ESTIMATION OF VITAMIN C STATUS IN CHILDREN AND ADOLESCENTS WITH BRONCHIAL ASTHMA

By

Ahmed Mahmoud Salah El-Din*, Hussein Mohammed Ibrahim El-Assal*, Amr Hemeda Mostafa*, Ahmed Abd-Allah Mohammed*, Nagah Mohamed Abo Mohamed**

Pediatrics* and Clinical Pathology** departments, Al-Azhar Faculty of Medicine

ABSTRACT

Background: *Bronchial asthma is a chronic inflammatory disorder of the airways represented by recurrent episodes of wheezing, breathlessness, chest tightness, and coughing together with variable expiratory airflow obstruction. Many recent reports have supported the critical role of oxidative stress in the development and pathogenesis of asthma. Oxidative stress also aggravates airway inflammation by increasing pro-inflammatory mediators. Vitamin C (ascorbic acid) is an important component of overall antioxidant mechanism found in cells and tissues. It acts as a potent free radical scavenger and protects against lipid peroxidation of both cellular and intracellular membranes.*

Objectives: *The aim of the study is to estimate the level of vitamin C among children and adolescents attending the pediatric asthma clinic at Al Hussien University Hospital and detect the relation between vitamin C blood level and both asthma symptoms and Spirometric measurements.*

Subjects and Methods: *A pilot cross sectional analytic study conducted in the Pediatric Asthma Clinic at Al Hussien University Hospital during the period from October 2018 to June 2019. 80 children and adolescents aged 5 – 18 years old were included in our study. The collected data were coded and analyzed using SPSS (Statistical Package of Social Sciences) version 20.*

Results: *All studied cases had normal levels of vitamin C with no signs of deficiency. There were statistically significant correlations between blood level of vitamin C in the studied cases and both frequency of asthmatic attacks and pulmonary index. Also, vitamin C reduces the severity of attacks in the study. In contrast, there was insignificant correlation between blood level of vitamin C in the studied cases and all pulmonary function tests' values. Significant inverse relation between levels of asthma control and blood level of vitamin C was observed revealing that the higher vitamin C level in blood the better level of asthma control we had. Significant inverse relations between both wheezes and work of accessory muscles with blood level of vitamin C*

were observed revealing the protective effect of vitamin C against acute asthmatic attacks. Regarding the gender of our subject 62.8% of cases were males while 37.2% were females indicating statically significant relation between male gender and bronchial asthma. More than half of the cases were of slum origin (51.2%) and significant relation between residences and both pulmonary index and pulmonary function tests' values were observed revealing a strong relation between asthma prevalence and severity and residential distribution in slum areas more than urban and rural ones. These results attributed to low socioeconomic and environmental status in slum areas. Also, there was significant relation between residence and blood level of vitamin C indicating that slum areas showed the lowest levels of vitamin C. There were significant correlations between BMI percentiles and both pulmonary index and levels of asthma control of the studied cases indicating a positive association between obesity and childhood asthma.

Conclusion: *Vitamin C could improve some bronchial asthma findings (e.g. frequency of attacks and pulmonary index), provide better asthma control and reduce the possibility and frequency of exacerbations but has no effect on spirometric measures.*

Keywords: *Bronchial Asthma, Spirometry, Vitamin C, Adolescents, Children.*

INTRODUCTION

Bronchial asthma is a significant public health problem and one of the most widespread diseases in the world affecting about 300 million patients **(Gallucci et al., 2019)**. The prevalence of asthma has increased dramatically in many countries over recent decades, demonstrating that environmental exposures play a dominant role in the etiology of this disease **(Mishra, 2017)**. Despite the high prevalence of asthma in industrialized countries, overall asthma control is still not completely satisfactory **(Gallucci et al., 2019)**.

Bronchial asthma is a heterogeneous disease usually characterized by chronic inflammation of the airways represented by recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. These episodes are usually associated with widespread but variable airflow obstruction **(Gold and Wright, 2005)** and **(Kleniewska and Pawliczak, 2017)**.

Symptoms and exacerbations are frequently caused by a wide range of triggers provoking allergic reactions **(Jesenak et al., 2017)**. Asthma is thought to be caused by a combination of genetic and environmental factors. Oxidative stress process is the major theory that has tried to explain the effect of antioxidant factors in asthma. Oxidative stress affects inflammatory status, the level of tissue distraction in the

respiratory and immune systems **(Nadi et al., 2012)**.

Ascorbic acid or vitamin C is an important water-soluble vitamin acting as effective antioxidant **(Akhtar et al., 2016)**. It can act as a hydrogen donor to reverse oxidation and reacts with free radicals and deactivates them before they damage proteins or lipids **(Domej et al., 2006)**.

Humans are unable to synthesize vitamin C endogenously, so it is an essential dietary component through fresh fruits and vegetables, and/or supplementary pills **(Devaki and Raveendran, 2017)**.

Vitamin C is an essential nutrient involved in immune system function **(Carr and Maggini, 2017)**. Enzymatic reactions dependent on vitamin C include the synthesis of norepinephrine, collagen and carnitine, amidation of peptide hormones, tyrosine metabolism and promotion of iron absorption in the small intestine **(Hill et al., 2018)** and it is important for the repair of tissue **(Devaki and Raveendran, 2017)**.

Aims of the Work

The aim of this research is to estimate the level of vitamin C among children and adolescents attending the pediatric asthma clinic at Al Hussien University Hospital and detect the relation between vitamin C blood level and both asthma symptoms and spirometric measurements.

SUBJECTS AND METHODS

Research Design:

A pilot cross sectional analytic study to estimate the level of vitamin C among children and adolescents attending the pediatric asthma clinic and its relation to their symptoms and spirometric measurements.

Research Setting and Target Population:

The target population is children and adolescents aged 5 – 18 years old.

Sample Size:

According to inclusion and exclusion criteria eighty (80) children and adolescents present at the time of the study in the Pediatric Asthma Clinic at Al Hussien University Hospital were included in our study.

Inclusion Criteria:

- Patients who are diagnosed with bronchial asthma and are regularly visiting the Pediatric Asthma Clinic at Al Hussien University Hospital for follow up.
- Age: 5 – 18 years.

- Sex: both male and female will be accepted.

Exclusion Criteria:

- Age less than 5 years or more than 18 years at the time of the study.
- Patients presenting with severe exacerbation requiring O2 therapy or hospitalization.
- Patients with intellectual or physical disability preventing performance of Spirometry.
- Patients with other co-morbid chronic condition without final diagnosis.
- Signs of vitamin c deficiency:
  - Easy bruising.
  - Swollen or bleeding gums.
  - Slow wound healing.
  - Dry and splitting hair.
  - Skin: (Rough, dry, scaly, red spots).
  - Nose bleeds.
  - Swollen, painful joints.

Methodology:

All cases were subjected to the following:

1. Medical History:

a. Personal, demographic, social history.

b. Focused history on symptoms of asthma and level of control (symptom score, medications).

c. Dietetic history, focusing on knowledge and consumption of Vitamin C rich foods.

2. Clinical Examination:

a. Anthropometry and Z scores according to the new WHO-CDC growth charts using WHO anthro Plus (PC application)

b. Vital signs: respiratory rate, heart rate, blood pressure, temperature.

c. Chest examination for signs of bronchial asthma and assessment of the degree of severity if in attack (pulmonary index).

3. Pulmonary function test:

Using "MIR MiniSpir®", Italy, spirometer, and all patients performed full spirometric evaluation including forced vital capacity FVC, maximal voluntary ventilation MVV and vital capacity VC.

4. Estimation of vitamin C level in serum:

Vitamin C level was detected in patients' sera using Human Vitamin C ELISA Kit No. SG-10149, LOT No.

201805 purchased from SinoGeneClon Biotech Co. – China.

5. Ethical considerations:

- Approval of the study from the faculty of medicine, Al-Azhar University ethics committee will be obtained.
- A written informed consent will be taken from the participant's caregivers.

Data Analysis and Management:

The collected data were coded and analyzed using SPSS (Statistical Package of Social Sciences) version 20. Data were expressed as mean ± SD, minimum and maximum of range for quantitative parametric measures in addition to both number and percentage for categorized data. The Student t-test was used for comparison between two independent groups for parametric data, and Analysis of variance (ANOVA) was used for comparison between independent groups for parametric data followed by LSD post hoc test to assess intergroup differences. The Chi‑square test or Fisher's exact test were used to compare categorical variables. Correlations between the parameters were analyzed Pearson correlation analysis. A P-value of 0.05 or less was considered significant, whereas values 0.01 and 0.001 were considered highly significant **(Greenland et al., 2016)**.

RESULTS

The results of the present study are displayed in tables 1-5 and figures 1-2.

Eighty (80) cases involved in the study were within the age of 5-18 years.

Table (1): Socio-demographic data of the study sample (n=78)

	Total (n=78)
Age (5-18 years)	8.2±2.8
	(5.2-17.5)
Gender	
Male	49 (62.8%)
Female	29 (37.2%)
Residence	
Rural	8 (10.3%)
Urban	30 (38.5%)
Slum	40 (51.2%)

According to socio-demographic distribution of the studied cases, the data showed that 62.8 % of cases were males and 37.2% of cases were females and according to the residence 51.2% of cases were of slum origin, 38.5% of cases were of urban origin and 10.3% of cases were of rural origin.

Table (2): Correlation between vitamin C blood level and socio-demographic data

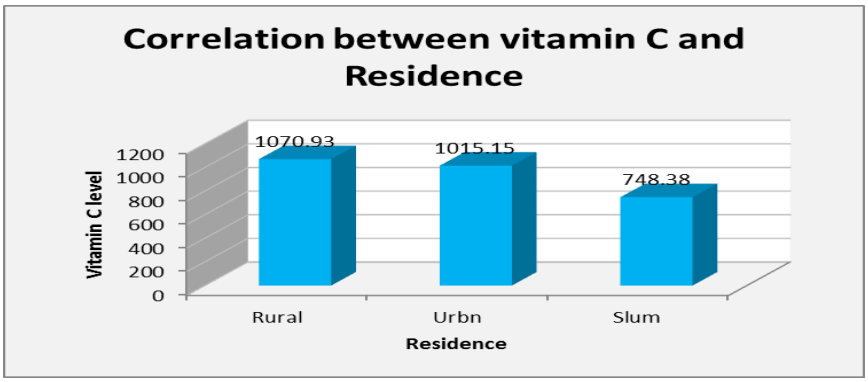
	Blood level of Vit C (150-1800 ng/L)		**p value**		
	Mean±SD	(Range)			
Age					
≤ 10 y	894.6±404.1	(281.5-1652.5)	0.660		
> 10 y	843.3±450.9	(84.9-1474.6)			
Gender					
Male	871.6±415.5	(84.9-1631.2)	0.731		
Female	905.1±411.4	(342.6-1652.5)			
Residence					
Rural (1)	1070.9±346.7	(375.3-1506)	**0.009***		
Urban (2)	1015.2±416.4	(283.3-1652.5)	(1) vs (2)	(1) vs (3)	(2) vs (3)
Slum (3)	748.4±380.5	(84.9-1364.6)	0.722	**0.037***	**0.006***

The data showed significant relation between residence and blood level of vitamin C (p value = 0.009) with significant inverse relation between rural versus slum (p value = 0.037) and urban versus slum distribution (p value = 0.006) as shown in figure 1.

Table (3): Correlation between pulmonary index and socio-demographic data

	Pulmonary index		**p value**		
	Mean± SD	(Range)			
Age					
≤ 10 y	2.3±2.3	(0-7)	0.639		
> 10 y	2.1±1.9	(0-6)			
Gender					
Male	2.2±2.2	(0-7)	0.952		
Female	2.3±2.3	(0-7)			
Residence					
Rural (1)	1.4±1.5	(0-4)	**0.033***		
Urban (2)	1.7±1.9	(0-7)	(1) vs (2)	(1) vs (3)	(2) vs (3)
Slum (3)	2.9±2.3	(0-7)	0.73	0.071	**0.020***

The data showed significant relation between residence and pulmonary index (p value = 0.033) with significant positive relation between slum and urban areas regarding pulmonary index



(p value = 0.020) as shown in figure 2.

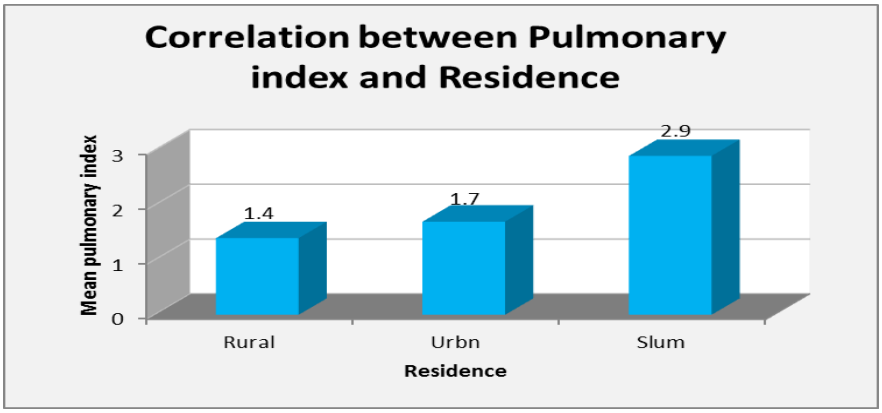


Figure (1): Correlation between vitamin C and residence

Figure (2): correlation between pulmonary index and residence

Table (4): Correlation of vitamin C and pulmonary index with other clinical data

	Vitamin C		Pulmonary index	
	R	**p**	**r**	**P**
Frequency in last year	-0.358	**0.001***	0.508	**<0.001***
Duration of wheezing spells	0.164	0.152	0.255	**0.024***
Hospital admission due to asthma	-0.165	0.150	0.405	**<0.001***
BMI percentile	-0.127	0.267	0.316	**0.005***
R.R	-0.198	0.082	0.577	**<0.001***

The data showed the following:

Significant correlations between blood level of vitamin c in the studied cases and both frequency of asthmatic attacks in last year and pulmonary index (p values were 0.001 and <0.001 respectively).

Significant correlation between pulmonary index of the

studied cases and BMI percentile (p values was 0.005).

Table (5): Correlation of vitamin C and pulmonary index with pulmonary function tests

	Vitamin C		Pulmonary index	
	R	**p**	**r**	**P**
FVC	0.08	0.484	-0.524	**<0.001***
FEV1	0.054	0.638	-0.524	**<0.001***
FEV1/FVC	-0.062	0.590	-0.088	0.442
PEF	-0.133	0.246	-0.11	0.336
IVC	0.078	0.498	-0.213	0.061
FEV1/VC	0.019	0.870	-0.248	**0.028***
IC	0.125	0.277	-0.091	0.428
MVV	-0.005	0.967	-0.072	0.531

The data showed insignificant correlation between blood level of vitamin c in the studied cases and all pulmonary function tests' values.

DISCUSSION

Bronchial asthma is a significant public health problem and a high economic burden disease for which prevention is partly possible **(Ginter, and Simko, 2016)**. It is defined as a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment **(Gold and Wright, 2005)**. The inflammation also causes an associated increase in the existing bronchial hyper-responsiveness to a variety of stimuli **(Brown and Griendling, 2009)**.

Oxidative stress is believed to play an important role in the pathogenesis of bronchial asthma. It's not clear whether the enhanced oxidative stress observed in asthma subjects is caused by inflammation or is a causative factor in the pathogenesis of the disease **(Cho and Moon, 2010)**.

In bronchial asthma, oxidative stress increase pro-inflammatory mediators causing airway inflammation, enhance bronchial hyper-responsiveness causing

bronchospasm and it also increases mucous secretion **(Terada, 2006)**, **(Li and Nel, 2006)**, and **(Brown and Griendling, 2009)**.

Ascorbic acid or vitamin C is an effective antioxidant. It is a potential scavenger of free radicals such as superoxide radical and singlet oxygen. It is also a coenzyme of other free radical scavenging enzymes like superoxide dismutase. This result in protection against lipid peroxidation of both cellular and intracellular membranes, thus making ascorbic acid an important component of overall antioxidant mechanism found in cells and tissues **(Akhtar et al., 2016)**.

In the present study 62.8% of cases were males while 37.2% were females (table 1) and this was in agreement with previous studies where **El-Saify et al., (2005)** reported that asthma occurs more common in boys during childhood with a male-to-female ratio of 2:1 until puberty when the male-to-female ratio becomes 1:1 and symptoms are more likely to decrease in boys by adolescence. Similarly **Ahmed et al., (2016)** and **Meatty et al., (2018)** reported that asthma was more prevalent among males. Male sex is a risk factor for asthma in prepubertal children, whereas female sex is a risk factor for persistence of asthma into adulthood. Girls are less likely to 'grow out' of their asthma **(British Thoracic Society, 2014)**. The exact reason for male predominance is unknown but it may be related to a greater degree of bronchial lia¬bility in males. Airways in boys are also smaller in comparison to their lung sizes when compared to girls **(Tepper et al., 1986)** and **(Abdel-Baseer et al., 2017)**.

Also, it was hypothesized that boys have a more severe airway hyper-responsiveness than girls. Higher exposure of males to outdoor allergens may partially explain this finding as most of them tend to spend most of their time outside home **(Deraz and Rafik, 2004)**.

Our study showed that 51.2% of cases were of slum origin, 38.5% of cases were of urban origin and 10.3% of cases were of rural origin (table 1) and this was in agreement with **Meatty et al., (2018)** who reported that asthma prevalence was higher in slums than rural and urban areas (21.7%, 11.2%, and 13.6%; respectively). This can be explained by the influence of environmental factors, especially air pollutants have been correlated with higher prevalence of asthma in the slum and urban regions. Although air

pollution is undoubtedly related to the worsening of allergic diseases, other factors, such as living conditions, may play an important role in the development of asthma in industrialized regions **(Shamssain and Shamsian, 2001)**. Similarly, **Deng et al., (2015)** stated that the association between environmental pollution and childhood asthma is controversial. Both early-life exposure to ambient air pollution and daily continuous exposures to pollutants were found to be associated with childhood asthma and both the two factors are more prevalent in slum and urban areas more than rural ones.

In our study, although the studied cases had normal levels of vitamin C in blood, there was significant relation between residence and blood level of vitamin C (table 2, figure 1) indicating that slum areas showed the lowest levels of vitamin C compared with urban and rural areas. This was in agreement with **Shohaimi et al., (2004)** who confirmed the association between socioeconomic status and plasma ascorbic acid concentration, and highlights particularly the independent effects of social class and educational status on vitamin C blood level. Poor vitamin C status is associated with low socioeconomic state in developed countries **(Mosdøl et al., 2008)**. Taken together it could be concluded that slum areas revealed the lowest levels of vitamin C compared with urban and rural areas.

There was significant relation between residence and pulmonary index (table 3, figure 2) with significant positive relation between slum and urban areas regarding pulmonary index. This was in accordance with **Linares et al., (2010)** who found an association between gaseous pollutants, such as sulfur dioxide and nitrogen dioxide, which is more prevalent in slum and urban areas more than rural ones, and respiratory symptoms in children with asthma.

Another study revealed that analysis of the International Study for Asthma and Allergy in Childhood phase III database indicated that symptoms of asthma are often more severe in poor nations. The rate of uncontrolled asthma is also higher among underprivileged communities of developed countries. Secondary analysis of data indicate symptoms of asthma are less frequent in middle-income countries and more frequent in the extremes, low income and high income **(Rodriguez et al., 2011)**. Urbanization and exposure to air

pollution also seem to contribute to an increasing prevalence and severity of asthma. Under diagnosis, under treatment, exposure to air pollution and unhygienic living conditions may contribute to a higher frequency and severity of symptoms of asthma among the poor in slum areas **(Cruz et al., 2017)**.

In the present study, data showed significant correlation between pulmonary index of the studied cases and BMI percentile (table 4). This was in agreement with **Nasiri Kalmarzi et al., (2016)** who reported positive association between obesity and childhood asthma. Similarly, the same association was reported in other studies **(Egan et al., 2013)** and **(Granell et al., 2014)**. This can be explained as obesity influences lung physiology with reductions in pulmonary compliance and limitations in airflow, systemic inflammation and dysfunctions of the sympathetic nervous system **(Brashier and Salvi, 2013)**. Other studies found that the diameter and size of the airways may be reduced in the bodies with overweight or obesity by creating inflammation in respiratory or systemic airways and asthma severity risk and physiological deficiencies intensify airway hyper–responsiveness **(Kronander et al., 2004)** and **(Parameswaran et al., 2006)**. In addition, reduction of pulmonary function or change in immunological balance including pre-inflammatory cytokines beside diet, mechanical effects of obesity, atopic effects have been introduced as potential mechanisms through which obesity can lead to asthma **(Shore, 2008)**.

There were significant correlations between blood level of vitamin C in the studied cases and both frequency of asthmatic attacks in the last year and pulmonary index (table 4). This were in agreement with **Cohen et al., (1997)** who stated that vitamin C reduces the number and severity of attacks in patients suffering from asthma and reduces the severity of the bronchial responses to exercise. This was also in the same line with many studies demonstrate that a low dietary intake of vitamin C seems to increase the risk of asthma **(Naidu, 2003)**, **(Shrader, 2004)** and **(Riccioni et al., 2006)**.

The functional hallmark of asthma is a reversible airway obstruction and its detection is often required for the diagnosis of asthma. The severity of obstruction is a known risk factor for exacerbations, therefore

functional monitoring is essential to achieve optimal control. The spirometry is the main test for detecting and measuring airway obstruction in children over 5 years old and adults and it has some precision for predicting future attacks **(Gallucci et al., 2019)**.

There was insignificant correlation between blood level of vitamin C in the studied cases and all pulmonary function tests' values (table 5). This result was in accordance with other study by **Fogarty et al., (2003)** who examined the association between vitamin C supplementation and the improvement of clinical control asthma (FEV1, FVC, peak flow, symptoms score, and bronchodilators use). The results demonstrated that a regular vitamin C dietary supplementation did not add any clinical benefits respect to current standard therapy of asthma in primary care patients evaluated. Similarly, **Nadi et al., (2012)** stated that none of the spirometry parameters changed after one month treatment with vitamin C indicating no effect of vitamin C treatment in the spirometry parameters.

CONCLUSION

Consequently, the previously mentioned data indicate the following:

1. All the studied cases have normal levels of vitamin C in blood.
2. Vitamin C has a strong impact on bronchial asthma symptoms improvement (e.g. frequency of asthmatic attacks and pulmonary index).
3. Vitamin C also affects the control level of asthma through its anti-oxidant and cellular protective activity.
4. Vitamin C significantly reduces exacerbations and their symptoms including wheezes and accessory muscles activity.
5. However there was no relation between vitamin C blood level and spirometric measurements in the studied cases.
6. Finally it could be concluded that vitamin C could improve some bronchial asthma symptoms, provide better asthma control and reduce the possibility and frequency of acute asthmatic attacks with no effect on spirometric values.

RECOMMENDATIONS

From the present study, the following could be recommended:

1. Addition of vitamin C for long term management of bronchial asthma in patients on standard regimens after larger clinical trials.

2. Further studies are required to evaluate the outcome and safety of long term vitamin C supplementation as a part of asthma management.

REFERENCES

1. **Abdel-Baseer, K. A., Hammad, E. E. M., Qubaisy, H., Naser, M. A. A. A., Ahmed, A. A., & Said, A. M. (2017):** Some Epidemiological Aspects of Bronchial Asthma in Children in Qena Governorate, Egypt. Immunome Research, 13(3), 1-5.
2. **Ahmed, E. E. G. E. R., Kamel, A. S., Amin, S. A., & Hashem, A. E. (2016):** Epidemiology of Childhood Asthma in Fayoum City (District) Egypt. UK J Pharm Biosci, 4(4), 67-75.
3. **Akhtar, R., Jain, S., Kumar, A., Bhatia, S., Joshi, J. C., Singh, D., Shamsuzzaman, M., Sharma, M., Pal, G., Vijayan, V.K. & Gaur, S. N. (2016):** Evaluation of therapeutic efficacy of ascorbic acid in patients with bronchial asthma. Journal of Young Pharmacists, 8(3), 214.
4. **Brashier, B., & Salvi, S. (2013):** Obesity and asthma: physiological perspective. Journal of allergy, 2013.
5. **British Thoracic Society Scottish Intercollegiate Guidelines Network. (2014):** British guideline on the management of asthma. Thorax, 69 (Suppl 1), i1-i192.
6. **Brown, D. I., & Griendling, K. K. (2009):** Nox proteins in signal transduction. Free Radical Biology and Medicine, 47(9), 1239-1253.
7. **Carr, A. C., & Maggini, S. (2017):** Vitamin C and immune function. Nutrients, 9(11), 1211.
8. **Cho, Y. S., & Moon, H. B. (2010):** The role of oxidative stress in the pathogenesis of asthma. Allergy, asthma & immunology research, 2(3), 183-187.
9. **Cohen, H. A., Neuman, I., & Nahum, H. (1997):** Blocking effect of vitamin C in exercise-induced asthma. Archives of pediatrics & adolescent medicine, 151(4), 367-370.
10. **Cruz, Á. A., Stelmach, R. & Ponte, E. V. (2017):** Asthma prevalence and severity in low-resource communities. Current opinion in allergy and clinical immunology, 17(3), 188-193.
11. **Deng, Q., Lu, C., Norbäck, D., Bornehag, C. G., Zhang, Y., Liu, W., Yuan, H. & Sundell, J. (2015):** Early life exposure to ambient air pollution and childhood asthma in China. Environmental research, 143, 83-92.
12. **Deraz, T. E. & Rafik, M. (2004):** Assessment of urinary leukotriene E4 and pulmonary function tests before and after leukotriene antagonist modifying agents in asthmatic children. Egypt J Pediatr, 7, 31-54.
13. **Devaki, S. J., & Raveendran, R. L. (2017):** Vitamin C: sources, functions, sensing and

analysis. In Vitamin C. IntechOpen.

14. **Domej, W., Foldes-Papp, Z., Flogel, E., & Haditsch, B. (2006):** Chronic obstructive pulmonary disease and oxidative stress. Current pharmaceutical biotechnology, 7(2), 117-123.
15. **Egan, K. B., Ettinger, A. S., & Bracken, M. B. (2013):** Childhood body mass index and subsequent physician-diagnosed asthma: a systematic review and meta-analysis of prospective cohort studies. BMC pediatrics, 13(1), 121.
16. **El-Saify, M., Malak, A. & Sahar, M.A. (2005):** 10 years retrospective study of pediatric asthma in pediatric chest clinic Ain Shams University. MD thesis, Faculty of Medicine, Ain Shams University, Cairo, Egypt, 2005.
17. **Fogarty, A., Lewis, S. A., Scrivener, S. L., Antoniak, M., Pacey, S., Pringle, M., & Britton, J. (2003): Oral magnesium and vitamin C supplements in asthma: a parallel group randomized placebo-controlled trial. Clinical & Experimental Allergy, 33(10), 1355-1359.**
18. **Gallucci, M., Carbonara, P., Pacilli, A. M. G., di Palmo, E., Ricci, G., & Nava, S. (2019):** Use of Symptoms Scores, Spirometry, and Other Pulmonary Function Testing for Asthma Monitoring. Frontiers in pediatrics, 7.
19. **Ginter, E., & Simko, V. (2016):** Deficiency of vitamin D and vitamin C in the pathogenesis of bronchial asthma. Bratislavske lekarske listy, 117(6), 305-307.
20. **Gold, D. R., & Wright, R. (2005):** Population disparities in asthma. Annu. Rev. Public Health, 26, 89-113.
21. **Granell, R., Henderson, A. J., Evans, D. M., Smith, G. D., Ness, A. R., Lewis, S., Palmer, T.M. & Sterne, J. A. (2014):** Effects of BMI, fat mass, and lean mass on asthma in childhood: a Mendelian randomization study. PLoS medicine, 11(7), e1001669.
22. **Greenland, S., Senn, S. J., Rothman, K. J., Carlin, J. B., Poole, C., Goodman, S. N., & Altman, D. G. (2016):** Statistical tests, P values, confidence intervals, and power: a guide to misinterpretations. European journal of epidemiology, 31(4), 337-350.
23. **Hill, A., Wendt, S., Benstoem, C., Neubauer, C., Meybohm, P., Langlois, P., Adhikari, N.K., Heyland, D.K. & Stoppe, C. (2018):** Vitamin C to improve organ dysfunction in cardiac surgery patients—Review and pragmatic approach. Nutrients, 10(8), 974.
24. **Jesenak, M., Zelieskova, M., & Babusikova, E. (2017):** Oxidative stress and bronchial asthma in children—causes or consequences?. Frontiers in pediatrics, 5, 162.
25. **Kleniewska, P., & Pawliczak, R. (2017):** The participation of oxidative stress in the pathogenesis of bronchial

asthma. Biomedicine & Pharmacotherapy, 94, 100-108.

26. **Kronander, U. N., Falkenberg, M., & Zetterström, O. (2004):** Prevalence and incidence of asthma related to waist circumference and BMI in a Swedish community sample. Respiratory medicine, 98(11), 1108-1116.

27. **Li, N., & Nel, A. E. (2006):** Role of the Nrf2-mediated signaling pathway as a negative regulator of inflammation: implications for the impact of particulate pollutants on asthma. Antioxidants & redox signaling, 8(1-2), 88-98.

28. **Linares, B., Guizar, J. M., Amador, N., Garcia, A., Miranda, V., Perez, J. R., & Chapela, R. (2010):** Impact of air pollution on pulmonary function and respiratory symptoms in children. Longitudinal repeated-measures study. BMC Pulmonary Medicine, 10(1), 62.

29. **Meatty, E. M., El-Desoky, T., El-Domyaty, H., El-Gilany, A., & Nasef, N. (2018):** Prevalence of childhood bronchial asthma and its associated factors: A communitybased study in Egypt. Progress Med Sci, 2(2), 14-20.

30. **Mishra, R. (2017):** Assessment of Nutritional Status of Patients Suffering from Asthma. Journal of Clinical Nutrition, 3(2), 16.

31. **Mosdøl, A., Erens, B., & Brunner, E. J. (2008):** Estimated prevalence and predictors of vitamin C deficiency within UK's low-income population. Journal of public health, 30(4), 456-460.

32. **Nadi, E., Tavakoli, F., Zeraati, F., Goodarzi, M. T., & Hashemi, S. H. (2012):** Effect of vitamin C administration on leukocyte vitamin C level and severity of bronchial asthma. Acta Medica Iranica, 233-238.

33. **Naidu, K. A. (2003):** Vitamin C in human health and disease is still a mystery? An overview. Nutrition journal, 2(1), 7.

34. **Nasiri Kalmarzi, R., Hamedi, R., Nasirian, R., Farsani, M., Kashefi, H., Khalafi, B., & Kooti, W. (2016):** Association of body mass index with asthma severity and pulmonary function among asthmatic children. International Journal of Pediatrics, 4(9), 3551-3559.

35. **Parameswaran, K., Todd, D. C., & Soth, M. (2006):** Altered respiratory physiology in obesity. Canadian respiratory journal, 13(4), 203-210.

36. **Riccioni, G., Mancini, B., Bucciarelli, T., di Ilio, C., & D'Orazio, N. (2006):** Role of anti-oxidants in the treatment of bronchial asthma. Drug Discovery Today: Therapeutic Strategies, 3(3), 293-298.

37. **Rodriguez, A., Vaca, M., Oviedo, G., Erazo, S., Chico, M. E., Teles, C., Barreto, M.L., Rodrigues, L.C. & Cooper, P. J. (2011):** Urbanisation is associated with prevalence of childhood asthma in diverse, small rural communities in

Ecuador. Thorax, 66(12), 1043-1050. Ranu, H., Wilde, M., & Madden, B. (2011). Pulmonary function tests. The Ulster medical journal, 80(2), 84.

38. **Shamssain, M. H., & Shamsian, N. (2001):** Prevalence and severity of asthma, rhinitis, and atopic eczema in 13-to 14-year-old schoolchildren from the northeast of England. Annals of allergy, asthma & immunology, 86(4), 428-432.

39. **Shohaimi, S., Bingham, S., Welch, A., Luben, R., Day, N., Wareham, N., & Khaw, K. T. (2004):** Occupational social class, educational level and area deprivation independently predict plasma ascorbic acid concentration: a cross-sectional population based study in the Norfolk cohort of the European Prospective Investigation into Cancer (EPIC-Norfolk). European journal of clinical nutrition, 58(10), 1432.

40. **Shore, S. A. (2008):** Obesity and asthma: possible mechanisms. Journal of Allergy and Clinical Immunology, 121(5), 1087-1093.

41. **Shrader, W. A. (2004):** Short and long term treatment of asthma with intravenous nutrients. Nutrition journal, 3(1), 6.

42. **Tepper, R. S., Morgan, W. J., Cota, K., Wright, A., Taussig, L. M., & Pediatricians, G. H. M. A. (1986):** Physiologic growth and development of the lung during the first year of life. American Review of Respiratory Disease, 134(3), 513-519.

43. **Terada, L. S. (2006):** Specificity in reactive oxidant signaling: think globally, act locally. The Journal of cell biology, 174(5), 615-623.

تقدير حالة فيتامين ج لدى الأطفال والمراهقين المصابين بالربو

أحمد محمود صلاح الدين*, حسين محمد إبراهيم العسال*, عمرو حميدة مصطفى*, أحمد عبد الله محمد*, نجاح محمد أبو محمد**

قسم الأطفال والباثولوجيا الاكلينيكية, كلية طب الأزهر

مقدمة البحث: إن الربو هو إضطراب إلتهابى مزمن فى الشعب الهوائية متمثل فى نوبات متكررة من الصفير، ضيق التنفس، ضيق الصدر، والسعال بالإضافة إلى إعاقة تدفق هواء الزفير المتغيرة. وقد أيدت العديد من التقاريرالحديثة الدور الحاسم للإجهاد التأكسدى فى تطورمرضية والتسبب فى العديد من الأمراض المناعية المزمنة ومنها الربو. ويؤدي الإجهاد التأكسدي أيضًا إلى تفاقم التهاب مجرى الهواء عن طريق زيادة مسببات الإلتهاب.

يعتبر فيتامين (ج) (حمض الأسكوربيك) مكونًا مهمًا لآلية مضادات الأكسدة الكلية الموجودة في الخلايا والأنسجة. إنه يعمل بمثابة كاسح قوى للجذور الحرة و يحمى من أكسدة الدهون للأغشية الخلوية وداخل الخلية أيضا.

الهدف من العمل:

كان الهدف من هذه الدراسة هو تقدير مستوى فيتامين (ج) بين الأطفال والمراهقين المتابعين بعيادة الربو والحساسية للأطفال بمستشفى الحسين الجامعى والكشف عن العلاقة بين مستوى فيتامين (ج) فى الدم وأعراض الربو وقياسات وظائف التنفس.

طريقة البحث: أجريت دراسة ارتيادية تحليلة مستعرضة في عيادة الربو والحساسية للأطفال بمستشفى الحسين الجامعى خلال الفترة من أكتوبر 2018 إلى يونيو 2019. تم تضمين ثمانون (80) طفلا ومراهقا تتراوح أعمارهم بين خمس وثمانية عشرة أعوام (5-18) في دراستنا.

النتائج: أسفرت الدراسة عن النتائج التالية :

- أظهرت الدراسة أن 62.8 ٪ من الحالات كانت من الذكور في حين أن 37.2 ٪ من الإناث مما أظهر وجود علاقة ذات دلاله إحصائية بين الذكور وحدوث مرض الربو بالمقارنة بالإناث.

- لوحظ أن أكثر من نصف الحالات محل الدراسة تنتمى إلى العشوئيات (51.2%) وأن هناك علاقة واضحة بين محل اقامة حالات البحث وكل من المؤشر الرئوى وقيم اختبارات وظائف التنفس مما يشير إلى علاقة قوية بين شدة و انتشار الربو والتوزيع السكني للحالات محل الدراسة فى العشوائيات أكثر من الريف والحضر. وتعزى هذه النتائج إلى تدني الوضع الاجتماعي والاقتصادي والبيئي في المناطق الفقيرة (العشوائيات).

- كانت هناك علاقة ذات دلالة بين محل الإقامة ومستوى فيتامين (ج) فى الدم موضحا أن العشوائيات أظهرت أدنى مستويات فيتامين (ج).

- كانت هناك علاقات ذات دلالات احصائية بين مستوى فيتامين (ج) في الدم في الحالات التي شملتها الدراسة وكل من تواتر نوبات الربو والمؤشر الرئوى. وبناءا عليه, فإن فيتامين (ج) يقلل من عدد وقوة النوبات في المرضى الذين يعانون من الربو. وعلى

النقـيض, كـان هنـاك ارتبـاط غيـر دال احصـائيا بـين مسـتوى الـدم لفيتامين (ج) في الحالات محل الدراسة ونتائج وظائف التنفس.

- وجـود علاقـة عكسـية ذات دلالـة بـين مسـتويات السـيطرة علـى الربـو ومسـتوى فيتـامين (ج) فـى الـدم ممـا يـدل علـى أنـه كلمـا ارتفـع مسـتوى فيتـامين (ج) فـي الـدم كلمـا اصـبح لـدينا مسـتوى أفضـل مـن السيطرة على الربو.

- وجـود علاقـات عكسـية ذات دلالـة بـين كـل مـن الصـفير وعمـل عضـلات التـنفس الثانويـة مـع مسـتوى فيتـامين (ج) فـى الـدم ممـا يكشف عن التأثير الوقائي لفيتامين (ج) ضد نوبات الربو الحادة.

- وجـود علاقـات ذات دلالـة احصـائية بـين مؤشـر كتلـة الجسـم المئـوي وكـل مـن مؤشـر الرئـة ومسـتويات السـيطرة علـى الربـو للحـالات موضـع البحـث، ولـوحظ وجـود علاقـة عكسـية قويـة بـين مؤشـر كتلـة الجسـم المئـوي BMI وقـيم اختبـار FEV1 / FVC والتـي تشـير إلى وجود علاقة إيجابية بين السمنة والربو في مرحلة الطفولة.

الاسـتنتاج: يمكـن لفيتـامين (ج) تحسـين بعـض أعـراض الربـو مثـل تـواتر النوبـات والمؤشـر الرئـوى، والتقليـل مـن احتماليـة وتـواتر نوبـات التفـاقم ولكـن لـيس لـه تـأثير علـى القياسـات الخاصـة بوظـائف التنفس.