Nutritional Status and Childhood Wheezing in Rural Bangladesh

Mohammad Delwer Hossain Hawlader[1], Emiko Noguchi[2,3], Shams El Arifeen[4], Lars Åke Persson[5], Sophie E. Moore[6], Rubhana Raqib[4], Yukiko Wagatsuma[1]

1. Department of Clinical Trial and Clinical Epidemiology, Faculty of Medicine, University of Tsukuba, Tsukuba, Japan
2. Department of Medical Genetics, Faculty of Medicine, University of Tsukuba, Tsukuba, Japan
3. Japan Science and Technology Agency, Core Research for Evolutional Science and Technology (CREST)
4. International Centre for Diarrhoeal Diseases Research, Bangladesh (icddr,b), Dhaka, Bangladesh
5. Department of International Women and Child Health, Uppsala University, Uppsala, Sweden
6. MRC International Nutrition Group, London School of Hygiene & Tropical Medicine, London, UK.

BACKGROUND

➢There is an increasing international interest in the causal role of nutrition and other dietary factors in the development of asthma and allergic diseases (Nurmatov U 2012).

➢Asthma and allergic manifestations are increasing, especially early in life, in both developed and developing countries (Elizabeth CM et al 2009).

➢Obesity has been widely recognized to be more common among children with asthma and the association between higher BMI and overweight were found in many countries like UK, Japan and Taiwan (Figueroa-Munoz J 2001, Okabe Y 2012, Yao TC 2001)

➢However, very little evidence exists on the potential association between undernutrition and current wheezing/asthma and allergic diseases.

PURPOSE

To investigate the association between current childhood nutritional status on current wheezing among pre-school children in rural Bangladesh.

METHODS

➢This is a cross-sectional study nested into a large-scale randomized clinical trial of nutrition interventions in pregnancy; the Maternal and Infant Nutrition Intervention in Matlab (MINIMat), rural Bangladesh.

➢The 4,436 mothers in MINIMat were followed during pregnancy, data on socio-economic status (SES) and morbidity of mothers were collected.

➢A total of 1,303 children were eligible for this cross-sectional study when they reached to 4.5 years of age

➢Total IgE was measured by human IgE quantitative ELISA.

➢Specific IgE level against house dust mites (*Dermatophagoides pteronyssinus)* was measured by the CAP-FEIA system.

➢Anti-DP IgE >0.70 UA/ml was considered positive.

➢Immediate hypersensitivity reaction was tested by a skin prick test using mite allergen (*DP).*

➢Children's weight was measured to the nearest 100g with a TANITA digital scale.

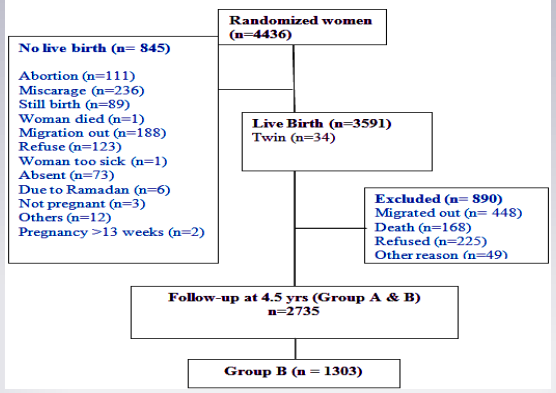
➢Height was measured to the nearest 0.1cm with a Holtain Stadiometer.

➢Stunting, wasting and underweight were calculated using the WHO Anthro.

➢Stunting was defined as height-for-age z-score < -2, wasting as weight-for-height z-score < -2, and underweight as weight-for-age z-score < -2

➢Current wheezing, ever wheezing and ever asthma were identified using the International Study on Asthma and Allergies in Childhood (ISAAC) questionnaire.

Fig 1: Flow chart of the study children



RESULTS

Table 1: Characteristics of the study children (n=912)

Characteristics	n	%
Gender (males)	480	52.6
Low birth weight (<2500gm)	241	26.4
Premature (GA <37week)	125	13.9
Stunting (height-for-age Z-score < -2)	289	31.7
Wasting (weight-for-height Z-score < -2)	158	17.3
Underweight (weight-for-age Z-score < -2)	371	40.7
Ever wheezing (yes)	412	45.2
Current wheezing (yes)	180	19.7
Ever asthma (yes)	164	18.0
Age of the children (month)	54.4 ± 0.7*	
Mother's BMI	21.0 ± 3.5*	
**mean + SD*		

Table 2: Geometric mean of serum total IgE and positivity of anti-DP IgE, mite antigen skin prick test and helminthes eggs

	Geo mean (95% CI)	Positive %
Total IgE (IU/ml)	526.44 (172.93 - 3039.15)*	
Anti-DP IgE (UA/ml)		44.3
Mite antigen skin prick test (>5mm)		15.2
Ascaris lumbricoids eggs (159/912)		17.4
Trichuris trichura eggs (160/912)		17.5

**Mean (range), DP-Dermatophyte Pteronyssinus, IgE-Immunoglobulin E*

Table 3 Association between current wheezing and different parameters

		Current Wheezing				
		Yes		No		P value
		n	%	n	%	
Sex	Male	92	19.2	388	80.8	0.648
	Female	88	20.4	344	79.6	
Low Birth weight	Yes	50	20.7	191	79.3	0.611
	No	114	19.2	480	80.8	
Prematurity	Yes	24	19.2	101	80.8	0.921
	No	152	19.6	625	80.4	
Stunting	Yes	72	24.9	217	75.1	**0.007**
	No	108	17.3	515	82.7	
Wasting	Yes	30	19.0	128	81.0	0.795
	No	150	19.9	604	80.1	
Underweight	Yes	85	22.9	286	77.1	0.046
	No	95	17.6	446	82.4	
Mother's BMI	Low	40	22.5	138	77.5	**0.033**
	Normal	113	15.7	605	84.3	
Family history of asthma	Positive	75	37.3	126	62.7	**0.000**
	Negative	105	14.8	606	85.2	

IgE = Immunoglobulin E, DP = Dermatophyte Pteronyssinus
Stunting = height-for-age Z-score < -2, Wasting = weight-for -height Z-score < -2, Underweight = weight-for-age Z-score < -2

Table 4 Univariate and multivariate logistic regression analyses with current wheezing as dependent variable

	Current Wheezing			
	Crude OR	95% CI	Adjusted OR	95% CI
Stunting	1.58	**1.13 – 2.22***	1.70	**1.17 – 2.47***
Wasting	0.94	0.61 – 1.46	0.88	0.54 – 1.43
Underweight	1.39	**1.00 – 1.94***	1.29	0.89 – 1.85

**P<0.05*
†OR = Odds Ratio, CI = Confidence Interval
Adjustment by sex, birth weight, birth length, gestational age at birth, mother's parity, maternal BMI, family history of asthma, socio-economic status and season of birth.

❑ Wheezing at 4.5 years old was significantly associated with stunting (OR (95%CI) =1.58(1.13-2.22) and underweight (OR (95%CI) = 1.39 (1.00–1.94)).

❑ The association with stunting remained significant after adjustment for sex, birth weight, birth length, gestational age at birth, mother's parity, maternal BMI, family history of asthma, socio-economic status and season of birth (OR (95%CI) = 1.70(1.17 – 2.47)).

DISCUSSION

❑ In this study we found that stunting, an indication of long-term chronic malnutrition was significantly associated with current wheezing in rural Bangladeshi children aged 4.5 years.

❑ Previous study has also shown that underweight children had lower lung function, and lower body fat was associated with higher occurrence of asthma symptoms

❑ Earlier study suggested that there was a defective T cell response in malnourished children, and that the proportion of total B cells, and those bearing the low-affinity IgE receptor (CD23+) increased in moderately malnourished children

CONCLUSIONS

❖ In conclusion, our data suggest that chronic under-nutrition has an influence on current wheezing in rural Bangladeshi children.

❖ Further analysis is required to examine the relationship between nutritional factors and asthma and allergic responses in population such as rural Bangladesh, with a high degree of undernutrition and a growing prevalence of asthma and atopic disease.

Acknowledgement:

The study was supported by the International Centre for Diarrhoeal Disease Research, Bangladesh; the UK Medical Research Council; the Swedish Research Council; the UK Department for International Development; the Grant-in-Aid for Scientific Research of the Japan Society for the Promotion of Science (JSPS, Grant #18256005); the Child Health and Nutrition Research Initiative; Uppsala University; the US Agency for International Development, under the Cooperative Agreement #388-G-00-02-00125-00; the Australian International Development Agency and core donor of icddr,b. We are grateful to the study participants for their involvement in the study. We thank the field team members and data management staff for their excellent work.

For further information: *Hawlader Mohammad **Delwer** Hossain, E-mail: hawlader2003@yahoo.com, s1030527@u.tsukuba.ac.jp*