

## Original Research Article

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# Effect of honey on nocturnal cough among children in Taif city

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## ABSTRACT

**Background:** Nocturnal cough is a common disturbing symptom that affects children during upper respiratory tract infections and can have a major negative impact on child and parents' sleep quality. Many pharmaceutical medications, herbal regimens, and non-pharmaceutical advice are prescribed to reduce nocturnal cough. The aim of this research was to study the impact of honey on nocturnal cough in children.

**Methods:** A descriptive study was conducted on 226 children in Taif city, KSA using a pre-prepared questionnaire to assess the cough severity and response to honey in comparison to other treatment modalities. Data collected were then analyzed using SPSS software.

**Results:** The study was conducted on 226 children (51.77% were females). Children who used honey were significantly older (mean age  $7.64 \pm 3.8$  years) than those who used medications (mean age  $6.98 \pm 6.0$ ) ( $p=0.025$ ). Children who used honey had a higher prevalence of headache ( $p=0.001$ ) and malaise ( $p<0.001$ ) than children who did not receive honey. The use of honey was also significantly associated with high cough severity scores. The use of honey seemed to significantly reduce both the cough severity score and combined severity scores, with odd's ratios of 0.46 and 0.19, respectively ( $p=0.020$  and  $<0.001$ ). However, it was associated with fewer satisfaction rates and fewer intentions to re-use in next attacks ( $p=0.025$ ).

**Conclusions:** Honey has a beneficial effect on treating nocturnal cough in children. It decreases the severity of cough as well as the frequency of cough. It is commonly used among older Saudi children who have cough associated with malaise and fever. However, it is not satisfactory for patient and parental relief in Taif city because it doesn't improve the sleep quality of patients or parents.

**Keywords:** Honey, Nocturnal cough, Children, Taif, Saudi Arabia

## INTRODUCTION

Nocturnal cough is a common disturbing symptom experienced by children with upper respiratory tract infections (URTI). It often causes disruption of sleep for both children as well as parents. Consequently, it results in high rates of school absenteeism among the affected children. Thus, caregivers and parents usually attempt to give their children herbal regimens and over the counter (OTC) medications to relieve their symptoms even if they know that viral upper respiratory tract infections are generally self-limited.<sup>1</sup>

A variety of herbal regimens and home remedies are commonly administered to children with cough to treat their symptoms, particularly honey, lemon, liquorice, and clove.<sup>2,3</sup> In spite of being not approved by the Food and Drug Administration (FDA), honey has been long considered a safe inexpensive demulcent that can relieve cough among pediatric population. Honey is an antioxidant with antimicrobial properties that can increase cytokine release and modulate inflammatory responses.<sup>4-6</sup>

The aim of this work was to study the effect of honey on nocturnal cough as well as sleep quality among Saudi children in Taif city and to compare the cough frequency and severity scores among children who were administered honey with those who did not.

## METHODS

This was a cross-sectional study that was conducted on children suffering from night cough attending pediatric and family medicine outpatient clinics in King Faisal Hospital in Taif city, Saudi Arabia on October 2017 using a pre-designed questionnaire. The pre-specified questionnaire was distributed as hard copies by research collaborators. Our questionnaire was structured by a series of questions about night cough and related symptoms as well as treatment used. Honey was specifically asked about in details. The questionnaire was translated into Arabic and the questions were re-phrased in everyday language whenever needed. We measured cough severity and control with a Likert scale with maximum score of 6 for each question. The options were "Extremely", "Very much", "A lot", "Somewhat", "A little", "Not much" and "Not at all", respectively.

Surveys were conducted by local teams at each hospital. The survey packet contained a cover letter and a questionnaire with Arabic and English versions. The survey was handed to each patient to read and decide whether to participate or not. Participants recruited to this study were all potential children suffering from night cough with no restrictions on severity, race, gender or socio-economic status.

## Statistical analysis

All collected data were transferred into a spread sheet for further analysis. Standard descriptive measures were calculated for each question/item individually. For data analysis, SPSS 24 for Windows (SPSS Inc., Chicago, IL, USA) was used. Chi-square test was used to measure the significance of difference between different groups. Regression analysis was used to assess association between using honey and the severity of the disease. Independent sample t-test was used to compare mean efficacy and disease control between honey and other treatments.

## RESULTS

The study was conducted on 226 children suffering from nocturnal cough. Males constituted 48.23% (n=109) and females constituted 51.77% (n=117). The children were classified into two groups according to the use of honey for treatment of cough symptom. Honey was used more frequently among older children ( $p=0.025$ ). The mean age of children who used honey was  $7.64 \pm 3.8$  years, and the mean age for those who did not use honey was  $6.98 \pm 9.3$  years. The socioeconomic status of the recruited patients was measured by the average monthly income of their caregiver (below 5000 SAR, between 5000 and 10000 SAR, or above 10000 SAR) and there was no statistically significant difference between the two-studied group ( $p=0.360$ ) (Table 1).

**Table 1: Baseline demographic and disease characteristics of participants.**

Characteristics	Patients receiving honey	Patients receiving other	P value <sup>Y</sup>
<b>Age: mean (SD)</b>	7.64 (3.8)	6.98 (3.60)	0.025*
<b>Gender: N (%)</b>	Male	78 (49.4)	0.602
	Female	80 (50.6)	
<b>Relation of participant to child</b>	Mother	19 (27.9)	0.033*
	Father	42 (26.6)	
	Brother or sister	66 (41.8)	
	Grandma or grandpa	10 (6.3)	
	Other	21 (13.3)	
<b>Socioeconomic</b>	Below 5000 SAR	31 (20.9)	0.360
	5000 -10000 SAR	78 (52.7)	
	Above 10000 SAR	39 (26.4)	
<b>Cough frequency score, mean (SD)</b>	2.22 (1.42)	2.68 (1.39)	0.022*
<b>Cough severity score, mean (SD)</b>	3.07 (1.64)	2.94 (1.36)	0.214
<b>Cough effect on child sleep score, mean (SD)</b>	3.25 (1.58)	2.79 (1.68)	0.059
<b>Cough effect on parent sleep score, mean (SD)</b>	3.06 (1.52)	2.98 (1.61)	0.820
<b>Combined symptom score, mean (SD)</b>	3.18 (2.08)	2.17 (1.36)	<0.001**
<b>Frequency of hospitalization, mean (SD)</b>	3.09 (3.29)	3.53 (3.476)	0.379
<b>Improvement after mean (SD)</b>	2.13 (0.809)	1.80 (0.93)	0.002*

**Table 2: Symptoms difference between patients using honey vs. other treatments.**

Symptoms	Treatment used		P value <sup>Y</sup>
	Honey	Other treatments	
Congestion	Yes	19 (27.9)	38 (24.1)
	No	49 (72.1)	120 (75.9)
Fatigue and weakness	Yes	29 (42.6)	51 (32.3)
	No	39 (57.4)	107 (67.7)
Discharge	Yes	22 (32.4)	56 (35.4)
	No	46 (67.6)	102 (64.6)
Sneezing	Yes	19 (27.9)	35 (22.2)
	No	49 (72.1)	123 (77.8)
Headache	Yes	22 (32.4)	22 (13.9)
	No	46 (67.6)	136 (86.1)
Wheezing	Yes	44 (64.7)	105 (66.9)
	No	24 (35.3)	52 (33.1)
Malaise	Yes	43 (63.2)	0 (0.0)
	No	25 (36.8)	158 (100.0)
Fever	Yes	16 (23.5)	32 (20.3)
	No	52 (76.5)	126 (79.7)

<sup>Y</sup>Chi-square test; \*statistically significant (>0.05); \*\* statistically significant (>0.001).

**Table 3: How often honey was used for cough.**

Frequency	Gender					
	Male		Female		Total	
	N	%	N	%	N	%
Honey times	Once	12	38.7	7	18.9	19
	Twice	13	41.9	21	56.8	34
	Three times	2	6.5	7	18.9	9
	More than 3	4	12.9	2	5.4	6

**Table 4: Disease progression and control comparing honey to other treatments.**

Characteristics	Honey	Other treatments	P value <sup>Y</sup>
Diagnosis	Yes	46 (67.6)	105 (66.9)
	No	22 (32.4)	52 (33.1)
Extra treatments used	Non	40 (58.8)	107 (67.7)
	Bronchodilator	9 (13.2)	9 (5.7)
	Ginger	0 (0.0)	7 (4.4)
	Antibiotics	6 (8.8)	13 (8.2)
	Syrup (don't know the name)	8 (11.8)	16 (10.1)
	Soolan syrup	1 (1.5)	1 (0.6)
	Antihistamine	0 (0.0)	2 (1.3)
	Lemon	2 (2.9)	2 (1.3)
Controlled	Ventolin + O2	2 (2.9)	1 (0.6)
	Yes	44 (68.8)	109 (74.1)
Hospitalized	No	20 (31.3)	38 (25.9)
	Yes	26 (38.8)	43 (27.2)
Satisfying	No	41 (61.2)	115 (72.8)
	Yes	50 (73.5)	135 (86.0)
Next attack	No	18 (26.5)	22 (14.0)
	Yes	50 (73.5)	135 (86.0)

<sup>Y</sup>Chi-square test; \*statistically significant (>0.05).

**Table 5: Linear regression testing association between honey use and different cough parameters.**

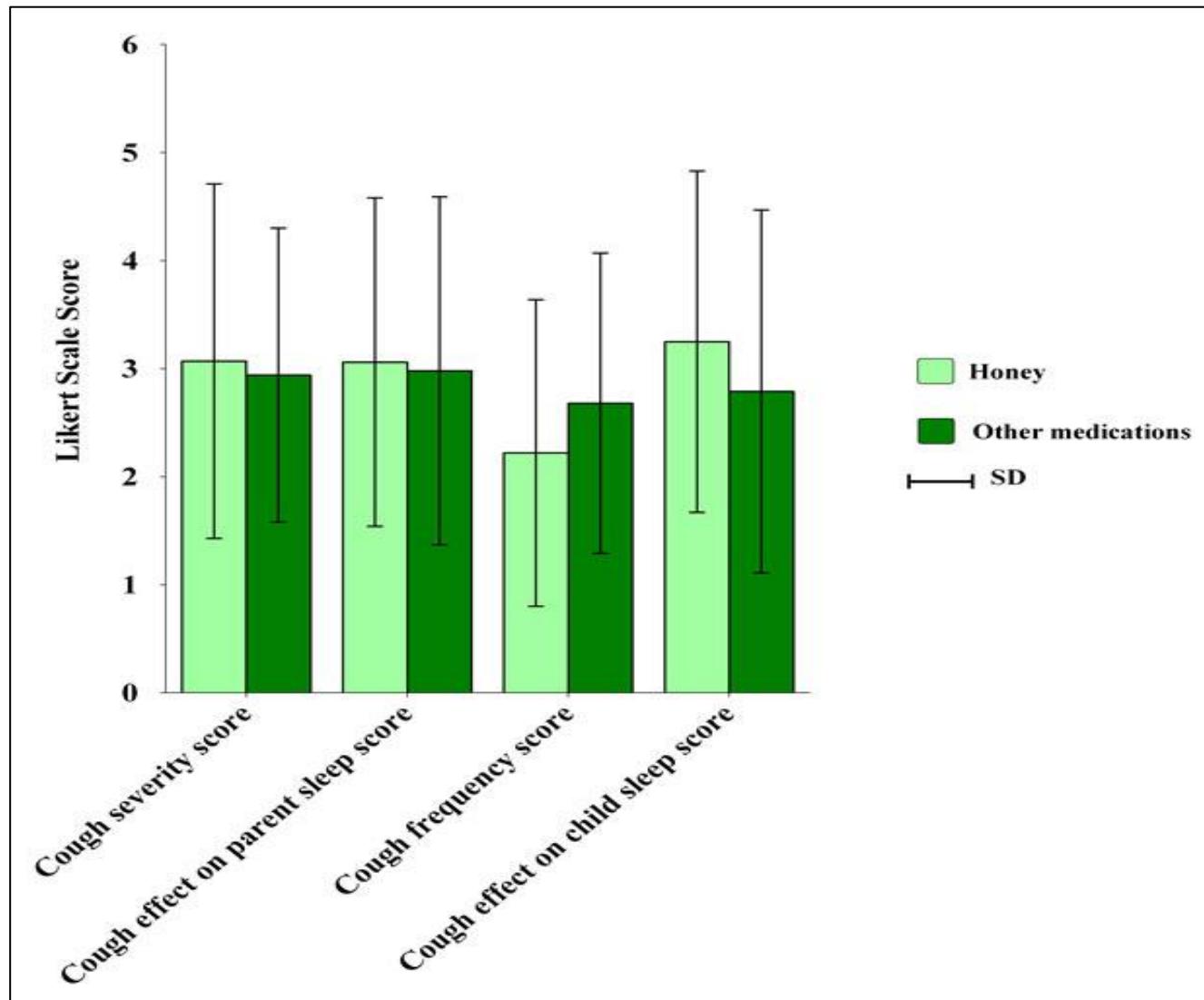
Predictors	B	S.E.	Adjusted OR (95% CI) <sup>†</sup>	P value
Cough frequency score	0.21	$\pm 0.25$	0.1 (-0.29-0.7)	0.410
Cough effect on child sleep score	0.33	0.19	0.24 (-0.05-0.7)	0.087
Cough severity score	-0.52	0.17	-0.39 (-0.86--0.17)	0.004 *
Cough effect on parent sleep score	-0.01	0.18	-0.01 (-0.36-0.35)	0.966
Combined symptom score	-0.96	0.78	-0.17 (-2.51-0.59)	0.220

B=Regression coefficient; S.E.=Standard error of regression coefficient; OR=Odds Ratio; CI=Confidence Interval; \*statistically significant (>0.05).

**Table 6: Comparison efficacy of honey and other treatments in different aspects of cough.**

Predictors	t	S.E.	Mean difference (95% CI) <sup>†</sup>	P value
Cough frequency score	-2.24	0.2	-0.46 (-0.86--0.05)	0.026 *
Cough effect on child sleep score	1.9	0.21	0.46 (-0.02-0.93)	0.059
Cough severity score	0.66	0.24	0.14 (-0.28-0.55)	0.513
Cough effect on parent sleep score	0.34	0.23	0.08 (-0.38-0.53)	0.735
Combined symptom score	0.84	0.05	0.19 (0.10-0.29)	<0.001**

t=t statistics; S.E.=Standard error difference; CI=Confidence Interval; \*statistically significant (>0.05); \*\*statistically significant (>0.001).



**Figure 1: Comparison of the mean effect of honey and other treatments on cough scores.**

The cough frequency score among children who did not use honey was significantly higher than those who used it, with figures of 2.68 and 2.22 among the two groups, respectively ( $p=0.0022$ ). Similarly, the combined symptom score was higher among patients who did not use honey (3.53) in comparison to those who used honey (3.05) with a probability value of  $<0.001$ . However, children who used honey improved slower than those who did not use honey; with a mean time to improvement of 2.43 days among those who used honey compared to 1.8 among those who did not ( $p=0.002$ ). The demographic data are detailed in Table 1.

The symptoms investigated in this study included congestion, fatigue and weakness, discharge, sneezing, headache, wheezing, malaise, and fever (Table 2). Of significance, headache was more prevalent among children who were using honey (32.4%) in comparison to those who did not (13.9%) ( $p=0.001$ ). Similarly, malaise was only experienced by children who used honey ( $p<0.001$ ), with percentage of how often the honey was used in Table 3.

There was no statistically significant difference between patients who used honey and those who did not as regards the disease diagnosis, outcome, control, hospitalization rates, and the need for using other treatments (Table 4). However, the satisfaction rates, as well as the intention to use honey versus other medical treatments in future attacks, were significantly lower among patients who received honey in comparison to those who did not ( $p=0.025$ ).

As regards the correlation of cough severity with honey use, Table 5 demonstrates that using honey was significantly correlated with the cough severity. Patients who used honey were 0.026 times vulnerable to have higher cough frequency scores than those who did not receive honey ( $p=0.026$ ). On the other hand, when the impact of honey on different cough severity scores was evaluated, it was found that the use of honey had significantly reduced the cough severity score and the combined severity score (for both severity and frequency) (Figure 1). The impact of honey on several scores was evaluated including the cough frequency score, the cough severity score, the combined cough severity and frequency score, child's sleep quality, and parents' sleep quality scores. Of note, the use of honey had a significantly beneficial effect on reducing the cough severity score and the combined cough severity and cough frequency scores. The odd's ratio of cough frequency was 0.46 ( $p=0.026$ ) and that for combined severity and frequency score was 0.19 ( $p<0.001$ ) (Table 6). However, there was no statistically significant difference between the two groups as regards the impact on cough effect on child's or parents' sleep quality, child's sleep quality, or cough severity score.

## DISCUSSION

Honey has been long considered a safe, inexpensive, and popular demulcent that can relieve cough, propose anti-microbial actions, and modulate inflammatory response and cytokine release. It is a complex natural remedy that contains at least 181 different substances.<sup>7-9</sup> Thus, parents and caregivers commonly administer it to their sick children even without seeking medical advice. This study aimed to explore the effect of honey on children's nocturnal cough and sleep quality. Results from this study showed that Saudi parents seemed to tend to use honey in older children ( $p=0.025$ ); they might have been careful about cough symptoms in younger children for fear of being more vulnerable to complications if not promptly treated with pharmaceutics. However, previous researchers did not find a statistically significant difference for using honey among children of different age groups.<sup>10-12</sup> The difference encountered in this study may be attributed to the cultural background and knowledge about honey use as several Saudi parents worry about the risk of infantile botulism with honey use in younger children. Honey is generally not recommended to be given for infants under the age of one year for the risk of infantile botulism, but there is no consensus against its use beyond this age.<sup>13</sup> Some researchers do not recommend the use of honey for long periods because it increases the risk for dental caries.<sup>1</sup> Another reason behind the avoidance of honey use in young children in this study might be the fact that honey seemed to take more time to improve the child's symptoms than medications ( $p=0.002$ ), which might have lead the caregivers to use other alternatives to fasten their children recovery. The use or non-use of honey, however, did not seem to have a statistically significant impact on disease control or frequency of hospitalization.

Of note, parents used to use honey for their children when they had more severe symptoms particularly headache and malaise ( $p=0.001$  and  $<0.001$ , respectively). However, it was not frequently used when children had higher nocturnal cough severity (OR=0.39,  $p=0.0041$ ).

The use of honey was found to have beneficial impact on nocturnal cough frequency, and combined cough severity and frequency scores. Children who received honey were less likely to have high nocturnal cough severity scores (OR=0.45,  $p=0.026$ ) or high combined nocturnal cough severity and frequency scores (OR=0.19,  $p<0.001$ ). In agreement with our results, Paul et al, in their study on the effect of honey, dextromethorphan, and placebo on nocturnal cough and sleep quality among children, reported that parents reported significant improvement in their children cough severity and sleep quality when they used honey in comparison to those who used dextromethorphan or placebo.<sup>10</sup> Similarly, Cohen et al stated that honey had significantly improved cough symptom severity and sleep quality among the studied

patients.<sup>1</sup> Other studies had also reported similar results.<sup>11,12,14-21</sup>

In spite of the significant improvement in nocturnal cough severity and frequency among the studied sample, parents and caregivers reported less satisfaction rates ( $p=0.025$ ), and fewer intentions to re-use it in future attacks ( $p=0.025$ ). This may be attributed to the fact that using honey, in spite of improving the nocturnal cough frequency and severity scores, did not have a significant impact on the quality of sleep either of children or their parents. In disagreement with our results, parents used to rate honey as a favorable regimen that improves their children's nocturnal cough and sleep quality.<sup>1,11,14,22</sup> The difference may be attributed to different cultures, different concepts about symptom relief and expectations, different types of honey used, and different dosage and compliance.

The effect of honey on improving cough severity is probably related to its immunomodulatory actions. Honey was found to stimulate the monocytes to release cytokines and chemokines particularly inter interleukin 6, interleukin 1 beta, and tumor necrosis factor alpha (TNF-alpha).<sup>8</sup> Given the known role of these cytokines in healing and tissue repair, honey can improve the cough symptom. Furthermore, different fractions of the honey were proved to have antioxidant properties. For instance, honey contains ascorbic acid, gluconic acid, hydroxymethylfuraldehyde, several peptides, phenolic compounds, and many enzymes such as peroxidases, catalases, and glucose oxidases which are known for their antioxidant capacity.<sup>9</sup>

#### **Limitations of the study**

The main limitation of this study was a cross-sectional study, it did not measure the impact of honey on prospective more objective follow-up basis. The scores used depended mainly on parents' memory about their children condition and their subjective judgement. Additionally, it was not blinded to reduce the bias. It focused on children and patients' subjective evaluation of their own symptoms and improvement. Finally, it was limited to one city in KSA and did recruit patients from different cities. So that, further multicenter prospective double-blinded studies are still recommended to confirm the results of this study and to be confident about generalizing the results to the Saudi community.

#### **CONCLUSION**

Honey can improve children's nocturnal cough severity and frequency. It is commonly used among older Saudi children who have cough associated with malaise and fever. However, it didn't improve the sleep quality of patients or parents. So that, it is associated with lower satisfaction rates and fewer intentions to be used in future attacks among Saudi individuals.

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