Water Consumption by Children in Relation to Temperature and Humidity and the Relation to Fluoridization of Water Supplies.

By
Margaret Matuschak Levin, B.S. in Chem. and Gerald J. Cox,Ph.D.

Notes for the speech given at the meeting of the International Association for Dental Research, Pittsburgh Section held in Lecture Room No. 2, Old Mellon Institute at 7:30 P.M. Tuesday December 6, 1949.

Some time before the birth of my daughter Paula on May 13, 1949 Dr. Cox and I discussed the feasibility of measuring the water intake of children but only that water taken as drinking water. Such data could be used in fluoridization of water supplies to furnish constant fluorine all year round. So with the co-operation of the Magee Hospital nurses (who kept records for the 1st five days) we have obtained drinking water values for Paula for all but 7 of her 207 days.

PICTURES:

Along with Paula who is on the left I have collected data for James, age 27 months (next slide) - Ruth aged 6 years and Carol 8 years and incidently myself. However there are less values for the three older children mainly because they are harder to nail down. Especially are there fewer for the 6 and 8 year olds as there was a 3 week summer vacation away from home and difficulty in obtaining values from drinking from school fountains.
The children themselves are quite cooperative, asking, "Are we measuring today?" in the two oldest and in the case of the 2 year asking for a drink from the water bottle rather than the tap. Also the 8 year old decided she didn't like standing water so she carefully measured some, poured it into the sink and drew the same amount from the tap to drink.

With Paula I have tried to force her to drink water to see if the daily value in the infant depends on how often she is offered a bottle but she sometimes refuses it and if she's really hungry she won't take the water after the first taste. Paula was breast fed for 3 months with supplimentary feeding of formula after 1 week. We have not included the water in the formula as it is considered food.

The data for Paula seems to be more valuable because variable other than climate which influences the amount of water drunk are minimized in the infant. Among these are (1) Clothing (2) Activity (3) Food with respect to Quantity and Quality and (4) as Dr. Cox suggests Social Drinking such as soft drinks, companionate drinking or - especially at the beginning of the study - vieing for precedence as to "How much water did you drink? - I emptied my bottle". However there is one factor which is probably more significant in the infant then in the older children - that is fatigue - if she takes a trip to Grandmas and does a lot of adult visiting - does she take less water next day because she spends most of her time between meals sleeping.

DATA:

Here we have the data as recalculated by Dr. Cox. The temp. chosen arbitrarily are between 56 and 80 degrees or 14 degrees above and below 70. The data is listed by ages and calculated on the oz. of water per 10 pounds body weight. We can see there is an increase in water consumption with increase in temp.

Also you can notice that the smallest subject has the greatest body surface per weight therefore requires more water.

CURVES:

Here we have the values plotted temperature against oz. of water per 10 pounds body weight. For Paula - age 0 days - Time 152 days. Observations 139. The small numbers are the no. of observations at a given temperature.

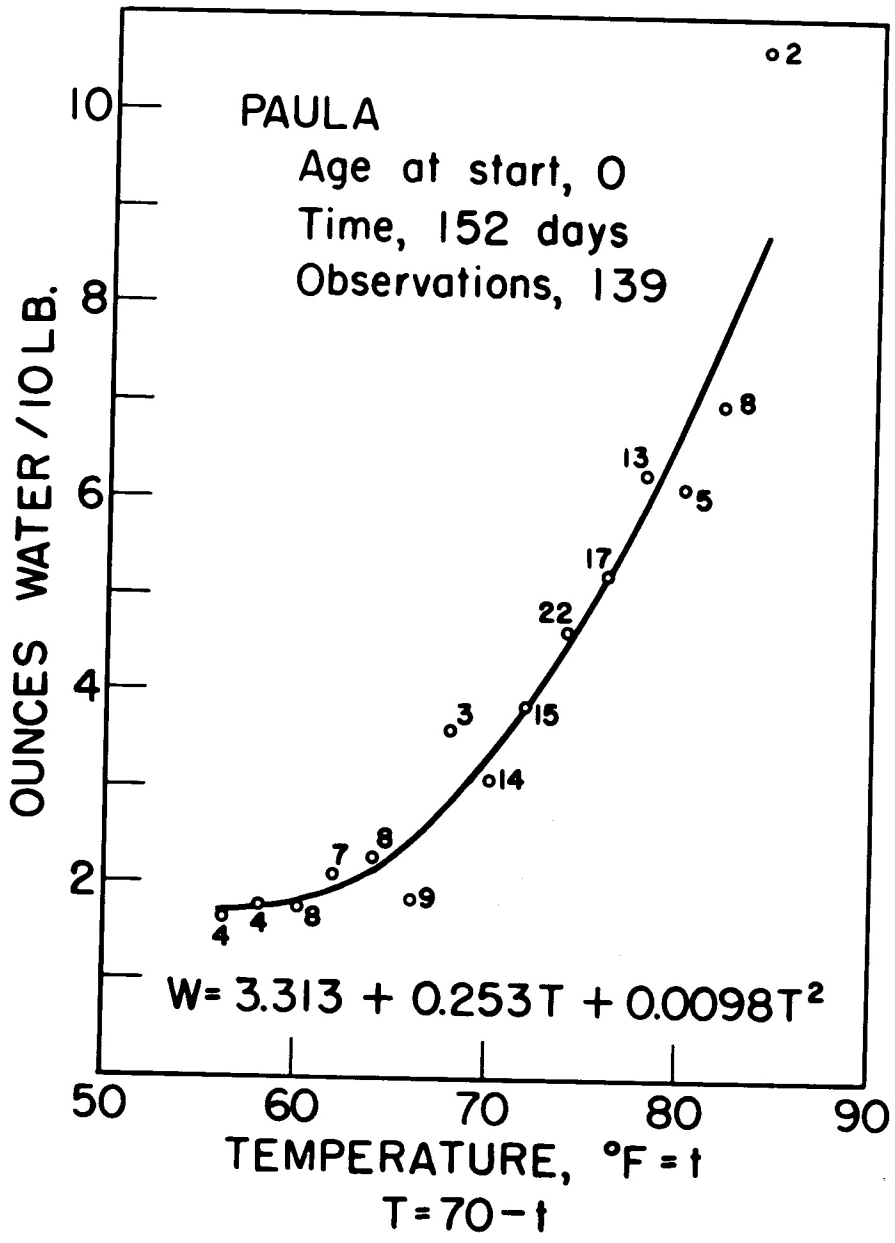
For James age at start 21-1/2 months. Time 137 days. Observations 56. Margaret age 33 observations 60. And a composite of the three curves indicates a crossing at slightly higher than 70°

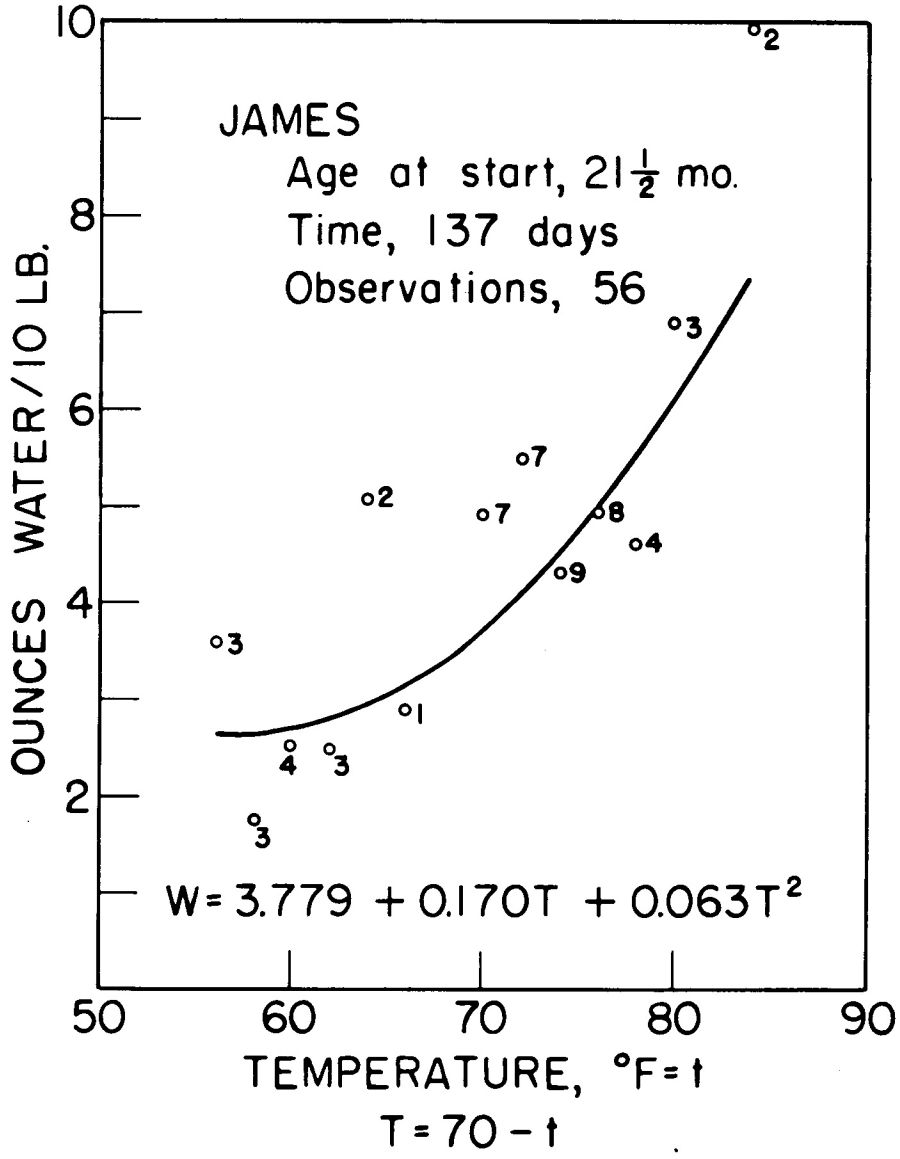
Dr. Cox would you like to tell about the calculus of the equations?

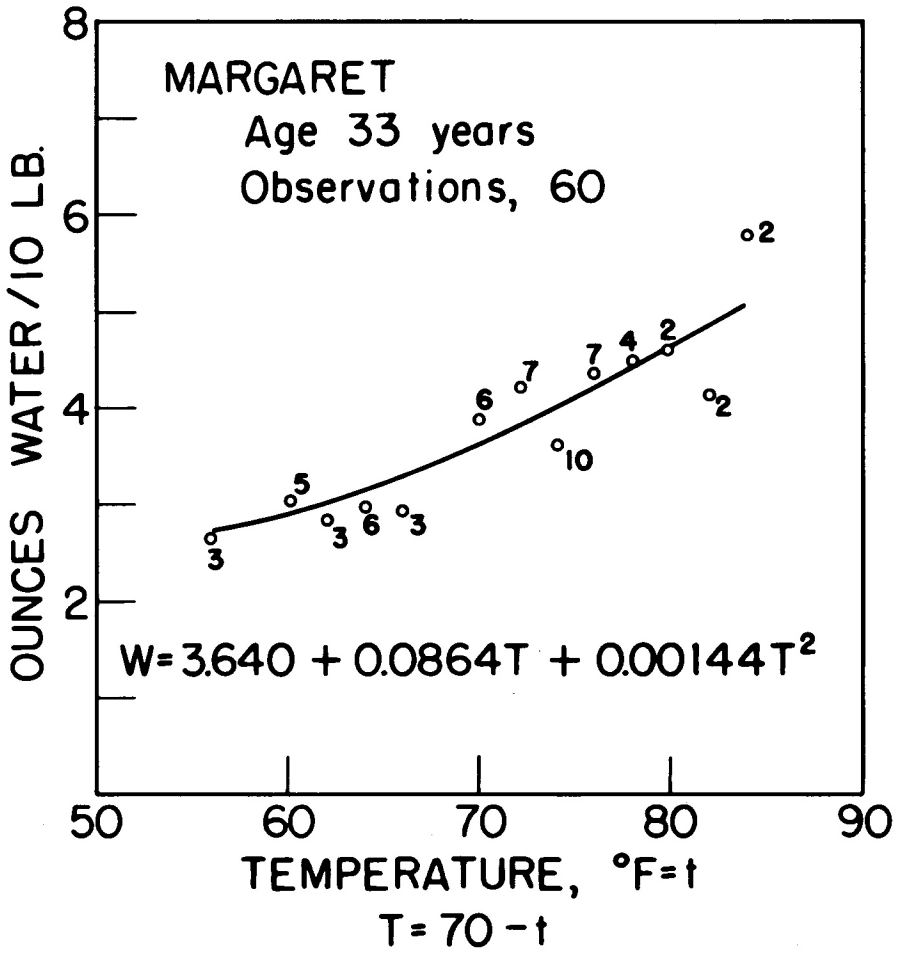
We are about 8 miles as the plane flies from the airport so weather bureau values were used for temperature. We correlated the data with the mean temperature which is the average of the High and Low temperature each day. Other possibilities of correlating the data and using the maximum temperature or the temperature at 1:30 which is one of the times the Humidity is recorded. However, starting with October 1949 the weather bureau began using a new form which does not record humidity. Also the effective temperature might be used - this being a T - H band or comfort band outside of which one becomes uncomfortable and does something about it like taking a drink of water.

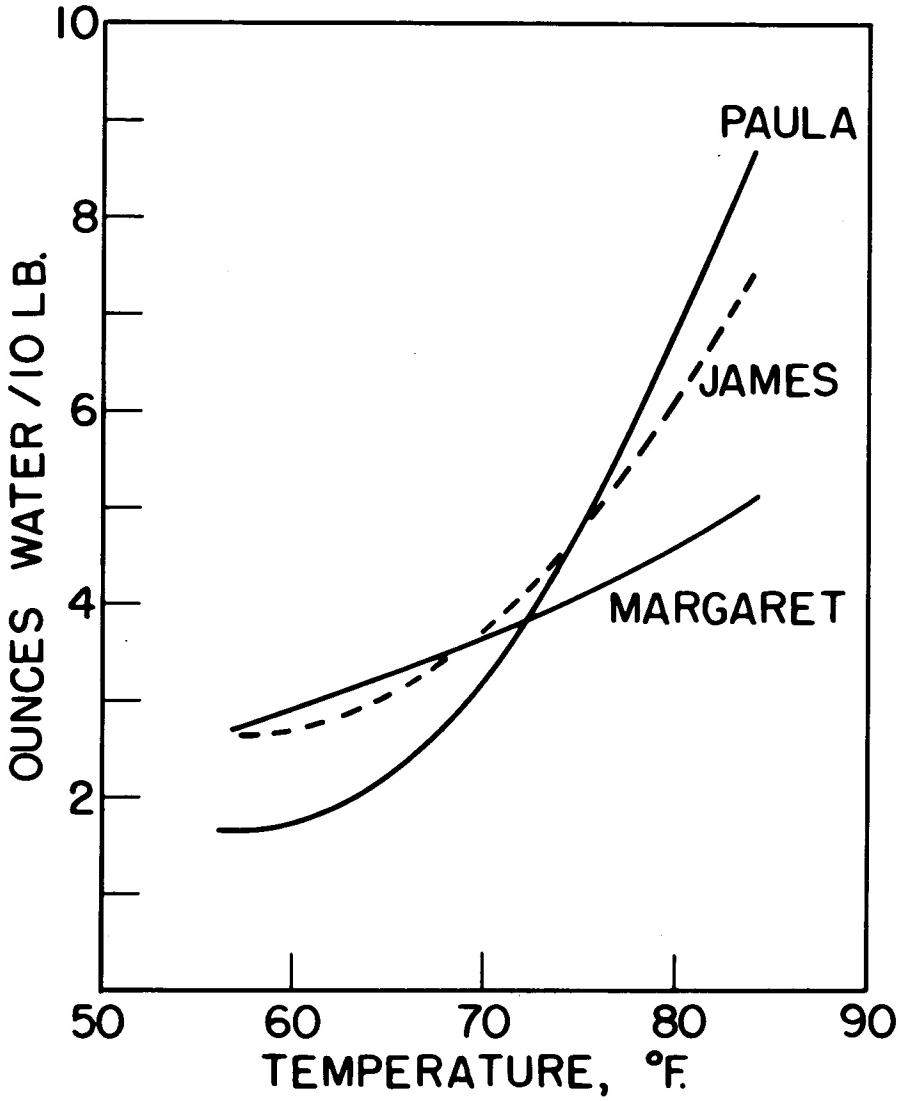
These data are definitely only exploratory but it is indicated that values for pre-school age are more valuable as by the age

of 6 the 6 year molars which decay frequently have erupted and the central incisors are pretty well developed and escape mottling with excess Fluorine. These observations should be expanded to about 25 or more families of about 3 pre-school children and residing near weather stations in all parts of the U.S.A.


PAULA
Age at start, 0
Time, 152 days
Observations, 139
W= 3.313 + 0.253T + 0.0098T²
OUNCES WATER / 10 LB.
10
8
6
4
2
50
60
70
80
90
TEMPERATURE, °F = t
T = 70 − t


JAMES
Age at start, 21½ mo.
Time, 137 days
Observations, 56
W = 3.779 + 0.170T + 0.063T²
OUNCES WATER/10 LB.
TEMPERATURE, °F = t
T = 70 − t
10
8
6
4
2
50
60
70
80
90


MARGARET
Age 33 years
Observations, 60
W= 3.640 + 0.0864T + 0.00144T²
OUNCES WATER/10 LB.
8
6
4
2
50
60
70
80
90
TEMPERATURE, °F=t
T= 70 − t


10
8
6
4
2
OUNCES WATER / 10 LB.
PAULA
JAMES
MARGARET
50
60
70
80
90
TEMPERATURE, °F.

WATER CONSUMPTION IN RELATION TO ENVIRONMENTAL TEMPERATURE AND ITS SIGNIFICANCE IN THE FLUORIDIZATION OF WATER SUPPLIES

BY

Margaret Matuschak Levin*, and
Gerald J. Cox, The School of Dentistry,
University of Pittsburgh, Pittsburgh, Pa.

The amount of water drunk by two children and one adult was measured in relation to the mean daily temperature. The objective was to establish a basis for the seasonal variation of the fluoridization of community water supplies pending determination of the optimum amount of fluorine for the formation of caries-resistant teeth with a minimum of mottled enamel. For the first 152 days of life for a girl, 139 observations were obtained beginning with birth on May 13, 1949. The data are summarized by the interpolation equation,

$$W = 3.313 + 0.253T + 0.0098T^2$$

in which W = ounces of water per 10 pounds body weight and T = mean daily temperature measured from 70°F. in the range 56 to 84°F. Water consumption by a boy, age 21-1/2 months at the start from 56 observations is shown by

$$W = 3.779 + 0.170T + 0.0063T^2$$

The data for the mother of the above children, aged 33, for 60 observations are summarized by

$$W = 3.640 + 0.0864T + 0.00144T^2$$

* By invitation

UNIVERSITY OF PITTSBURGH
SCHOOL OF DENTISTRY
PITTSBURGH 13, PENNSYLVANIA

DEPARTMENT OF RESEARCH

December 7, 1949

Mrs. H. J. Levin
Belle Vernon
R.D.#1, Pa.

Dear Margaret:

Enclosed is a copy of your speech given in the December 6, meeting of the Pittsburgh Section of the International Association for Dental Research. You did a very thorough job of writing that speech as I learned to my amazement when I found that you had re-written it before going on.

In sending in an abstract of the speech to Dr. Sissman, copy enclosed, I have also sent along a copy as you have written it. Of course he will re-write it as he sees fit because his space is very limited.

There's really no reason why this material shouldn't be written up at once for publication and I will welcome all the pushing you can do to get me to write that up. On the other hand since you do so well at writing, I will invite you to come in at any time and I will supply you with the necessary literature or leads thereto for you to write it up yourself. This is not an attempt to evade my duty to write it up but more a plea to you to see that it gets done.

I haven't looked much into the journals, but I would suggest that this one probably would go into Pediatrics. I recall in that connection that Joe Volker objected to publication of my paper in the Journal of American Water Works Association in that I had hidden it from the dentists. I don't know where the paper would better go which deals with fluoridization of water than in the Water Works Journal; I don't know why an article dealing with pediatrics shouldn't go in to a pediatric journal.

You did a very fine job of presenting your paper and I was proud of you.

Yours,

Gerald J. Cox
Director of Dental Research

GJC:ajw
Encl: 1

SCHOOL OF DENTAL MEDICINE
PITTSBURGH, PA. 15213
U.S.A.

Thursday, January 27, 1972

DEPARTMENT OF RESEARCH

Dr. David R. Wallace
2929 Rather Road
Camp Hill, Pa. 17011

Dear Dave:

Quite a coincidence! After talking to you yesterday, several times about House Bill 1620 on mandatory fluoridation for Pennsylvania, at home was a newspaper clipping from Mrs. H.J. Levin, R.D. 4, Belle Vernon, Pa. 15012, Xerox copy enclosed.

Mrs. Levin, Margaret, worked with me in Mellon Institute in the '30's. When Paula Levin was born on May 13, 1949, Margaret measured her water consumption daily for the summer. On the hottest day, Paula consumed 5 times the amount as at the breakpoint, 73° F, her brother, James, 3 times and Margaret doubled her intake. So the body surface relative to body weight is important in loss of water.

It is my guess that water consumption by children, age 4, when the central incisors and the first molar teeth are being development, should be studied in tropical areas where mildly mottled enamel occurs. This would be to determine the amount of fluoride needed per day for best development of enamel.

Also, it is my guess that for Pennsylvania the fluoride of water should be at 2.5 p.p.m. in the winter and 1.0 p.p.m. in the summer. The current ruling that in the south the level should be 0.7 p.p.m. because of mean annual temperature. The children are in schools and homes in the winter at same temperatures as in the north and the temperature in February, which contributes to the mean annual temperature, does not seem to me to influence the amount of water that children drink in August.

Zeller is from Emmaus, where Prevention magazine is published and he repeats the false things that that magazine publishes.

Very truly yours,

Jerry

Gerald J. Cox, Ph.D.
Professor Emeritus of Biochemistry
and Dental Research

Copies to : Margaret Levin, Dr. Jay R. Wells, and Dr. W. Arthur George