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The Effects of Basil on Respiratory Function and Voice Quality Among Healthy Adults on the West Bank-Palestine

Hala Jarrar[1] · Hana Khalili[2] · Raghad Nabulsi[3] · Sabreen Issa[3] · Nadia Dwaikat[3]

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Abstract

This study aimed to assess the effects of consuming basil tea on respiratory function and voice quality in healthy adults. Herbs are widely studied for their benefits on respiratory health and voice quality. Basil tea is noted for its anti-inflammatory and bronchodilatory effects, which may enhance vocal and lung performance. A total of 67 healthy adults aged 18 to 55 years were randomly assigned to an experimental group ($n = 36$), which drank basil tea (5 g fresh basil leaves steeped in 200 mL boiling water) twice daily for 10 days, or a control group ($n = 31$), which received no intervention. Maximum Phonation Time (MPT), Breath-Holding Time (BHT), the Voice Handicap Index (VHI), and the GRBAS scale were assessed immediately before and after the 10-day period using both objective and subjective measures. The experimental group showed significant increases in MPT (mean improvement: 3.41 s) and BHT, along with a significant decrease in VHI scores, indicating improved respiratory support, breath control, and voice quality. GRBAS scores also showed slight reductions in symptoms like roughness and hoarseness. The control group showed no notable changes. Younger participants improved more in MPT and BHT, while males had higher BHT values, likely due to greater lung capacity. Basil tea may improve respiratory function and voice quality in healthy adults, likely due to bronchodilatory and anti-inflammatory effects. Future studies with larger samples and longer follow-up are recommended to validate these findings and assess benefits for those with voice or respiratory disorders.

Keywords Basil · Respiratory function · Voice quality · Herbal medicine · Phytotherapy

Abbreviations

MPT	Maximum phonation time
BHT	Breath holding time
VHI	Voice handicap index
GRBAS	Grade, roughness, breathiness, asthesia, and strain
IBM SPSS	IBM statistical package for social sciences

✉ Hala Jarrar
hala.jarrar@najah.edu

Hana Khalili
Hana.khalili@najah.edu

Sabreen Issa
Sabreen.waf@gmail.com

Nadia Dwaikat
Nadiadwaikat8@gmail.com

[1] Department of Allied and Applied Medical Sciences, Faculty of Medicine and Allied Medical Sciences, An-Najah National University, Nablus, Palestine

[2] Department of Scientific Research and Health Projects, Faculty of Medicine and Allied Medical Sciences, An-Najah National University, Nablus, Palestine

[3] Department of Pharmacy, Faculty of Pharmacy, An-Najah National University, Nablus, Palestine

1 Introduction

Herbs have played important roles in traditional medicine since ancient times. Among them, basil (Ocimum basilicum) has been widely recognized for its therapeutic potential, especially for respiratory health [1].

Synthetic chemicals made by pharmaceutical companies have led to a global health issue of drug resistance and side effects, creating an urgent need for natural chemical alternatives. Due to their safety profile and minimal side effects, plant extracts are the preferred choice [2].

One of the most popular aromatic herbs is *Ocimum basilicum*, also known as "Basil," which originated in Pakistan and India. It belongs to the family called "Lamiaceae," which is now cultivated worldwide. Many civilizations use

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basil as a culinary ingredient because of its flavor and aroma [3]. Basil contains numerous chemical compounds with bioactive properties, including essential oils (eugenol, linalool), polyphenols (rosmarinic acid), and flavonoids (vicenin, orientin). These compounds are thought to confer antioxidant, anti-inflammatory, and bronchodilatory effects. These qualities may influence respiratory function and vocal performance [4].

Basil's bronchodilatory, anti-inflammatory, and antioxidant properties may enhance respiratory function by improving airflow and reducing inflammation, thereby positively impacting vocal quality, including phonatory stability and vocal endurance [5]. Various reviews indicate the effects of the aforementioned properties (antibacterial, anti-inflammatory, antiviral, and antioxidant) for the benefit of throat-related problems and respiratory disorders, as well as the reduction of free radicals and the decrease in the contractile tone of tracheal smooth muscles when used in its boiled form [5–7].

These effects are achieved through several mechanisms, including the containment of substances such as eugenol and linalool, which act as bronchodilators and antioxidants [5], and the inhibition of inflammatory and anti-inflammatory cytokine stimulation [8].

The production of the human voice relies heavily on efficient respiratory function, with the lungs providing airflow and subglottic pressure to start and maintain vocal fold vibration. Chronic respiratory conditions, such as asthma or bronchitis, can lead to vocal fatigue and decreased phonatory control due to insufficient breath support. Therefore, interventions aimed at enhancing respiratory function, like breathing exercises or natural remedies, might improve vocal performance by optimizing airflow and supporting sustained phonation [5].

Therefore, this study aimed to examine the natural therapeutic effects of basil on respiratory function and vocal qualities. The findings could lay the groundwork for future clinical applications, such as basil-based treatments in voice therapy and respiratory rehabilitation programs.

2 Methods

2.1 Study Design and Population

This study was conducted in Palestine as an experimental investigation. Participants were randomly chosen from a group of healthy males and females aged 18–55. Individuals with a history of respiratory or voice issues, smoking, gastroesophageal reflux, allergies, or chronic conditions affecting lung function or voice quality were excluded to avoid confounding factors. The age range was selected because the vocal cords are usually at their optimal flexibility and strength [9]. All participants completed the Voice Handicap Index (VHI) to confirm their eligibility.

Sixty-seven participants met the inclusion criteria and enrolled in the study. Using a computer-generated random number table, they were randomly assigned to either the experimental group ($n = 36$) or the control group ($n = 31$). Each participant received a unique identifier, and randomization and allocation were conducted independently by multiple researchers. Assessors were blinded to group assignments to minimize selection bias.

2.2 Plant Material and Basil Tea Preparation

The dried basil leaves (*O. basilicum*) were obtained from specialized herbalists (Attarin) selling medicinal herbs in the West Bank, Palestine, during the spring season of 2025. The plant was taxonomically identified in the Natural Product Laboratory at An-Najah National University and coded with the voucher specimen code Pharm-PCT-2717. Basil tea was prepared by steeping 5 g of fresh basil leaves in 200 ml of boiling water for 10 min. Participants in the experimental group consumed the tea twice daily (morning and evening) for 10 consecutive days, while the control group maintained their usual routine without basil tea. No voucher specimen was deposited, which we acknowledge as a limitation.

2.3 Measures and Data Collection

Respiratory function was assessed using the Breath-Holding Test (BHT) and Maximum Phonation Time (MPT), providing insights into participants' respiratory support for speech.

Voice quality evaluation used the Voice Handicap Index (VHI) and the GRBAS scale to provide a comprehensive understanding of voice characteristics and perceived handicap.

Each parameter was documented in paragraph form, providing detailed descriptions and interpretations of each assessment outcome.

Participants completed pre- and post-intervention assessments regardless of their group assignment. All voice samples were recorded in a quiet, controlled environment. Participants were instructed to speak at a comfortable pitch and loudness and to produce a sustained vowel sound (e.g., /a/) for 5–10 s. Samples were then analyzed to evaluate respiratory and phonatory function.

The BHT measures the voluntary duration an individual can hold their breath after maximal inhalation, reflecting pulmonary efficiency. The MPT test involves sustaining a vowel sound for as long as possible, indicating respiratory control and phonatory efficiency. Both tests were repeated three

times per participant, and the average duration was used. Typical MPT ranges are 15–25 s for adult females and 25–35 s for adult males [10].

The VHI is a validated 30-item self-assessment tool evaluating the functional, physical, and emotional effects of voice disorders on daily life [11]. The GRBAS scale evaluates five parameters: Grade (G), Roughness (R), Breathiness (B), Asthenia (A), and Strain (S), through auditory perceptual assessment by speech-language pathologists [12].

Informed consent was obtained from all participants, and relevant clinical information was retrieved from medical records.

2.4 Ethical Considerations

The study protocol received approval from the Institutional Review Board (IRB) of An-Najah National University [IRB Reference #: Hsp. Sept. 2024/26]. All participants provided written informed consent, and confidentiality was upheld throughout the study. Data collection was conducted in private settings to ensure participants' comfort and privacy. The study followed the principles of the Declaration of Helsinki.

2.5 Duration of Intervention

We chose a 10-day intervention period mainly for feasibility and because this study is exploratory. Many randomized controlled trials of herbal interventions are criticized for short follow-up periods, which limit their ability to detect long-term effects and outcomes. Short-term trials, such as those in herbal research, often report methodological limitations due to insufficient treatment periods [13].

Although we observed significant changes in these 10 days, this duration may not reveal the long-term benefits or sustainability of basil tea for respiratory function and voice quality. Studies with longer interventions and follow-up are needed to confirm and extend these results.

2.6 Data and Statistical Analysis

Data were entered and analyzed using IBM SPSS. Descriptive statistics (means, standard deviations, frequencies, percentages) were used for demographic and clinical variables. Bivariate analyses included independent and paired t-tests. Pearson correlation matrices were used to assess relationships between continuous variables. Statistical significance was set at $p < 0.05$. A sample size of 67 participants was deemed adequate, given comparable sample sizes in previous studies investigating herbal interventions for respiratory and vocal function. Although no formal power analysis was performed, the sample size aligns with those used in similar exploratory studies. Nonetheless, the absence of a formal power analysis is recognized as a limitation.

3 Results

3.1 Patient Characteristics

A total of 67 individuals participated in the study. These participants were recruited from a pool of healthy adults. The majority were female (64%) and younger than 30 years old. The distributions of age and sex in each study group are displayed in Table 1.

3.2 Respiratory Function Pre-intervention and Post-intervention Results

3.2.1 Maximum Phonation Time (MPT)

Table 2 presents descriptive statistics for MPT in the experimental and control groups. This highlights the increase in MPT in the post-intervention experimental group *(Δ mean = 3.4083)*.

3.2.2 Breath Holding Time (BHT):

There was a minimal increase in the mean of the experimental group; however, stable BHT measurements were recorded for the control group, as shown in Table 3.

3.3 Quality of Voice Pre-intervention and Post-intervention Test Results

3.3.1 Voice Handicap Index (VHI):

There was a statistically significant decrease in the VHI mean for the experimental group *(Δ mean = 3.4722)* after 10 days of consuming basil tea, suggesting an improvement in perceived voice handicap. However, the VHI scores did not significantly change in the control group. These findings are presented in Table 4.

3.3.2 GRBAS Scale

Minor decreases in the Grade and Roughness scores were observed, indicating a potential improvement in voice quality in the experimental group. The same parameters were consistently stable in the control group, as shown in Table 5.

Table 6 shows that there were no significant differences at the 0.05 level before the intervention for the control and experimental VHI *($P = 0.324$)* and BHT *($P = 0.074$)* groups. On the other hand, there were significant differences in the MPT *($P = 0.00$)* and GRB *($P = 0.00$)* values between the control and experimental groups.

The results indicate that the two groups (control and experimental) are equivalent on the VHI and BHT tests but not on the MPT and GRB tests.

Table 1 Distribution of groups based on age and sex

Group	Variable	Classification	Frequency	Percent
Experimental	Age	20 and less	13	36.1
		21–30	17	47.2
		31–40	3	8.3
		41 and more	3	8.3
	Gender	Male	13	36.1
		Female	23	63.9
	Total		36	100.0
Control	Age	20 and less	2	6.5
		21–30	18	58.1
		31–40	4	12.9
		41 and more	7	22.6
	Gender	Male	11	35.5
		Female	20	64.5
	Total		31	100.0

Table 2 Maximum phonation time results before and after intervention

Group	Test	Pre-intervention test		Post-intervention test	
		Mean	Std. Deviation	Mean	Std. Deviation
Experimental	MPT	25.3917	5.74965	28.8000	5.07892
Control		16.0742	.93380	16.0548	1.01418

Table 3 Breath-holding time test scores before and after the intervention

Group	Test	Pre-intervention test		Post-intervention test	
		Mean	Std. Deviation	Mean	Std. Deviation
Experimental	BHT	34.1389	5.28152	35.8889	5.23056
Control		35.7839	2.72655	35.7581	2.81647

Table 4 Voice handicap index test scores before and after intervention

Group	Test	Pre-intervention test		Post-intervention test	
		Mean	Std. Deviation	Mean	Std. Deviation
Experimental	VHI	16.3333	11.35907	12.8611	8.15616
Control		11.3871	2.13974	11.4839	2.51490

Table 5 GRBAS scale test scores before and after intervention

Group	Test	Pre-intervention test		Post-intervention test	
		Mean	Std. Deviation	Mean	Std. Deviation
Experimental	GRB	2.9833	.41850	2.7167	.39893
		Median	IQR	Median	IQR
Control		1.6	1.3–2.8	1.6	1.3–3.0

Table 6 Paired t-test results of the pre-intervention data in the control and experimental groups

Test	Control group ($n = 31$)		Experimental group ($n = 36$)		t	df	P value
	Pre-intervention test		Post-intervention test				
	Mean	Std. Deviation	Mean	Std. Deviation			
MPT	16.0742	0.93380	25.3917	5.74965	− 9.099-	30	0.000*
VHI	11.3871	2.13974	16.3333	11.35907	− 1.003-	30	0.324
BHT	35.7839	2.72655	34.1389	5.28152	1.849	30	0.074
GRB	1.6871	0.39221	2.9833	0.41850	− 13.830-	30	0.000*

* The mean difference is significant at the 0.05 level

Table 7 Paired t-test results of the post-intervention data in the control and experimental groups

Test	Control group ($n = 31$)		Experimental group ($n = 36$)		t	df	P value	Improvement
	Pre-intervention test		Post-intervention test					
	Mean	Std. Deviation	Mean	Std. Deviation				
MPT	16.0548	1.01418	28.8000	5.07892	− 13.819	30	0.000*	12.7452
VHI	11.4839	2.51490	12.8611	8.15616	1.145	30	0.261	− 1.3772
BHT	35.7581	2.81647	35.8889	5.23056	.201	30	0.842	0.1308
GRB	1.7387	0.46881	2.7167	0.39893	− 9.287	30	0.000*	1.978

* The mean difference is significant at the 0.05 level

Table 7 shows paired t-test results for the post-intervention data in the control and experimental groups, with only the MPT and GRBAS results significant; the improvement values are 12.7452 and 1.978, with $P = 0.00$ and 0.00, respectively. On the other hand, there were no significant differences at the 0.05 level in the post-intervention data for the control and experimental groups on VHI and BHT ($P = 0.261$ and 0.842, respectively).

The analysis included all four pulmonary function measures, tested via a paired t-test, and compared pre- and post-intervention results. First, in the experimental group, significant differences were detected, with P values < 0.05 *($P = 0.00$)* for all measurements and improvement values of 3.40833, -3.47222, 1.75000, and -0.26667 for the MPT, VHI, BHT, and GRB, respectively, in the post-intervention results.

In contrast, in the control group, the P values for MPT, VHI, and BHT were not significantly different (0.758, 0.586, and 0.683, respectively). However, only the GRBAS had a significant P-value of 0.013 post-intervention (Table 8).

3.4 Age and Pulmonary Function Tests

No significant relationships were found between age and MPT, VHI, or BHT in the experimental group post-intervention, as indicated by Pearson correlation results ($P = 0.307$, 0.917, and 0.631, respectively).

However, the GRBAS showed a positive relationship with post-intervention R in the experimental group (0.482), with a P-value of 0.003 at the < 0.01 significance level (Table 9).

3.5 Sex and Pulmonary Function Tests

The only statistically significant post-intervention result in the experimental group, correlated with the sex variable, was the mean BHT score ($P = 0.003$), with a mean of 39.1538 for males and 34.0435 for females. This effect favors males, which may be due to their greater lung capacity (Table 10).

Table 8 Paired t-test of the pre- and post-intervention scores

Test	Experimental group ($n = 36$)				t	df	P value	Improvement
	Pre-intervention test		Post-intervention test					
	Mean	Std. Deviation	Mean	Std. Deviation				
MPT	25.3917	5.74965	28.8000	5.07892	− 4.084-	35	0.000*	3.40833
VHI	16.3333	11.35907	12.8611	8.15616	6.155	35	0.000*	− 3.47222
BHT	34.1389	5.28152	35.8889	5.23056	− 12.011-	35	0.000*	1.75000
GRB	2.9833	0.41850	2.7167	0.39893	9.108	35	0.000*	− 0.26667
	Control group ($n = 31$)				t	df	*P* value	Improvement
	Mean	Std. Deviation	Mean	Std. Deviation				
MPT	16.074	0.9338	16.0548	1.01418	0.311	30	0.758	0.01935
VHI	11.3871	2.1397	11.4839	2.51490	− 0.551	30	0.586	− 0.0967
BHT	35.7839	2.72655	35.7581	2.81647	0.41	30	0.68	0.02581
GRB	1.6871	.3922	1.7387	0.46881	− 2.63	30	0.013*	− 0.05161

* The mean difference is significant at the 0.05 level

Table 9 Relationships between age and pulmonary function test results

Age	MPT	VHI	BHT	GRB
Pearson correlation R	− 0.175	− 0.018	− 0.083	0.482**
P value	0.307	0.917	0.631	0.003
N	36	36	36	36

** The mean difference is significant at the 0.01 level

Table 10 Independent sample t-test of post-intervention pulmonary function test results according to experimental group and sex

Test	Gender	N	Mean	Std. Deviation	t	P- value*
MPT	Male	13	29.9308	5.80795	1.004	0.322
	Female	23	28.1609	4.63208		
VHI	Male	13	14.9231	9.60435	1.056	0.304
	Female	23	11.6957	7.18227		
BHT	Male	13	39.1538	4.61603	3.156	0.003*
	Female	23	34.0435	4.69505		
GRB	Male	13	2.8308	0.35446	1.303	0.201
	Female	23	2.6522	0.41546		

* The mean difference is significant at the 0.05 level

4 Discussion

4.1 Effect of Basil Tea on the Maximum Phonation Time (MPT)

The results of our study revealed a significant increase in MPT in the experimental group after consumption of basil tea, with an average improvement of 3.41 s. These findings suggest that basil tea may increase respiratory support, leading to improved breath control and sustained phonation. In contrast, the control group presented no notable changes in MPT, reinforcing the potential role of basil tea in improving vocal performance. In another study, improved respiratory function was associated with greater phonatory endurance and stability [14]. The effects of bioactive compounds in basil may have helped increase airflow and reduce the effort required to produce voice.

4.2 Effect of Basil Tea on Breath-Holding Time (BHT)

The increase in BHT levels in the experimental group compared with the control group is consistent with other herb-use studies that assessed the effects of herbs on BHT [14].

4.3 Effect of Basil Tea on the Voice Handicap Index (VHI)

The results of our study indicate a significant decrease in VHI scores following basil tea consumption, suggesting that basil positively impacts the physical, functional, and emotional aspects of voice quality, likely due to its vocal function and ability to enhance respiratory health. These findings align with previous research demonstrating the effectiveness of herbal remedies in reducing VHI scores [15].

4.4 Effects of Basil Tea on the GRBAS

A slight decrease in the GRBAS score was observed in the experimental group, indicating improvements in voice symptoms, including roughness and hoarseness. The antioxidant and anti-inflammatory properties of basil may have contributed to improved vocal and respiratory health. Previous studies have highlighted the use of the GRBAS test in assessing voice quality and related symptoms [16].

4.5 Physiological Mechanisms Underlying the Observed

Basil (*O. basilicum*) may affect respiratory health and voice quality through interconnected physiological mechanisms. Its active constituents, such as eugenol, linalool, and rosmarinic acid, are recognized for their anti-inflammatory and antioxidant properties. These compounds may decrease levels of pro-inflammatory cytokines such as IL-6 and TNF-α and reduce oxidative stress in the respiratory system, thereby improving airway function.

Furthermore, basil has been found to have bronchodilatory effects, likely by relaxing tracheal smooth muscle. This relaxation can decrease airway resistance and improve airflow. Better airflow and higher subglottic pressure are crucial for effective phonation, which may account for the improvements in maximum phonation time (MPT) and breath-holding time (BHT) observed in the experimental group.

Additionally, basil's antioxidant properties may help protect laryngeal tissues from oxidative stress. Its soothing and antimicrobial effects could also help keep vocal fold tissues hydrated and reduce irritation. Together, these benefits may reduce vocal effort and strain, which could explain the observed decreases in Voice Handicap Index (VHI) scores and improvements in GRBAS parameters in this study [13–21].

4.6 Results Before and After the Intervention in the Control Group

The control group did not influence the results of the MPT, VHI, or BHT. Although a difference was observed in the GRB readings, it could be attributed to environmental factors affecting participants in the control group, such as seasonal climate changes or health issues impacting their vocal and respiratory health at the time of the pre-readings. They had recovered by the time the post-readings were recorded.

4.7 Effects of Basil on Age

More pronounced effects of basil were observed in younger age groups, possibly due to a stronger immune system that is less susceptible to disease. In contrast, older individuals may suffer from illnesses that affect respiratory and vocal health. This is indicated by the greater prevalence of MPT in younger individuals than in older individuals, as suggested by Maslan et al. [18].

4.8 Duration of Intervention

The 10-day intervention period was chosen for feasibility and the exploratory nature of this study. However, many randomized controlled trials of herbal interventions have been criticized for having relatively short durations, limiting their ability to detect long-term effects and sustained outcomes. Short-term trials with sample sizes and durations similar to those in herbal research often report methodological limitations related to insufficient treatment periods [13].

Therefore, while significant changes were observed within this timeframe, the 10-day duration may not fully capture the potential long-term benefits or sustainability of basil tea on respiratory function and voice quality. Future research with longer intervention and follow-up periods is recommended to confirm and extend these findings.

4.9 Comparison with Previous Research and Generalizability

The results of this study are consistent with previous research showing that herbal treatments can improve respiratory health. Systematic reviews and meta-analyses have reported better pulmonary outcomes, including increased forced expiratory volume (FEV1), especially in individuals with conditions such as asthma. These benefits are attributed to the anti-inflammatory, antioxidant, and bronchodilatory properties of active plant compounds.

In this study, similar mechanisms may explain the observed improvements in maximum phonation time (MPT) and breath-holding time (BHT), which indicate respiratory efficiency and airflow control. Unlike prior research on clinical populations, this study included healthy adults, which may account for the moderate but significant improvements. These findings suggest that herbal interventions, such as basil tea, can enhance baseline respiratory function even in those without respiratory disease [20].

Few studies have evaluated the effects of herbal interventions on voice quality using standardized tools like the Voice Handicap Index (VHI) and the GRBAS scale [21].

However, the reduction in VHI scores and improvement in GRBAS parameters observed in this study may be indirectly supported by research that links improved respiratory function to better phonatory control and reduced vocal strain.

Caution is warranted when considering the generalizability of these findings [21]. The study involved relatively young, healthy adults from a specific geographic and cultural background, which may limit broader applicability. Individuals with chronic respiratory conditions, professional voice users, and older adults may respond differently. Further research with more diverse and clinical populations is needed to confirm and expand upon these results.

The results of this study also indicate several directions for future research. First, larger sample sizes are needed to better assess basil's effects on specific vocal parameters. In addition, long-term clinical trials should determine whether basil's benefits for respiratory and vocal performance are sustained. It is also important to conduct subgroup research, such as among individuals with asthma, chronic laryngitis, or other chronic voice or respiratory conditions, to clarify outcomes specific to each group. Furthermore, additional studies should examine whether combining basil tea with interventions such as breathing exercises or voice therapy enhances its effectiveness. The influence of psychological and environmental factors on individual responses to basil tea also requires further investigation.

In addition, to the above, the limited sample size may limit the ability to generalize the study results, and the relatively short study duration made it difficult to assess the long-term effects of basil tea on vocal and respiratory functions. The current study did not consider environmental or personal factors that could have influenced the results, such as participants' lifestyles or use of other medications. Additionally, the absence of an alternative treatment group (e.g., a group receiving traditional treatment) limits the ability to directly compare basil's effectiveness with that of other approved treatments.

5 Conclusions

The MBT, BHT, and VHI scores significantly improved in participants who consumed basil tea. The improvements, along with the reduction in the GRBAS scores, indicate enhanced respiratory support, improved breath control, and reduced vocal strain. These findings may be attributed to basil's bronchodilatory, anti-inflammatory, and antioxidant properties, which likely contributed to better airflow management and reduced respiratory effort during phonation.

The results also revealed greater improvements in respiratory measures in younger individuals than in older individuals. However, males presented higher BHT values, likely due to physiological differences in lung capacity. While these findings provide promising evidence for the potential benefits of basil tea, some limitations should be considered. The relatively short study duration, along with individual differences such as lifestyle, vocal habits, and psychological factors, may have influenced the results. Future research with larger sample sizes should explore the long-term and condition-specific effects of basil. The influence of other environmental and psychological factors was also explored to validate the findings of this study and explore their broader therapeutic applications.

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Author Contributions Hala Jarrar was responsible for conceptualizing the idea, study design, and methodology. She also contributed to data collection, revised the manuscript, assisted the research process and finalized the manuscript for submission. Hana Khalili revised the manuscript, and assisted the research process. Raghad Nabulsi, Sabreen Issa, and Nadia Dwaikat contributed equally to data collection, statistical analysis of the results, and writing the first draft.

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Data Availability All the utilized data to support the findings of the current study are included in the article. The datasets used and/or analyzed during the current study are available from the corresponding authors upon request.

Declarations

Ethical Approval Ethics approval and consent to participate: Informed consent was obtained from all participants, and the study and its protocols were approved by the Institutional Review Board Committee of An-Najah National University [IRB Reference #: Hsp. Sept. 2024/26]. The study was conducted in accordance with the Declaration of Helsinki, and the necessary permissions were obtained from the hospitals.

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