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RESPIRATORY ALLERGY IN THE COASTAL AREAS OF SOUTH AFRICA

THE CLIMATE FACTORS IN RELATION TO HOUSE-DUST SENSITIVITY *

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Summary of Parts I and II

Numerous sufferers from perennial respiratory allergy have been studied in Johannesburg and in various coastal towns of the Union of South Africa who maintain good allergic health inland but who develop more or less severe respiratory symptoms at the coast. The case-histories are given of a number of these sufferers, who are referred to as the 'Climate group' of respiratory allergy patients.

Evidence is advanced eliminating pollens, atmospheric fungi and other exogenous allergens as aetiological factors.

It is suggested that the precipitation of symptoms at the coast is due to climate, in particular the combination of high temperature and high relative humidity.

Charts are presented of the 'climate patterns' of inland and coastal towns of South Africa in which are contrasted the characteristically wide diurnal and annual range inland of temperature and relative humidity and the narrow diurnal and annual range at the coast.

The problem for consideration is now whether the aggravating symptomatic effect of the coastal climate on this group of sufferers is due to physiological changes resulting from the climate. Such changes for example in the endocrine pattern of the patient may result in possibly greater susceptibility to sensitization. There is however reason to think that the climate factors mentioned do not themselves directly precipitate symptoms. In this group of sufferers there are many who declare that on board ship they enjoy freedom from respiratory symptoms. It will be remembered that the voyage from Cape Town northwards to Europe or America entails passage through equatorial waters for many days when both temperature and humidity are as high as and even higher at certain seasons of the year than in the coastal cities of South Africa. Psychological factors associ-

ated with a voyage abroad might of course counter adverse physiological influences. Another argument against the purely physiological effect of heat and humidity in provoking respiratory symptoms derives from evidence from the deep mines of Witwatersrand goldfields in Johannesburg and neighbourhood. In these mines, 5,000-10,000 feet deep, the temperature increases with depth. In many of these mines the humidity is high because of the large quantities of water used for dust control and other purposes (dust of course refers to fine siliceous material from rock breaking). Miners may thus be at work underground for 8 or more hours daily in a climate of higher temperature and relative humidity than obtains in any of the coastal towns. Our studies of respiratory allergy in these miners has so far brought no evidence of exacerbation of respiratory symptoms underground. Further work however in this connection is being carried out. The obvious alternative suggestion to the idea that climate affects the patient physiologically is that high temperature and high relative humidity render potential sensitizing substances more highly allergenic. The results of our investigations of this aspect of the matter are reported below.

Maunsell³ studying the occurrence of asthma in Britain put forward the hypothesis that in houses built on damp soil, fungi found favourable conditions to break down the fibres of animal and plant origin of the complex of house-dust antigen and that a greater quantity of dust antigen may thus be present per unit of house-dust. At the same time Harsh⁴ discussing the relationship between humidity and house-dust sensitivity was of opinion that the chief reason for the greater incidence of respiratory allergy in a humid climate is not the climate *per se* but that the humidity rendered house-dust and possibly certain other inhalants more allergenic by favouring the action of micro-organisms on certain constituents of the dust.

As indicated previously⁵ no confirmation was obtained that air-borne fungi were allergenically important in climate asthma although admittedly there was an increased growth

* This is Part III of a paper¹ presented at the Second International Congress of Allergology at Rio de Janeiro in November 1955 and is reproduced here (with the consent of the publishers of the *International Archives of Allergy and Applied Immunology*) because it represents the author's work and conclusions since the publication of his paper on this subject in the *South African Medical Journal*.²

of such fungi in the warm humid coastal regions, more especially on the east coast of the Union of South Africa.

The possibility that house dust was in fact rendered more allergenically potent by climate factors through the agency of fungal or bacterial growth remained to be considered. It was therefore decided to make a systematic comparative study of house dust collected at the coast and house dust collected inland. Chemical and electrophoretic investigations are being carried out on these dusts, the extracts of which were used in the skin-testing of respiratory allergy sufferers.

The first experiments were done with extracts in Coca's fluid of coastal dust obtained from Durban, and inland dust from Johannesburg. Identical weight-volume mixtures were extracted for 24 hours at room temperature, filtered through paper filters, and then submitted to Seitz filtration and sterility control tests. In addition to the original extracts, which were regarded as of full strength (1/1), dilutions of 1/1000, 1/100, 1/10 of this strength were also prepared for use in skin testing.

The allergic potency of these extracts was determined by the method of Rimington and Maunsell⁶ for estimating the 'threshold concentration' for each dust extract. The patient's skin was titrated by intradermal injection of 0.02 ml. of the above serial dilutions, the end-point being the dilution which just gave a definitely positive reaction. Skin tests with dilution of extracts of inland and coastal house-dust extracts all carried out at the same session were performed on 123 allergic patients. The results of these tests are shown in Table 1. It will be observed that in 90 patients there was no

TABLE 1. COMPARATIVE 'THRESHOLD CONCENTRATION' OF INLAND AND COASTAL HOUSE DUST EXTRACTS

Number of Patients	Highest Dilutions of House-dust Extracts to which Patients Reacted by Skin Tests									
	Inland					Coastal				
	1/1	1/10	1/50	1/100	1/1000	1/1	1/10	1/50	1/100	1/1000
22 21 35 12 } 90						+				
7 1 1 } 9	+	+				+	+			
5 1 } 6		+				+	+			
1 1 1 1 } 4			+					+		+
2 1 } 3					+				+	+
6 4 } 10	+	+							Negative	Negative
1 1 } 1		+				+				

reaction to inland house-dust extract even at the highest concentration used. Of these more than half reacted to 1/50 or higher dilution of the coastal house-dust extract and the remainder to a 1/10 or lower dilution. In 22 patients where the reaction was positive to both inland and coastal house-dust extracts the reaction to the latter was obtained with somewhat higher dilutions. Eleven patients were found sensitive to inland house dust alone. The explanation for this is as yet not clear.

The above findings, which indicate that Durban house dust is more highly allergenic than the house dust from Johannesburg, should be given due weight in assessing the merit of explanations regarding the aggravation of symptoms at the coast. Much, however, remains to be done, not only to confirm these findings with further groups of patients, but also with the use of house-dust extracts and their purified antigens from other coastal and inland towns.

In view of the evidence so far obtained of the higher allergenicity of coastal house dust an investigation is in progress to discover whether the 'Climate group' respiratory allergy patients whose symptoms are aggravated when they visit the coast can be effectively desensitized with coastal house-dust extract to permit their future enjoyment of symptom-free coastal visits. The marked benefit accruing to the small number of patients so far desensitized in this way has been encouraging.

SUMMARY

The question is considered whether climate acts physiologically *per se* in the climate respiratory allergy sufferers or whether the combination of high temperature and high relative humidity renders potential sensitizing substances, such as house dust, more highly allergenic to allergic subjects.

The allergenic potency of house dust collected at the coast has been compared with that collected inland by the 'threshold concentration' skin-testing method carried out on allergic patients.

Coastal house dust is shown to be more highly allergenic than inland house dust.

Further work in connection with these investigations is outlined. There are indications that patients of the climate respiratory allergy group are benefited by desensitization with extracts of coastal house dust.

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