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The Efficacy and safety of honey as a treatment for pediatric cough and relation to future sport performance: a literature review

Joanna Maria Szewczyk
Wojskowy Instytut Medyczny, Szaserów 128, 04-141 Warsaw
https://orcid.org/0009-0006-7252-2379
szewczyk.asia@yahoo.com

Aleksandra Małgorzata Rybak
Maria Skłodowska-Curie Provincial Specialist Hospital in Zgierz, ul. Parzęczewska 35, 95-100 Zgierz, Poland
https://orcid.org/0009-0002-6146-1057
aleksmalgorzatarybak@gmail.com

Donat Sławomir Cupiał
105 Kresowy Szpital Wojskowy z Przychodnią SPZOZ, ul. Domańskiego 2: 68-200 Żary, Lubuskie, PL
https://orcid.org/0009-0004-1096-7589
doninator96@gmail.com

Natalia Katarzyna Seliga
Akademia Wojsk Lądowych
Piotra Czajkowskiego 109, 51-147 Wrocław
https://orcid.org/0009-0006-0934-9569
nataliakatarzynaseliga@gmail.com

Katarzyna Płudowska
Wojskowy Instytut Medycyny Lotniczej, ul. Zygmunta Krasińskiego 54/56, 01-755 Warszawa, PL
https://orcid.org/0009-0009-0698-1798
katarzyna_pludowska@wp.pl

Kamila Ptasińska
5 Wojskowy Szpital Kliniczny z Poliklinika SPZOZ
ul. Wrocławska 1/3, 30-901 Kraków
https://orcid.org/0009-0000-6269-2995
kamila.pta0203@wp.pl

Paulina Grzeszczyk
Wojskowy Instytut Medyczny,
Szaserów 128, 04-141 Warsaw
https://orcid.org/0009-0001-0840-1365
grzeszczykpaulina@wp.pl

Anna Rosińska
Wojskowy Instytut Medycyny Lotniczej,
ul. Zygmunta Krasińskiego 54/56, 01-755 Warsaw
https://orcid.org/0009-0006-3224-5004
rosinskania@gmail.com

Karolina Arciszewska
5 Wojskowy Szpital Kliniczny z Poliklinika SPZOZ Wrocławska 1/3 Kraków: Kraków, PL
https://orcid.org/0009-0008-7776-8890
karolinaarciszewska@op.pl

Katarzyna Krawczyk
107 Szpital Wojskowy z Przychodnią SPZOZ w Wałczu
https://orcid.org/0009-0005-5607-074X
kasiutkasemrau.99@gmail.com

Harold Jakubowski
Wojskowy Instytut Medyczny,
Szaserów 128, 04-141 Warsaw
https://orcid.org/0009-0007-8824-9749
harrison1997.hj@gmail.com

ABSTRACT

Honey has been used for centuries as a natural aid in treating various ailments, including respiratory tract infections. Its antibacterial, antiviral, anti-inflammatory, and immunomodulatory properties make it an interesting subject of research in the context of relieving the symptoms of upper respiratory tract infections, especially cough.

Cough is one of the most common symptoms in children. Although it is usually self-limiting and does not require causal treatment, it can significantly affect the child's comfort and worry parents. Cough, especially dry and paroxysmal, often worsens at night, disturbing the sleep of both the child and caregivers, which in turn can prolong the convalescence process and lead to a deterioration in general well-being.

Modern scientific research increasingly confirms the effectiveness of natural bee products as support in treating upper respiratory tract infections. Honey affects many levels: it can soothe a sore throat, reduce cough, improve the functioning of the immune system, and shorten the duration of symptoms. The variety of available honey species, rich in bioactive compounds such as flavonoids, phenolic acids, and enzymes, creates a wide range of possibilities for their therapeutic use. This article aims to review the literature on the effect of honey on the relief of symptoms of upper respiratory tract infections. The mechanisms of honey action, its chemical composition, clinical evidence, and possible limitations in its use will be analysed, along with its potential impact on the future athletic activity of children.

KEY WORLDS

Cough, Children, Pediatric Cough, Upper Respiratory Tract Infections, Honey,

INTRODUCTION

Cough is one of the most frequent symptoms in pediatric patients and a leading cause of medical consultations, particularly in the context of viral upper respiratory tract infections. [1] While

usually self-limiting, persistent, or severe cough can disrupt sleep, cause distress in children and caregivers, and may lead to the overuse of medications.

Pharmacological options for pediatric cough are limited. Antitussive drugs such as Dextromethorphan or codeine-based products are generally discouraged in children under the age of six due to safety concerns. This gap in effectiveness has led to growing interest in natural and traditional remedies, including honey.

Preliminary evidence, including randomised controlled trials, suggests that honey may reduce cough frequency and severity, improve sleep quality, and provide symptom relief comparable or superior to conventional treatments.

CHEMICAL COMPOSITION AND BIOLOGICAL PROPERTIES OF HONEY

Honey is a natural product produced by honeybees that we reach for first when cold and flu symptoms appear. The characteristic of honey is significantly influenced by various factors, including the geographical region, climate conditions, harvesting season, and the specific floral sources from which bees collect nectar. [2]

Honey is a complex natural substance comprising approximately 200 different compounds. Its main parts are sugars, water, and different helpful substances like proteins (including enzymes), free amino acids, essential minerals, vitamins, phenolic compounds, volatile compounds (like monoterpenes and benzene derivatives), and solid bits that come from how honey is collected. This diverse composition makes honey a valuable source of both macronutrients and micronutrients. Honey's sugar content is predominantly composed of monosaccharides-mainly glucose and fructose, which together account for approximately 60-70% of its total sugar content. Proteins in honey are primarily enzymes, including invertase, diastase, glucose oxidase, catalase, peroxidase, and acid phosphatase. These enzymes play crucial roles in the transformation of nectar into honey. Amino acids constitute about 1% of honey's composition, with proline being the most abundant. It mainly originates from the salivary glands of honeybees. This compound is commonly used as an indicator to assess how mature the honey is. [3,4]

Honey also contains trace amounts of vitamins (such as tocopherol (E), anti-hemorrhagic vitamin (K), ascorbic acid (C), thiamine (B1), niacin (B3), pantothenic acid (B5), and pyridoxine (B6). [2]

THE COUGH

A cough is scientifically described as a forceful expiratory action, typically performed against a closed glottis, and accompanied by a distinctive sound. Importantly, it serves as a protective physiological reflex aimed at clearing airway secretions or expelling inhaled particles. As a normal reflex, healthy children are estimated to cough approximately 11 times per day, with a typical range between 1 and 34 episodes. The acoustic characteristics of a cough exhibit significant variability, encompassing differences in pitch, timbre, and amplitude. This spectrum ranges from a distinct, loud, barking quality to a subdued, akin to a throat-clearing sound.

When it comes to its nature, a cough can be either wet, also known as productive, meaning it brings up mucus**,** or dry, which is typically just irritating.[5]

In the pediatric population, cough duration is a key criterion for classification. An acute cough is defined as one lasting under four weeks, whereas a chronic cough persists for more than four weeks [5,6,7]. More than half of children have at least one episode of acute cough annually. [8,9] The majority of acute cough episodes in children are commonly attributed to viral upper respiratory tract infections (URTIs). On average, a preschool-aged child may experience 6 to 8 viral respiratory infections per year, each accompanied by coughing. [5] Chronic cough affects approximately 5% to 10% of children. The prevalence of cough demonstrates an inverse correlation with age within the pediatric demographic, presenting at its lowest incidence during the summer months. [10]

THE TREATMENT OF COUGH

Cough treatment frequently requires self-medication or medical consultation. Current medical evidence indicates that pediatric cough medications and syrups have demonstrated efficacy and are associated with a risk of significant adverse events. Consequently, contemporary clinical

guidelines strongly discourage the administration of these pharmaceutical products to children. [11,12] Given the predominantly viral aetiology and self-limiting nature of acute cough episodes in the pediatric population, current clinical guidelines emphasise symptomatic and supportive management, thereby mitigating the unnecessary use of antibiotics, which are ineffective against viral pathogens and contribute to the escalating concern of antimicrobial resistance.

Recent scholarly investigations and clinical recommendations, published since 2020, consistently underscore the limited efficacy and potential risks associated with numerous over-the-counter cough medications when administered to pediatric patients, particularly within younger age cohorts. [13,14] The American Academy of Paediatrics (AAP) and other prominent health organisations strongly advise against their administration in children under six years of age, and frequently in older pediatric patients as well, citing a lack of substantiated efficacy and the potential for serious adverse effects. [15] Consequently, contemporary management strategies are increasingly focused on non-pharmacological interventions and natural remedies aimed at alleviating pediatric discomfort and bolstering innate physiological defence mechanisms. Paramount among these approaches is ensuring adequate hydration, which facilitates the thinning of respiratory secretions, thereby promoting their expectoration. Furthermore, humidifying ambient air, particularly within sleeping environments, can mitigate the irritation associated with a dry cough by reducing mucosal dryness. The avoidance of exposure to environmental irritants, such as tobacco smoke or atmospheric pollutants, also constitutes a fundamental aspect of both prophylaxis and cough management. [13,16] Increasingly, contemporary research and clinical guidelines, including those published in recent years, advocate for the utility of honey as an efficacious and safe symptomatic intervention for cough in pediatric patients over one year of age, thereby establishing it as a valuable alternative to pharmaceutical agents. This evolving therapeutic paradigm reflects a global shift in pediatric medicine, prioritising patient safety and evidence-based efficacy. [12, 17, 18]

THE MECHANISM OF ACTION OF HONEY IN COUGH

Honey's multifaceted properties position it as an effective agent in cough amelioration, a finding corroborated by extensive scientific literature. [19] Its efficacy is attributable to a complex interplay of both physical and biochemical mechanisms. Honey demonstrates therapeutic potential in the mitigation of cough, particularly in pediatric populations over 12 months of age. [19,20,21] As a demulcent, honey forms a protective mucosal barrier over the pharyngeal epithelium, thereby reducing mechanical irritation and suppressing the cough reflex. Moreover, honey contains a range of bioactive constituents-including flavonoids, enzymatic antioxidants, and vitamins that exhibit anti-inflammatory and antioxidative effects. These properties may contribute to mucosal healing and attenuation of inflammation within the respiratory tract. [6,19,20,21,22]

COMPARATIVE EFFICACY OF HONEY AND USUAL CARE IN PEDIATRIC COUGH MANAGEMENT

Analysis of available clinical studies on the use of honey in treating pediatric cough reveals its significant superiority in symptom reduction compared to usual care. Data regarding combined symptom scores were obtained from three studies, albeit with a considerable risk of bias. Cough frequency and severity, however, were analysed in eight and five studies, respectively, which presented variable risk of bias. Across all these analysed parameters, significantly greater improvement was observed in patients receiving honey than in those receiving usual care, with low statistical heterogeneity. These findings were also consistent when compared with placebo groups. [14]

LIMITATIONS IN THE USE OF HONEY IN PEDIATRIC POPULATIONS.

Despite its recognised therapeutic benefits, the administration of honey in children is subject to critical limitations, primarily concerning patient age and potential adverse effects. Most notably, honey is contraindicated in infants under 12 months of age due to the risk of infant botulism, a rare but potentially life-threatening condition caused by Clostridium botulinum spores that may be present in unpasteurized honey. The immature gastrointestinal microbiota of neonates and

young infants lack the protective capacity to inhibit the germination of these spores, rendering them particularly susceptible to neurotoxin production and associated morbidity. [12, 23, 24, 25]

Furthermore, potential allergic reactions to honey or other agricultural products warrant consideration, notwithstanding their relatively infrequent occurrence. The presence of pollen grains within honey can act as allergens, precipitating hypersensitivity responses in predisposed pediatric individuals. Consequently, in children with a confirmed history of allergy to pollen, bee products, or other honey constituents, prudent caution or complete avoidance of honey administration is advised. [12, 26]

Moreover, it is imperative to acknowledge that honey constitutes a source of simple carbohydrates, necessitating caution in pediatric patients with diabetes mellitus or those at risk for its development. Furthermore, its high sugar content warrants consideration regarding oral hygiene and the associated risk of dental care. [27,28,29,30]

HONEY AND ITS ROLE IN PHYSICAL ACTIVITY AMONG CHILDREN

Honey, as a natural source of readily absorbable carbohydrates, may play a significant role in the nutrition of physically active children. Due to its high content of glucose and fructose, honey provides both immediate and sustained energy, thereby supporting exercise performance and facilitating post-exercise recovery. Research suggests that regular honey consumption in young athletes may contribute to improvements in muscular strength, endurance, and overall physical capacity. Moreover, honey possesses anti-inflammatory and antioxidant properties, which can enhance immune function and help mitigate the negative effects of exercise-induced oxidative stress. Additionally, honey may assist in relieving exercise-related cough, commonly observed in children during respiratory infections. Acting as a demulcent, honey forms a protective coating over the mucous membranes of the throat, reducing the cough reflex and promoting respiratory comfort during physical exertion. [31,32]

However, despite its health-promoting potential, honey is also a calorie-dense food. Excessive intake particularly in the context of low physical activity – may contribute to an increased risk

of overweigh or obesity. For this reason, honey should be incorporated into children's diets in moderation and as part of a well-balanced nutritional plan. When used appropriately, honey may serve as a natural energy booster that supports physical development, immune health, and training efficacy in children, offering a safe alternative to synthetic supplements and commercial sports beverages. [33]

Recent studies indicate that honey ingestion before physical activity may help maintain blood glucose levels during prolonged or high-intensity exercise, thereby delaying the onset of fatigue. Its low glycemic index compared to refined sugars also promotes more stable energy release, which may be especially beneficial for children engaged in endurance-based sports. Furthermore, honey's micronutrient content-including trace elements such as potassium and magnesium- may support muscular function and hydration during physical exertion. These properties position honey as a practical and functional nutritional component for young athletes aiming to optimize training outcomes and long-term physical performance.[31]

CONCLUSION

This literature review comprehensively evaluates the efficacy and safety of honey in managing pediatric cough. The synthesised evidence consistently shows that honey effectively serves as a symptomatic intervention for acute cough in children over one year of age. Research indicates its superiority over placebo, no treatment, and several conventional over-the-counter cough medications in mitigating both cough frequency and severity, concurrently enhancing sleep quality for pediatric patients and their caregivers.

The therapeutic advantages stem from its multifaceted mechanisms of action. These include its demulcent properties, which soothe irritated pharyngeal mucosa; its anti-inflammatory effects, which derive from various bioactive compounds, and its broad-spectrum antimicrobial activity against a range of respiratory pathogens.

However, despite its demonstrated efficacy, honey's application in pediatric populations necessitates meticulous consideration of its safety profile and specific limitations. Notably, honey is strictly contraindicated for infants under 12 months of age due to the associated risk of infant botulism. Furthermore, while generally well-tolerated, potential allergic reactions,

although rare, require attention, particularly in predisposed individuals. Its substantial simple carbohydrate content mandates caution in diabetic children and those at risk and presents implications for oral hygiene and the potential for dental caries.

Given the robust evidence supporting its benefits and favourable safety profile (when administered appropriately), honey is recognised as a valuable, evidence-based, and natural alternative within the therapeutic approaches for pediatric cough. Its judicious integration aligns with current clinical guidelines promoting non-pharmacological strategies and responsible medication use. This approach reduces global efforts to combat antimicrobial resistance. Future research should further clarify optimal dosing, specific honey types, and long-term outcomes to fully realise its therapeutic potential.

Conceptualization: Joanna Maria Szewczyk
Methodology: Aleksandra Małgorzata Rybak, Joanna Maria Szewczyk and Anna Rosińska
Software: Harold Jakubowski, Donat Sławomir Cupiał
Check: Katarzyna Płudowska, Kamila Ptasińska
Formal analysis: Paulina Grzeszczyk, Natalia Katarzyna Seliga
Investigation: Harold Jakubowski, Donat Sławomir Cupiał
Resources: Karolina Arciszewska, Katarzyna Płudowska
Data curation: Katarzyna Krawczyk, Paulina Grzeszczyk
Writing - rough preparation: Aleksandra Małgorzata Rybak, Joanna Maria Szewczyk
Writing - review and editing: Joanna Maria Szewczyk and Kamila Ptasińska
Visualization: Karolina Arciszewska, Katarzyna Krawczyk
Supervision: Anna Rosińska, Paulina Grzeszczyk and Natalia Katarzyna Seliga
Project administration: Aleksandra Małgorzata Rybak

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