

were unavailable on timing of medications, such as antihistamines, and room temperature that may mediate itch. Parent-proxy report data may be limited during working hours and sleep and could explain increased itch observation in the evening and at bedtime. Nevertheless, weekend and child self-reported data corroborate the evening or bedtime prevalence. Cross-sectional survey design precluded examination of trends in itch.

In conclusion, we found that itch in children with AD is generally most intense in the evening or bedtime, approximately 3 hours before going to sleep, consistent in both parent-reported and child self-reported data. Children also self-report an afternoon uptick at approximately 2 PM, which might affect the school day.^{6,7} These findings highlight systemic effects of AD¹ and its potential association with circadian rhythm dysfunction.^{5,8} Skin barrier and inflammatory changes in patients with atopy may explain increased itch before bedtime.⁵ Children may benefit from tailored therapy to address timing of itch intensity, and clinicians should consider querying on itch timing and its impact on school and sleep.

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Reducing parental anxiety during oral food challenges

A randomized controlled trial of deep breathing exercises



Oral food challenge (OFC) is the gold standard procedure to diagnose food allergy (FA). Oral food challenges can instill anxiety in parents because of the risk of the child experiencing a severe allergic reaction.¹ Managing parental anxiety during medical procedures is critical because it may also minimize the child's distress or anxiety.² Previous studies have noted the benefits of cognitive behavioral therapy (CBT) in improving psychological well-being, quality of life,³ and reducing anxiety⁴ in mothers of children with FA. However, CBT treatment is not always feasible because of time and resource constraints. Diaphragmatic (or deep) breathing (DB) is a nonpharmacological intervention that has been found to reduce parental anxiety⁵ but has not been studied in the context of FA.

To address this gap, a randomized controlled trial was conducted to determine the effect of a 5-minute DB intervention on parental anxiety during the child's OFC vs standard of care (control). Parents

of children scheduled for an OFC at an outpatient pediatric allergy clinic were recruited. This study received ethics approval and informed consent was obtained.

Subjective (self-reported) anxiety was measured with the Spielberger state trait anxiety inventory-state (STAI-S), consisting of 20 questions with scores ranging from 20 to 80, and higher scores indicate greater anxiety. All parents completed the STAI-S pre-OFC (baseline) and 1-hour post-OFC (the observation period after the child ingested the last dose of food). Physiological indicators of anxiety were measured by means of galvanic skin response (GSR) by having the parent hold the personal input pod (Pip) between their thumb and index fingers. Pip is a Bluetooth biofeedback GSR device measuring electrodermal activity in response to stress⁶ and generated on a scale of 0 to 100 (%), with a higher percentage denoting increased stress. The GSR was measured for 5 minutes for all parents at 3 time points: pre-OFC (baseline), postintervention (or 2 minutes after baseline for the control group to mimic the same timing as postintervention) before the first dose of food, and 1-hour post-OFC.

The DB group used the Belly Breath app (Newlove and Petersen, British Columbia Children's Hospital, Vancouver, Canada), which aims to help children reduce preprocedural anxiety and pain.⁷ The Belly Breath app uses a biofeedback finger sensor to guide slow, deep diaphragm breathing by following an avatar's breathing pattern and feedback.⁷ The research nurse introduced the procedure and

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Table 1

Comparison of Parent and Child Characteristics Between Those in Deep Breathing Group and Control Group

	AIIN = 92	Deep breathing N = 54	Control N = 38
Child characteristics			
Child age, median (IQR)	4.00 (2.00–7.25)	3.00 (2.00–6.75)	4.50 (2.00–9.00)
Male sex, n (%)	60 (65.2)	35 (64.8)	25 (65.8)
Previous anaphylaxis, n (%)	49 (53.3)	31 (57.4)	18 (47.4)
Previous emergency department visit for FA, n (%)	41 (44.6)	27 (50.0)	14 (36.8)
Foods challenged, n (%)			
Peanut	27 (29.3)	15 (27.8)	12 (31.6)
Tree nuts	24 (26.1)	17 (31.5)	7 (18.4)
Egg	19 (20.7)	12 (22.2)	7 (18.4)
Milk	10 (10.9)	6 (11.1)	4 (10.5)
Soy	3 (3.26)	3 (5.56)	0 (0.00)
Salmon	3 (3.26)	1 (1.85)	2 (5.26)
Crustaceans (shrimp)	2 (2.17)	0 (0.00)	2 (5.26)
Other	4 (4.35)	0 (0.00)	4 (10.5)
Passed OFC, n (%)	68 (73.9)	41 (75.9)	27 (71.1)
Failed OFC, n (%)	19 (20.7)	9 (16.7)	10 (26.3)
Inconclusive	5 (5.4)	4 (7.41)	1 (2.63)
Required epinephrine during OFC, (%)	7 (7.61)	4 (7.41)	3 (7.89)
Parental perceived severity of FA (%)			
Mild	12 (13.04)	8 (14.8)	4 (10.52)
Moderate	20 (21.73)	11 (20.37)	9 (23.68)
Severe	49 (53.26)	29 (53.70)	20 (52.63)
Do not know	5 (5.43)	4 (7.41)	1 (2.63)
Incomplete	6 (6.52)	2 (3.7)	4 (10.52)
STAI-S scores (range 20 to 80), mean (SD)	N = 92	N = 54	N = 38
Pre-OFC (baseline)	46.8 (5.44)	46.1 (5.97)	47.9 (4.46)
1-h post-OFC	46.7 (5.22)	45.7 (4.95) ^b	48.1 (5.37) ^b
GSR/(Pip), % (SD)			
A. Pre-OFC score (preintervention)	54.0 (6.91)	54.3 (6.82)	53.5 (7.09)
B. Pre-OFC score (postintervention, before first dose of food)	54.2 (9.32)	54.6 (9.05)	53.7 (9.81)
C. 1-h post-OFC score	53.0 (6.82)	53.3 (7.00)	52.6 (6.62)
^aParent characteristics (optional questions)	N = 89	N = 53	N = 36
Parent age, median (IQR)	37.0 (33.0–41.0)	37.0 (33.0–41.0)	38.0 (34.0–41.0)
^b Female sex, N = 89, n (%)	76 (85.4)	50 (94.3)	26 (72.2)
^b Income Level, N = 86, n (%)			
\$0–\$59,999	18 (20.9)	12 (23.1)	6 (17.6)
\$60,000–\$99,999	18 (20.9)	16 (30.8)	2 (5.88)
\$100,000 and greater	42 (48.8)	21 (40.4)	21 (61.8)
Refused/do not know	8 (9.30)	3 (5.77)	5 (14.7)
^a Personal or family history of anxiety. N = 86, n (%)	N = 86	N = 52	N = 34
	26 (30.2)	16 (30.8)	10 (29.4)

Abbreviations: FA, food allergy; GSR, galvanic skin response; IQR, interquartile range; OFC, oral food challenge; Pip, personal input pod; STAI-S, state trait anxiety inventory-state.

^aOptional questions.^bStatistically significant ($P < .05$).

connected the parent to the GSR device to initiate the guided DB intervention by means of the app.

Descriptive statistics were compiled for all variables (Table 1). An independent Student's *t* test was conducted to compare the mean pre/post–STAI-S between the intervention and control groups. Statistical significance was defined as *P* less than .05; clinical significance was defined as a change in STAI-S from baseline to post-OFC greater than 10 points⁸ according to the minimal clinical important difference for anxiety and depression surveys after intervention in smokers, and subsequently used by Kansen et al⁹ in a food-allergic population. A 2-way repeated-measures analysis of variance was performed for GSR measurements at 3 time points. Statistical analyses were performed using the Statistical Package for the Social Sciences.

Between April 2018 and April 2019, 92 of 97 eligible parents participated (94.8% response rate); 54 received the DB intervention and 38 were controls. The median age of parents was 37.0 (interquartile range, 33.0–41.0), and 30.2% reported a personal/family history of anxiety. There were significant differences in sex with more women in the DB group vs controls (94.3% vs 72.2%; $P < .05$) (Table 1). The control group reported higher household income greater than or equal to 100 thousand than the DB group (61.8% vs 40.4%; $P < .05$). A

Microsoft Excel (Microsoft Corporation, Redmond, Washington) number generator was used for randomization. The groups were not balanced because 16 randomized parents did not complete the study or OFC (ie, uncontrolled asthma or other clinical reasons necessitating cancellation of the OFC, or software technical issues).

There was no significant difference in the mean pre-OFC STAI-S between DB and control groups ($P > .05$). Post-OFC, the STAI-S for the DB group were significantly lower than pre-OFC ($P = .04$), in contrast to a slight increase in STAI-S for the control group, with absolute differences of -0.4 and $+0.2$, respectively. The GSR (measured using Pip) found no significant difference between groups ($P > .05$) at any of the 3 time points (Table 1).

This is the first study (that the authors are aware of) to implement a DB intervention to reduce parental anxiety associated with their child's OFC. This study used both a self-report subjective measure of anxiety and Pip technology to measure GSR as a physiological indicator of anxiety and the Belly Breath app as the intervention.

Physiological measures of anxiety did not respond to the intervention, and improvement in parents' self-reported anxiety, though statistically significant, was marginal (and not clinically relevant according to published minimal clinical important

difference for STAI of 10 points).⁸ More than 90% of the DB group endorsed a coping intervention to help anxious parents manage stress before the child's OFC. Of those that received the intervention, 79.2% of parents said they would use DB for stress reduction in the future.

Studies have reported high parental anxiety pre-OFC, especially in mothers.^{1,4} We did not identify a difference in anxiety between mothers and fathers; however, many parents in our study reported moderate-to-high anxiety (STAI-S ≥ 35)⁴ pre-OFC. Interestingly, Boyle et al⁴ found that mothers with moderate-to-high anxiety may benefit the most from coping interventions like CBT, which could be similar for DB. Interventions that reduce parental subjective experiences of anxiety may also have a positive impact on the child's experience of anxiety.²

Although used in other FA studies,^{1,4} the STAI is neither sensitive nor specific¹⁰ in detecting FA-associated anxiety. However, there are currently no validated tools for this purpose. We did not detect clinically meaningful short-term or long-term effects of the intervention on subjective or physiological indicators of anxiety. We hypothesize this could be from the DB intervention not being long enough to induce physiological changes in GSR, or parents who declined participation having greater anxiety levels than those who participated. Other limitations included small sample size, STAI not being measured at 3 time points because of time constraints, and the use of the Belly Breath app with graphics created for children rather than adults.

In conclusion, the DB intervention with the Belly Breath app did not reduce subjective or physiological anxiety during OFC sufficiently; however, parents expressed interest in having access to a coping intervention to reduce anxiety. This study highlights the need to screen for and improve parental preprocedural anxiety, which could help parents feel more comfortable with the OFC experience. Though not the focus of this study, improving post-OFC anxiety may help reduce anxiety on FA in general and encourage parents to participate in additional OFCs, as required. Future studies with larger samples, longer duration of DB, or other coping interventions to reduce procedural anxiety for both parents and children with FA are needed.

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Fish allergy

Unusual patterns of parvalbumin allergenicity

Fish is one of the most common foods responsible for allergic reactions worldwide, particularly in Portugal, the second biggest consumer of fish per capita in the European Union.¹ Its prevalence has been calculated as high as 7% in pediatric populations, and in many cases, it persists into adulthood and is potentially life-threatening.²

β -parvalbumin is a major allergen in fish allergy with extensive cross-reactivity between species.³ As a result, patients with parvalbumin-mediated allergy are often advised to avoid all fish.⁴ We report 2 cases of parvalbumin-mediated fish allergy. The first, in the form of oligosensitization to sea bream (*Sparus aurata*), sea bass (*Dicentrarchus labrax*), sardine (*Sardina pilchardus*), and sole (*Pleuronectes platessa*), and the second, monosensitization to redfish (*Sebastes marinus*) mediated by an 11-kDa isoform.

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