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Nutritional status and childhood wheezing in rural Bangladesh

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Introduction:

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- 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).

- Currently asthma affects 300 million people worldwide (Braman SS 2006)

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Introduction (Cont…)

- 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.

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Objectives

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

Conceptual Framework

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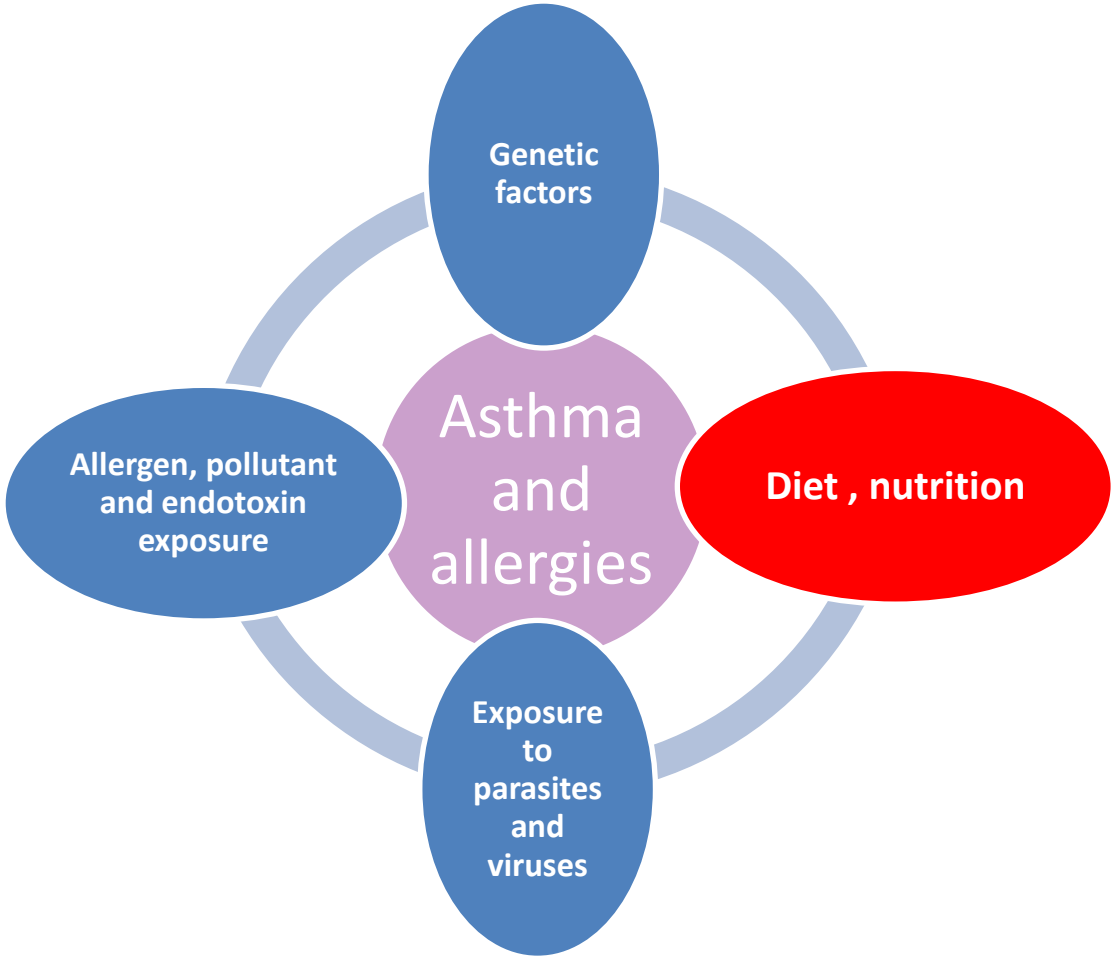

Methods

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- This cross-sectional study was 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 icddr,b has been running a health and demographic surveillance system (HDSS) in the area since 1966 that covers a population of about 225,000.

Methods (Cont…)

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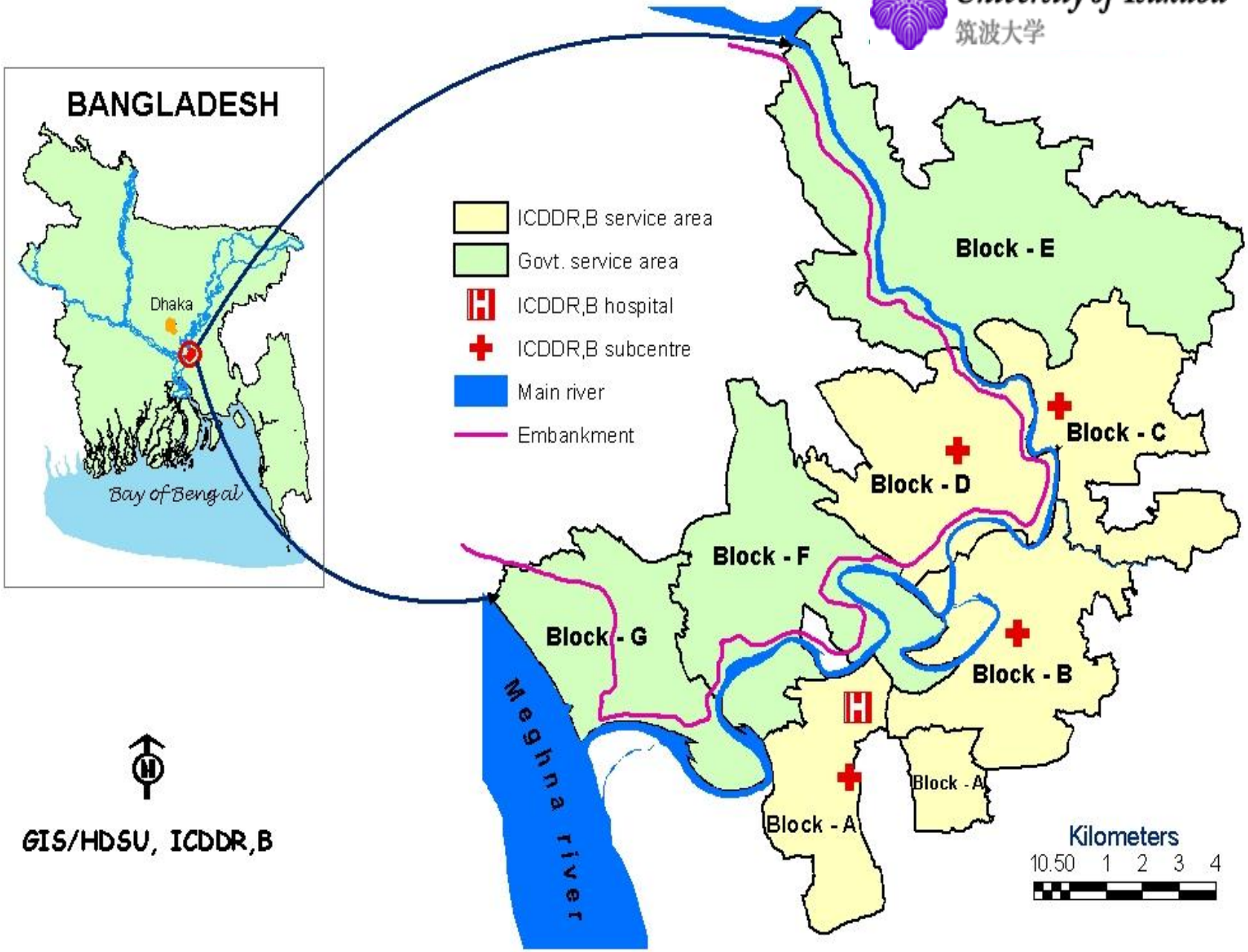
- The MINIMat trial was conducted in the Matlab HDSS area from November 2001 to October 2003.

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

- Information about their children's gestational age, birth weight, birth length were also collected at delivery.


BANGLADESH
Dhaka
Bay of Bengal
ICDDR,B service area
Govt. service area
ICDDR,B hospital
ICDDR,B subcentre
Main river
Embankment
Block - E
Block - C
Block - D
Block - F
Block - G
Block - B
Block - A
Block - A
Meghna river
N
GIS/HDSU, ICDDR,B
Kilometers
0 .5 1 2 3 4

Identification of Individuals

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RID (Registered Identification #): It is a 10 digit code given to all population of study area and it never changes – "**1V32003202**"

- First 1 digit (**1**) digit for census phase
- Next 3 digits (**V32**) for Village code
- Next to village code (**0032**), 4 digits is family code
- Last 2 digits (**02**) for Individual Number

Explanation on Phase of RID

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Phase of RID: The phase of RID changes regarding the census period. Our first census was held in 1974. For this census we have used 1 as phase of the RID, like "**1V32003202**".

- **1V32003202, 1 used in 1974, until the next census**
- **2VB4046710, 2 used in 1982, until the next census**
- **3D34013708, 3 used in 1993, until the next census**
- **4C00052008, 4 used in 2000, until the next census**

Identification of Individuals

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- CID (Current Identification #): It is a 9 digit code given to all population of study area. This code changes when an individual moves within study area – "**V32003202**"

  - First 3 digits (**V32**) for Village code
  - Next to village code (**0032**), 4 digits is family code
  - Last 2 digits (**02**) for Individual Number

Demographic & Health Data Collection

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Responsibilities of CHRWs

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- Health and demographic data collection by visiting house holds
- Provide Diarrhoeal treatment to the patients
- Conduct pregnancy test
- Refer Diarrhoeal patients either to icddr,b Sub-center or Matlab Hospital, referral of other patient to Govt. service center
- Assist in special research works

Refresher Training Among Field Staffs

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Block / Sub center (contd.)

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- This is the second tier of HDSS infrastructure
- Activities are planned based on Blocks
- Block is the place of meeting and refresher training for CHRWs
- CHRWs meets twice in Block in a month

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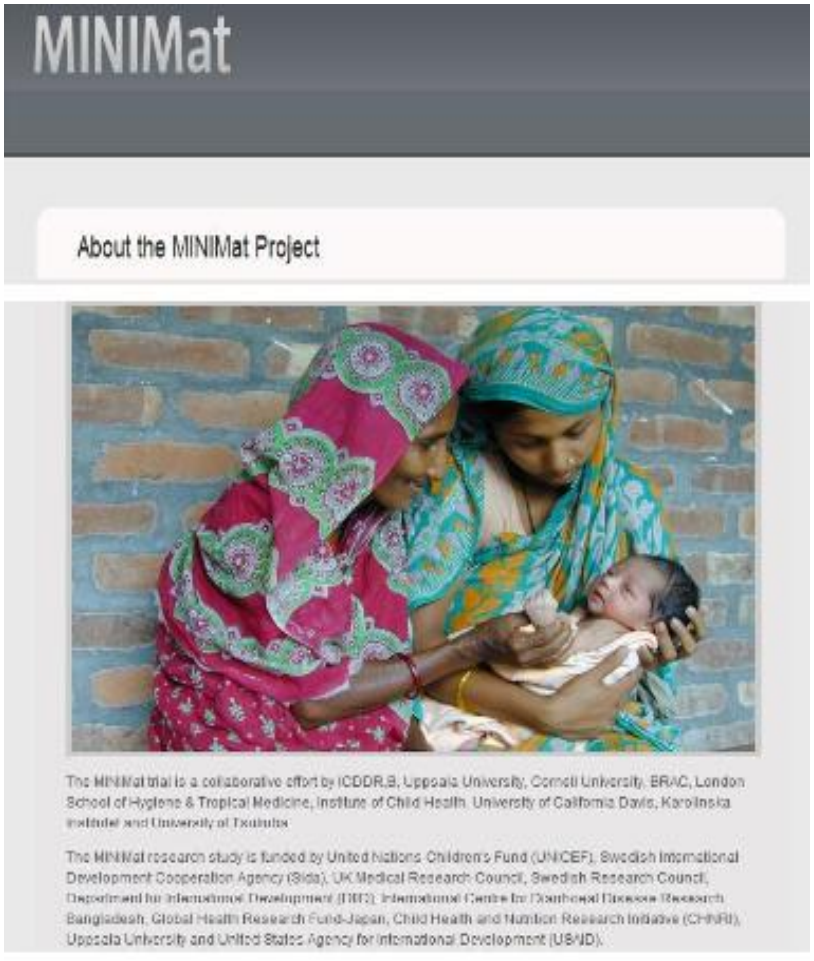
MINIMat Trial



Effects of Prenatal Micronutrient and Early Food Supplementation on Maternal Hemoglobin, Birth Weight, and Infant Mortality Among Children in Bangladesh
The MINIMat Randomized Trial

JAMA, May 16, 2012; Vol 307, No 19

Methods (Cont…)

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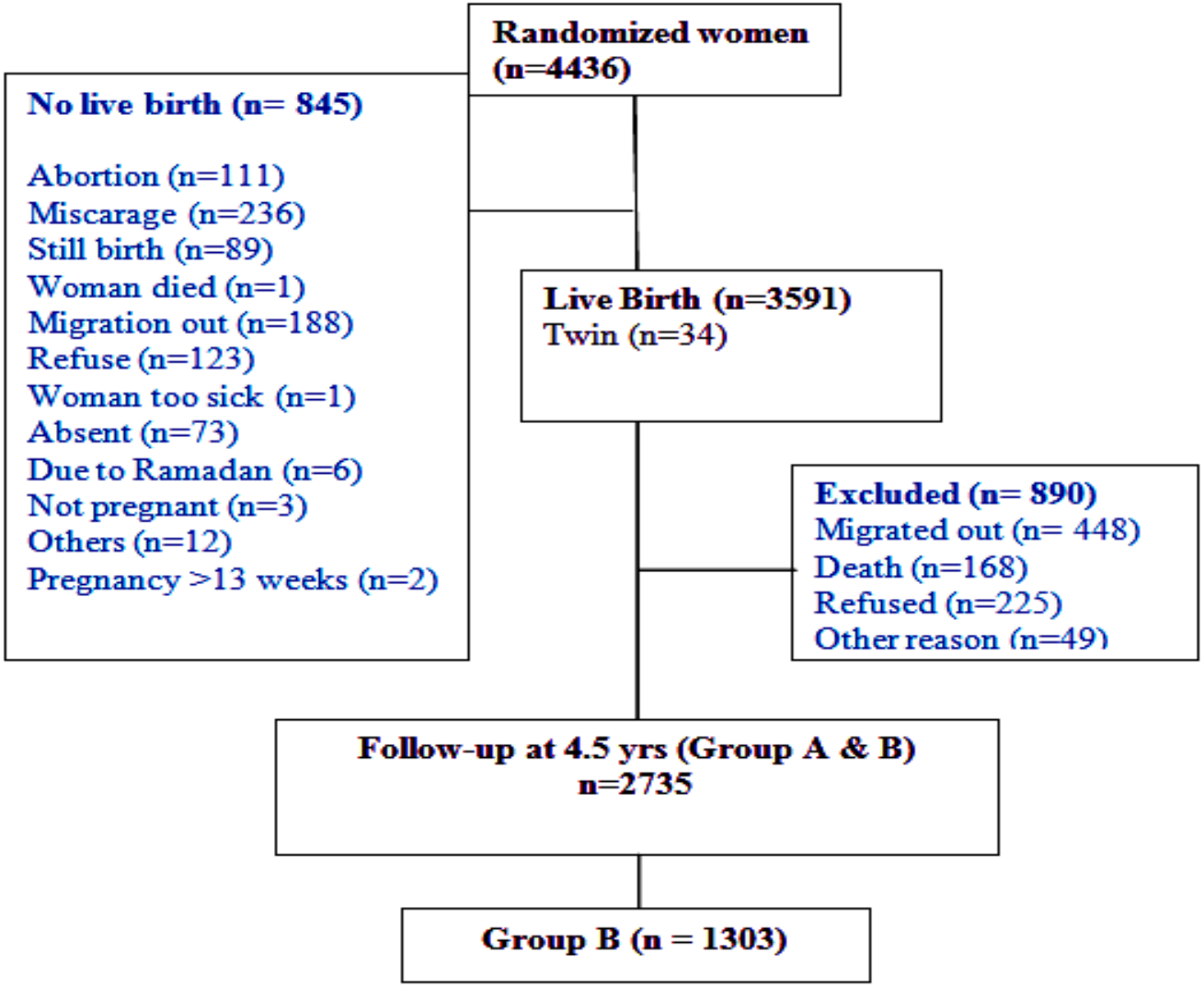
Fig 1: Flow chart of the study children



Measurements

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- Total IgE was measured by human IgE quantitative ELISA kit
- 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.
- Fresh stools from the participants were collected in the morning for parasite-egg examination.

Measurements (Cont.…)

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- Immediate hypersensitivity reaction was tested by a skin prick test using mite allergen (Dermatophagoides pteronyssinus)
- 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.

Measurements (Cont….)

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Measurements (Cont.…)

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- 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

Results

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Table 1: Characteristics of the study participants

Characteristics	n	%
Sex (male)	480	52.6
Low birth weight (<2500gms)	241	26.4
Prematurity (GA<37 weeks)	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	412	45.2
Current wheezing	180	19.7
Ever asthma	164	18.0

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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), IgE-Immunoglobulin E, DP-Dermatophyte Pteronyssinus

Table 3: Association between current wheezing and different parameters

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		Current Wheezing				
		Yes		No		
		n	%	n	%	P value
Sex	Male	92	19.2	388	80.8	0.648
	Female	88	20.4	344	79.6	
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.

Discussion

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- 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 (Berntsen S et al 2009).

Discussion (cont....)

- 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 (Hagel I et al 2003).

- And those may cause increased specific IgE, which leads to wheezing and asthma symptoms.

Discussion (Cont.…)

- Strengths of this study
  - large sample size and good retention of participants.
  - 76% of eligible individuals born during the maternal trial were successfully recruited at 4.5 years of age.

Discussion (Cont.…)

- Limitations
  - This was a cross-sectional study, the data did not provide direct information on whether stunting is a cause of the development of current wheezing.
  - We used a questionnaire based on the ISAAC to diagnose current wheezing.
  - Wheezing in children may be attributed to allergic asthma, exercise-induced asthma or be a symptom of viral/other respiratory infections.

Discussion (Cont....)

- The term wheezing is also often misinterpreted by parents and this may produce overestimation or underestimation of the symptoms.

- However, the ISAAC questionnaire has been extensively used worldwide and it has reportedly provided an acceptable estimation of the prevalence of asthma in children 2-6 years of age

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.

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Acknowledgement

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