

Vocal folds nodules among Egyptian children and adolescents: Behavior aspects

Original
Article

Nesreen F. Mahmoud¹, Ahmad A. Aziz Ezzat², Alshimaa M. Mohamed lotfy³,
Hassnaa O. Mohammed⁴

¹Departments of ENT, ²Psychiatry, ³Public Health and Community Medicine, Faculty of
Medicine, Beni-Suef University, ⁴Medical Department, Faculty of Postgraduate Childhood
Studies, Ain Shams University, Egypt.

ABSTRACT

Objective: This study aimed to verify the relationships between voice, and behavior in children and adolescents with and without dysphonia based on parents' reports and perceptual voice analysis by Phoniaticians.

Study Design: This is a case control study.

Patients and Methods: The study involved 51 of dysphonic school-age children and adolescents and 62 vocally normal controls aged from 6-18 years. Participants were assessed with auditory perceptual voice analysis, clinical laryngoscopic examination (CLE). Parents of all participants completed the Child Behavior Checklist for ages 6–18 years (CBCL)..

Results: Children and adolescents with dysphonia scored higher on Internalizing, Externalizing, Anxiety/depression, Withdrawal/depression, Somatic complaints, Social problems, Attention problems, Rule-breaking, and Aggressive behavior. Children and adolescents with vocal problem scored lower on Activities, Social, School, and thought problems. Correlation analysis between dysphonia severity and CBCL scores demonstrated significant positive correlation in the following scales (Internalizing scale $r=0.549$; $P=0.001$, externalizing scale ($r=0.370$; $P=0.001$ and total Behavior scales ($r=0.581$; $P=0.00$), school scale score ($r=0.288$; $P=0.002$), and total Competence indicators ($r=0.230$; $P=0.014$), withdrawal/depression, social problems, rule-breaking, and aggressive behavior .

Conclusion: Vocal fold nodules may be a risk for behavior problems due to the higher scores on behavior problems scales in children and adolescents, especially internalization and externalization aspects and significant positive correlation found between dysphonia severity and CBCL scores. Early interventions of these problems are needed to prevent the persistence of such problems, and reduce its negative impact.

Key Words: Behavior problems, CBCL, Dysphonia, Vocal folds nodules.

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Corresponding Author: Nesreen Fathi Mahmoud, MD, Lecturer of Phoniaticians, Phoniatic Unit-Department of ENT, Faculty of Medicine, Beni-Suef University, Beni-Suef, , Egypt, **Tel.:** 01006501928, **E-mail:** Nesreen.hussien@med.bsu.edu.eg

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INTRODUCTION

Functional dysphonia (FD) refers to a voice disorder in the absence of any organic laryngeal disease. It is relatively common in adults.^[1] However, it may be underestimated in the pediatric population^[2]. Vocal fold nodules (VN) represent the most frequent causes of functional dysphonia in childhood, and diagnosed by laryngostroboscopy^[3,4], which appear as benign lesions that occur bilaterally on the mid membranous vocal folds

The etiology of VN attributed to certain abusive vocal behaviors as vocal misuse, overuse^[2], prolonged loud talking, screaming and singing⁵, which in turn cause the development of voice disorders.^[6]

Specific behavioral patterns have received attention as potential risk factors to VN formation and maintenance such as extraversion and anxiety. Roy *et al.*,^[7,8] proposed

that some women develop VNs because of sustained vocal "excesses" related to their personality. Recent results by Verduyck *et al.*^[9] confirmed the previous hypothesis that extraversion trait could be translated into abusive vocal behaviors which significantly predicts the presence of VN.

A positive link has been reported between behavior and voice problems, as the incidence of hyperactivity,^[10-14] aggression, and immature behavior, in dysphonic children.^[15] This in turn negatively affects the social integration and self-esteem of children. Previous findings suggested that voice misuse can be linked to behavioral difficulties (especially externalizing behaviors).^[17]

It was hypothesized that vocal problems in childhood and adolescence may be associated with behavior problems^[18]. The vast majority of studies^[18-21] investigated

this issue but little is known about how the severity of behavioral difficulties correlated with the voice problem. This issue is of great importance to understand the parents' experiences of their children adverse behaviors regarding their voice problem. Yet, the prevalence and negative impacts on child's social, psychological and behavioral aspects indicate the need for consideration to this population. Moreover, voice therapy approaches in children are mainly behavioral by eliminating behaviors that can lead to injury of the vocal folds. It is not easy to change the vocal behaviors in children with FD. It is expected that these children outgrow these disorders by the time they are teenagers.

In summary, there is a lack of research on voice problems and behaviors and how these behaviors differ across ages especially in children and adolescents with dysphonia and hardly any research work has been reported from Egypt. Therefore, this present study aimed to first to verify the behavioral competences and problems among dysphonic children and adolescents using a well-validated, standardized parent-report measure, the Childhood Behavior Checklist (CBCL 6/18), second to investigate whether the degree of dysphonia severity associated with the behavioral problems in both groups under the study.

PATIENTS AND METHODS:

Parents of 51 school-aged children and adolescents with dysphonia (group with dysphonia, GWD) and 62 vocally normal controls (group without dysphonia, GWOD) participated in this study. It should be noted that 120 children were originally identified, and their parents were subsequently invited to participate. From that total, 113 parents agreed to complete the questionnaire. The group with dysphonia (GWD) consisted of 51 school-aged children and adolescents who were recruited to outpatient clinic of Phoniatrics unit complaining from dysphonia during periods from June 2019 to October 2019 and were diagnosed with VN using clinical laryngoscopic examination. Participants met the following inclusions criteria: All participants' child age corresponded to the age group reported in the Child Behavior Checklist (CBCL), aged 6–18 years, all participants or their parents gave a history of voice overuse, no current or previous communication disorders, with the except voice disorders; presence of acute upper respiratory tract infections, no cold, upper respiratory infection, sinusitis, or allergy symptoms on the days of testing (confirmed via direct observation) ; no prior voice treatment; and no previously diagnosed neurological or psychiatric diseases. Exclusion criteria were as follows: Patients with other vocal pathologies such as laryngeal papillomatosis, cyst, Reinke disease, polyps, and so on, were excluded. Any pathology related to obstructive sleep apnea, which may affect the behavior due to restless sleep (eg, thyroid disease, craniofacial syndrome, obesity, adenoid, and tonsil hypertrophy)

was excluded. Participants with chronic organic medical conditions, including hearing deficit and intellectual disability were also excluded.

Children, adolescents and their parents/caregivers from each following age groups were interviewed and underwent the following: 1. *Subject's interview*: name, age, sex, address and education. Analysis of the complaint was done concerning the onset, course and duration of the symptoms and rating of self-perception of voice complaints, where 0 is normal, 1 is a slight degree, 2 is a medium degree, and 3 is a high degree of handicap. 2. *Auditory perceptual analysis (APA)*: For all GWD, Modified GRBAS^[22] scale was used to subjectively assess the degree of dysphonia severity by Phoniatrics physicians. The following voice parameters were measured: Overall grade, character, pitch, register, loudness, glottal attacks and associated laryngeal functions, evaluated and tabulated according to the modified GRBAS scale, which gives scores of 0, 1, 2, or 3 for the grade of hoarseness; Roughness, Breathiness, Asthenia, and Strain, where 0 is normal, 1 is a slight degree, 2 is a medium degree, and 3 is a high degree. The assessment was done in an acoustically favorable environment and based on approximately 5 min of spontaneous speech, describing the vocal complaint, number counting from 1 to 20, and prolonged /a/. Each judgment was performed by two certified examiners specializing in voice disorders expert in vocal evaluation and rehabilitation with more than 10 years of experience and familiarity with the modified GRBAS scale; without knowing the identity of the subject. To assess intra-rater and inter-rater reliability, all subjects and their voice samples were re-evaluated by each examiner individually two days apart. 3. *Clinical laryngoscopic examination (CLE)*: by flexible nasopharyngoscope (Laryngo fiberscope, length 30 cm, diameter 3.5 mm KARL STORZ GmbH & Co. KG, Tuttlingen, Germany, 11101RP) for assessment of vocal fold structure, configuration and gross mobility. 4. *The child behavior checklist (CBCL)*^[23] (Arabic version): All parents of children and adolescents signed the informed consent and completed the child behavior checklist (CBCL) the gold standard for child and adolescent mental health screenings, with preliminary validation of an Arabic version. The instrument consists of 7 items assessing social competence and 113 assessing behavior problems in children and adolescents.

Description of test instrument

The CBCL/6-18 is a parent behavior rating scale used to assess the behavioral characteristics of the children based on parents' observations of the child over the previous 6-month period. It consists of 120 items that the parent rates in the following format of 0 "Not True," 1 "Sometimes True," or 2 "Very True". Raw scores of the CBCL/6-18 were converted into T-scores for eight syndrome behavior scales, three superfactor scales, and the Social Competence

Scale. It does not only describes children's behaviors in specific terms, but also identifies syndromes of problems.

Eight core syndromes are constructed based on responses to specific questions on the CBCL/6-18, The Withdrawn, Somatic Complaints, and Anxious/Depressed subscales combine for the Internalizing superfactor. Delinquent behavior and aggressive Behavior subscales combine for the Externalizing dimension. Social problems, thought problems, and attention problems subscales do not load onto the internalizing or externalizing scales but do contribute to the total behavior problems score. The social competence scale includes ratings to the child's preferred activities, social interaction patterns, and school competence. The purpose of the tool is to assess descriptive data in a standardized fashion that allows for the identification of specific features of a child and compared with normative samples of peers. The profiles display areas in which the child's behavior is consistent with the normal, borderline, and clinical range based on normative expectations. A T-score of 50–67 is within the normal range, whereas 67–70 is borderline, and a T-score greater than 70 is within the clinical range.

After the completion of the CBCL administration, the raw scores were converted to T-scores and analyzed to the clinical, nonclinical, and borderline clinical profiles according to standardization and cutoffs. The clinical data of the sample were divided according to the age variable into two age groups: school-aged children (6 years of age to 11 years and 11 months of age) and adolescents (12–18 years of age).

Data collected were coded, analyzed by Statistical Package for Social Science, (SPSS) version 20; processed and tabulated. Frequency distribution, percentage and descriptive statistics including mean \pm SD were calculated. McNemar Test, paired t- test and correlations were performed when indicated. *P values* of ≤ 0.05 were considered significant. The power of sample size was estimated using g*power software based on effect size of 0.5, overall type I error rate (α) ≤ 0.05 113 subjects (52 case, 63 control) expected to achieve a power of more than 80%.

RESULTS:

A total of 51 cases and 62 controls were enrolled in the study. Overall, 51% of participants in the case group (GWD) and 53.2% in the control group (GWOD) were school-aged children. There was a statistically significant difference regarding gender between the case and control group, in which 66.7% were female in the case group while 51.6% were male in the control group. The case group's self-perception showed that the most of the case group had mild to moderate self-perception (31.4% & 37.3%, respectively) and there was a statistically significant difference in

self-perception between the case group and control group. The mean \pm SD of age was 8.62 \pm 1.52 and 8.11 \pm 1.48 years in the case and control school-aged children, respectively, also mean \pm SD of age was 14.64 \pm 1.96 and 13.76 \pm 1.94 years in case and control adolescent, respectively. The mean age was 11.57 \pm 3.50 years in the total case group and 10.75 \pm 3.41 years was in the total control group. (Table 1)

Voice Characteristics according to Modified GRBAS in all GWD

The perceptual voice analysis shows the following results, the case group voice parameter (GWDs) revealed that; the majority of school-aged group and adolescent aged groups regarding the grade of the dysphonia (the main parameter) had grade 1 and grade 2 (28.6%, 71.4%, and 26.1%, 60.9%) respectively. For the grade of roughness; most of the school-aged group and adolescent aged group had grade 0, grade 1 and grade 2 in the following pattern (25%, 39.3%, 35.7%, and 21.7%, 26.1%, 39.1%). Nearly both school-aged and adolescent aged groups had grade 0 (96.4% and 91.4%) respectively. For a grade of strain, both groups, school-aged and adolescent aged had a degree from land 2 (28.6%, 71.4%, and 26.1%, 60.9%) respectively. (Table 2)

Analysis of CBCL Scales: According to Age Groups, case group (School-Aged Children and Adolescents with dysphonia) and control group (School-Aged Children and Adolescents without dysphonia)

The assessment of CBCL scores revealed that the children and adolescents in the GWD scored lower on the competence scales and higher on the superfactor and syndrome scales except thoughts in which they scored lower than their controls. (Table 3).

When data were assessed according to age, it was observed that SGWD scored significantly higher on internalization, externalization, and total superfactors scales compared to values established by the SGWOD (Table 3).

Alternatively, SGWD scored insignificantly lower in activities, school, and total competence compared to values established by the SGWOD. Meanwhile, SGWD scored a slightly raised school subscale score.

Regarding Syndrome behavior scales, SGWD scored higher on Anxiety/depression, Withdrawal/depression, Somatic complaints, Social problems, Attention problems, Rule-breaking, and Aggressive behavior. SGWD showed a significant difference ($P < 0.005$) in the following Syndrome behavior scales Withdrawal/depression, somatic complaints, and Social problems

According to Table 3, when only the adolescent-aged group with dysphonia (AGWD) was assessed, it was observed that the subscales that showed a significant difference ($P < 0.005$) were Externalizing, Total superfactor, School, Total competence, Withdrawal/depression, Social problems, and Aggressive behavior.

Clinical categorization of CBCL among groups under the study

Regarding superfactors; a statistically significant difference between cases and controls; internalizing scale ($p=0.001$), externalizing scale ($p=0.004$) and total behavior scale ($P=0.001$). As for the grade of competence indicators: there was a statistical difference, disparity relating to school indicator ($p=0.020$). (Table 4)

Concerning the grade of behavior indicators; There was a statistically significant difference between cases and control participants regard to: withdrawal\depression ($p=0.004$), somatic complaints ($p=0.040$), social problems ($p=0.001$), rule-breaking behavior ($p=0.010$) and aggressive behavior ($p=0.030$), but there was no significant relation relevant to anxiety\depression ($p=0.240$), thought problems ($p=0.360$) and attention problems ($p=0.490$). It was noted that no one either in GWD or GWOD was presented within the clinical range on thought scale.

Comparison between SGWD and AGWD by CBCL scales scores

Table 5 illustrates that there is no significant difference between SGWD and AGWD in all total and individual CBCL items scale (all T-scores presented $P > 0.05$), demonstrating that the overall social competence and the competences relating to activities, sociability, and school issues do not differ between children and adolescents with dysphonia in the analyses by an age group of the participants. Mean T scores of competence scales are insignificant higher in the school group than the adolescent group except school domain.

Correlation analysis between dysphonia severity and CBCL scores

Correlation analysis between dysphonia severity and CBCL scores demonstrated that; there was a significant positive correlation between dysphonia severity and behavior scale scores (Internalizing scale $r=0.549$; $P=0.001$, externalizing scale $r=0.370$; $P= 0.001$ and total Behavior scales $r= 0.581$; $P=0.00$). Regarding competence indicators, only school scale and total competence scale showed a significant positive correlation ($r= 0.288$; $P=0.002$, $r= 0.230$; $P= 0.014$, respectively). All behavior indicator scores were showing a significant positive correlation except somatic complaints score, thought problem score and attention problems scores.

Table 1: Clinical characterization of the study Participant (n = 113)

Variables	GWD (Case) N = 51		GWOD (Control) N = 62		P
	N	%	N	%	
<u>Age groups</u>					
School-aged children	26	51	33	53.2	0.812
Adolescents	25	49	35	46.8	
Total	51	45.1	62	45.9	
<u>Gender</u>					
Female	34	66.7	30	48.4	*0.05
Male	17	33.3	32	51.6	
<u>Self-perception</u>					
Normal	2	3.9	62	100	*0.001
Mild	16	31.4	0	0	
Moderate	19	37.2	0	0	
Severe handicap	14	27.5	0	0	
<u>Mean age</u>					
School-aged children	8.62±1.52		8.11±1.48		0.205
Adolescents	14.64±1.96		13.76±1.94		
Total	11.57±3.50		10.75±3.41		

Table 2: Voice Characteristics in all GWD: According to Modified GRBAS

Voice parameter	School aged group (n = 28)		Adolescents aged group (n = 23)	
	NO	%	NO	%
Grade of Dysphonia				
Grade 0	0	0	0	0
Grade 1	8	28.6	6	26.1
Grade 2	20	71.4	14	60.9
Grade 3	0	0	3	13
Grade of Roughness				
Grade 0	7	25	5	21.7
Grade 1	11	39.3	6	26.1
Grade 2	10	35.7	9	39.1
Grade 3	0	0	3	13.1
Grade of Breathiness				
Grade 0	27	96.4	21	91.4
Grade 1	0	0	1	4.3
Grade 2	1	3.6	1	4.3
Grade 3	0	0	0	0
Grade of Strain				
Grade 0	0	0	0	0
Grade 1	8	28.6	6	26.1
Grade 2	20	71.4	14	60.9
Grade 3	0	0	3	13

Table 3: Comparison between school –aged children and adolescents regarding CBCL scales among study participants (n = 113)

CBCL scales	GWD (Case) NO=51	GWOD (Control) NO=62	P
	Mean ± SD	Mean ± SD	
<u>SG-Superfactor scales</u>			
Internalizing	61.65±7.89	56.35±5.22	*0.003
Externalizing	58.85±7.23	55.91±5.81	*0.023
Total	61.15±6.89	55.76±4.32	*0.001
<u>AG-Superfactor scales</u>			
Internalizing	58.48±9.34	56.29±4.99	0.287
Externalizing	60.16±7.03	55.39±5.78	*0.009
Total	60.68±8.08	55.07±4.29	*0.002
<u>SG-Competence scales</u>			
Activities	27.04±3.35	29.27±6.36	0.082
Social	43.65±6.96	43.41±6.37	0.889
School	43.35±6.09	44.79±6.29	0.367
Total competence	27.27±4.71	30.96±1.19	0.443
<u>AG-Competence scales</u>			
Activities	26.24±4.01	27.89±6.00	0.250
Social	42.28±5.39	45.14±6.28	0.080
School	40.16±6.97	44.07±5.33	*0.025
Total competence	27.72±4.70	30.96±6.19	*0.038
<u>SG-Syndrome scales</u>			
Anxiety/depression	63.65±7.98	59.85±8.99	0.094
Withdrawal/depression	57.88±8.25	53.35±6.42	*0.020
Somatic complaints	57.58±6.93	53.06±9.40	*0.044
Social problems	60.73±6.06	55.68±5.10	*0.001
Thought problems	53.08±3.35	54.06±4.96	0.389
Attention problems	56.19±5.04	54.44±3.99	0.138
Rule-breaking	59.42±6.45	58.12±4.77	0.371
Aggressive behavior	59.46±5.68	57.32±4.50	0.109
<u>AG-Syndrome scales</u>			
Anxiety/depression	60.12±7.53	59.11±8.54	0.651
Withdrawal/depression	60.28±11.23	53.29±5.33	*0.005
Somatic complaints	54.64±5.36	51.60±8.09	0.119
Social problems	59.28±6.39	55.07±3.95	*0.005
Thought problems	54.16±5.49	55.32±4.41	0.398
Attention problems	58.76±6.57	55.60±4.92	0.050
Rule-breaking	59.76±5.92	58.57±4.32	0.404
Aggressive behavior	60.36±6.63	56.43±4.90	*0.019

Table 4: The distribution of the categorized total and subscales of CBCL between groups.

CBCL			Cases (N = 51)		Controls (N = 62)		P	
			NO	%	NO	%		
Superfactors scales	Internalizing scale	Normal	28	54.9	56	90.3	*0.001	
		Borderline	6	11.8	6	9.7		
		Clinical range	17	33.3	0	0		
	Externalizing scale	Normal	24	47.1	46	74.2		
		Borderline	12	23.5	11	17.7		
		Clinical range	15	29.4	5	8.1		
	Total behavior scales	Normal	23	45.1	53	85.5		*0.001
		Borderline	11	21.6	9	14.5		
		Clinical range	17	33.3	0	0		
Competence indicators	Activities indicator	Normal	0	0	5	8.1	0.110	
		Borderline	7	13.7	9	14.5		
		Clinical range	44	86.3	48	77.4		
	Social indicator	Normal	43	84.3	55	88.7		0.490
		Borderline	8	15.7	7	11.3		
		Clinical range	0	0	0	0		
	School indicator	Normal	45	88.2	62	100		*0.020
		Borderline	3	5.9	0	0		
		Clinical range	3	5.9	0	0		
Total Competence indicators	Normal	1	2	3	4.8	0.490		
	Borderline	4	7.8	13	21			
	Clinical range	46	90.2	46	74.2			
Syndrome Behavior indicators	Anxiety/ depression	Normal	30	58.8	37	59.6	0.240	
		Borderline	13	25.5	21	33.9		
		Clinical range	8	15.7	4	6.5		
	Withdrawal/ depression	Normal	39	76.5	60	96.8		*0.004
		Borderline	8	15.7	2	3.2		
		Clinical range	4	7.8	0	0		
	Somatic complaints	Normal	43	84.3	57	91.9		*0.040
		Borderline	5	9.8	0	0		
		Clinical range	3	5.9	5	8.1		
Social problems	Normal	37	72.5	60	96.8	*0.001		
	Borderline	11	21.6	2	3.2			
	Clinical range	3	5.9	0	0			
Thought problems	Normal	49	96.1	57	91.9	0.360		
	Borderline	2	3.9	3	8.1			
	Clinical range	0	0	0	0			
Attention problems	Normal	43	84.3	55	88.7	0.490		
	Borderline	7	13.7	7	11.3			
	Clinical range	1	2	0	0			
Rule-breaking behavior	Normal	44	86.3	62	100	*0.010		
	Borderline	3	5.9	0	0			
	Clinical range	4	7.8	0	0			
Aggressive behavior	Normal	39	76.5	58	93.5	*0.030		
	Borderline	10	19.6	4	6.5			
	Clinical range	2	3.9	0	0			

Table 5: Mean, Standard Deviation, and P Value from T Scores of the CBCL for the school-age children and adolescents with dysphonia groups

CBCL Scales	SGWD (n = 28)		AGWD (n = 23)		P Value
	Mean	SD	Mean	SD	
Superfactor scales					
Internalizing	60.8929	9.87829	59.1304	7.13700	0.478
Externalizing	60.2857	8.26352	59.6522	5.40714	0.753
Total	61.8571	8.54060	59.7826	5.89265	0.328
Competence scales					
Activities	27.0000	3.99073	26.2174	3.28850	0.633
Social	43.7500	6.47860	42.0435	5.89667	0.263
School	41.2500	6.65902	42.4348	6.77446	0.161
Total competence	29.5714	6.31535	28.0435	4.05057	0.552
Syndrome scales					
Anxiety/depression	62.6429	8.93687	61.0435	6.47006	0.477
Withdrawal/depression	60.4286	11.08696	57.3913	7.88404	0.275
Somatic complaints	56.3214	7.10792	55.9130	5.36752	0.821
Social problems	60.1786	6.20665	59.8261	6.34359	0.842
Thought problems	54.1071	4.96908	53.0000	3.90803	0.389
Attention problems	57.8214	6.27195	57.0000	5.57592	0.627
Rule-breaking	60.3571	6.34919	58.6522	5.87451	0.329
Aggressive behavior	59.9643	7.16722	59.8261	4.69673	0.937

Table 6: Correlation between dysphonia severity and CBCL scores among study participants (N=113)

CBCL	Dysphonia severity		
	r	P-value	
Superfactors scales	Internalizing scale	0.549	*0.001
	Externalizing scale	0.370	*0.001
	Total Behavior scales	0.581	*0.001
Competence indicators	Activities	0.156	0.098
	Social	0.125	0.186
	School	0.288	*0.002
	Total Competence indicators	0.230	*0.014
Syndrome Behavior indicators	Anxiety/depression	0.170	0.071
	Withdrawal/depression	0.364	*0.001
	Somatic complaints	0.151	0.109
	Social problems	0.401	*0.001
	Thought problems	- 0.029	- 0.757
	Attention problems	0.115	0.223
	Rule-breaking behavior	0.310	*0.001
	Aggressive behavior	0.289	*0.002

DISCUSSION

In this study, we aimed to verify how the age influences the behavior in different age groups among dysphonic population. To the best of our knowledge, there are few studies^[21,22] examining the relationship of voice parameters and behavior in children and adolescents with functional dysphonia, but even fewer^[19] assessing the overall psychological well-being in 6 - to 18 -year old children, specifically with the use of CBCL/6-18, as a valid tool for behavioral rating scale. We globally examined the dysphonic

participants through videolaryngoscopic evaluation, a perceptual evaluation, performed on recorded voice samples by two experienced phoniatricans using modified GRBAS (hoarseness; Roughness, Breathiness, Asthenia, and Strain) scale, CBCL/6-18, which considered as the gold standard for child and adolescent mental health screenings^[26], and finally comparing the obtained results with the vocally normal medical control group. Krohling *et al.*^[19] assessed the psychological profile of 48 school-age children and adolescents and 55 controls through clinical analysis based on CBCL. Their methodology lacked of using

videolaryngoscopic or perceptual evaluation of dysphonic children.

Previous studies highlighted that the perception of behavioral problems differed in the different age groups and adolescents become more critical in their analyses^[27-29], therefore, the findings of an age group cannot be generalized to another.^[30] However, our analysis by age group revealed that school aged children and adolescents with dysphonia presented no significant difference in all CBCL subscales. As a whole, SGWD and AGWD scored lower on the competence scales and higher on the superfactor and syndrome scales except thoughts in which they scored lower than their controls. The absence of differences between the groups (SGWD and AGWD) can be explained by the fact that the level of social, socio-economic environment, parental education, and parental attitude^[31] toward their children voice problems which were not investigated in this study. It is worth noting that both groups (SGWD, AGWD) shared clinical significance differences for only the following items Externalizing, Withdrawal/depression, and Social problems scales domains compared with their controls.

Concerning comparison of mean T scores of superfactor scales between GWD and GWOD, our data demonstrated that GWD scored higher on Internalizing, and Externalizing than those on the control group, but no significant difference was found in Internalizing scores among adolescents. Also, there was a significant difference in clinical categorization between both groups (GWD, GWOD) under the study ($P < 0.001$) for the internalizing, externalizing, and total scales.

The two previous superfactor scales; the externalizing behaviors, predominantly characterized by the relationship with other people, such as physical and verbal aggressiveness, agitation, and impulsiveness^[32,33] meanwhile, the internalizing behaviors, directed toward the behaviors expressed in the individual himself such as anxiety, depression, withdrawal, and somatic complaints^[32,33].

The elevated scores obtained on the mean T scores of externalizing scale among both the school-aged children and adolescents groups with dysphonia go with the hypothesis that assumed that individuals with voice problems tend to present more externalizing problems. This has been confirmed by a positive significant correlation found between externalizing behavior and dysphonia severity. It has been argued that certain behavioral patterns translate into vocally aggressive behaviors, such as screaming, which are involved in the etiology of dysphonia itself^[18, 34].

These externalizing problems are common indicators in childhood and trigger depression later in adolescence^[35, 36]. Again, this has been confirmed by our data that demonstrated a significant difference in the withdrawal/ depression subscale in both children and adolescents with dysphonia.

Alternatively, our findings were partially against Rescorla *et al.*^[37], and Borges de Moura *et al.*^[38] studies, which indicate that school-aged children present more externalizing behavior indicators than adolescents, especially regarding problems with attention and impulsivity; while, adolescents present higher scores for internalizing problems, especially anxiety/ depression.^[35,39] Our findings showed significant differences in the mean T scores of anxiety/depression in both school-aged children and adolescents with dysphonia. This means that anxiety/ depression behavior associated with voice problems starts early in childhood and continues for adolescence, meanwhile, no significant difference was found in AGWD in internalizing subscale scores.

Thus, the hypothesis that assumed that age variable^[40] can interfere with the average profile of emotional/behavioral indicators needs to be verified in future ad hoc investigations.

According to our analysis of clinical categorization of superfactor scale, externalizing behaviors were more evident than internalizing behaviors in the form of aggressive behavior, rule-breaking behavior, and social problems.

Regarding competence scales, our findings revealed that there were no significant differences in either the mean T-scores or the clinical categorization of activities, or social subscales, for children and adolescents with and without VN. In addition to, the absence of differences in the correlation was obtained between dysphonia severity measured by dysphonia grade (the main parameter for assessing dysphonia severity), and activities, and social subscales. This means that despite the presence of voice disorders, they still did not limit their social interactions or academic abilities as measured by the CBCL according to the parents' perception. An earlier study illustrated that children who misuse their voices have more disturbed peer relations than children who do not^[15]. Dual evidence explains this finding as children who are less accepted in the peer group showed a louder voice to affirm themselves. Simultaneously, a louder voice judged negatively and cause problems with peers.

This remains unclear how activities and social subscales expressed in the presence of elevated mean T scores in the previous superfactor scales;

the externalizing and internalizing subscales demonstrating more inappropriate and aggressive behaviors toward others.

Some researchers^[18] have found that children with VN are socially active, and demonstrate leadership in social situations. Children with better school performance and social interaction present a lower incidence of behavior problems^[41] because these skills provide better personal relations^[42].

Generally, our results seem to be consistent with other researchers like Green^[15], Nemeč^[43] and Wilson^[44]. Green's study compared the behavior characteristics of children with VN and vocally normal school-age children, the children with VN also displayed significantly higher ratings in distractibility, disturbed peer relations, and aggression than did the normal children. Nemeč showed that children with hyperkinetic dysphonia were significantly more aggressive interacting with their social, educational, and familial environments than their vocally normal peers. Also, Wilson concluded that children with VN are verbally and physically aggressive in their social environment and tend to be three times more talkative than their peers.

However, our results contrast sharply with those obtained by Wilson and Lamb^[45] and Roy *et al.*^[18]. The first ones used the Rorschach test and the latter used CBCL/4-18. Both of them failed to identify significant differences in behavioral characteristics between children with VN and a vocally normal control group.

As a whole, regarding the comparison of the syndrome behavioral indicators between GWD and GWOD, GWD scored higher on syndrome scales except thoughts in which they scored lower than their controls. Further analysis, SGWD showed a significant difference in the following syndrome subscales: Withdrawal/depression, somatic complaints, and Social problems. Whereas, AGWD showed a significant difference in the following syndrome subscales: Withdrawal/depression, Social problems, and Aggressive problems.

Regarding the clinical categorization of the syndrome behavioral indicators by the CBCL, most of GWD scored in the normal range. Significant differences were found in the following items withdrawal/depression, somatic complaints, social problems, rule-breaking, and aggressive behavior between GWD and GWOD. Therefore, the occurrence of a voice complaint can impact domains that are associated with potential communication problems, aggressiveness, withdrawal and depressive behaviors, and physical signs of somatization, which lead to improper externalization of emotions.^[46]

It is worthy to note that the increased T-scores for anxiety/depression that observed in the adolescent group may reflect emotional inconsistency that the voice triggered in this developmental stage^[47] and in turn impair the self-confidence of this group^[48].

It is important to highlight that correlation analysis between dysphonia severity and CBCL scores demonstrated that; there was a significant positive correlation between dysphonia severity and Internalizing scale ($r=0.549$; $P=0.001$), externalizing scale ($r=0.370$; $P=0.001$) and total behavior scales ($r=0.581$; $P=0.00$). Regarding competence indicators, School scale score and total competence scale scores showed a significant positive correlation ($r=0.288$; $P=0.002$, $r=0.230$; $P=0.014$, respectively). All behavior indicator scores showed a significant positive correlation except somatic complaints score, thought problem score and attention problems scores. Accordingly, children and adolescents with VN display greater vocal hyperfunction, suggesting a higher risk of developing behavior problems. This calls for the implementation of preventive and intervention measures in schools focusing on voice-related quality of life among children and adolescents.

Poulain *et al.*^[25] conducted a longitudinal study in healthy school-aged children using speaking-voice task and found associations between speaking-voice intensity and extraversion.

The elevated mean T scores of somatic complaints explained the relation between voice and behavior in which some individuals who somatize the various complaints often trigger functional dysphonia, which, if not diagnosed or treated, can progress to organofunctional conditions and further compromise individual health.^[15] Furthermore, dysphonic individuals experience disadvantages in their interpersonal relationships due to problems in communication and therefore they may be frustrated or socially isolated.^[48] The significant increase in mean T-scores for somatic complaints and anxiety/depression that observed in children and adolescent group with dysphonia, respectively, can be attributed to the fact that the voice disorder potentiated the insecurity and emotional conflicts that are characteristic of this developmental stage.^[49] Therefore, the voice disorder had a psychological impact and impaired the self-confidence of this group^[16, 50, 51].

Limitations of our study should be considered. The questions about the participants' behavior were answered by parents, and parents might not be the most reliable source of information. Consequently, self-reported assessment coupled with the parent report are necessary for better understanding the behavioral

issues related to vocal problems among children and adolescents. The voice parameters were measured during a specific voice task (i.e., counting). This setting differs from daily life situations. Moreover, few studies^[52] on behavioral assessment methods before and after voice therapy in dysphonic children and adolescents were found, which would allow more detailed characterization of their behavior. We believe that using only one behavior test to investigate the indicators of competences may be a limitation of this research. Additional assessment of personality or sense of disability should be included. The study does not show whether the vocal nodules in adolescence are a continuation of childhood, as the same behavioral traits occur in younger children and adolescents.

Future studies should emphasize division of the study group into subgroups by gender or by age e.g. 6-8 years and older. New investigations to analyze the behavior should include self-perspective of each child and adolescent^[18] and explore the importance of physical, social, and personality-related factors on the presence of VN in children.

Finally, this study raised the issue of the association between behavioral tendencies and functional dysphonia among Egyptian children and adolescents.

CONCLUSION

In terms of age, children and adolescents with VF nodules shared most of the same behavioral characters, which may start in childhood and continue to adolescence. The positive significant correlation between dysphonia severity and CBCL scores signifies the risk for developing behavioral problems in these particular populations with voice complaints. We propose that every child with functional dysphonia should be evaluated from a psychiatric perspective as an important part of the global evaluation for proper management.

CONFLICT OF INTEREST

There are no conflicts of interest.

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