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RESEARCH ARTICLE
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ASSOCIATION OF UNDER NUTRITION WITH SEVERITY OF CHILDHOOD ASTHMA

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ABSTRACT

Background

Asthma is one of the common chronic childhood illnesses and the majority of kids affected are having associated poor nutritional status. Undernutrition and hence decreased muscle mass leads to poor functional reserve for respiration, vital capacity and more breathing difficulty. A significant proportion of asthmatic children are found to have associated anaemia also. Understanding of association of undernutrition with asthma helps in optimizing treatment for asthma

Objective

To estimate the prevalence of undernutrition among children with asthma and investigate the association of undernutrition with severity of asthma.

Methods

A cross-sectional study was done on 471 children with asthma attending the Paediatrics department of Government Medical College, Kottayam. Children with asthma were classified according to their severity and level of control of symptoms according to NAEPP (National Asthma Education and Prevention Program) guidelines using a predesigned questionnaire, detailed history and examination. Children with undernutrition detected on auxological examination in terms of underweight and stunting were categorized using IAP growth charts and anaemia categorized according to WHO based on a complete blood count study and Peripheral smear report. The data was analysed using SPSS 22.

Results

Out of 471 children with asthma, the prevalence of underweight was 35.5%, stunting was 3.6% and anemia was 29.9%. Moderate persistent asthma was found to be significantly more common among children with underweight and stunting (p value 0.031 and <0.001 respectively). Intermittent asthma was found to be more common among children with anemia. (p value <0.001). Undernutrition was significantly associated with severity of asthma.

Conclusion

Asthmatic children have a significant proportion of undernutrition and undernutrition is associated with severity of asthma. Hence, correction of nutritional deficiency can be hypothesized as a measure to decrease asthma severity and improve well-being.

Key Words: Severity of Asthma; Undernutrition; Anemia.

INTRODUCTION

Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airflow obstruction. Asthma management is aimed at reducing airways inflammation by minimizing proinflammatory environmental exposures, using daily controller anti-inflammatory medications, controlling comorbid conditions that can worsen asthma and maintaining good nutritional status.

Asthma is diagnosed based on the history of variable respiratory symptoms and confirmed variable expiratory airflow limitation documented using spirometry or PEF (Peak Expiratory Flow) meter.[1]

It is known that loss of body mass produces disturbances in breathing physiology, diminution of diffusion capacity and increased air-trapping and hence reduced muscle mass can increase the severity of asthma.[2-5]

The mainstay of treatment of asthma is inhaled corticosteroids which may reduce the final growth. Hence it is important to assess the nutritional status in these children. Increase in number of exacerbations and the severity of hospital admissions also leads to undernutrition and in turn leads to decreased muscle mass. This leads to more severity of asthma attacks; more hospital stays and need for ICU care.

Asthmatic children are also found to have anemia and micronutrient deficiency which may be associated with their poor dietary intake but there is no proved evidence of anemia as a risk factor for asthma and its severity.[6-15] There are studies showing protective effect of breastfeeding in asthma and atopy.[11,12] Many studies have proven a strong correlation between acute lower respiratory tract infection and anemia suggesting that severe lower respiratory infection exaggerates iron-deficient erythropoiesis by blocking release of iron from the storage pools and hence causing anemia, but less known is studies related to asthma.[10-15] Hence this study is done to evaluate for any association of undernutrition with severity of asthma and this can throw light on further studies to modify nutritional status to reduce the severity of asthma and hence to improve the well-being of children with diagnosed childhood asthma.

OBJECTIVES

Primary Objective

To estimate the prevalence of undernutrition among children with asthma in the age group 6-12 years

Secondary Objective

To investigate the association of undernutrition with severity of asthma among asthmatic children in the age group 6-12 years.

MATERIALS & METHODS

Research Question

Is there any association between undernutrition and severity of Childhood Asthma?

Hypothesis Statement

Children with undernutrition have more severity of asthma.

Study Design

The current cross sectional study was conducted for a period of 9 months (May 2022-Jan 2023) in the department of Paediatrics, Government Medical College, Kottayam on Children aged 6-12 years who were diagnosed with childhood asthma attending OPD and In-Patients department. Ethical committee clearance was obtained (Ethics clearance permission number – IRB No. 14/2022).

Sample Size

Sample size calculated by formula N $= \frac{4pq}{d^2}$

In a prior study, by Dr. Rugmini K², 17.5% of asthmatic children were underweight
P= 17.5, Q = 82.5 d-3.5%
Sample size= 471

Sampling Method
Convenient sampling is done till the required sample size is met.

Study Tool
Pre structured questionnaire to collect data

Inclusion Criteria
Children aged 6-12 years who are diagnosed with childhood asthma according to GINA (Global Initiative for Asthma) guidelines.

Exclusion Criteria
Cases with possible causes of wheezes other than asthma
1. Congenital malformations of the chest wall
2. 2.Gastroesophageal reflux disease
3. Congenital heart disease
4. Possible immune deficiency
5. Parasitic infestations
6. Wheezers at first time of presentation
7. Poor treatment compliance

Study Procedure
All children satisfying the inclusion and exclusion criteria who attended the outpatient clinic and those children who were admitted as In Patients in the wards of Department of Pediatrics, Government Medical College, Kottayam were selected as study group based on GINA guidelines and confirmed variable expiratory airflow limitation documented using PEF meter. A detailed history was taken, and a thorough clinical examination was conducted for each patient as per the questionnaire. Their detailed nutritional and dietary history were also taken. They were classified according to severity of asthma into intermittent, mild persistent, moderate persistent and severe persistent asthma based on latest NAEPP guidelines (2020). They were also classified according to the level of control of symptoms, number of recurrence of attacks, duration of hospital stays and ICU requirement during the flares. Pre-structured questionnaire was used for collecting the required data.
Then detailed anthropometry including weight for age (WFA), height for age (HFA) and BMI for all children were recorded and classified into underweight, stunting according to IAP growth charts.
They were also subjected to investigations, which included complete blood count and a peripheral smear as an evaluation for nutritional anemia. The total number of children with anemia among the asthmatic children was calculated. Those who were diagnosed with anemia were classified according to severity of anemia as per WHO reference values.
Undernutrition in children was assessed in terms of the following parameters including underweight, stunting and anemia. The prevalence of children with underweight, stunting and anemia in each category of severity of asthma was calculated. They were compared and assessed for any association of undernutrition with severity of asthma.

Data Management and Statistical Analysis
All the data collected were coded and entered in Microsoft Excel sheet which was re-checked and analyzed using SPSS statistical software version 22. Normality of distribution was checked using Kolmogorov Smirnov test. Quantitative variables were summarized using mean and standard deviation (SD) or using median and interquartile range depending on the normality of distribution. Categorical variables were represented using frequency and percentage. Independent sample t test or

Mann Whitney test were used depending on the normality of distribution to test statistical significance of difference between means of variables among different independent groups. Pearson Chi-square test and Fisher's exact test were used for comparing categorical variables between groups. A p value of <0.05 was considered statistically significant.

RESULTS

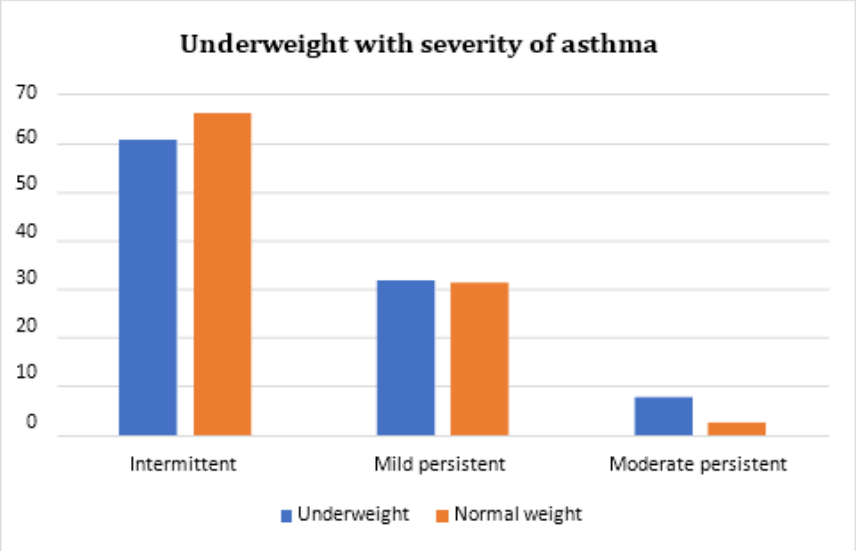
Among 471 cases, 51.2% (241) of the cases were males and 48.8% (230) of the cases were females, with male to female ratio being 1.04 and mean age at diagnosis of asthma among the cases were 7.51±2.06 with a median of 8 and interquartile range of 6-9.

Among 471 cases, 64.1% cases (302) were having intermittent asthma, 31.4% cases (148) were having mild persistent asthma, 4.5% (21) cases were having moderate persistent asthma. No cases were found to have severe persistent asthma which may be attributed to the advanced treatment guidelines and better disease education and compliance among the study population.

Of the cases, 167 children (35.5%) were found to be underweight according to Weight for age and BMI and 304 children (64.5%) were having adequate weight for age and BMI and 17 children (3.6%) were found to have stunting and 454 children (96.4%) were having adequate height for age.

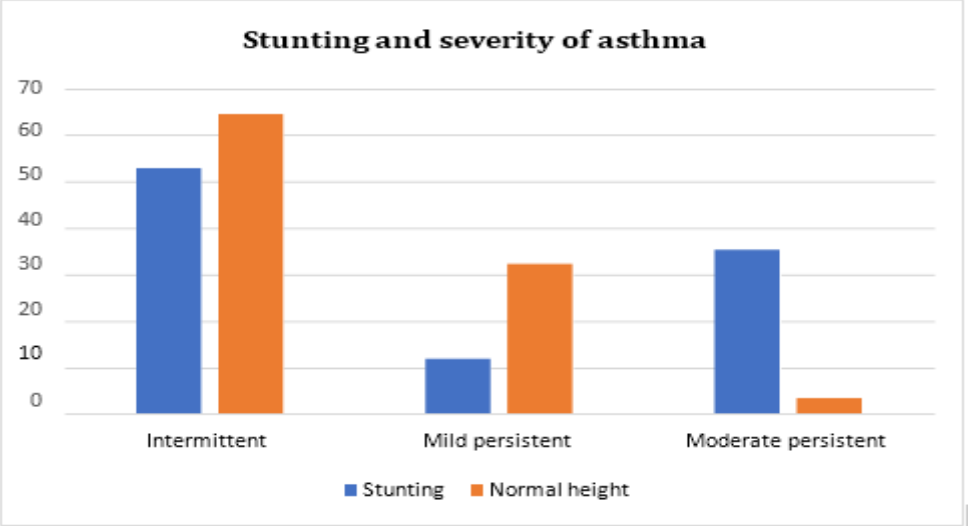
Also, among the study group, 141 cases (29.9%) had anemia, and 330 cases (70.1%) had no anemia. Among anemic children, 97.9% (138) were having mild anemia and 2.1% (3) were having moderate anemia, no cases were having severe anemia.

Moderate persistent asthma was found to be significantly more common among children who were detected to be underweight. This difference in proportion of children with underweight and severity of asthma was found to be statistically significant with a p value of 0.031(<0.05) as shown in figure 1.



Graph 1

Moderate persistent asthma was found to be significantly more common among children with stunting. This difference in proportion of children with stunting and severity of asthma was found to be statistically significant with a p value of <0.001(<0.05) as shown in figure 2.



Graph 2

It was seen that intermittent asthma was found to be significantly more common among children with anemia. This difference in proportion of children with anemia and severity of asthma was found to be statistically significant with a p value of <0.001. (<0.05) as in table 1.

Variable	**Anemia**				**p value**
	Yes (N=141)		**No (N=330)**		
Severity of Asthma	**(N)**	**%**	**(N)**	**%**	
Intermittent	109	77.3	193	58.5	<0.001*
Mild Persistent	27	19.1	121	36.7	
Moderate Persistent	5	3.5	16	4.8	
Table 1					

DISCUSSION

It is known that significant proportion of Asthmatic children have associated undernutrition due to various influencing factors.[2,3,4,5] In this study, out of 471 cases, 51.2% were males and 48.8% were females, with male to female ratio being 1.04. Among them 64.1% cases (302) were having intermittent asthma, 31.4% cases (148) were having mild persistent asthma, 4.5% (21) cases were having moderate persistent asthma. No cases were found to have severe persistent asthma which may be attributed to the advanced treatment guidelines, better disease education and compliance among population.

In the present study, the prevalence of underweight children with childhood asthma in weight for age was 35.5%, prevalence of stunting in children with asthma in height for age was 3.6%, prevalence of underweight measured in terms of low BMI values was 35.5%, 3.9% asthmatic children were having obesity and the prevalence of anemia among the study population was 29.9%.

The comparison with previous studies is given in table 2 below.[2,3,13,14]

Studies	**Prevalence**		
	Underweight	**Stunting**	**Anemia**
K.Rugmini et al	17.5%	15%	-
Hawlader MD et al	51.39(OR)	51.58(OR)	-
Muthu et al			61%
Fida et al			19.7%
Present study	35.5%	3.6%	29.9%
Table 2			

Severity of Asthma and Undernutrition

In the present study, severity of asthma with undernutrition was studied in terms of underweight, stunting and anemia. It was found that moderate persistent asthma was found to be significantly more common among children with underweight (p-0.031). Similar was the result obtained when BMI values were compared. Children with underweight and low BMI have low muscle mass. These children will be having low functional reserve for respiration, lesser values of forced vital capacity (FVC) and as a result more work of breathing and may lead to worsening severity of asthma. Due to poor generalized nutrition, they may undergo easy respiratory muscle fatigue which adds to the worsening severity of asthma and the need for respiratory supports and escalation of care.

All these factors may have contributed to the found statistical significance.

This result was comparable with previous studies which found a negative association between nutritional status and severity of asthma,[2] underweight children appeared to have the greatest impairment in forced vital capacity and had the greatest controller treatment burden.[3] In another study spirometry parameters, FEV1, FVC, PEFR, and FEV1/FVC ratio were determined in study population and results showed that thin children had significantly lower FVC and FEV1 than normal/overweight/obese children.

Another study concluded that obstruction was related to the rate of fat-free mass FFMI (17.3±2.4 vs 18.5±2.6 $p<0.016$).[5]

In the present study, only 17 children were found to have stunting, it was concluded that moderate persistent asthma was found to be significantly more common among children with stunting.

Stunting in these children may be a part of their generalized undernutrition. Also, the main stay of treatment in asthma is ICS. Although the dose is very less compared to oral route, one of the known adverse effects of inhaled cortico-steroids is growth retardation in turn leading to stunting.

The more severe the asthma, the more the dosage of steroids will be as well as the duration of treatment. So, this may be attributed to the above statistical significance.

Around 141 children with asthma had anemia, of which intermittent asthma was found to be significantly more common among children with anemia. It was comparable with previous studies.[13-15]

Anemia in these children may be due to the recurrence of attacks, associated infections and severity of asthma leading to poor nutritional intake.

The comparison of the findings in various blood parameters with previous studies is given in the table below.

This variation may be due to the difference in the study settings, different sample sizes, various age categories and different dietary patterns followed by the study groups.

	Muthu et al	**Present study**
Parameters(mean ± SD)		
Hb	7.93 ± 1.66	11.16 ±0.21
PCV (Packed Cell Volume)	26.06 ±5.89	36.44 ±2.24
RBC	3.05 ±0.733	3.74 ±0.15
MCV (Mean Corpuscular volume)	62.42 ±9.31	75.55 ±2.21
MCH (Mean Corpuscular Hemoglobin)	21.31±5.83	25.99±0.61
MCHC (Mean Corpuscular Hemoglobin Concentration)	26.73±6.07	31.12±0.63
RDWCV (Red cell Distribution width)	19.05±6.01	17.28±1.43
Table 3		

In the present study, severity of asthma and undernutrition was studied based on other variables like

level of control of asthma, number of recurrences, number of PICU (Paediatric Intensive Care Unit) admissions, duration of hospital stay but none were found to be statistically significant unlike other studies.

CONCLUSION

It was found that asthmatic children have a significant proportion of undernutrition and stunting and asthma was found to be more common among children with anemia. (p value <0.001) and undernutrition is associated with severity of asthma. Hence, correction of nutritional deficiency can be hypothesized as a measure to decrease asthma severity and improve the well-being of the affected children.

LIMITATIONS OF THE STUDY

1. This study does not address whether nutritional correction improved asthma severity in the subjects.
2. This study has not fully analyzed all the confounding risk factors of Asthma and anemia

What is already Known?

A higher proportion of asthmatic children have undernutrition

What Study ADDS?

Asthma severity is related to undernutrition and the correction of nutritional deficiency can be hypothesized as a measure to decrease asthma severity and improve well-being.

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