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RESEARCH ARTICLE

DISEASE SEVERITY IN RELATION TO NUTRITIONAL STATUS AMONG 2-5-YEAR OLD CHILDREN WITH WHEEZE

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Abstract

Introduction: Effect of nutritional status on under-five wheezers is less studied. Undernutrition which is prevalent in this age group may have an impact on the severity of asthma.

Objective: To determine the association of nutritional status as measured by anthropometric parameters Weight for Age (WFA), Height for Age (HFA) and Body Mass Index (BMI) on severity of asthma.

Materials and Methods: A study was undertaken on 40 consecutive children in the age group of 2-5-years with a clinical diagnosis of asthma (> 3 episodes of wheezing) which included children on controller therapy and those on intermittent treatment. These children were categorized into Well-controlled, Poorly-controlled and Uncontrolled asthma as per GINA Guidelines, 2018. Weight, Height and BMI were recorded.

Statistical-Analysis: Data analyzed by SPSS software version 16.0, Chi-square test and One-way ANOVA test.

Results: Out of 40 children, 24 children were on controller therapy and the rest were on intermittent therapy. They were categorized as Well-controlled(45%), Poorly-controlled(20%) and Uncontrolled asthma(35%). 16(40%) were under-weight, 2(5%) overweight and 2(5%) were obese. 14(35%) were stunted and 18(45%) had BMI<5^{th} percentile. Significant negative association (p value < 0.05) was noted between all the three anthropometric parameters (WFA, HFA and BMI) and severity of asthma.

Conclusion: There was a significant negative association between severity of asthma and poor nutritional status. This highlights the need for periodic growth monitoring and appropriate nutritional intervention to achieve optimal growth and control of asthma.

Keywords: BMI, Nutritional status, Severity of asthma

1 | INTRODUCTION

Asthma is known to cause considerable morbidity in children. Prevalence of asthma in Indian school children has doubled over the last ten years reaching upto 23%[1]. Study by Chen X et al., shows that exposure to early life under nutrition is related to higher risks of adverse immunologic outcomes later in life[2].

Berntsen S et al., concluded that in malnourished children, normal lung growth might be affected and this can lead to an increased likelihood of the occurrence of asthma symptoms[3].

Cohen et al., observed that growth retardation and delayed bone maturation can be caused by persistence of allergy symptoms and that there was an association between asthma and growth inhibition[4]. Disturbances in breathing physiology are produced by loss in body mass[5].

Stojanovic et al., stated that, more the systemic inflammation, more is the role of malnutrition as seen in asthma[6].

Hagel et al., stated that malnourished children had a defective T-cell response and the proportion of B cells and low affinity IgE receptors are increased in them and this may cause an increase in specific IgE, which leads to wheezing and asthma symptom[7].

Loss of body mass can cause disturbance in breathing physiology, decrease in diminution capacity and increased air trapping[5].

Apart from this, decrease in intake of nutrients like vitamin D, Vitamin A, Vitamin E, Selenium, Zinc, n-3 polyunsaturated fatty acids (PUFAs) and increase in intake of n-6 polyunsaturated fatty acids (PUFAs) has got some effect on the increase in prevalence of asthma[8]. Considering all these facts this study was conducted to note the effect of nutrition on severity of asthma.

2 | EXPERIMENTAL WORK

This is a cross sectional study, where 40 consecutive children of age 2 to 5 years, who have a clinical diagnosis of asthma and who attended Paediatric Out Patient Department of a teaching hospital from October 2018-August 2019 were included.

Inclusion Criteria: Children of age 2 to 5 years with a diagnosis of asthma, attending our asthma clinic and also emergency were included in the study. These included children who were on controller/intermittent therapy during the study period and from whose care givers consent has been obtained.

Exclusion criteria: Children with co morbidities like Cystic Fibrosis, Congenital Heart Disease, Congenital Malformations, CNS abnormalities, Hematological or Endocrine abnormalities were excluded.

Classification of participants:Symptom control of asthma was categorized according to 2018 GINA Guidelines, based on day and night symptoms, use of reliever and limitation of activity for the past 4 weeks into 3 subgroups as I) Well-controlled asthma, II) Poorly-controlled asthma and III) Uncontrolled asthma. For poor asthma outcomes risk factors were also considered.

Study Parameters: In all children weight, height and BMI were recorded. Birth weight was also noted. Body weight was measured on a Phoenix electronic weighing machine while the patients wore minimal clothing to the nearest 0.1 kg. Height was measured by making patients stand barefoot with backs and heels touching a vertical bar to the nearest 0.5 cm. This data was used to calculate BMI using the formula BMI= weight (kg)/height (m2).

Weight and height were plotted in WHO growth charts and graded accordingly. CDC charts were used for BMI.

Supplementary information The online version of this article (https://doi.org/10.15520/ijmhs.v11i05.3312) contains supplementary material, which is available to authorized users.

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Ethics: Prior to enrolment, Institutional ethics committee approval and Informed consent from parents was taken.

Statistical Methods: Using SPSS software version 16.0 statistical analysis and using Chi-square test the association between asthma and anthropometric parameters were analyzed. One-way ANOVA test was used to do group comparison.

3 | RESULTS

In this study 40 children were included. They all belonged to socioeconomic status of Upper and Lower Middle Class. The study population were sex matched.

Among these children, 24 children were on controller therapy but poor compliance was noted in 4 children. 2 children had symptoms of asthma even on proper controller therapy. 16 children were on intermittent therapy due to care giver refusal to take prophylaxis or were under treatment in a peripheral hospital prior to this episode. On categorizing according to GINA 2018 guidelines majority of children- 18 (45%) belonged to Well-controlled category, closely followed by 14 (35%) children in Uncontrolled category and 8 (20%) in Poorly-controlled category (Figure 1).

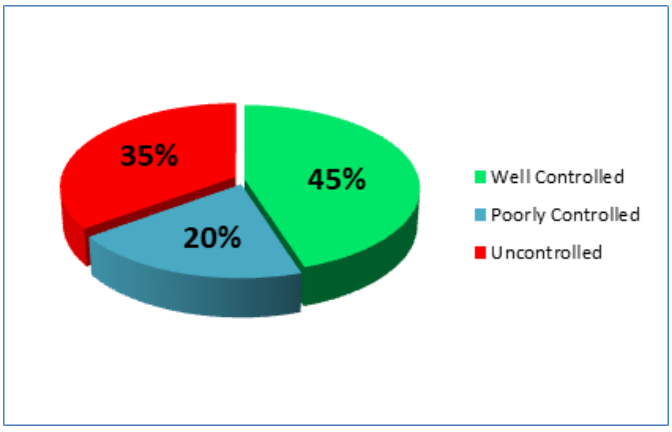

FIGURE 1: Proportion of children as per severity of asthma

Mean birth weight was 2.8Kg. Mean birth weight of those with Well-controlled asthma was 2.8 Kg, those with Poorly-controlled asthma had a mean birth weight of 3 Kg and those with Uncontrolled asthma had a mean birth weight of 2.75Kg. Severity of asthma did not show much difference in different birth weight cohorts (p value >0.05).

Mean age was 3.8 years. Mean age of children who had Uncontrolled asthma was 3.4 years and those with Well-controlled asthma had a mean age of 4.2 years. On comparing those with Poorly-controlled asthma, the mean age was 3.5 years. On statistical analysis there was no significant association between age and severity of disease.

Among 40 children, 16 (40%) were in under-weight, 14 (35%) in stunted, 2 (5%) in overweight, 2 (5%) in obese categories and 18 had a low BMI of $<5^{th}$ percentile according to CDC growth charts 2000.

Mean WFA of the whole group was 83.82 % but those who had Uncontrolled asthma had a mean WFA of 75.00% whereas it was 81.00% in the subgroup of Poorly-controlled asthma and 91.94% in Well-controlled asthma. Mean HFA of the total group was 95.32% and that in the Uncontrolled, Poorly-controlled and Well-controlled was 95.85%, 93.57% and 95.98% respectively. BMI of the subgroup of Uncontrolled asthma was 12.73, whereas in the Poorly-controlled subgroup it was 13.95 and in Well-controlled subgroup it was 15.93. It was noted that the severity of asthma was found to be increasing with a decrease in the anthropometric parameters assessed above. A significant negative association with severity of asthma (p value <0.05) was noted (Table I).

4 | DISCUSSION

In this study, children below 2 years were excluded so that those children with viral wheeze were excluded from the study.

In our study majority of children belonged to Well-controlled asthma as they were recruited for the study from the asthma clinic. This was closely followed by Uncontrolled asthma which was about 35%. This high number may be due to the fact that our institution is a tertiary care centre and these children were recruited from emergency and had either life threatening asthma or acute exacerbation of asthma.

TABLE 1: Association between asthma and nutritional parameters

Average	Grading of Asthma			p Value
	Well Controlled	Poorly Controlled	Uncontrolled	
BW	2.87±0.41	3.02±0.35	2.75±0.27	0.513
WFA (%)	91.9±8.1	81±9.7	75±4.2	0.001
HFA (%)	95.97±2.53	93.57±4.56	92.85±5.01	0.028
BMI	15.9±1.29	13.95±0.47	12.73±0.39	0.000

Those children who had Poorly-controlled asthma and Uncontrolled asthma were on intermittent bronchodilators and steroids. Poor compliance to inhalational therapy was observed in some children.

Majority of children had under nutrition- 40% were under-weight, 35% were stunted and 45% has a low BMI of $<5^{th}$ whereas only 10% children were overweight and obese. When the nutritional status as evidenced by WFA was compared with the severity of asthma episodes, it was found that the severity increased with an increase in under nutrition showing a negative association with a p value of 0.001, 0.028 and 0.000 for WFA, HFA and BMI respectively.

A study in 172 children of age 9-10 years by Berntsen et al., in 2009 showed that children with underweight had lower lung function and that lower body fat was associated with higher occurrence of asthma (odds ration and 95% CI)[3]. In this study 37% of children were under weight, 24% had asthma symptoms and 5% had severe wheezing respectively in the last one year. This was in concordance to the results of our study. In under nutrition, inadequate muscle mass especially of the respiratory muscles may be the contributing factor for increasing severity of asthma.

Even though a study done by Mohammad et al., in 2012 on 912 children of age 4-5 years showed that children with under-weight and stunting were more likely to have wheezing compared with non under weight and non-stunted children, wasting did not show a significant relationship with wheezing[9]. In this study 41% had under weight, 32% had stunting and 17% had wasting. In contrast, our study showed that BMI (p value 0.000), underweight (p value 0.001) and stunting (p value 0.028) had an association with severity of asthma.

It is a well known fact that pulmonary function especially vital capacity correlates with the height of the individual. As height increases, peak expiratory flow also increases in children. So reduction in height for age can have a significant effect on peak expiratory flow of the individual which is one of the determinants of the severity of asthma. Height and weight together gives BMI and so BMI has a significant association with severity of asthma. In our study the severity of asthma increased with a decrease in HFA showing that stunted children have more episodes of wheezing. This fact is stated in a previous study done by Mohammad et al[9].

BMI is yet another factor which is studied and found to have a good negative association with severity of asthma. In our study group majority of children had low BMI (45%) than high BMI (10%) showing that there was a significant relation with asthma as evidenced by a p value of 0.000.

In 1995 a study done in 122 children belonging to age 5-11 years by Faridi et al., showed that children with PEM had reduced FVC, FEV1 and PEFR which are objective evidence of bronchospasm which is a major component of asthma[10]. In this study 80 malnourished children were included.

We explored whether birth weight had any significant effect on severity of asthma and found no association. This factor needs further studies as our cohort had majority of patients more that 2.5 Kg which was AGA, further studies including preterm and SGA babies will show some light into the association between birth weight and severity of asthma.

5 | CONCLUSION

More children were undernourished in our study. However those who were over nourished constituted 10%. A significant negative association between

severity of asthma and nutritional status which is a reflection of anthropometry was noted. Decrease in WFA, BM and HFA was noted to have a significant negative association with severity of asthma. Anthropometry which reflects poor nutritional status is significantly associated with severity of asthma. This study suggests the need for early nutritional supplementation in asthma. This study also recommends periodic monitoring of nutritional parameters, anticipatory nutritional guidance and appropriate early intervention in children with asthma.

6 | LIMITATIONS

- Sample size was less. Further studies with a higher sample size is suggested
- Even though we found an association between poor nutrition and severity of asthma, nutritional intervention and reassessment after correcting the nutritional status was not done.

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