

SWEAT ELECTROLYTES IN ALLERGIC CHILDREN

Eula Faye Perry, M.D., and Roland B. Scott, M.D., Washington, D. C.

SWEAT electrolyte determinations were found to be useful in the diagnosis of cystic fibrosis of the pancreas by Darling and co-workers¹ in 1953. Their results were confirmed by other investigators. Within the last few years, there has arisen some interest in the possible association of allergy with cystic fibrosis of the pancreas and, accordingly, attempts have been made to determine if sweat electrolyte levels are elevated in the allergic patient. Conflicting reports have appeared on this point. The purpose of this report is to present our data on the concentration of electrolyte (chloride) in the sweat of allergic children.

PATIENT MATERIAL

Fifty-five patients with allergic conditions were tested. Among this group were 41 asthmatics, 12 patients with allergic skin conditions, and 2 with allergic rhinitis.

A control group consisted of 70 patients who were believed to be free from any condition that would cause an elevation of sweat electrolytes. The majority were apparently normal children and the remaining ones had been hospitalized for treatment of fractures, circumcisions, tonsillectomies, and hernioplasties.

PROCEDURE

The procedure of Gibson and Cooke,² utilizing pilocarpine by iontophoresis, was used for performing the tests. The sweat was collected on 3 by 3 inch squares of cotton gauze. Four milliliters of a 0.10 per cent pilocarpine nitrate solution was iontophoresed with a current of 4 Ma. for 15 minutes. The collection periods varied from 30 to 60 minutes.

The tests for chloride on the samples were performed according to the method of Schales and Schales.³ The principle involved titrating the sample with standard mercuric nitrate solution at the proper acidity in the presence of diphenylcarbazone as indicator. Chloride present reacted with the added mercuric ions to form soluble but undissociated mercuric chloride. An excess of mercuric ions gave an end-point of a purple hue.

From the Department of Pediatrics, Howard University College of Medicine, the Pediatric Service of Freedman's Hospital, and the Pediatric Allergy Clinic of the District of Columbia General Hospital, Washington, D. C.

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RESULTS

The results are summarized in Table I. The upper limit of normal for chloride in sweat was set at 80 mEq. per liter for this study.

TABLE I. RESULTS OF SWEAT TESTS IN ALLERGIC PATIENTS AND CONTROLS

	SUBJECTS (NUMBER)	MEAN SWEAT CHLORIDE (MEQ./L.)	MEDIAN SWEAT CHLORIDE (MEQ./L.)
Controls	70	35.26	34
Allergic patients	55	46.07	35

For further analysis of the data the subjects were divided into three age groups as shown in Table II. There was a slight trend toward increase in sweat chloride with advancing age among the allergic patients. This, however, was not true with the controls.

TABLE II. COMPARISON OF SWEAT CHLORIDE IN ALLERGIC PATIENTS AND CONTROLS BY AGE

CATEGORY	NO.	AGE (YR.)	MEAN SWEAT CHLORIDE (MEQ./L.)
Allergic patients			
I	16	under 6	43.0
II	18	6-12	46.5
III	21	over 12	48.0
Controls			
I	32	under 6	39.8
II	25	6-12	35.0
III	13	over 12	24.2

Another interesting observation was the fact that in both categories of patients, that is, allergic and controls, the females tended to have higher values in at least two out of three age divisions.

DISCUSSION

In 1958, Hsia and co-workers⁴ reported finding an increase in sodium and chloride in the sweat of patients with allergies. Using the conventional sweat test, they found that sweat sodium was 45.4 ± 4.2 mEq. per liter among 32 allergic patients, as compared with a value of 21.7 ± 1.9 mEq. per liter for 83 normal controls. Likewise, the sweat chloride was 38.6 ± 3.3 mEq. per liter in 31 allergic patients, as compared with a value of 19.5 ± 1.3 mEq. per liter for 83 normal controls. These investigators stated that the sweat electrolyte abnormalities were unrelated to age, sex, race, type of allergy, or medication used by the patient.

Subsequent investigators^{5, 6} have not been able to confirm the significant difference in sweat electrolytes between allergic and normal individuals, as reported by Hsia and his colleagues. In Table III, the results of 4 different studies are listed.

Although no acceptable physiologic explanation for the pathologic elevation of electrolytes in sweat has been given up to the present time, nevertheless, there are numerous factors that influence the chloride content of sweat.⁷ It is possible to increase the chloride by increasing the skin temperature. The salt

TABLE III. COMPARISON OF RESULTS FROM FOUR DIFFERENT STUDIES ON SWEAT CHLORIDE (MEQ./L.)

INVESTIGATOR	CONTROLS			ALLERGIC PATIENTS		
	NO.	MEAN	MEDIAN	NO.	MEAN	MEDIAN
1. Hsia et al.	83	19.5	—	31	38.6	—
2. Kulezycki et al.	39	21.6	—	31	19.8	—
3. Van Metre et al.	64	23	18	47	18	14
4. Our study	70	35	34	55	46	35

content in sweat is greater in winter than in summer. When sweating occurs, the rate and duration influence the salt content. Other factors are diet, presence of fever, dehydration, state of renal and adrenal function, and malnutrition.

In a study by Johnson and associates,⁸ it was found that the three primary factors concerned with the concentration of chloride in sweat are: (1) skin temperature, (2) rectal temperature and rate of sweating, and (3) individual idiosyncrasies.

Gochberg and Cooke⁹ suggest that the abnormality in sweat in cystic fibrosis of the pancreas may result from an alteration in the quantity of energy available for secretion. Thus, when readily available energy is limited, there may be a rise in concentration of solute.

SUMMARY

The concentration of chloride in the sweat of allergic children was compared with the concentration of this electrolyte in 70 normal children who were used as controls. The mean concentrations of chloride in the experimental and control groups were both within the normal physiologic range, and no significant differences were found. An unexplained variation in concentration of sweat chloride was observed in male and female children at different age periods.

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