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Original article

Prevalence of Cow Milk Protein Allergy among Libyan Asthmatic Children

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Abstract
Coexistent food allergy and asthma is a significant burden in the pediatric population, and the incidences of both have increased dramatically over the past two decades. Cow milk protein allergy is the most common allergy in children with prevalence between 1.8% and 7.5% during the first year of life. The variability between studies may be attributable to different methods used for diagnosis, the different ages of the populations studied or to geographical factors. The purpose of this study is to determine the prevalence and clinical impact of cow milk protein allergy in Libyan asthmatic children. This was a cross-sectional study done between December 2021 and December 2022 at Tripoli children hospital. The study included 200 asthmatic children who regularly attending the childhood asthma clinic. Detailed questionnaire was used, and data were analyzed using SPSS and presented as descriptive statistics. Out of 200 asthmatic children included, 10% of them had cow milk protein allergy, their mean age was 2.7± 2.6years, and about 80% of cases were below 5 years of age ($P < 0.05$). Furthermore, our findings exhibited significant association between family history of atopy and cow milk protein allergy ($P < 0.05$). About 45% of asthmatic cases were affected by cow milk protein allergy, of which 5% of them had progressive course. Future studies should aim to include larger samples of cow milk protein allergy cases, which allow sufficient statistical power to uncover the epidemiology of this allergy.
Keywords. Asthmatic, Cow Milk, Allergy, Libyan.

Introduction

Food allergy and asthma are two common childhood conditions that are familiar to many. Children with both food allergies and asthma are at increased risk for severe anaphylaxis, including fatal and near-fatal anaphylaxis, particularly if the asthma is uncontrolled [1]. Cow's Milk Protein Allergy (CMPA) is defined as an immune-mediated response to cow's milk proteins that occurs consistently with ingestion. CMPA occur particularly in infancy and early childhood [2]. It presents with a variety of symptoms and signs, which commonly develop in infants and can regress by six years of age. It can be a cause of parental and family stress due to a milk-free diet and if not treated appropriately can lead to a subsequent nutritional deficiency [3].

It is difficult to determine the exact prevalence of CMPA due to a lack of uniformity of the criteria for diagnosis. Consequently, it remains unclear whether the prevalence is increasing [4]. CAMP is the most common food allergy in young children. Its accounts for approximately one-fifth of childhood food allergies, with global prevalence 2.0% -7.5% [5]. In Libya, a study done among children in Al Ajeilat city, showed that cow's milk was the second most common food allergens after fruits, with a percentage 13.9% [6]. Among young Egyptian children, the frequency of documented CMPA was 3.2% [7]. In asthmatic children, its prevalence was 10.8% [8], in breast-fed infants was 0.5%, and it decreases to less than 1% in children with 6 years or older [9].

The prevalence of CMPA varies significantly across different regions and populations, influenced by genetic, environmental, and dietary factors [10]. In developed countries, the reported prevalence ranges from 1.9% to 4.9% among infants, with higher rates observed in some European countries such as Norway and the United Kingdom [11]. In contrast, lower prevalence rates have been reported in Asian and African countries, although underdiagnosis and limited access to healthcare in these regions may contribute to these disparities. The incidence of CMPA tends to peak during the first year of life, coinciding with the introduction of cow's milk-based formulas or complementary foods. By the age of six, approximately 80-90% of children outgrow the allergy, but for some, it may persist into adolescence or adulthood [12].

The rising prevalence of CMPA over the past few decades has been attributed to several factors, including changes in dietary patterns, increased awareness and diagnosis, and the "hygiene hypothesis," which suggests that reduced exposure to infections in early childhood may predispose individuals to allergic diseases. Additionally, the widespread use of cow's milk-based formulas as a substitute for breastfeeding has been implicated in the increased incidence of CMPA, as exclusive breastfeeding is known to have a protective effect against the development of food allergies [13,14].

The prevalence and management of CMPA vary widely across different regions, reflecting disparities in healthcare access, cultural practices, and dietary habits [15]. In high-income countries, increased awareness and improved diagnostic capabilities have led to higher reported rates of CMPA, as well as the

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development of specialized hypoallergenic formulas and dietary guidelines. In contrast, low- and middle-income countries often face challenges in diagnosing and managing CMPA due to limited healthcare infrastructure, lack of access to hypoallergenic formulas, and cultural preferences for breastfeeding [16].
The socioeconomic impact of CMPA is substantial, affecting families, healthcare systems, and society as a whole. The cost of hypoallergenic formulas, which are significantly more expensive than standard formulas, can place a financial burden on families, particularly in low-resource settings. Additionally, the long-term consequences of untreated or poorly managed CMPA, such as impaired growth, developmental delays, and reduced quality of life, underscore the importance of early diagnosis and appropriate dietary management [17]. The aim of our study was to find out the prevalence of CMPA among Libyan asthmatic children and its impact on their asthma control.

Methods

Study design and period

A cross-sectional study was carried out on 200 children patients diagnosed with asthma who were referred to asthma clinic in Tripoli children hospital during the period from December 2021 to December 2022.
The inclusion criteria were children diagnosed with cow mile allergy, and we had excluded patients with other types of allergies.

Study tool

A performed case sheet was used to obtain the relevant data including the following: Age, sex, address, diagnosis and prognosis in the patients.

Statistical analysis

The collected data was coded and SPSS software was used for analysis. Frequency, percentage, mean, SD were used for descriptive statistics. Inferential statistics were used accordingly, considering a P value < 0.05 as significant.

Ethical considerations and consent process

An ethical approval was obtained from the scientific committee and the head of Tripoli children hospital before starting the study.

Results

A total of 200 asthmatic children seen in asthma clinic during the study period. The age of patients was ranged from 10 months to 16 years, with a mean of 6.6 ± 3.8. Male to female ratio was 1.7:1 (Table 1).

Table 1. Clinical characteristics of the study population

Variables	**Asthmatic patients. (n=200)**	
Age (years)	Mean ± SD	6.6 ± 3.8
	Range	10 months -16 years
Gender	Male	126 (63%)
	Female	74 (37%)
Nationality	Libyan	200 (100%)
Residence	Tripoli	137 (68.5%)
	Other cities	63 (31.5%)
Asthma duration (years)	Mean ± SD	3.8 ± 3.1
	Median	3.0
Family history of atopy	Positive	197 (98.5%)
	Negative	3 (1.5%)

Cow milk protein allergy was reported in 20 (10%) of Libyan asthmatic children (Figure 1). In 75% of the cases, CMPA was diagnosed first.

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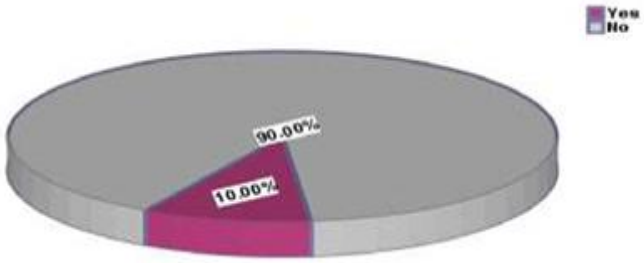

Figure 1. Prevalence of CMPA in Libyan asthmatic children

In our study, mean of age with standard deviation were 2.7± 2.6years (Range: 10 months - 8 years). 80% of cases were below 5 years of age (P < 0.05) (Figure 2).

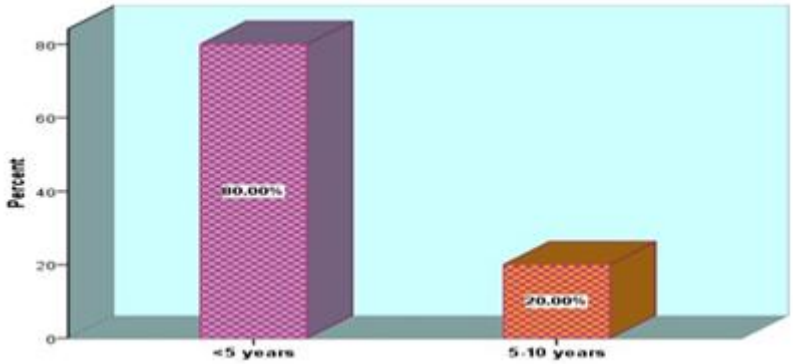

Figure 2. Age distribution of CMPA patients

In terms of gender, there was male predominance with ratio 4:1 (Figure 3). In all of the females CMPA was diagnosed first (Table 2).

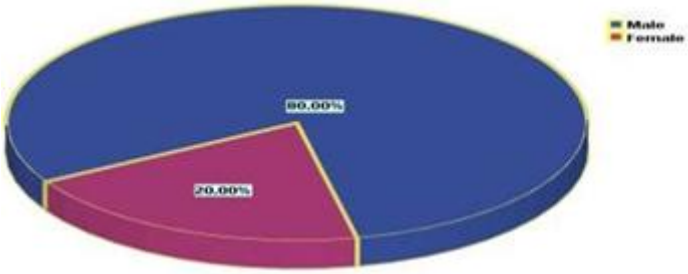

Figure 3. Gender distribution of CMPA patients

Table 2. Which disease diagnosed first concerning gender

Gender	Asthma	CMPA	P value
Male	5	11	0.197
Female	0	4	

Table 3 shows that most of the cases included in the study were from Tripoli (65%), followed by Tarhuna 15%. There was significant relation between residence and cow milk allergy (p < 0.05).

Table 3. Residence of cow milk protein allergy patients

Residence	CMPA patients (n=20)
Tripoli	13 (65%)
Tarhuna	3 (15%)
Gharyan	1 (5%)
Sabha	1 (5%)
Ghadames	1 (5%)
Suq Alkhamis	1 (5%)

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About 90% of cases had positive family history of atopy, where asthma was presented in 40% of cases, CMPA in 10%, and other allergies reported in 45% of cases (Figure 4). There was significant association between family history of atopy and cow milk protein allergy (P < 0.05).

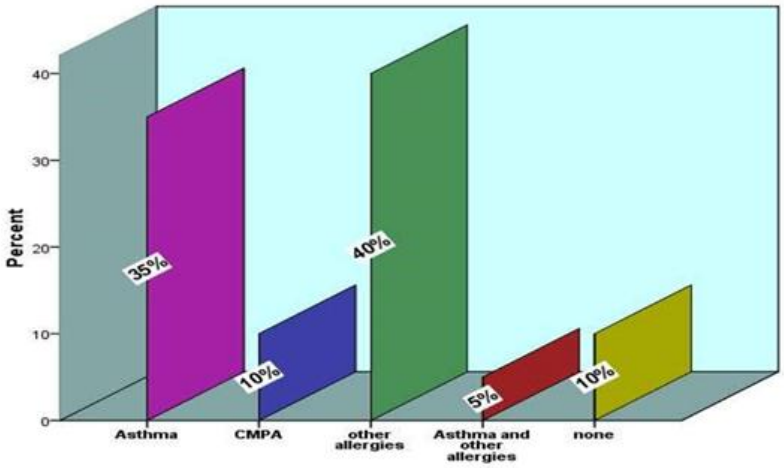

Figure 4. CMPA cases regarding family history of atopy

Among CMPA cases, 20% were diagnosed clinically, while 70% of them diagnosed by mixed methods (Figure 5).

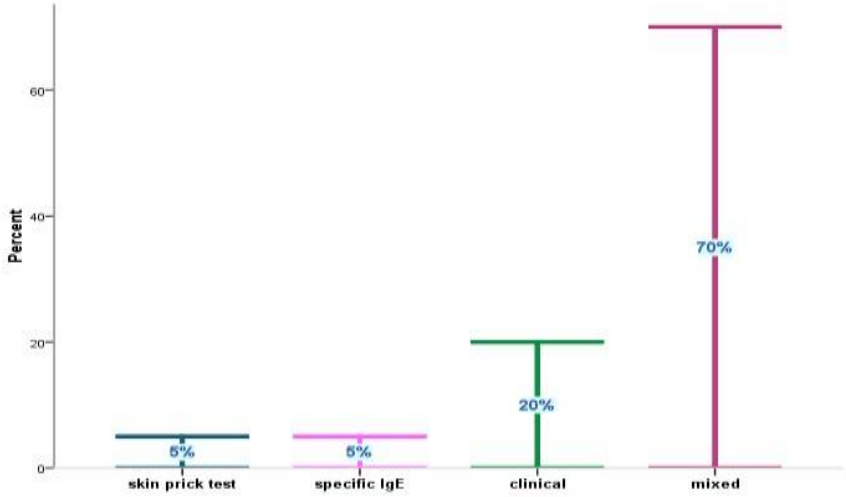

Figure 5. Diagnostic methods

CMPA was exacerbated asthma in 5% of the cases, while 25% of asthmatic patients were improved (Figure 6).

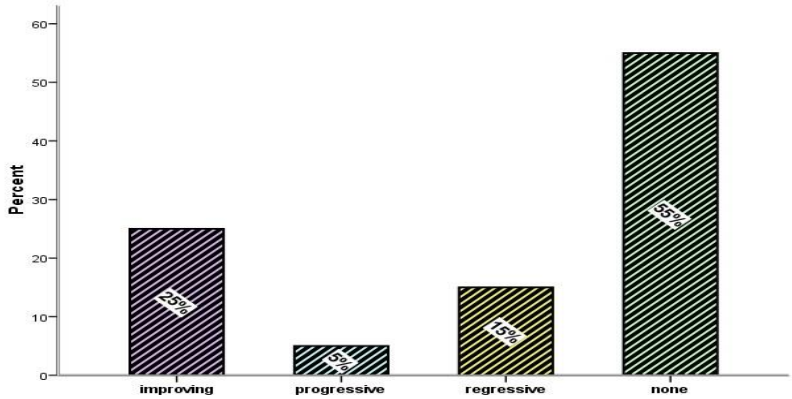

Figure 6. Impact of CMPA on asthma control

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The correlation between age groups and asthma control were shown in Table 4. The P value of 0.132 suggests that there is no statistically significant correlation between asthma control and the age of CMPA patients in this study. However, the data still provide valuable insights into the relationship between asthma and CMPA, particularly in pediatric populations.

Table 4. Correlation between asthma control and CMPA patient's age

Asthma course	CMPA patient's age		P value
	< 5years	5-10 years	
Improving	5	0	0.132
Progressive	1	0	
Regressive	1	2	
No effect	9	2	

Discussion

This study carried out on 200 asthmatic children, who attended their follow up in asthma clinic at Tripoli children hospital, over a period between December 2021 and December 2022. All studied subjects were Libyan with mean of age was 6.6 ± 3.8.

In our study the prevalence of cow milk protein allergy in asthmatic Libyan children was 10 %, which similar to previous study done in India by Cherian et al [8]. While its lower than that reported in Italy by Calamelli et al (28%) [18].

In this study, the mean age for cow milk protein allergy patients was 2.7± 2.6years, meanwhile in Egyptian study by Enany et al. the mean age was 8.0 ± 1.9 [36]. Concerning sex, there was male predominance (80%), Similarly, other study found male predominance (59.7%) [19]. Female predominance was found in Italian study by Mehaudy et al., that included children diagnosed with cow milk protein allergy only [39]. Family history of asthma and CMPA in the current study was (40%,10%, respectively), on contrary to other study that reported higher results (70.1%, 59.7%, respectively) [19].

Regarding disease impact, our results revealed that cow milk protein allergy was exacerbated asthma in 5% of the cases. Other study in United States by Simpson et al., found that cow milk protein allergy was associated with increased hospitalization and steroid use in asthmatic patients [20].

Regarding the correlation between asthma control and CMPA patient's age, the majority of younger children (n=9) fell into the "no effect" category, indicating that their asthma control was not significantly influenced by their CMPA status. This could suggest that asthma in this age group is driven more by other factors, such as viral infections or environmental triggers, rather than CMPA [21]. A smaller proportion of younger children (n=5) showed "improving" asthma control, which may reflect the natural course of asthma in early childhood, where symptoms often fluctuate and may improve over time. Only one child in this age group had "progressive" asthma, and one had "regressive" asthma, highlighting the variability in asthma outcomes among younger CMPA patients [22].

In the older age group, no children showed "improving" or "progressive" asthma control. This could indicate that asthma in older children with CMPA is more stable or less likely to improve compared to younger children. Two children in this age group had "regressive" asthma, suggesting that their asthma symptoms worsened over time. This may reflect the persistence or progression of allergic inflammation in older children with CMPA. Similar to the younger age group, two children in the 5–10 years category had "no effect" on asthma control, reinforcing the idea that CMPA may not always play a significant role in asthma outcomes.

The P value of 0.132 indicates that the observed differences in asthma control between the two age groups are not statistically significant. This could be due to the small sample size, which limits the power of the study to detect meaningful differences. Alternatively, the lack of significance may suggest that age is not a major determinant of asthma control in CMPA patients, and other factors, such as the severity of CMPA, coexisting allergies, or environmental exposures, may play a more critical role [23].

The data in the current study suggest that age may not be a strong predictor of asthma control in children with CMPA. However, the trends observed in table 4—such as the higher proportion of younger children with "improving" asthma and the absence of "improving" asthma in older children—warrant further investigation. Larger studies with more participants are needed to confirm whether age-related differences exist and to explore potential underlying mechanisms [24]. The findings highlight the importance of longitudinal studies to track asthma control over time in children with CMPA. Such studies could provide insights into how asthma outcomes evolve with age and whether early dietary interventions for CMPA can influence long-term asthma control.

Limitations of the Study

The small number of participants in each age group limits the generalizability of the findings and reduces the statistical power to detect significant differences. The absence of a control group (e.g., children without

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CMPA) makes it difficult to determine whether the observed asthma outcomes are specific to CMPA or reflect broader trends in pediatric asthma. Moreover, the study does not account for other variables that may influence asthma control, such as the severity of CMPA, adherence to treatment, or environmental exposures.

Conclusion

To conclude, we find presumed food allergy to be relatively common in children with asthma. Results also showed significant association between cow milk protein allergy and younger age group. Cow milk protein allergy was exacerbated asthma symptoms in 5% of asthmatic children. A better understanding of the epidemiology will guide pediatrician and health education programs to increase awareness, knowledge and perception of food allergies, also treatment and prevention of growth restriction.

Conflict of interest. Nil

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المستخلص

تشكل حساسية الطعام والربو المتزامنين عبئًا كبيرًا على الأطفال، وقد زادت حالات الإصابة بكليهما بشكل كبير على مدى العقدين الماضيين. تعد حساسية بروتين حليب البقر أكثر أنواع الحساسية شيوعًا لدى الأطفال مع انتشار يتراوح بين 1.8٪ و 7.5٪ خلال السنة الأولى من العمر. قد يُعزى التباين بين الدراسات إلى الأساليب المختلفة المستخدمة للتشخيص، أو الأعمار المختلفة للسكان الذين تمت دراستهم أو إلى العوامل الجغرافية. الغرض من هذه الدراسة هو تحديد انتشار وتأثير حساسية بروتين حليب البقر السريري لدى الأطفال الليبيين المصابين بالربو. كانت هذه دراسة مقطعية أجريت بين ديسمبر 2021 وديسمبر 2022 في مستشفى طرابلس للأطفال. شملت الدراسة 200 طفل مصاب بالربو يرتادون عيادة الربو للأطفال بانتظام. تم استخدام استبيان مفصل، وتم تحليل البيانات باستخدام برنامج SPSS وتقديمها كإحصائيات وصفية. من بين 200 طفل مصاب بالربو، كان 10٪ منهم مصابين بحساسية بروتين حليب البقر، وكان متوسط أعمارهم 2.7 ± 2.6 سنة، وكان حوالي 80٪ من الحالات أقل من 5 سنوات .(P < 0.05) وعلاوة على ذلك، أظهرت نتائجنا وجود ارتباط كبير بين التاريخ العائلي للحساسية وحساسية بروتين حليب البقر .(P < 0.05) تأثر حوالي 45٪ من حالات الربو بحساسية بروتين حليب البقر، وكان 5٪ منهم لديهم مسار تقدمي. يجب أن تهدف الدراسات المستقبلية إلى تضمين عينات أكبر من حالات حساسية بروتين حليب البقر، مما يسمح بقوة إحصائية كافية للكشف عن علم الأوبئة لهذه الحساسية.

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