

Bronchial asthma in the southern Maldives

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Summary

A whole population survey was performed in Addu Atoll, southern Maldives to establish the prevalence of bronchial asthma. Assessments of atopic eczema, allergic rhinitis, conjunctivitis and intestinal infestation were made, and serum specific IgE titres to a number of allergens were measured. Asthma is a common condition in the southern Maldives, and there is no evidence that the IgE produced by intestinal helminths prevents the condition.

Introduction

Bronchial asthma is becoming recognised increasingly as an important problem in tropical countries, in some representing a significant cause of hospital admission and chronic ill-health (Sofowora, 1970; Anim & Edoo, 1972; Warell *et al.*, 1975).

This study of asthma was performed in Addu Atoll, the most southerly atoll in the Republic of Maldives. The Maldives, situated 200 to 500 miles south-west of Sri Lanka, consist of a chain of over 2000 islands of which approximately 100 are inhabited. The total population is 120,000 of whom 14,000 live in Addu Atoll. The main occupation is fishing, although prior to 1976 several hundred male Maldivians had been employed by the Royal Air Force at the airbase on Gan, an island at the southern tip of Addu Atoll.

Patients from the Atoll attended the medical centre on Gan. During the seven month period April to October 1976 asthma was found to be the fourth most common cause of attendance amongst the total population and the third commonest in those under the age of fifteen (Table 1).

It was this finding that prompted this investigation of bronchial asthma in Addu Atoll, which was performed between April 1976 and January 1977.

Table 1. Patients seen at Medical Centre Gan, April–October 1976

	All patients (Total 2393)		Patients < 15 years old (total 1085)	
	No.	%	No.	(%)
Diarrhoea	388	16.2	Diarrhoea	278 25.6
Dermatology	336	14	Dermatology	210 19.4
Respiratory	326	13.6	Asthma	141 13.6
(excluding asthma)				
Asthma	246	10.3	Respiratory (excluding asthma)	130 12.0
Aural	118	4.9	Aural	80 7.4
Others			Others	22
(Mainly musculo-skeletal disorders and gynaecological/obstetrical conditions)				

Methods

Diagnosis

A diagnosis of bronchial asthma was made on a history of paroxysmal, recurrent, generalized airways obstruction, which was reversible either spontaneously or as a result of treatment. Airways obstruction, manifested by hyperinflation of the chest and audible rhonchi was verified by a medical officer.

Whole population survey

Medical assistants, trained by the Royal Air Force, visited each island in Addu Atoll and by means of questionnaire interviewed household occupants. Where there was a history suggestive of bronchial asthma the individual was referred to the medical centre on Gan.

One hundred and thirty-seven patients who had frequent severe episodes of airways obstruction were studied in more detail. Note was made of precipitating factors and home conditions. Clinical examination concentrated on evidence of cardio-respiratory and atopic disease, particularly chronic hyperinflation of the chest, audible rhonchi, atopic eczema and allergic rhinitis and conjunctivitis.

Radiographs

Chest radiographs were taken when indicated for clinical reasons.

Stool parasites

Unconcentrated stool samples were obtained, without purgation, from eighty-five asthmatics and 817 unselected out-patients.

Skin tests

These were performed by the modified prick test method (Hendrick *et al.*, 1975). Eleven allergens were used. *Dermatophagoides farinae* allergen was supplied by Dome Laboratories. The coral dust solutions were prepared by making 1% suspension of the

coral dust in 1% aqueous phenol, leaving for 2 days and then the insoluble material was filtered off prior to use for prick testing.

The remaining test solutions were supplied by Bencard. Glycero-saline and 1% aqueous phenol controls were included.

Only immediate (type I) reactions were recorded, weal diameter being measured at 10–15 min. Weals of diameter 3 mm or more were regarded as positive.

Fifty asthmatics and fifty controls were tested. None of the latter group gave a history, or showed clinical evidence of atopic disease.

IgE scores

Blood was obtained from forty-seven asthmatics by venepuncture. The blood was immediately centrifuged, the serum removed and frozen before being flown to London. At the NIBSC the IgE scores to a variety of allergens were measured by the RAST technique.

Results

Whole population survey

Eight hundred and fifty-seven homes were visited, housing 5663 individuals. Two thousand, nine hundred and three were under the age of 15.

When examined at the medical centre, Gan, 692 were diagnosed as having asthma, 600 being less than 15 years old. There were 329 males, 363 females.

This gives a prevalence of asthma in the whole population of 12.2% and 20% in those under the age of 15.

The histogram (Fig. 1) shows the age distribution of asthma within the population studied, with the numbers of male and female asthmatics superimposed.

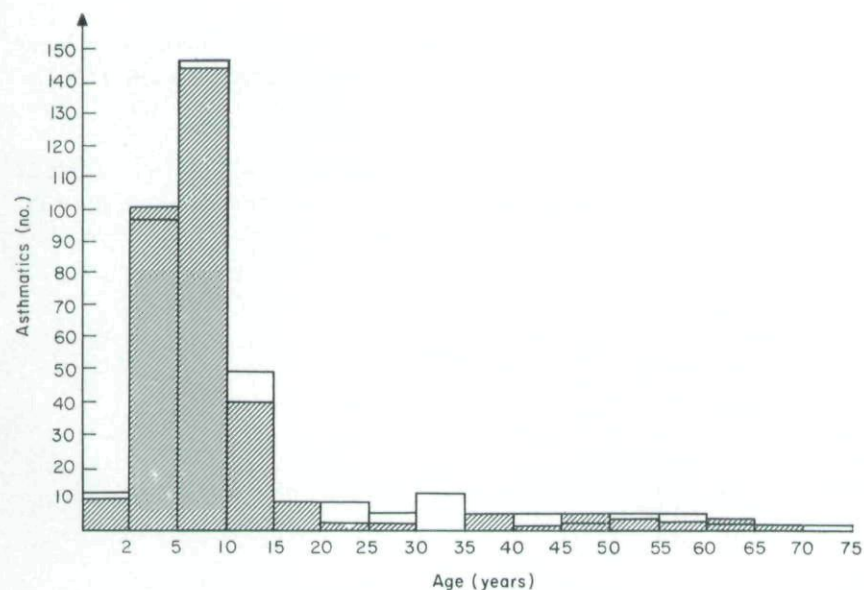


Fig. 1. Histogram showing incidence of asthma related to age and sex. Whole population survey of 5663 individuals. □, males; ▨, females.

Clinical studies on 137 asthmatics

Sixty-two of the 137 severe asthmatics (45.3%) were males. One hundred and thirty-five lived in single-storey houses built of coral pieces topped with corrugated iron roofs. Two lived in palm-thatch huts. Most patients slept on wooden-frame beds, only ten slept on floor-mats. Ninety-nine used Kapok as pillow stuffing, twenty-one a rubber compound, four fibres from coconut husks and two used feathers.

Water for drinking and household purposes is drawn from fresh water wells, each family having such a well in their house compound. A latrine area is to be found at the rear of the houses. Faecal contamination of the drinking water is common as there is no piped water system or satisfactory method of safe disposal of sewage. Such an arrangement accounts for the high incidence of diarrhoeal diseases and helminthic infection.

However, their style of housing and furnishing reflected a higher level of material comfort than was present in other atolls in the Maldives, with the exception of the capital Male, this being due to the large number of men in Addu Atoll who were employed by the RAF.

Ten were smokers, four using the European-type cigarette and six a local leaf in a hookah.

Frequency and severity of asthmatic symptoms

Eighty-six experienced asthmatic attacks at least every 2 weeks and thirty claimed that wheeze persisted for over 7 days once airways obstruction occurred.

Twenty-five had required hospitalisation and treatment with bronchodilators and steroids. However, only one was maintained on long-term Prednisolone. This was a woman of 60, age of onset of asthma being 39 years, having negative skin tests, apart from a positive response to *Ascaris*.

Family History

Sixty-four (46.7%) gave a family history of asthma with either a sibling or parent being similarly affected. The history was verified by interviewing the relative concerned.

Precipitating factors

Nocturnal asthma was particularly common occurring in 104 (75.9%) patients (Table 2).

Sixty (43.8%) claimed that during periods of rain their asthma was more severe

Table 2. Significant features in the history of 137 asthmatics

	Nos	%
Family history	64	46.7
Nocturnal asthma	104	75.9
U.R.T.I.	10	7.3
Rain	60	43.8
Dry	9	6.6
Cool	11	8.0
Hot	3	2.2

whereas many fewer claimed that cold, eleven (8.0%), dry, nine (6.6%) or hot, three (2.2%) weather was associated with exacerbation of asthmatic symptoms.

There was no objective evidence of seasonal variation in the incidence of asthma during the course of the investigation. However, the nocturnal asthma and subjective increase of asthmatic symptoms during rain might be the result of confinement to the home and hence increased exposure to house dust.

Ten (7.3%) claimed that upper respiratory tract infections were an aggravating factor.

Personal History of atopic disease

Only 2 (1.5%) showed evidence of atopic eczema whereas 28 (20.4%) had allergic rhinitis and/or conjunctivitis (Table 3).

Table 3. Associated atopic diseases in 137 asthmatics

	Nos	%
Eczema	2	1.5
Allergic rhinitis and or conjunctivitis	28	20.4

Other clinical investigations

Blood eosinophilia. Blood eosinophil counts were not used in the assessments of asthma as eosinophilia was common amongst apparently healthy people and the results were not consistently reproducible.

Radiographs. Sixty-six (48.2%) had chest radiographs. None showed changes suggestive of pulmonary eosinophilia.

Stool parasites. Stools were obtained from eighty-five asthmatics. Sixty-three (74.1%) contained ova from *Trichuris* and twenty-eight (32.9%) ova from *Ascaris*. Stools from 817 unselected outpatients were examined of which 561 (68.7%) contained *Trichuris* ova and 292 (35.7%) *Ascaris* ova (Table 4).

Skin tests. Eleven test solutions were used in testing fifty asthmatics and fifty controls. The results are shown (Fig. 2).

There were no positive responses to mould or *Aspergillus fumigatus*.

One control subject showed a positive reaction to *A. fumigatus* but none of the control group produced a weal diameter > 3 mm with the two coral dusts, kapok, flock, mould or plantain.

Table 4. Stool parasites

	Nos	<i>Trichuris</i>	<i>Ascaris</i>
Unselected outpatients	817	68.7%	35.7%
Asthmatics	85	74.1%	32.9%

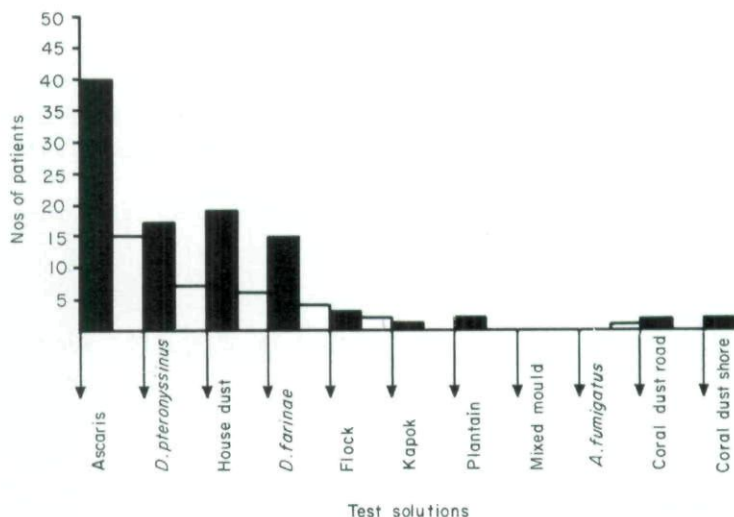


Fig. 2. Skin testing of fifty controls and fifty asthmatics showing asthmatics and controls with strong positive responses (i.e. > 3 mm weal) to test antigens. ■, asthmatics; □, controls.

Specific IgE titres. The IgE titres for six allergens, measured by the RAST technique, were obtained from forty-seven asthmatics. The results are expressed as number of times that of a normal serum run in the same assay (Fig. 3).

There was no evidence that the specific IgE titres to the house dust mite allergens were enhanced by potentiation caused by the *Ascaris*, the IgE scores for the mite allergens being unrelated to the magnitude of the *Ascaris* scores.

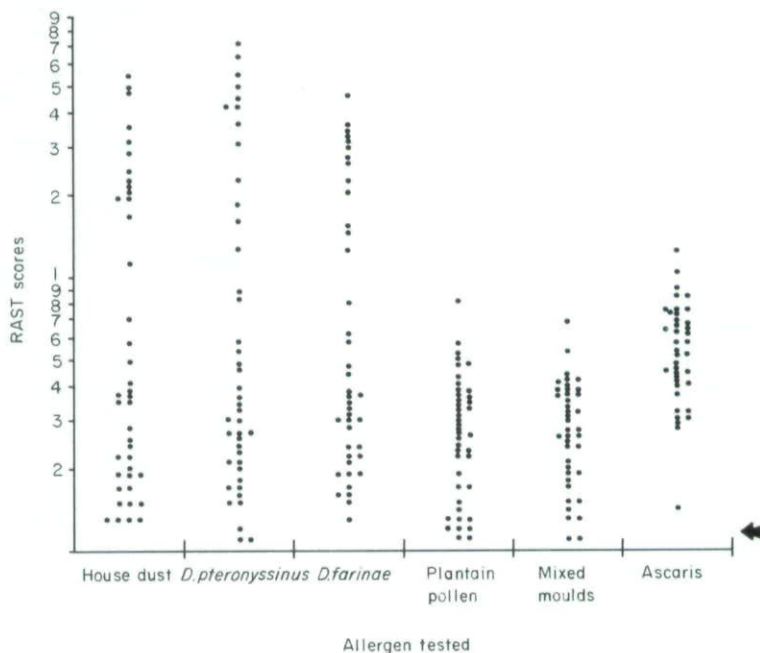


Fig. 3. Specific IgE titres for six allergens measured by the RAST technique.

Discussion

Bronchial asthma is a major cause of morbidity in Addu Atoll in the Maldives. The prevalence of asthma in tropical countries varies widely being uncommon in the Highlands of New Guinea (Anderson, 1974) but an important cause of hospital attendance in Kenya (Mitchell, 1970), Ghana (Anim & Edo, 1972), Zambia (Buchanan & Jones, 1972) and Nigeria (Warell *et al.*, 1975). In the Gambia where there is a marked discrepancy between the prevalence of asthma in rural communities and that in towns (Godfrey, 1975), it has been suggested that parasite-induced IgE in the rural areas prevents the development of atopic illness.

There did not appear to be any sex difference in the incidence of bronchial asthma in the Maldives under the age of 15. This is in contrast to the findings in Europe (Dawson *et al.*, 1969) and Australia where asthma is more commonly found in boys than girls. However, in Tanzania (Carswell *et al.*, 1977) boys have asthma less frequently than girls, the male/female ratio of asthma being 0.3/1. Certainly in the Maldives no explanation was obvious to account for the difference in sex ratio compared to Europe. However, a family history of bronchial asthma was found in 46.7% of patients, similar results occurring in England (Williams & Williams, 1949). A family history of atopic disease is much less common in Nigeria (Warell *et al.*, 1975).

Atopic eczema was unusual amongst the patients, this condition also being noted to be rare amongst asthmatics in Nigeria (Warell *et al.*, 1975) and Barbados (Pearson, 1973). This is probably related to the lack of cows' milk in the infant's diet.

Breast feeding did not appear to confer protection against the development of allergic rhinitis or conjunctivitis. However, the incidence of 20.4% for these conditions amongst the Maldivian asthmatics was less than that reported for similar patients in Nigeria (Warell *et al.*, 1975), Barbados (Pearson, 1973) or England (Pepys, 1973).

Cutaneous hypersensitivity amongst control groups in tropical countries (Dawson *et al.*, 1969) has been noted to be relatively common, the incidence tending to be higher than in Europe (Turner-Warwick, 1971). The Maldivian controls frequently showed cutaneous hypersensitivity to house dust derived allergens and *Ascaris*. This might be related to genetic factors or, particularly, in the case of *Ascaris* to prolonged and repeated exposure.

IgE titres amongst the patients were raised to a variety of allergens but were particularly high for house dust and house dust mites. There did not appear to be any relationship between scores for the house dust derived allergens and *ascaris*.

Therefore in the group of patients studied there was no evidence that intestinal infestation with *Ascaris* protects against the development of bronchial asthma. It is clear that asthma and helminthic infection can co-exist.

Although it might be postulated that the helminth infection could have potentiated the effects of exposure to house dust derived allergens, there was no evidence that this was the case.

A repetition of the clinical assessment with objective measurements such as peak expiratory flow or forced expiratory volume in the first second, together with repeat IgE titres after helminthic dis-infestation would prove useful.

Therefore at present the high incidence of bronchial asthma in the southern Maldives would not appear to be related to *Ascaris* infection but possibly due to either a genetic predisposition or an unidentified source of allergen in addition to house dust mite.

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