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this study. Schwartz et.al. study<sup>(24)</sup> revealed that increase in odds of asthma for 2 SD increase in skin fold, RO= 1.6 increased prevalence of asthma in obesity.

Hala (2018) found that consanguineous marriage was significantly associated with DLD and this wasn't in agreement with results of the current study.<sup>(25)</sup>

Socioeconomic level was insignificantly associated with DLD in the present study. This finding was concomitant with other studies,<sup>(26)</sup> but other studies reported significant association.<sup>(27)</sup> This discrepancy could be due to the different place, socio- demographic characteristics of participants or different scale of classification.

Family history of DLD was highly significant in this study, as the same finding was recorded by many studies.<sup>(26)</sup> This finding may be due to genetic factors or family members exposed to the same environmental influences or to a combination of both.

Pregnancy is a critical period of human development.<sup>(28)</sup> Based on this, there were prenatal exposures that modify the risk of developing childhood wheezing illnesses, such as asthma, as this could lead to primary prevention interventions.<sup>(29)</sup> This study showed that the perinatal period is significant, the same was recorded by Silva et.al. (2013), who stated that the delay in physiological and neurobiological maturation is accompanied by a delay in language development.<sup>(30)</sup> On the other hand, Mondal et.al. (2016) recorded an insignificant association of preterm delivery and DLD.<sup>(26)</sup> Shanthini (2013) found that the neonates who were exposed to asphyxia neonatorum are more vulnerable to DLD due to injury or malfunctioning of the brain.<sup>(31)</sup>

Bronchial asthma is one of the most ordinary chronic chest troubles in children and can affect children's cognition, and psychosocial behavior.<sup>(6)</sup> This explains why developmental history delayed due to cognitive affection. Language development is an indicator of a child's overall development and cognitive ability. Identification of children at risk for developmental delay or related problems may lead to intervention services and family assistance at a young age when chances for improvement are best.<sup>(35)</sup>

Thirty percent of children with persistent asthma who take inhaled corticosteroids (ICS) as a controller medication, to decrease airway inflammation, have one or more episodes of asthma exacerbation requiring oral corticosteroid treatment in a year.<sup>(36)</sup> Although there was not non significance result of use corticosteroids in asthmatic children in both groups, The benefit of prednisolone for language scores was more evident in participants who were younger than five years.<sup>(37)</sup>

#### **Conclusions:**

To conclude, children with bronchial asthma are very vulnerable to develop delayed language. There are many factors influencing DLD in asthmatics as the severity of bronchial asthma, educational grade, positive prenatal/ postnatal history, difficult toilet training, ability to imitate and using gestures have a significant statistic difference between groups, and family history delayed language development, and family history of

asthma. So, the asthmatic children (2- 5) years are at high risk of DLD.

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

There were some limitations to this study. The cross- sectional design prevents any conclusions from being made on causality or direction of association. Finally, we were unable to determine whether treatments of asthma, or sleep disturbance could affect manifestation of DLD or vice versa.

#### **Recommendation:**

Further study including control group are needed to better understand the strength of association and possible causative factors of elevated association of childhood asthma with delayed language development.

#### **Conflict Of Interest**

There is no conflict of interest.

#### **Acknowledgement:**

I would also like to express my hearty appreciation and thankfulness to all my colleagues for their support and cooperation. I wish to express my deep thanks and gratitude to my supervisors (The co- authors) for their constructive criticism, scientific instructions, and discussion throughout this work. Finally, I owe a special dept of gratitude to my patients and their families for their help, and positive participation in our study.

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Table (4) Comparison between both groups according to pre- natal, post- natal, medical, and family history

Item		Asthmatic Children		P- Value
		Negative DLD(n= 300)	Positive DLD(N= 66)	
		N(%)	N(%)	
Prenatal/Postnatal History	Negative	270(90%)	53(80.3%)	0.027(S)
	Positive	30(10%)	13(19.7%)	
History of chronic illness or major surgeries	Negative	278(92.7%)	61(92.4%)	0.946(N. S)
	Positive	22(7.3%)	5(7.6%)	
Family History Of Asthma	Negative	238(79.3%)	38(57.6%)	<0.001(HS)
	Positive	62(20.6%)	28(42.4%)	
Family History Of Delayed Language	Negative	284(94.7%)	40(60.6%)	<0.001(HS)
	Positive	16(5.3%)	26(39.4%)	

Chi Square

This table shows a significant difference between children with delayed language development and children without delayed language development regarding eventful positive pre- natal and post- natal history, with a P- value of 0.027.

Table (5) Comparison between both groups according to developmental History

Item		Asthmatic Children		P- Value
		Negative DLD (n= 300)	Positive DLD (n= 66)	
		N(%)	N(%)	
Toilet Training	Difficult	46(15.3%)	17(25.8%)	0.004(S)
	Normal	197(65.7%)	29(43.9%)	
	Not Yet	57(19%)	20(30.3%)	
Ability To Imitate	Negative	42(14%)	18(27.3%)	0.008(S)
	Positive	258(86%)	48(72.7%)	
Obey Simple Orders	Negative	55(18.3)	11(16.7%)	0.750(NS)
	Positive	245(81.7%)	55(83.3%)	
Using Gestures	Negative	27(9%)	14(21.2%)	0.004(S)
	Positive	273(91%)	52(78.8%)	

Chi Square

This table shows a significant difference between children with delayed language development and children without delayed language development regarding educational grade, toilet training, ability to imitate, and using gestures. Difficult toilet training occurred in 25.8% of children with delayed language development in comparison to 15.3% of the other group with p- value 0.004 (p <0.05). Difficult toilet training, development of the ability to imitate and using gestures are significantly related to the occurrence of delayed language development.

Table (6) Comparison between both groups according to different pharmacological treatment of asthma

Item		Asthmatic Children		P- Value
		Negative DLD (n= 300)	Positive DLD (n= 66)	
		N (%)	N (%)	
(Long term controller) Inhaled corticosteroids	Negative	258(86%)	52(78.8%)	0.141(NS)
	Positive	42(14%)	14(21.2%)	
(Long term controller) Leukotriene modifiers	Negative	245(81.7%)	55(83.3%)	0.750(NS)
	Positive	55(18.3%)	11(16.7%)	
(Long term controller) Combination inhalers	Negative	261(87%)	58(87.9%)	0.847(NS)
	Positive	39(13%)	8(12.1%)	
(Quick relief medications) Oral and parenteral corticosteroids	Negative	163(54.3%)	33(50%)	0.523(NS)
	Positive	137(45.7%)	33(50%)	

Chi Square

This table shows that there is no significant difference between asthmatic children in both groups as regard asthma treatment options.

**Discussion:**

The current work was conducted on 366 asthmatic children diagnosed by clinical examination, lab investigations, x- ray findings, and receiving medical treatment for at least 12 months. Eighteen% of them had DLD, and these came in agreement with the study conducted by McQuiston and Kloczko (2011) who reported that 20% of children have DLD at two years old.<sup>(15)</sup> 50%- 60% of these asthmatic cases who improved at 4 to 5 years had DLD.<sup>(16)</sup> DLD at age of five years extended throughout childhood and into adolescence with language and educational difficulties.<sup>(17)</sup> Parents who were not requesting an evaluation for a child often wait until they are three years old.<sup>(18)</sup>

The asthmatic children with DLD had male: female ratio was 2:1 in group 2. This ratio was concordant to that reported by Pinborough-Zimmerman et.al. (2007), who stated that a male: female ratio was 1.8: 1.<sup>(19)</sup> The age of onset of asthma in asthmatic children with DLD (15ms± 6.4) was non- significant (p value= 0.060) in relation to asthmatic children with non- DLD. The younger the age in months and the age at asthma onset, the more the liability of delayed language development. This association could be explained due to early stressful poor quality of life in children with asthma that affect proper acquisition of normal language development.

There are many ways to categorize childhood asthma clinically. One of these most known classifications that used by Stout et.al.<sup>(13)</sup> This classification depends on days and nights of symptoms per week and per month consecutively. There was a significant difference between children with DLD and children without DLD regarding the severity of bronchial asthma. Most DLD children had mild intermittent asthma (57.6%), mild persistent (16.7%), moderate persistent (21.2%), severe persistent (4.5%).

Symptoms of asthma mainly occur at night. Asthmatic children have sleep disturbance.<sup>(20)</sup> Sleep disruptions interfere with daily activities and may disrupt family life.<sup>(21)</sup> Childhood asthma is accompanied by sleep disturbance, affecting neurocircuitry involved in language disorders.<sup>(22)</sup> Also, Strom and Silverberg<sup>(23)</sup> found that a history of asthma is increased the risk of language disorder. Strom and Silverberg<sup>(23)</sup> found that language disorder has the highest risk of occurrence in asthmatic children either with/without sleep disturbance.

The BMI showed non- significant difference between both groups in

disabilities in children and to establish whether or not remediation and language therapy is needed.

**Statistical Analysis:**

Collected data will be entered and analyzed on PC computer and presented using appropriate statistical tests by SPSS version 24 statistical data program. Numerical data were summarized using means and standard deviations or medians and ranges. Data were explored for normality using Kolmogrov- Smirnov test and Shapiro- Wilk test. Chi-square tests was used to examine the relation between qualitative variables. P- values  $\leq 0.05$  were considered significant.

**Results:**

Three hundred sixty- six children were enrolled in this study after fulfilling the criteria mentioned above. Their age ranged between 2- 5 years ( $2.4y \pm 11.3$ ). This study included 219 boys (59.8%), g 147 (40.2%)& positive parent consanguinity presented in 47 (12.8%).

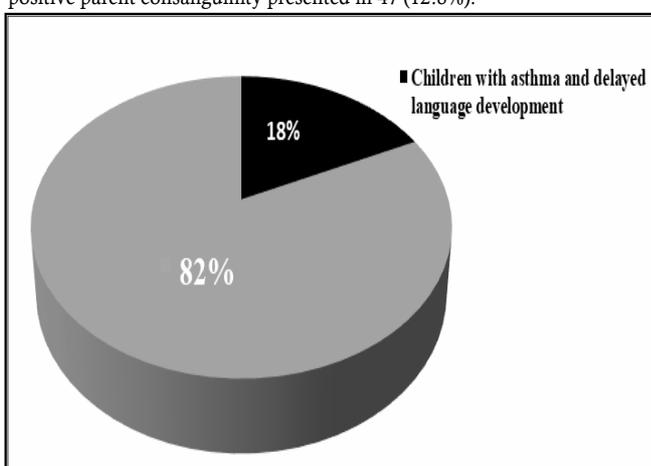


Figure (1): Distribution of 366 children according to Modified preschool language scale- four (Arabic edition).<sup>(14)</sup>

After applying the Modified preschool language scale- four (Arabic edition), we classified 366 children with bronchial asthma into two groups:

- ⊠ Group (1): 300 cases of bronchial asthma with typical language development (82%).
- ⊠ Group (2): 66 cases of bronchial asthma with delayed language

Table (3) Comparison between two groups according to child personal data

Item		Patients With Delayed Language		P- Value
		Negative (N= 300)	Positive (N= 66)	
		N(%)	N(%)	
Educational Grade	Household Education	59(19.7%)	22(33.3%)	0.048(S)
	KG1	75(25%)	12(18.2%)	
	Play School	166(55.3%)	32(48.5%)	
Caregiver	Two Parents	267(89%)	53(80.3%)	0.132(NS)
	One Parent	23(7.7%)	10(15.2%)	
	Other Extended Family Members	10(3.3%)	3(4.5%)	
Consanguinity	Negative	265(88.3%)	54(81.8%)	0.152(N.S)
	Positive	35(11.7%)	12(18.2%)	
Socioeconomic Status	High	23(7.7%)	2(3%)	0.125(NS)
	Low	36(12%)	13(19.7%)	
	Middle	241(80.3%)	51(77.2%)	

Chi Square

The table shows a significant difference between children with delayed language development and children without delayed language development regarding educational grade with a P- value of 0.048.

development (DLD) (18%).

Table (1) Socio- demographic data according to Modified preschool language scale- four (Arabic edition).

Item		Asthmatic Children		P- Value
		Negative DLD (n= 300)	Positive DLD (n= 66)	
		Mean± SD	Mean± SD	
Sex	Female	125(41.7%)	22(33.3%)	0.211(NS)
	Male	175(58.3%)	44(66.7%)	
Age (Months)		40.7±11.2	36.6±11.5	0.007(S)
Age at asthma onset (M)		17.1±8.7	15±6.4	0.060(NS)
Body Mass Index		16.4±1.6	16.7±1.7	0.158(NS)

The table shows a significant difference between children with delayed language development and children without delayed language development regarding age (in months), age (in months) at asthma onset with a P- value of 0.007, 0.060 respectively.

Table (2) Comparison between two groups according to different categories of bronchial asthma

Item		Asthmatic Children		P- Value
		Negative DLD (n= 300)	Positive DLD (n= 66)	
		N (%)	N (%)	
Asthma Category	Mild Intermittent	216(72%)	38(57.6%)	0.018(S)
	Mild Persistent	18(6%)	11(16.7%)	
	Moderate Persistent	58(19.3%)	14(21.2%)	
	Severe Persistent	8(2.7%)	3(4.5%)	
Total		300(100%)	66(100%)	

Chi- Square

The table shows that there is a significant difference between children with DLD and children without DLD as regard asthma category. The highest percentage of children with delayed language development was categorized as having intermittent mild asthma. This may be explained by the greater percentage of children with mild intermittent asthma (69.4%) among all patients. It is noticed also that children with moderate persistent asthma and mild persistent asthma represents (21.2%) and (16.7%) consecutively from total number of group 2 in comparison to (19.3%) and (6%) consecutively in the same asthma categories in group 1 with a P- value of 0.018.

Household Education is noticed in (33.3%) of children with delayed language development in comparison to (18.2%) and (48.5%) in KG1 grade and Play school (nursery) respectively.

**Introduction:**

Bronchial asthma is a heterogeneous disease, usually defined as a chronic inflammatory disorder of the airways accompanied with reversible airway obstruction caused by airway hyperresponsiveness leading to respiratory symptoms such as shortness of breath, cough, chest tightness, and wheeze that vary over time and in intensity, together with variable expiratory airflow limitation.<sup>(1)</sup>

Delayed language development is the most common disability of children. The negative impacts of delayed speech development were limited by early detection of language impairment,<sup>(2)</sup> by the age of 24- 30 months.<sup>(3)</sup> Ghariba et.al. (2017) stated that the prevalence of delayed language development was 6.4% in a study in the Alexandria governorate.<sup>(4)</sup> Gad Allah (2012) reported that 19.7% of their studied children with age ranged (3- 6) years, had delayed language development.<sup>(5)</sup> A study conducted in Assiut University 5% to 12% (median, 6%) of children aged (2- 5) years had delayed language development.<sup>(3)</sup> Also, attention and concentration for children with asthma get a lower correlation.<sup>(6)</sup> Wheezing and childhood asthma are not synonymous but comprise a heterogeneous group of conditions that have different outcomes throughout childhood. Most infants who wheeze have a transient condition associated with diminished airway function at birth and have no increased risk of asthma later in life. However, children with persistent wheezing throughout childhood and frequent exacerbations represent the main challenge today. Studying the natural history of asthma is essential for the understanding and accurate prediction of the clinical course of different phenotypes. To date, a significant improvement has been achieved in reducing the frequency of asthma symptoms. However, neither decreased environmental exposure nor controller treatment, as recommended by the recent national asthma education and prevention program, can halt the progression of asthma in childhood or the development of persistent wheezing phenotype. This review focuses on the recent studies that led to the current understanding of asthma phenotypes in childhood and the recommended treatments.

Al- Qerem et.al. (2016) stated that the overall prevalence rate of asthma in both urban and rural areas in Egypt ranged between 6.8 and 7.5%.<sup>(7)</sup> These findings are similar in different cities and villages in Egypt, reporting an overall prevalence rate for asthma of 7.7%.<sup>(8)</sup>

The Cognition plays an essential role in an individual's language skills. Cognitive abilities correlate the language abilities.<sup>(9)</sup> This is concordant with the study results of Guo et.al. (2013) who reported that regular asthmatic hypoxia impaired learning and memory ability, they revealed the Impact of chronic asthma- induced hypoxia on cognitive function in children.<sup>(10)</sup>

The Japanese Pediatric Guideline issued a simplified classification that depends on symptoms and effect on daily life activities:<sup>(11)</sup> Intermittent asthma is seasonal cough/wheeze& dyspnea but released with SABA. Mild persistent is cough/ mild wheezing > 1 month for <1 week& dyspnea for a short time does not affect the quality of life. Moderate

persistent is cough/ mild wheezing for > 1 month for > 1 week& dyspnea affects life quality. Severe persistent is Cough/wheezing occurs every day, disturbing daily life and sleep. Uncontrolled asthma is associated with impaired QoL and impaired performance in physical exercise.<sup>(12)</sup>

Our study aimed to determine the percentage of delayed language development among asthmatic Egyptian children aged 2- 5 years old.

**Material and Methods**

**Subjects:**

The cross- sectional study was done between February 2018 and January 2020 at Al- Tahrir public hospital, Giza governorate. Three hundred sixty- six asthmatic children were enrolled in this study, their ages ranged from 2- 5 years. All parents agreed to undergo the assessment and had informal consent. The study was approved by ethical committee of faculty of postgraduate childhood studies (FPGCS), Ain Shams University, and protocol no. RHDIRB2020110401.

1. Inclusion criteria:

- a. All children with asthma aged (2- 5) years old are either controlled or uncontrolled.
- b. The children who enrolled in the study came to receive asthma treatment and follow- up services for 12 months.
- c. Children were received adequate environmental stimulation.
- d. The Arabic language was the mother tongue language and the only used language in the child's environment.

2. Exclusion criteria:

- a. The presence of any medical, psychological illness, or sensory impairment.
- b. No genetic or structural abnormalities.

**Methods:**

The children who were fulfilling the criteria mentioned above will be subjected to: Formal history taking and pediatric examination were done, including general and local chest examination to diagnose bronchial asthma and exclude any other diseases. Diagnosis of bronchial asthma was confirmed clinically and by the laboratory (mild elevation of eosinophils in CBC and mild reduction of oxygen saturation by pulse oximeter) and radiological findings (pulmonary hyperinflation and bronchial wall thickening in chest X- ray).

Table (1) Asthma Severity Classifications

Asthma Classification	Days With Symptoms	Nights With Symptoms
Severe Persistent	Continual	Frequent
Moderate Persistent	Daily	>5/Mo.
Mild Persistent	>2/Wk.	3- 4/mo.
Mild Intermittent	<2/Wk.	<2/Mo.

Derived from the Expert Panel Report 2 National Asthma Guidelines in children less than five years old (could not use Spirometer).<sup>(13)</sup>

Complete phoniatric evaluation to children with asthma, done by a phoniatiation, and assessing language abilities detect children with delayed language development by Modified preschool language scale- four (Arabic edition),<sup>(14)</sup> it has two standardized subscales and two supplemental measures. It is used to identify language abilities and

## Delayed Language Development in Children with Bronchial Asthma Aged 2- 5 Years Old

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## Summary

**Background:** Bronchial asthma is one of the most ordinary chronic chest troubles that are the most common cause of chronic illness in children and impaired cognition, language disorders, sleep disturbances, behavior, and learning of children.

**Aims:** The current study aimed to determine the percentage of delayed language development among asthmatic Egyptian children aged (2- 5) years old.

**Materials& Methods:** This study was done between February 2018 and January 2020 at Al- Tahrir public hospital, Giza governorate. Three hundred and sixty six asthmatic children were conducted in this cross- sectional study; their ages ranged from (2- 5) years. Modified preschool language scale- four (Arabic edition) was applied to diagnose delayed language development (DLD). After that, the studied group was classified into group1: Three hundred asthmatic children with typical language acquisition, group2: 66 asthmatic children with abnormal language acquisition DLD.

**Results:** Eighteen percent of the studied group (66 children) had DLD. Sex, Body Mass Index (BMI), consanguinity, and different medical treatments showed non- significant correlations between both groups. Children with moderate persistent asthma and mild persistent asthma represents (21.2%) and (16.7%) consecutively from total number of group 2 in comparison to (19.3%) and (6%) consecutively in the same asthma categories in group 1 with a P- value of 0.018. Household Education is noticed in (33.3%) of group 2 in comparison to (19.7%) in group1 with a P- value of 0.048. Positive prenatal/ postnatal history was positive in (19.7%) of children with DLD in comparison to (10%) in the other group with a P- value= 0.027. Difficult toilet training detected in (25.8%) of group 2 in comparison to (15.3%) of group 1 with a P- value of 0.004. Family history of asthma was found to be more prevalent in group 2 (42.4%) in comparison to (20.6%) in group 1 with a P- value of (P< 0.001).

**Conclusion:** Asthmatic children (2- 5) years having a high risk for delayed language development.

**Keywords:** Delayed Language Development- Bronchial asthma- Modified preschool language scale.

## التأخر اللغوي في الأطفال المصابين بالربو الشعبي من سن سنتين الى خمس سنوات

**المقدمة:** يعتبر الربو الشعبي واحد من أكثر الأمراض المزمنة شيوعاً في الأطفال وإيضاً من أكثر الأسباب شيوعاً لتأخر الإدراك والمشاكل اللغوية واضطرابات النوم والسلوك والتعلم في الأطفال.

**الهدف:** تهدف الدراسة الى تحديد نسبة الأطفال المصابين بالتأخر اللغوي من بين الأطفال المصريين في المرحلة العمرية من سنتين الى خمس سنوات.

**طريقة الدراسة:** هي دراسة مقطوع عرضي يشمل ٣٦٦ طفل مصاب بالربو الشعبي في المرحلة العمرية من سنتين الى خمس سنوات تم تنفيذها في الفترة بين فبراير ٢٠١٨ ويناير ٢٠٢٠ في مستشفى التحرير العام بالجيزة. وقد استخدم المقياس اللغوي المعدل لما قبل مرحلة المدرسة (النسخة العربية- المراجعة الرابعة) لتشخيص التأخر اللغوي. وبعد ذلك تم تقسيم مجموعة الدراسة الى مجموعتين. المجموعة الأولى تحتوي على ثلاثمائة طفل مصاب بالربو الشعبي، ولكن مع تطور لغوي طبيعي. والمجموعة الثانية تشمل ستة وستون طفل مصاب بالربو الشعبي مع تأخر في التطور اللغوي.

**النتائج:** جاءت النتائج لتدل على ان حوالي ١٨% من مجموعة الدراسة (٦٦ طفل) لديهم تأخر لغوي. وبالنظر الى النوع ومؤشر كتلة الجسم والقرابة بين الأبوين والعلاجات التي تم تلقيها وجد انها ليست ذات علاقة بدلالة إحصائية مع التأخر اللغوي. وتلاحظ ان نسبة الأطفال ذوى الربو الشعبي من النوع البسيط المستمر والمتوسط المستمر نسبتهم ٢١,٢% و ١٦,٧% على التوالي من إجمالي عدد المجموعة الثانية بالمقارنة بنسبة ١٩,٣% و ٦% على التوالي من المجموعة الأولى وذلك بدلالة إحصائية ٠,٠١٨. وتلاحظ أيضاً ان التعليم المنزلي كان مرتبطاً بنسبة ٣٣,٣% من المجموعة الثانية بالمقارنة بـ ١٩,٧% في المجموعة الأولى بدلالة إحصائية ٠,٠٤٨. التاريخ الإيجابي لأي مضاعفات للحمل قبل او بعد الولادة وجد في ١٩,٧% من المجموعة الثانية بالمقارنة بـ ١٠% من المجموعة الأولى بدلالة إحصائية ٠,٠٢٧. صعوبة التدريب على استخدام الحمام وجد بنسبة ٢٥,٨% من المجموعة الثانية بالمقارنة بـ ١٥,٣% من المجموعة الأولى بدلالة إحصائية ٠,٠٠٤. التاريخ العائلي للربو الشعبي وجد شائعاً في المجموعة الثانية بنسبة ٤٢,٤% مقارنة بـ ٢٠,٦% من المجموعة الأولى بدلالة إحصائية اقل من ٠,٠٠١.

**الاستنتاج:** الأطفال المصابين بالربو الشعبي في المرحلة العمرية من سنتين الى خمس سنوات لديهم معدل خطورة عالي للإصابة بالتأخر اللغوي.

**الكلمات الدالة:** التأخر اللغوي، الربو الشعبي، المقياس اللغوي المعدل لما قبل مرحلة المدرسة.