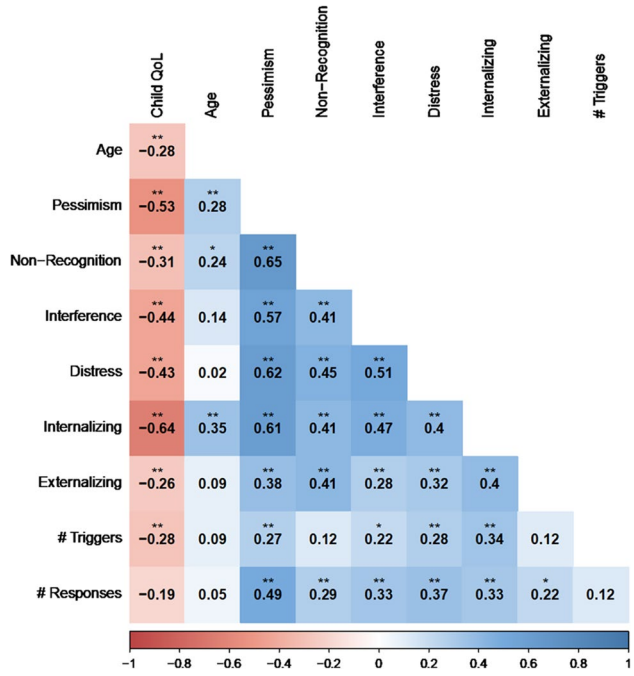

Fig. 2 Zero-order correlations among study variables. * p < .05, ** p < .01

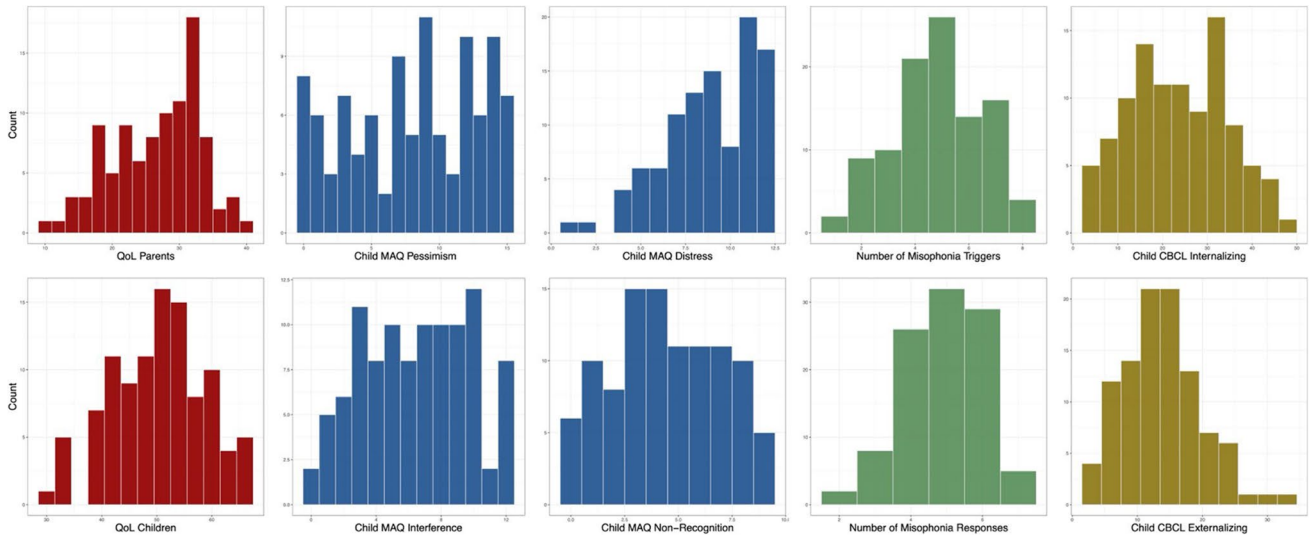

Fig. 1 Distributions of scores on study variables. MAQ = Misophonia Assessment Questionnaire. QoL = Quality of Life

Table 2 Results from the linear regression models. Each model includes youth-reported QoL as the dependent variable

	Standardized beta (95% CI)	*p*
Model 1, explained variance = 8.1%		
Age	-0.26 (-0.45, -0.07)	.008
Gender (female vs non-female)	-0.33 (-0.73, 0.09)	.12
Model 2, explained variance = 31.2%		
Age	-0.18 (-0.35, -0.00)	.05
Gender (female vs non-female)	-0.32 (-0.21, 0.51)	.72
MAQ Pessimism	-0.34 (-0.61, -0.07)	.02
MAQ Non-Recognition	0.11 (-0.11, 0.33)	.33
MAQ Interference	-0.17 (-0.38, 0.04)	.12
MAQ Distress	-0.18 (-0.40, 0.05)	.12
Model 3, explained variance = 14.2%		
Age	-0.24 (-0.42, -0.05)	.01
Gender (female vs non-female)	-0.10 (-0.28, 0.09)	.32
Number of misophonia triggers	-0.23 (-0.42, -0.05)	.02
Number of misophonia responses	-0.14 (-0.32, 0.05)	.15
Model 4, explained variance = 39.9%		
Age	-0.08 (-0.24, 0.09)	.35
Gender (female vs non-female)	0.06 (-0.10, 0.23)	.45
Internalizing symptoms	-0.64 (-0.83, -0.45)	< .001
Externalizing symptoms	0.00 (-0.17, 0.17)	.96
Final Model, explained variance = 44.5%		
Age	-0.06 (-0.22, 0.10)	.48
Gender (female vs non-female)	-0.07 (-0.09 0.23)	.37
Internalizing symptoms	-0.51 (-0.72, -0.30)	< .001
Number of misophonia triggers	-0.05 (-0.21, 0.12)	.56
MAQ Pessimism	-0.20 (-0.40, -0.01)	.04

CI confidence interval, *QoL* quality of life

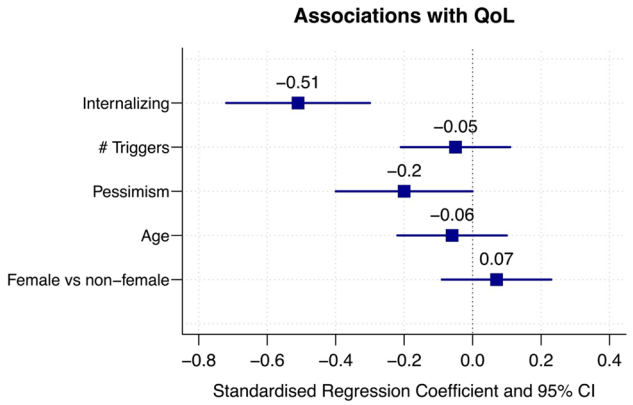

Fig. 3 Associations (standardized regression coefficients) between independent variables and QoL in the final model. CI = Confidence Interval. QoL = Quality of Life

significant associations with QoL, which is presented at the bottom of Table 2. The model included age, MAQ pessimism, number of triggers and self-reported internalizing symptoms. We also accounted for gender in the model. Results are depicted in Fig. 3. Internalizing symptoms and pessimism were significantly associated with QoL. The model explained 45.1% of the variation in QoL and dominance analysis showed that internalizing symptoms explained 24.9% of unique variance, pessimism 13.3%, number of triggers 2.9%, age 2.8% and gender 1.1%. Of note, age was not a significant predictor of QoL when accounting for internalizing symptoms and number of misophonia triggers.

Discussion

We report on QoL in 102 youth with clinically significant misophonia, including baseline estimates, comparison to a normative sample of US youth, and clinical and sociodemographic correlates. We found that youth with misophonia had lower QoL than a general US youth sample, and the difference was particularly pronounced for older youth. Internalizing symptoms (25%) and pessimism about one's sound difficulties (13%) contributed mostly to poor QoL among the youth with misophonia. These findings emphasize that youth, especially adolescents, with misophonia might be at risk of experiencing poor QoL and identify variables

associated with misophonia that should be considered in the assessment and treatment of misophonia.

Older youth with misophonia reported a moderately lower level of QoL than non-misophonic peers, whereas younger children with misophonia reported similar QoL to their counterparts. This may be because misophonia-associated impairment increases as youth transition into adolescence. Adolescence is a challenging time, during which QoL and life satisfaction naturally tend to decrease (Aymerich et al., 2021; Haraldstad et al., 2011) and many forms of psychiatric problems emerge (Paus et al., 2008; Solmi et al., 2022). The inverse association between age and QoL among youth with misophonia in the present study appears to be particularly driven by an increase in internalizing symptoms. Indeed, age was significantly correlated with internalizing symptoms, indicating more symptoms among older participants, and the association between age and QoL was no longer significant when internalizing symptoms were accounted for.

Among four MAQ scales, assessing different aspects of misophonia severity (i.e., pessimism, distress, interference, and non-recognition), only pessimism was significantly associated with poor QoL. This result is consistent with findings in non-clinical youth, where pessimism has been negatively associated with QoL (Häggström Westberg et al., 2019) and satisfaction with life (Extremera et al., 2007). Pessimism involves negative thoughts about one's future and a lack of hope, which has potential to be uniquely associated with the experiences of misophonia symptoms. Individuals with pessimism are more prone to experience negative emotions, ruminate, and be vulnerable to stressful events (Jones et al., 2017). Therefore, youth with misophonia who are pessimistic might be especially susceptible to severe distress in response to stressful misophonic events and subsequently have poor QoL. Conversely, severe distress and daily interference associated with misophonia might lead youth to feel helpless and be more pessimistic about their symptoms, which could contribute to poor QoL. Moreover, children and their parents might feel despair and isolated due to many triggers being located in their home/family environment (Siepsiak et al., 2023). As family climate and social support are important protective factors of QoL (Otto, C., Haller, A.-C., Klasen, F., Hölling, H., Bullinger, M., Ravens-Sieberer, U., & Group, on behalf of the B. study, 2017), we speculate that this may be related to poorer QoL. Finally, lack of available effective treatment options for misophonia (Smith et al., 2022) and lack of understanding from significant others (e.g., clinicians, school personnel, family members, peers) (Guzick et al., 2024) could also lead youth with misophonia feel pessimistic about their symptom prognosis. Therefore, clinicians would be well-advised to consider pessimism as a relevant treatment target and assess its level at baseline as well as throughout treatment due to its relationship with QoL and potential to negatively influence treatment outcome. However, it is important to note that the MAQ pessimism only measures the level of pessimism related to misophonia and not a general tendency of feeling pessimistic. While it is important, we did not examine correlations between the overall MAQ (or A-MISO-S) and QoL as well, because these results were reported in another study ($r = -0.52$, $p < 0.001$; $r = -0.26$, $p < 0.05$) (Guzick et al., 2023).

In support of our hypothesis, internalizing symptoms were inversely associated with QoL. However, contrary to our hypothesis, externalizing symptoms were not significantly associated with QoL. The result for internalizing symptoms is in line with findings from non-misophonic conditions such as obsessive–compulsive disorder, anxiety, depression and medical illnesses (Lack et al., 2009; Luyckx et al., 2014; Stevanovic et al., 2011) and is consistent with the inverse relationship we found between pessimism and QoL since feeling more pessimistic about misophonia symptoms could lead to experiencing more exacerbated negative emotions and distress, or alternatively, negative emotions and distress could aggravate the feelings of pessimism. Internalizing symptoms are consistently associated with loneliness, low friendship-quality, health problems, and school challenges (Keenan-Miller et al., 2007; Ladd & Ettekal, 2013; Lijster et al., 2018, 2019; Mychailyszyn et al., 2010; Proctor et al., 2009), and the compounded impact of misophonia symptoms with internalizing problems may particularly influence misophonic youth, which indicates youth with both misophonia and internalizing symptoms might be at a particular risk of experiencing poor QoL. Externalizing symptoms were not uniquely associated with QoL in this study. This may reflect that externalizing symptoms do not confer additional morbidity perhaps, because youth who exhibit externalizing symptoms are often not bothered by their expression as much as their parents (Ooi et al., 2017).

The number of misophonia triggers was also significantly associated with QoL, where youth with more misophonia triggers reported lower QoL. This is not surprising, as youth with more triggers may experience distress and frustration across multiple environments. These youth may be hypervigilant regarding possible future triggers, which may be associated with poorer QoL, as has been shown in traumatic injury survivors (Forbes et al., 2019). The number of triggers may also reflect an important dimension of misophonia severity. Number of misophonia responses, such as experienced emotion (e.g., anger) or physical response (e.g., verbal aggression), was not associated with QoL, which suggests that amount of response to misophonia triggers is less relevant to QoL than the frequency of misophonic events. Although it was not collected as part of the current study, the severity of response to misophonia triggers, as well as the frequency of exposure to misophonia triggers, might also

be strongly correlated with QoL along with the number of responses to misophonia triggers.

There are several study limitations. First, although QoL is comprised of multiple dimensions and can be evaluated subjectively and objectively (Felce & Perry, 1995), we used a single measure of QoL, which focused on self-reported life enjoyment and satisfaction due to the scope of the current study. Second, we recruited participants mostly from online resources due to challenges in reaching this unique population, and our sample was predominantly white and non-Hispanic. Third, the current study used a cross-sectional design. Hence, we only examined QoL at a single time point, and all of our analyses were correlational, which means our results do not imply causation between variables.. Fourth, we only analyzed QoL in the children and adolescents with misophonia and not their family members. Despite the minimal amount of systematic research on impact of misophonia on families, clinical anecdotes suggest that misophonia greatly disrupts families' lives as well. Fifth, the MAI included an incomplete list of potential misophonia triggers, and its psychometric properties have not been reported yet. Lastly, we did not collect data on the frequency of exposure to misophonia triggers or the duration of experiencing misophonia triggers in a day, which may limit our understanding of the impact of misophonia on QoL.

Hence, further research is warranted to address these limitations and expand on our results. That is, future studies should examine objective markers of QoL among youth with misophonia, recruit a more racially and ethnically diverse sample, collect longitudinal data and study how QoL shifts over time as misophonia symptoms progress or diminish, assess QoL more broadly among family members of youth with misophonia as well as in their close network, and utilize various dimensions of misophonia impact to examine its effect on QoL in a more comprehensive way. Additionally, developmentally-appropriate measures that assess the symptoms and impact of misophonia should be considered in future studies (e.g., Misophonia Impact Questionnaire (Aazh et al., n.d), MisoQuest (Siepsiak et al., 2020b), Duke Misophonia Questionnaire (Siepsiak et al., 2020b) were developed since the present study was concluded).

This study highlights that QoL is attenuated in adolescents with misophonia and has a strong association with internalizing symptoms and pessimism about one's misophonia symptoms. The group difference in QoL between our sample and the general US youth sample is concerning and warrants further investigation. These data also highlight the need for comprehensive assessment of QoL among youth with misophonia, particularly as they age, in order to better measure and understand the impact of misophonia in this population. Further, interventions need to be developed that address both symptom severity and life enjoyment and satisfaction, especially given that parents of youth with misophonia are dissatisfied with most of the currently available interventions (Smith et al., 2022). Along with reducing symptoms, promoting general well-being of youth should be another important goal of treatment. Targeted interventions that include a wellness component have demonstrated significant promise in other conditions such as generalized anxiety disorder, chronic tic disorder, and comorbid depression and acute coronary syndrome (Fava & Tomba, 2009; McGuire et al., 2015; Rafanelli et al., 2020). As misophonia is characterized by severe distress and high emotional burden similar to these conditions, this treatment approach could not only address the core symptom but also foster a value-filled life that effectively improves QoL while minimizing opportunities for misophonia to adversely impact life.

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Data Availability Data are available at request by contacting the corresponding author.

Declarations

Ethics Approval All procedures performed in this study were in line with the principles of the Declaration of Helsinki. The study was approved by the Institutional Review Board at Baylor College of Medicine.

Consent to Participate All participants provided their assent or consent based on their age to participate in the study.

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