

ORIGINAL ARTICLE

**Sweat Sodium and Chloride
Contents in 8-14 Years Old Children
(A Preliminary Study)**

by

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Abstract

A modified Shwachman sweat test was performed on 152 children aged between 8-14 years old, consisting of 54 girls (35.5%) and 98 boys (64%), to look for sweat electrolyte values. Mean sweat electrolyte contents in boys was higher than in girls. The mean sweat Na⁺ and Cl⁻ were 50.15 ± 25.83 mEq/L and 43.76 mEq/l ± 24.67 respectively. The sweat electrolyte contents were not influenced by age.

Introduction

Sweat test is a measurement of sweat Sodium (Na^+) and Chloride (Cl^-) contents in human sweat, either qualitatively or quantitatively. It is the major diagnostic effort to establish the diagnosis of Cystic Fibrosis (CF) considering that more than 99% CF cases will demonstrate an increase of sweat electrolyte content 3-5 times above the normal value. For this reason, it is very important to know the normal values of sweat electrolyte contents [1,2].

CF remains a life limiting disease. Most of the patients died in the first year of life and many were even not detected. Fatal cases, frequently died from meconium ileus and progressive pulmonary problems, and lack of diagnostic equipment gives different incidence figures in many countries. Di Sant Agnese et al. (1967) pointed out that migration of Caucasian people to Asia will soon alter the incidence of CF in Asia [3]. Although most of CF cases reported were from Europe and America, Handoyo et al. (1980) reported a case of an Indonesian Chinese

girl and Karjoo (1980) found 3 cases in Iran [4,5].

Some factors influence the sweat electrolyte contents, but different results are mainly because of the different sweat test method and laboratory analysis used [6,7].

There are 5 methods of sweat test available, and each method may be used to establish the diagnosis of CF. The best one is the iontophoresis method, unfortunately nowadays it is not available in Indonesia.

Of all methods available, the most feasible one done in Cipto Mangunkusumo Hospital is the Shwachman method, with some modifications in collecting and measuring the sweat samples [8].

As far as the authors know, there is no data about the standard sweat test as well as sweat electrolyte study in children reported in Indonesia. In this study, we attempted to find out the value of sweat electrolyte contents in 8-14 years old children, applying a modified Shwachman sweat test method.

Materials and Methods

During a six-month-period (May 1 - October 31, 1989) 152 sweat tests were performed on 152 children of 8-14 years old who were visiting the Pediatric Out-patient Clinic Dept. of Child Health, Medical School University of Indonesia-Cipto Mangunkusumo Hospital (IKA FKUI-RSCM).

All children were (1) not suffering from CF disease nor showing an indication for sweat testing; (2) clinically there were no other factors that could influence the result; (3) in good or fairly good nutritional state.

Clarification of these criteria were confirmed by anamnesis and detailed

physical examination.

Materials were subjects to Shwachman (plastic bag) sweat test with some modifications in sweat sample collection and laboratory analysis. The sweat Na^+ content was determined by flame photometry, and the Cl^- by chloridometry.

Data were processed either by computer or manually. Statistic analysis includes means, standard deviation, 95% confidence interval and correlation analysis to look for correlation between age and sweat electrolyte contents.

Before conducting the test, all parents or close relative were asked to give their informed consent.

Results

During this study period there were 163 children with the ages ranging between 8-15 years old. Based on the study criteria one hundred and fifty two children, consisting of 54 girls (35.5%) and 98 boys (64.5%), were included in this study. Those whose sweat could only be collected in small amounts were excluded from this study.

While tests were conducted, all children should in a good condition. Room temperature was managed between 28-34°C and air humidity 65-74%. Sweat samples were directly delivered to the Dept. of Clinical Pathology for further laboratory analysis (double measure).

The mean sweat Na^+ in girls was 47.37 \pm 25.46 mEq/l with a 95% confidence interval of 40.58-54.16 mEq/l. Results in boys were higher, i.e. 51.68 26.03 mEq/l with a 95% confidence interval of 46.53-56.83 mEq/l. The mean sweat Cl^- in girls was 41.31 23.93 mEq/l and the 95% confidence interval 34.39-47.69 mEq/l,

while in boys it was 45.11 25.09 mEq/l and the 95% confidence interval 40.14-50.08 mEq/l (Table I).

Most of the subjects were children of 8 years old, with a mean sweat Na^+ of 43.81 24.77 mEq/l and a 95% CI of 37.26-50.35 mEq/l; the mean Cl^- was 36.96 22.52 mEq/l and the 95% CI 31.00-42.91 mEq/l. The smallest group were children of 13 years old with a mean sweat Na^+ of 71.33 39.95 and Cl^- 13.63 39.95 mEq/l; 95% CI was not counted (samples were too small).

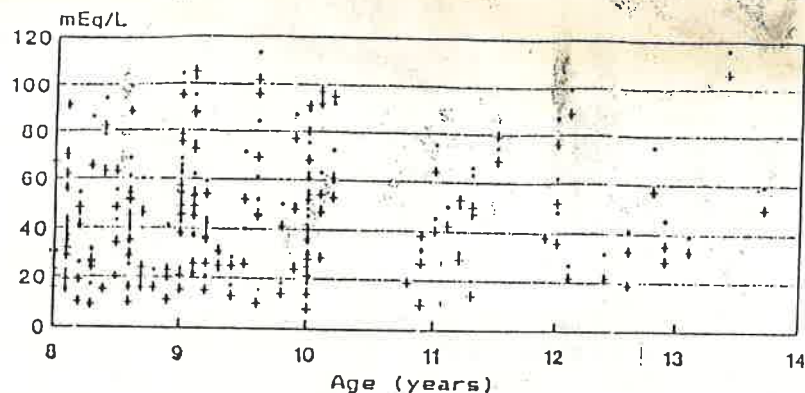
The results also revealed that by doing the scattered diagram we might say that there was no correlation between the age and the sweat electrolyte contents (Figure 1).

Of all 152 measurements, the mean sweat Na^+ was 50.15 25.82 mEq/l (range) 9-116 mEq/l and the 95% CI 46.04-54.26 mEq/l. The mean sweat Cl^- was 43.76 24.67 mEq/l (range 8-105 mEq/l) and the 95% CI 39.84-47.68 mEq/l.

Table I. Mean sweat Na^+ and Cl^- by sex

Sex	n	Na ⁺ (mEq/l)		Cl ⁻ (mEq/l)	
		Mean (SD)	95% CI	Mean (SD)	95% CI
Girls	54	47.37 (25.36)	40.58-54.16	41.31 (23.93)	34.39-47.69
Boys	98	51.68 (26.03)	46.53-56.83	45.11 (25.09)	40.14-50.08

SD = Standard deviation 95% CI = 95% confidence interval .PA



Natrium + Chlorida

Figure 1 : Scattered diagram of electrolyte contents by age

Discussion

Many factors may influence the sweat electrolytes, but the most important ones are the sample collection, the sweat test method and the method of laboratory analysis used [7]. In this study, apart from those three factors, confounding factors were excluded by the study design. Some authors had proved that air temperature and climate are not related with sweat test results [9,10]. Shwachman (1962) pointed out that a daily sodium intake of 1-5 g/day will not influence the result assuming that normal daily sodium intake in children was 1-3 g/day [11], we may expect that this study was not influenced by daily sodium intake.

By conducting different methods, we may come to various results though most studies also reported the same normal range [Peterson et al., 1959; Sibinga and Barbero, 1961].

Compared to the study by Anderson and Freeman (1960), the mean sweat electrolytes in the same age group were

higher in this study [10]. This difference might be due to the different sweat test method used, though the results were in accordance with some investigations.

Lobeck and Heubner (1962) reported that mean sweat Na^+ in children under 11 years old was 20 mEq/l and Kendrick (1962) found 27 mEq/l in children under 14 years old [13,14].

The higher mean sweat electrolytes in boys in this study might be due to different sample size in both sexes. Sweat electrolytes in men may be higher than in women, because of different perspiration rate, but Anderson and Freeman (1960), Sibinga and Barbero (1961), Lobeck and Heubner (1962) stated that sweat electrolytes in children were not influenced by perspiration rate nor by sex [10,12,13]. Of all 152 measurements, the mean sweat electrolytes values were close to the 95% CI and we may say that they do not differ from the estimated values of the sample populations.

Conclusion

1. Mean sweat Na^+ of 152 children of 8-14 years old was 50.15 25.83 mEq/l and Cl^- 43.76 24.67 mEq/l.
2. Modified Swachman sweat test was easy to perform and provides a fairly good and accurate result.
3. Sweat electrolytes in boys were higher than girls.
4. There was no correlation between the age and sweat electrolyte contents.

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