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Risk Factors of Chronic Cough and Wheezing in Outpatient and Hospitalized Children

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Abstract

Background: Wheezing and chronic cough are the most common respiratory disorders in children. They, as a multifactorial disorder, have different respiratory-associated illnesses and occur because of different etiologies.
Objectives: In this study, we investigated correlation between wheezing and cough conditions and different probable risk factors.
Methods: This is a cross-sectional and hospital-based study conducted on 485 children with wheezing and chronic cough in hospitalized and outpatients. The pediatrician confirmed these disorders after evaluating children's respiratory systems. Interns filled out the related standardized questionnaires for evaluating the risk factors.
Results: In total, 485 children were evaluated, 268 children (55.3%) were male, and 217 children (44.7%) were female. Smoke and steam were recorded as the most common etiologies and risk factors of chronic cough and wheezing. Other factors evaluated in this study included 14% dust, 9% flowers, and plants, 10.9% cold air, 5.8% sporting, 4.5% spicy, and 35.7% other stimulants foods, and out of these factors had other stimulating factors ($P = 0.0001$).
Conclusions: Based on these findings, lifestyle, diet, location, contact with triggers, treatment, and control of underlying disease, environmental hygiene, and type of fuel consumption may be effective in reducing the symptoms.

Keywords: Wheezing, Chronic Cough, Risk Factors, Children

1. Background

Wheezing and chronic cough, as the most common respiratory disorders, are multifactorial with different respiratory-associated illnesses, which occur due to different etiologies (1, 2). These appear to be common, with a prevalence of five to seven percent in preschoolers and 12% to 15% in older cases (3). Chronic cough is typically defined as a cough lasting more than four weeks, and wheezing is diagnosed by chest auscultation (4, 5). Probable risk factors of wheezing and chronic cough include smoking, inherited traits, infection of airway at a very young age, bronchitis, air pollution, physical activity, increased sensitivity of the immune system, previous allergic reactions to dust mites, sinusitis, pet dander, cold air and weather changes, hives or eczema, allergic rhinitis, obesity, pneumonia, gastroesophageal reflux disease (GERD), black breed and male gender, which can influence these conditions (6-8). Etiologies of chronic cough in children are quite different from that of adults, so evaluation and management of children should not be based on adult protocols (9). Gastroesophageal reflux, upper airway cough syndrome, and sinusitis are sometimes misdiagnosed, because of associations with chronic cough in adults, but their role in causing chronic cough in children is controversial (10, 11). Child evaluation with chronic cough composed of a detailed history, chest radiograph, physical examination, and spirometry. If the initial evaluation suggests a specific cause, further evaluation is focused on that diagnostic possibility (2). Other diagnoses of chronic cough included chronic and sub-acute infections, aspiration of foreign body, and cough-dominant asthma (12). Red flags included failure to thrive, cough that is unusually frequent and severe, exertional dyspnea, growth retardation, purulent sputum, chest pain, hemoptysis, or hypoxemia (13). Based on the content, we can find the importance of this issue, so this study aimed to investigate risk factors of chronic cough and wheezing in outpatients and hospitalized cases.

2. Methods

2.1. Study Setting

This is a cross-sectional study conducted in Amir-Kabir hospital, pediatric clinic.

2.2. Study Population

This cross-sectional study was conducted on 485 children who were hospitalized or outpatient with wheezing and chronic cough from one month to 14 years of age.

2.3. Measurements

The procedure was explained to children and their parents. Data were analyzed with SPSS software version 21. In hospitalized patients, according to the tests conducted during hospital stay, such as chest-X-ray (CXR), pH meter, sweat chloride test, computed tomography (CT) scan, sputum test, bronchoscopy, spirometry, and drugs examinations, patients' status was assessed, and eligible patients were enrolled in the study. In outpatients, in addition to any examination, auscultation of the lungs in wheeze was carefully done, and patients with rhonchi, stridor, and crackles heard in the chest auscultation were excluded from the study. In the following, additional data, including clinical, epidemiological, and demographic status, were recorded in questionnaires by interns.

2.4. Statistical Analysis

Data were recorded in SPSS software and analyzed by Chi-square, logistic regression analysis, and descriptive indicators. The significance level was considered at $P < 0.05$.

2.5. Inclusion and Exclusion Criteria

All hospitalized or outpatients' children that were referred to hospital owing to related symptoms and those who were diagnosed with wheezing and chronic cough aged one month to 14 years were included in the study, but those who did not contribute to examinations and were not willing to fill the questionnaires were excluded from the study.

2.6. Ethical Consideration

Ethical issues have been completely observed by the authors. In addition, the Ethics Committee of Arak University of Medical Sciences approved the study protocol, with ethical code IR.ARAKMU.REC.88.74.6.

3. Results

In total, 485 children were evaluated. Demographic and social factors had a significant effect on chronic cough and wheezing in children. Age parameter was classified into four groups as follows: 59 children (%12.1) were lower than one year, 130 children (%26.8) were 1 - 3 years, 203 children (%41.9) were 3 - 5 years, and 93 children (%19.2) were more than five years ($P = 0.0001$). In gender section, 268 children (%55.3) were male and 217 children (44.7) were female ($P = 0.0001$). In addition, other factors, including BMI, housing status, pet, living area, beetle in living location, type of heating device, consanguineous marriage, education status of fathers and mothers, and smoking in mothers and fathers had a significant effect on chronic cough and wheezing in children ($P < 0.05$) (Table 1).

Cough status of affected children was evaluated. In the following, important information was presented. Smoke and steam were recorded as the most common etiologies and risk factors of chronic cough and wheezing. Other effective factors included 14% dust, 9% flowers and plants, 10.9% cold air, 5.8% sporting, 4.5% spicy and 35.7% other stimulants foods ($P = 0.0001$). The most common onset time of symptoms was spring ($P = 0.0001$), and the most common onset age of chronic cough was 3 - 5 years ($P = 0.0001$). Also, 173 children (35.7%) had a history of chronic cough in parents (father and/or mother) (Table 2). We evaluated clinical status of children and their parents, including atopic history of children and parents, history of lung diseases in parents, pneumonia, surfactant administration, medications, and chest tube in children. In this regard, 75 children (15.5%) and 309 parents of children (63.7%) had a history of atopy ($P = 0.0001$). Most common medication was corticosteroid ($P = 0.0001$) and most common etiology of hospital admission was asthma ($P = 0.0001$). Other factors had a significant effect on chronic cough and wheezing ($P < 0.05$) (Table 3).

Feeding status of children was evaluated, and the most common age of complementary feeding was more than six years ($P = 0.0001$). The most common type of complementary feeding was gruel ($P = 0.0001$), 272 children (56.1%) had salt in food ($P = 0.0001$), and 125 children (25.8%) had a history of milk consumption ($P = 0.0001$) (Table 4). Delivery status of children was evaluated and in total 349 cases (72%) was under cesarean section ($P = 0.0001$). In body birth weight (BBW) section, six children (1.2%) had very low birth weight (VLBW), 60 children (12.4%) had low birth weight (LBW), and 36 children (7.4%) had high birth weight (HBW) ($P = 0.0001$). About gestational age, 58 children (12%) were preterm and 12 children (2.5%) were post-term ($P = 0.0001$) (Table 5).

Table 1. Demographic and Social Status of Children with Chronic Cough and Wheezing (No: 485)

Variables	No. (%)	P-Value
Age (y)		0.0001
< 1	59 (12.1)	
1 - 3	130 (26.8)	
3 - 5	203 (41.9)	
> 5	93 (19.2)	
Gender		0.021
Male	268 (55.3)	
Female	217 (44.7)	
BMI (kg/m^2)		0.0001
< 24.9	64 (13.2)	
25 - 29.9	381 (78.5)	
> 30	40 (8.3)	
Housing status		0.0001
Apartment	148 (30.5)	
Villa	281 (57.9)	
Underground	56 (11.6)	
Pet		
Yes	221 (45.6)	
No	264 (54.4)	
Living area		0.0001
Rural	180 (37.1)	
Urban	305 (62.9)	
Beetle in living location		0.0001
Yes	213 (43.9)	
No	272 (56.1)	
Type of heating device		0.0001
Gas heaters	240 (49.5)	
Oil heaters	151 (31.1)	
Radiators	94 (19.4)	
Consanguineous marriage		0.0001
Yes	44 (9)	
No	441 (91)	
Education status of father		0.005
Under diploma	171 (35.2)	
Diploma-associate	147 (30.3)	
Bachelors-masters	134 (27.7)	
Ph.D.	33 (6.8)	
Education status of mother		0.023
Under diploma	227 (46.8)	
Diploma-associate	159 (32.8)	
Bachelors-masters	89 (18.4)	
Ph.D.	10 (2)	
Smoking in mothers		0.0001
Yes	44 (9.1)	
No	441 (90.9)	
Smoking in fathers		0.0001
Yes	324 (66.8)	
No	157 (33.2)	

Table 2. Information About Cough Status in Children and Their Parents

Variables	No. (%)	P-Value
History of chronic cough in family		0.0001
Father	91 (18.8)	
Mother	82 (16.9)	
Father and mother	25 (5.2)	
Second degree relatives	37 (10.9)	
None	234 (48.2)	
Onset time of symptoms		0.0001
Spring	143 (29.5)	
Summer	83 (17.1)	
Autumn	122 (25.1)	
Winter	137 (28.3)	
Cough stimulating factor		0.0001
Dust	68 (14)	
Flowers and plants	44 (9)	
Cold	53 (10.9)	
Smoke and steam	97 (20)	
Sporting	28 (5.8)	
Spicy and stimulants foods	22 (4.5)	
None	173 (35.7)	
Onset age of chronic cough (y)		0.0001
< 1	93 (19.2)	
1 - 3	168 (34.6)	
3 - 5	195 (40.2)	
> 5	29 (6)	

4. Discussion

The findings of this study showed different risk factors of chronic cough and wheezing in outpatients and hospitalized children, so our results confirm most related studies regarding this issue in other countries, and related studies about these risk factors were compared with our results. A study by Weinberger and Abu-Hasan in Turkey was done on 731 children from one month to 8 years who had cough and wheezing. Maximum age of coughing and wheezing was in the range of 3 to 5 years (14). In addition, this was consistent with our study, and 9.41% was in range of 3 to 5 years and the lowest prevalence was related to lower than one year of age. In another study by Sennhauser and Kuhni, 250 children in five to 15 years of age were evaluated. They investigated the prevalence of respiratory disorder and its correlation with gender of children. Of 250 children, 61% were male, and 31% were female (15). In our study, 55.3% were male and 44.7% were female, which confirms the stated study. A study by de Jongste and Shields was conducted in Austria, which demonstrated the effect of smoking on the prevalence of respiratory disorders, as an important risk factor for chronic cough and wheezing (16). In our study, 86.6% of the parents were cigarettes smoker, which is consistent with the study conducted in Austria. In a study conducted in Canada, angiotensin-converting enzyme inhibitors (ACEI) and cytotoxic agents were recognized as important factors involved in the pathogenesis of chronic cough (17), but in our study, most patients did not use any drugs, and 10.7% of patients used non-steroidal anti-inflammatory drugs (NSAID), which may cause cough in children with asthma. Based on low prevalence of high blood pressure (hypertension) in children, this miscorrelation to the study of Canada is predictable. In a study conducted by Murray et al. in 2010 in Italy, the relationship between body mass index (BMI) and respiratory symptoms was investigated in children, and they concluded that increased BMI was associated with respiratory symptoms, particularly wheezing (18). In our study, 78.6% of children had normal range of BMI, and only 8.2% had higher than normal BMI. In two studies carried out in Austria and US, pets and animals were found as important factors in causing chronic cough and atopy in children (19, 20). In our study, 45.6% of children kept animals and birds at home, which confirmed the results of the above-mentioned studies. A study in Austria was conducted on 752 children, one to four years of age, with chronic cough. In this study, atopy history of children and their parents were mentioned as risk factors for chronic cough incidence (20). In our study, 36.6% of children and 15.5% of parents had a history of atopy, which is in agreement with the previous studies. In a study by Menezes, delivery status of children and its correlation with wheezing were evaluated. They found that wheezing was equal in caesarean section and vaginal delivery (21). In our study, 28% of children had CS and 72% had NVD delivery, which was not consistent with the stated study. In a study by Rosenstreich et al. (22), the role of cockroach allergens in children with respiratory symptoms was examined. They showed that 36.8% of children were sensitized to cockroach allergens, and 50.2% of cockroach allergens were found in dust of bedrooms, indicating cockroach allergens are associated with respiratory symptoms in pediatric population. In a study conducted by Robin et al., the correlation between fuel consumption and chronic cough was investigated. They indicated that 60% in case and 10% in control groups had wood fuel, demonstrating its effect on respiratory dysfunction (23). Also, in our study, 49.5% have fuel gas consumption, which is consistent with the mentioned study. In a study conducted in 2007 in Italy, the effect of diet in the development of respiratory symptoms in children was investi-

Table 3. Clinical Status of Children and Their Parents with Chronic Cough and Wheezing (No: 485)

Variables	No. (%)	P-Value
Atopic history of parents		0.0001
Yes	75(15.5)	
No	405(84.5)	
Atopic history of children		0.0001
Yes	309 (63.7)	
No	176 (36.3)	
History of lung disease of father		0.0001
Yes	87 (17.9)	
No	398 (82.1)	
History of lung disease of mother		0.0001
Yes	53 (10.9)	
No	432 (89.1)	
Pneumonia		0.0001
Yes	49 (10.1)	
No	436 (89.9)	
Administration of surfactant		0.0001
Yes	7 (1.5)	
No	478 (98.5)	
Chest tube		0.0001
Yes	1 (0.2)	
No	484 (99.8)	
Medications		0.0001
Without use drugs	161 (33.1)	
Non-steroidal anti inflammatory drugs	52 (10.6)	
Corticosteroid	84 (17.1)	
Bronchodilator	11 (2.4)	
Acetaminophen	25 (5.1)	
Antibiotics	33 (6.8)	
Anti-acid	41 (9)	
Antihistamine	78 (15.9)	
Frequency of hospitalization		0.0001
Non-hospitalized	293 (60.4)	
1 - 3	124 (25.6)	
3 - 5	49 (10.1)	
> 5	19 (3.9)	
Cause of hospitalization		0.0001
Outpatient	293 (60.4)	
Asthma	90 (18.6)	
GERD	41 (8.4)	
Sinusitis	27 (5.6)	
Foreign body	9 (1.9)	
Bronchiolitis	14 (2.9)	
Habitual cough	8 (1.6)	
CF	3 (0.6)	

Abbreviations: CF, cystic fibrosis; GERD, gastroesophageal reflux disease.

gated. This study showed that adding salt to food and carbonated beverages is associated with an increased risk of respiratory symptoms (24). In our study, NaCl was added to the food of children as 56.1%, which was consistent with the Corbo study. In a study conducted in 1996 by Zedja et al., formula feeding is known as a risk factor for chronic cough (25). In our study, 25.8% of the children have used formula feeding as a risk factor for chronic cough. In a

Table 4. Feeding Status of Children with Chronic Cough and Wheezing

Variables	No. (%)	P-Value
Age of complementary feeding		0.0001
< 3	52 (10.7)	
3 - 6	105 (21.7)	
> 6	328 (67.6)	
Type of complementary feeding		0.0001
Porridge	148 (30.5)	
Gruel	157 (32.5)	
Soup	65 (13.4)	
Mashed potatoes	56 (11.5)	
Dining table foods	59 (12.1)	
The presence of salt in foods		0.007
Yes	272 (56.1)	
No	213 (43.9)	
History of milk consumption		0.0001
Yes	125 (25.8)	
No	360 (74.2)	

Table 5. Delivery Status of Children with Chronic Cough and Wheezing

Variables	No. (%)	P-Value
Delivery type		0.0001
Natural	136 (28)	
Cesarean	349 (72)	
BBW (g)		0.0001
< 1500 (VLBW)	6 (1.2)	
1500 - 2500 (LBW)	60 (12.4)	
2500 - 4000 (NBW)	383 (79)	
> 4000 (HBW)	36 (7.4)	
Gestational age		0.0001
Preterm	58 (12)	
Term	415 (85.5)	
Post-term	12 (2.5)	
Delivery problem		0.0001
Yes	77 (15.9)	
No	408 (84.1)	

Abbreviations: BBW, body birth weight; VLBW, very low birth weight, LBW, low birth weight; HBW, high birth weight.

study conducted in the US in 2009, GERD (27.5%), allergy (24.5%), asthma (12.5%), infection (5%), foreign body aspiration (2.5%), have been identified as etiologies of chronic cough. In general, allergies and asthma form more than 80% of etiology of chronic cough in children (26). In our study, asthma and rhinosinusitis form more than 80% of the etiology of chronic cough cases, which confirms the previous study. Limitations of our study include providing personal satisfaction and failure to cooperate in the study courses. It is recommended to do related case-control studies for better evaluation of these risk factors.

4.1. Conclusions

In summary, mentioned risk factors have a significant correlation with chronic cough. Most patients with chronic cough were male children between 3 - 5 years of age, passive smoker, and had a positive familial history of chronic cough. Based on these findings, risk factors, including lifestyle, diet, location, contact with triggers, treatment, and control of underlying disease, environmental hygiene, and type of fuel consumption, have a significant effect on chronic cough and wheezing incidence. Therefore, we may reduce complications of these conditions with control of related risk factors.

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Footnotes

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Conflict of Interests: The authors declared no conflict of interests.

Ethical Approval: Ethical issues were completely observed by the authors. In addition, the Ethics Committee of Arak University of Medical Sciences approved the study protocol, with ethical code IR.ARAKMU.REC.88.74.6.

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