

DIET AND TOOTH DECAY ARE RELATED

INTRODUCTION: Our present so-called "balanced diet" is inadequate, for teeth of our American children prove this, for

- a. 98% have teeth with decay or caries.
- b. Midshipmen's caries increased although their diet was superior nutritionally according to accepted standards.

WHAT IS WRONG? WHAT CAUSES THIS DECAY? DOES DIET CONTRIBUTE TO IT? IF SO, HOW?

HELD:

1. Tooth decay is one of many manifestations of a certain imbalance in nutrition.
2. Diet is a prime factor in causing, correcting and preventing this particular nutritional disturbance.
3. Bones and teeth (enamel) do not react alike to certain nutritional faults.

HISTORY:

I. DISCOVERIES:

A. Earliest discoveries:

1. Galen, 131-210 A. D. noted this, for
a. Held: disturbances in nutrition caused tooth decay.

B. Later nutritional factors discovered, for

1. Protein defined, for
 - a. Mulden, 1839, coined the word: "Protein"- meaning "first"
2. Calories defined.
3. Amino acid defined.
4. Vitamins defined.
 - a. Funk, 1900, coined the word, called it "vitamine",
 - x. From "vita" (essential to life) and "amine" belonging to class of nitrogenous substances called "amines"

- 1) Found could prevent and cure beriberi and rickets by a "something" in cod liver oil.
- 2) Experiments on rice polishings showed this.

C. Teeth and Bone relationship discovered:

1. Originally held the same (up to 1800), for
a. Claimed caries of teeth and bone the same.

2. Differentiated:

- a. Fox, 1800, differentiated, for
x. Held bones could be repaired by nature.
y. Teeth could not be repaired, had to be extracted.

- surface* {
- b. Miller, 1881, held decay externally caused, for
x. Enamel affected by food debris, for
1) Starches and sugars trapped in pits and fissures converted into lactic acid, for
a) Bacteria did this.

- c. Williams (J. Leon), held tooth decay due to environment:
"Clean teeth can not decay" for
x. Held enamel does not change once it is formed.

- intake* {
- d. Mrs. May Mellanby held tooth decay due to deficiency in "Vitamin D".

- e. Agnew (6) held tooth decay due to lack of phosphorous and "D".

- f. Price (8) held fat soluble activitors and phosphorous play dominant role in control of caries.

- g. Bunting (2), Boyd and Drain (9), held acid-base balance not a factor in dental disease.

II. DIET INADEQUACY.

A. Our present diet is inadequate, for

1. Average diet recommended for children shows this, for

- a. 83% of large group of children (1) on this diet had progressive tooth decay (caries), for

x. Diet consisted of:

- 1) 1 qt. milk
- 2) 1 egg
- 3) 1- 2 oz. butter
- 4) 1 - 2 pounds fruits and vegetables
- 5) Other foods

2. Milk and calcium not the controlling factors, for

- a. Good teeth found where no milk taken, for
 - x. Polynesians show this, for
 - 1) No milk in the diet excepting mother's milk.
 - y. Chinese orphan children show this (37)
- b. Long breast feeding does not insure development of good teeth, for
 - x. Hawaiian babies (18) shows this, for
 - 1) Almost universally breast fed for a year or much longer
 - 2) 95% of 64 babies had decayed teeth for 15 months.
 - y. Day and Sedwick (14) show this, for found
 - 1) Little difference in caries between breastfed and artificially fed babies, for
 - a) Complete statistics of 370 children showed this.
- z. Hess (13) showed this, for
 - 1) Each of four breastfed babies controlled had caries in both deciduous and permanent teeth.
 - 2) Diet of each of above included:
 - a) 1 pt. milk, butter, 3 eggs week, vegetables
 - b) 1 pt. milk, butter, 2 eggs daily, orange juice, no vegetables.
 - c) 1 pt. milk, butter, 2 eggs daily, no vegetables.
 - d) 1 qt. milk, 1 egg daily, few vegetables.
- c. Cows milk not the answer, for
 - x. Babies fed on it are 3 times as liable to rickets as breastfed.
 - 1) Cows milk has 3 times the calcium, 6 times the phosphorous of woman's milk.

3. Vitamins and phosphorous not the answer, for

- a. Honoroff (4) diet shows this, for
 - u. High in phosphorous (1.8 gm)
 - v. Rich in vitamins, for
 - 1) Supplemented base diet with cod liver oil, cream, malt extract and egg.
 - w. Low in calcium (.090 gm).
 - x. Result:
 - 1) 92.5% of children had active caries to unusual degree during the 2 yr. control.
 - a) Number of new cavities higher than average child under ordinary diet and hygiene, for
 - x) 37 of 40 children developed average of 3.6 new cavities per child.
- b. Mellanby (7) diet shows this, for
 - x. Shows Vit. D. not the determining factor, for
 - 1) Diet # 7, highest in "D" (12.9 times daily requirement) produced 4 times number of new cavities as Diet # 8 with only 1/3rd as much "D".
 - 2) Diet # 6 and #8, with comparable amounts of "D" show this
 - a) Diet #6 has 5 times increase in caries as # 8.

- 3) Increase in cavities almost as high as average
American child for
a) American child increase in cavities, in six Mos...75
b) Mellanby " " " " .63

c. Hanke (1) shows this, for

x. Caries reduced 50% in child with low "D".

d. Day and Sedwick (14) show this, for

x. Gave 147 children 6000 A, 1400 D, for 1 yr. found
"no appreciable affect."

e. Mooseheart (1) experiments show this, for 3 yr. control does, for

x. Shows Vitamin C not a contributing factor, for

1) Orange- lemon juice proven not controlling factor, for

a) 16 oz. orange juice, plus 1 lemon daily (1 oz
is all that is necessary)

- plus 1 qt. milk, almost one egg, 1½ oz. butter,

- " other food, show this for

x) 33.7% of children had active caries.

y) 83.4% " " " - orange juice reduced

z) Less caries when no orange juice, than when
3 oz. (3 times requirement) taken.

f. Hawaii shows this, for

x. Shows Vit "D" not the controlling factor, for

1) Tooth decay almost universal and rampant amongst
islanders of laboring population, for

a) Teeth of their babies erupt defective with little
or not enamel.

2) Bone quality poor, for

a) Flat, broad, flexible chests of child show this.

b) Histologic studies of bone show this.

4.

3. Carbohydrates not controlling factor, for

a. Caries immunity found in diets low in carbohydrates, for

x. Boyd and Drain (9) show this.

b. Caries immunity found in diets excessive in carbohydrates, for

x. Original Polynesian diet shows this, for

1) 80% of calories were in form of sugar and starch, for

a) Taro, sweet potato and sugar cane, and taro
leaf tops principal foods. No milk.

y. Plantation negro diet shows this, for

1) Carbohydrates from corn, sweet potato, sugar cane and
sorghum. Little milk. Turnip tops used in large
quantities.

z. Chinese children (37) 74- 78% of diet in form of carbohydrates,

II. DIET DEFINITELY AFFECTS TEETH, for

A. Bones and teeth respond differently to diet, for

1. Experiments prove enamel and bone (including dentin and cementum)
respond differently, for

a. Enamel on dogs' teeth proved this, for

x. Jones (16) experiment 1920-1928 proved this, for

1) Enamel and bone responded differently, for

a) Alkaline excess diet shows this, for

x) Enamel showed this, for

(1) Enamel excellent, for

(a) Never had disintegration of
enamel (odontoclasia) on
highly alkaline diet.

(b) No caries seen in 300 dogs studied.

y) Bones, dentin and cementum showed this, for

(1) Retrograded, for

(a) Long bones and alveolar process re-
sorbed.

(b) Cementum, dentin showed this, for

(x) Roots of teeth resorbed leaving
only enamel in tact, for

((1)) Enamel caps, only, left
in one case.

((a)) Dentin as well as
entire root end miss-
ing.

((b)) Carnivorous animal
more susceptible to
metabolic disturbance
from alkaline diet
than man.

b) Alkaline, if neutralized, showed this, for

x) Enamel showed this, for

(a) Enamel disintegrated.

y) Bones, dentin, cementum showed this, for

(1) Conditions improved.

b. Experiments on babies and children proved this, for

x. Jones (4, 33) experiments 1929-1933, showed this, for

1) Enamel showed this, for

a) Excellent if good balance of excess alkaline
maintained, for

w) Old Hawaiian balance of alkaline and
acid foods showed this, for

(1) Enamel, bones excellent.

- x) Samoan alkaline diet showed this, for
 - (1) Enamel excellent.
- y) Microscopic study of autopsy showed this, for
 - (1) Hawaiian cases showed this, for
 - (a) Dentin found comparable to bone tissue, not necessarily like enamel.
 - (u) Case 1: Baby 5 days old showed this;
 - (v) Case 2: Dentin and bone good; enamel poor.
 - ((1)) Mother had acute nephritis.
 - (w) Case 3: dentine, bones abnormal; enamel excellent.
 - ((1)) Baby had 100 fractures.
 - (x) Case 4: dentin mass of loosely put together globules; bones poor; enamel good, well calcified.
 - ((1)) Baby had rickets.
 - (y) Case 5: dentine, bones relatively good; enamel completely disorganized.
 - ((1)) Baby died of starvation.
- z) Adult rickets showed this, for
 - (1) Retrograde changes in bone; no change in enamel.

C. Comparative Diets show this, for

1. Average American diet (37) show s this, for

- a. Tooth decay found in 98% of children, for
 - x. Diet neutral in reaction, for
 - 1) Bureau of Human Nutrition and Home Economics shows this,
 - a) Diet consists of
 - (1) milk
 - (2) meat
 - (3) eggs
 - (4) cereals
 - (5) potato
 - (6) citrus and other fruits
 - (7) mixed vegetables
 - (8) dried peas, beans, peanuts
 - (9) butter, 1 ard
 - (10) sugar, jam.
 - b) Diet produces 1.2 alkali excess (see chart in Appendix)

2. Southern Plantation negro (37) diet shows this, for

- a. Teeth excellent, for
 - x. Diet strongly alkaline in reaxtion, for

1). Consists, essentially, of

- a) Corn
- b) Turnip tops and other greens and vegetables
- c) Sweet potato
- d) Molasses
- e) Small amount meat, mostly pork
- f) Little, if any, milk or egg.

2) Diet calcium and vitamins found in

- a) Greens, molasses and sweet potato

3. Samoa diet (24- Ferguson) shows this, for

a. Teeth excellent, for

x. Diet strongly alkaline in reaction, for

1) Diet consists essentially of

- a) Taro, root and leaves
- b) Bananas, coconuts, breadfruit, papayas
- c) Sugar cane- chewed
- d) Luxuries: limes, oranges, fish, pig, chicken.
- e) no milk or egg.

y. Check of 1365 children showed this, for

1) 4.9% had a total of 85 carious teeth.

z. Parodontoclasia in 98% of adults.

4. Samoa-Hawaiian diet shows this, for

a. Change in diet shows this, for

x. Native (old custom) diet produced good teeth, for

1) Record of 22 children (18) 1 to 15 yrs. old showed this.

> a) Native food produced:

- x) 96.4% had excellent teeth
- y) 72.7% had no decay
- z) 22.7% had 1 or 2 small cavities.

b) Changed diet showed this (diet: rice, bread, refined sugar substituted)

x) 40% (8 out of 20) had no decayed teeth

(1) 12 (60%) had 89 decayed or extracted

2) Record of family of 8 (37) showed this, for

a) Only 1 carious tooth in all 8: 2 grandparents, four grown children, 2 grand children, for

x) Family ate native food only, cooked in native fashion (on hot rocks in pit dug out in ground)

- (1) taro roots
- (2) sweet potato
- (3) breadfruit
- (4) bananas, ~~apples~~ papayas
- (5) leaf package containing young taro leaf and grated coconut
- (6) 2½ feet sugar cane used for dessert.

5. Chinese diet showed this (McCollum, 22 quoting Wang)
 - a. Teeth of coolies excellent, for
 - x. Diet strongly alkaline in reaction, for
 - 1) Eggs, bean sprouts, blood, liberal quantities of leafy vegetables, some corn; sorghum syrup.
 - b. 96 Chinese boys' diet showed this.
 - c. "Millions of people in Asia learned the unique nutritive value of green plants which we in America have never learned to appreciate" (McCollum)
6. Japanese diet shows this (23- Marimoto)
 - a. Largest consumers of vegetables in world.
 - b. Effect of sweet potato, principal food in many sections, shows this
 - x. White rice a luxury, assoc. with wealth and office.
 - y. Sweet potato " poor man's" food.
 - c. When sweet potato substituted for rice
 - x. Better teeth produced, for
 - 1) Japanese babies born in Hawaii and taken to Japan sweet-potato-district shows this (37) for
 - a) Had no decay until returned to Hawaii
 - b) Brothers and sisters reared in Hawaii, with rice, had teeth full of decay.
7. Mooseheart (1) diet shows this, for
 - a. Tooth decay decreased as alkalinity of diet increased.
 - x. 83% of children had caries on 22 cc alkali excess in diet
 - y. 34% of children had caries on 55cc alkali excess in diet.
 - b. Too much alkali excess bad, for
 - x. Probably should not exceed 80 cc for 3200 calories diet (37)
 - 1) Findings in Samoa, Tristan da Cunha, show this
 - a) 98% adults in Samoa have paradontoclasia: (excellent teeth but they loosen and fall out)
 - x) diet is 1 34 cc excess alkali ash.
 - y) accumulation of calculus, for
 - (1) due to long continued use of vegetable-fruit diet, rich in mineral and alkali.
 - z) betel nut forms deposit of lime over teeth.
8. Sherman (5) and Honoroff (4) diet shows this, for
 - a. Teeth poor, for
 - x. Almost 100% had caries (Av. American child now over 98%)
 - 1) Sherman- average American diet.
 - 2) Honoroff- " " " plus (over two yr. period)
 - a) egg.
 - b) cod liver oil
 - c) malt.
9. Navy (38,39) diet showed this
 - a. 202 of 212 enlisted men (1935 Pearl Harbor) showed this, for
 - x. Had active tooth decay, average number defects per man: 14.78%
 - y. Dental defects paralleled time served in Hawaii, for

	1 yr.	1-2 yr.	2-5 yr.
a)Percentage:	23.50%	30.06%	39.97%

1)Age no factor in increase.

2)Diet low in alkali excess: 18.86cc, for

- a)17.20 oz. meat
- b)1 egg
- c)9 oz.whole milk
- d)1 1/3rd oz butter
- e) 11 oz. bread and grain prod.
- f)2; lb. potato and vegetables
- g) 1 lb. fruit
- h) 4 oz. sugar and syrup

b.Midshipmen diet: 1937 class, Pearl Harbor, showed this (328 men)

x.Caries: 96.0% on admission

98.5% on graduation, for

1) Average number defects increased from 12.46 to 22.42

a) Increase 3 times that found in comparable civilian life.

b) Due to

x)Diet low in alkali excess, for

(1) rich in protein, calories, phosphorous, iron and vitamins.

(a) Field Ration A-.54 cc normal acid.

(b) Midshipmen: alkali excess 7.2 cc

(c) Enlisted men: alkali excess 5.2 cc

y) Nervous tension

z) Physical activity lowers bloods base reserve.

c.Army Field Ration A- 1942- compared to Navy diet:

	Army 1942	Navy 1935 Enlisted	1937 Midship.
meats	15.0 oz	17.2	15.0
eggs	1	1	1 1/2
milk	17.5oz	11.7 oz	41.2 oz
butter	1.44 oz	1.37 oz	3.49 oz
bread	12.1 oz	10.8 oz	11.7 oz
citrus, tomato	3.0 oz	5.8 oz	9.7 oz
green, yellow veg.	7.0 oz	9.1 oz	10.1 oz
Other veg.	17.0 oz	19.1 oz	18.5 oz
" fruits	6.5 oz	6.7 oz	10.9 oz
sugar,syrup	4.8 oz	4.4 oz	7.0 oz
ALKALI EXCESS			
per 100 calories	---	5.2 cc	7.2 cc
ACID EXCESS	.54	---	---

C. BALANCED ACID- ALKALI DIET shows this, for

1.Jones' Balance shows this, for

a.Hawaiian Health Project (40), (Ewa Plantation 1929-1933) shows this

x. Results show this, for

1) Conditions found in 1929, amongst babies and pre-school children show this, for

a) Incidence high in

- v) colds
- w) impetigo
- x) pink eye
- y) ear infections
- z) rampant tooth decay, for
 - (1) of 50 babies, 40 had decayed teeth at 1
 - (2) 49 out of 50 had decayed teeth at 2 yr.

b) Mortality high, for

- x) 25 out of the 75 Filipino babies born, 1929,
- y) 12 pre-school children died in 1929

2) Conditions found in 1933, show this

a) Incidence low in

- v) colds, pneumonia
- w) impetigo
- x) pink eye
- y) ear infections
- z) tooth decay, for
 - (1) cleared or arrest in Health Center babies on Jones' Balanced Diet. for
 - (a) Taro and sweet potato substituted for grain foods.

b) Mortality low, for

- x) Charts show this (see Appendix)
- y) 225 babies enrolled in Health Center in 1933 with 85% in daily attendance.
- z) Death rate remains high in sections where Jones' Balanced Diet not used.

b. Food factors (37) show this, for

x. Natural foods balance each other, for

1) Leaves are rich in

- a) Minerals
- b) Vitamins
- c) Alkali excess

2) Grains are rich in

- a) Carbohydrates
- b) Acid in reaction

3) Flesh foods:

- a) Blood- alkaline in reaction
- b) Muscle- acid in reaction

y. Food reactions show this, for

1) Vegetables show this, for

a) Leafy vegetables show this, for

x) Rich in vitamins, minerals, iron

(1) Thinner, greener leaves best, as

(a) Spinach, dandelion greens, turnip tops, mustard greens, etc.

(2) Thicker leaves less valuable, such as

(Cabbage, chard, head lettuce

y) Low in starch, calories

z) Alkaline in reaction, for

(1) High in excess alkali cc.

b) Root vegetables show this, for

x) Rich in starch (calories)

y) Poor in minerals

z) Vitamins:

(1) Yellower- higher in "A" vitamin

(a) Carrot rich in "A".

2) Fruits show this, for

a) Good in minerals, vitamins

b) Yellow fruits highest in "A" vitamin

c) Alkaline in reaction

x) Inferior to leafy vegetables.

(1) Do not insure sound teeth.

3) Flesh foods show this, for

a) Good in proteins, calories

b) Nutritive value depends on tissue:

x) Blood highest nutritive value.

(1) Greatest source of minerals, vitamins

(2) Alkaline in reaction

(a) Excess alkali in 1 pt. blood

neutralizes acid in 500 calories of muscle meat.

w) Liver and organs.

x) Fat

y) Marrow and cartilaginous bone

z) Muscle

(1) Low in minerals

(2) Acid in reaction

c) Protein of muscle is broken down into urea, which in turn is split into ammonia (alkali) and carbon dioxide (acid).

- 4) Grains show this, for
- a) Rich in calories, proteins
 - b) Acid in reaction
 - c) When polished, loss of vitamins
 - x) Beriberi (lack of "B" results from eating too much polished rice.
- 5) Eggs show this, for
- a) Rich in phosphorous, protein and vitamin ("D")
 - b) Acid in reaction.
 - x) Too many eggs can create an imbalance toward acid and may result in tooth decay.
- 6) Milk shows this, for
- a) Good in minerals, proteins, fat, some vitamins.
 - b) Does not insure sound teeth, for
 - x) Not indispensable, for
 - (1) 1 qt. cows milk gives 22 cc n.alkali but does not prevent tooth decay.
 - (2) Orientals, Polynesians and others do not have milk in diet (other than mothers milk) but had sound teeth.

z. Other food factors show this, for

- 1) Calcium and phosphorous show this,
- 2) Vitamins show this, for
- a) "A" Vitamin shows this.
 - x) Source: fish liver oils, yellow, green vegetables, apricots, tomatoes, liver, butter, egg y.
 - y) Value:
 - (1) To prevent:
 - (a) Respiratory infections of mucous membranes of eyes, ears, nose, sinuses, throat, intestines, lungs, k.
 - (b) Night blindness.
 - (2) To build:
 - (a) bones, skin, teeth, nerves, tooth enamel.
 - b) "B" Vitamin shows this
 - x) Source: wheat germ, yeast, soy bean, ham, pork, liver, kidneys, heart.
 - y) Value:
 - (1) To prevent:
 - (a) indigestion, constipation
 - (b) nerves
 - (c) beriberi
 - (d) cold sores, cracked lips, quick lips
 - (2) To build:
 - (a) Normal functioning digestive, nerve
 - (b) Aids in metabolism of carbohydrates and fats

c)"C" Vitamin shows this, for

x)Source: guavas, honeydew melon, mustard greens, green peppers, citrus fruits.

y)Value:

(1)To prevent:

- (a) Scurvy
- (b) Breaking of small blood vessels
- (c) infections
- (d) fragile bones

(2)To build:

- (a) strong teeth and bones
- (b) healthy gums.

d)"D" Vitamin shows this, for

x)Source: sunshine, fish liver oils.

y)Value:

(1) To prevent:

- (a) weak, rigid bones
- (b) rickets.

(2) To build:

- (a) strong bones
- (x) Important effect on mineral metabolism
- ((1)) May, in excess, increase sm caries, for

((a)) Violet Ray did this, for
((u)) "Irradiating blood in vitro increases its acidity--fatal doses always accompanied by acidosis"
(19- Laurens)

((v)) Liecht found an increased local sub-cutaneous acid lasting several days following ultra violet radiation. (31- Grayzel and Miller)

((w)) Potassium in blood diminished after 3 or more radiation with mercury vapor quartz lamp (Pincus and Makrineos)

((x)) Increased acid of intestinal contents of

((1)) Rachitic babies

((2)) dogs, rats.

((y)) Increased acid condition of skin
(32- Koplansky)

- ((y)) Carnivorous animals
prowl at night to avoid
sun and " D" stimulant.
- ((z)) Carnivorous African tribes
lethargic, sleep much of t
(((1))) Said to be due to
protein putrefaction i
intestines.
- ((b)) May increase liability to
respiratory and blood vessel
disease, for
- ((x)) Diet imbalance has shown

III, JONES' BALANCED DIET: " To insure good health and sound teeth, on a mixed diet it is necessary to have sufficient amounts of protein, fat, carbohydrates, calcium, phosphorous, iron, vitamin and all other essential food constituents, PLUS A CERT MINIMUM OF ALKALI ASH.

A. Maintain Alkali excess by:

1. Fruits and vegetables.

a. Child:

x. Needs more than adult, for needs

- 1) 2 servings of fruit or vegetable for every serving of acid ash-food (meat, fish, eggs, cereal, bread, pastry,
- a) Serve 1 thin, green leaf vegetable (spinach, turnip tops and beet tops, mustard greens, etc. for every 4 servings of vegetables (one thin-leaf green vegetable in every five vegetable servings) for
- x) Thin leaf green vegetable yields more calcium minerals and alkali excess, for
- (1) The thinner and greener the leaf, the richer in minerals, vitamins and potent alkalinity.

b. Increase amount of fruits and vegetables in summer and sun exposure

x. Necessary to balance Vitamin "D" (42), for

- 1) Alkali lowered in blood plasma by sun-exposure (5, 30, 42)
- 2) High degree urine acidity reaction from sun (5-Blatherwic
- 3) Poor physical development, rampant tooth decay if on a grain and little vegetable diet (42, 30)
- 4) In tropical climates adults may need 150 cc alkali (42)

c. Avoid excessive alkali balance, for

- x. Over 100 cc (unless in hot season of temperate climate, or in tropical climates) may result in

- 1) Calculus formations (37)
- 2) Alveolar atrophy (loosening of teeth in adult life)
 - (a) Samoa showed this for
 - x) Sea food (protein-acid) reduced, increased alkali excess and paradontoclasia resulted almost universally in people over 35.(37)

B .JONES' BALANCED DIET APPLIED TO:

1.Sherman (Average American Diet)

a.Option One:

x.Reduce grains.

- 1) From 1220 calories to 600 calories ($\frac{1}{2}$ loaf of bread)

y.Substitute:

- 1) 400 calories of potato
- 2) 20 " thin leaf, green vegetable.
- 3) 200 " molasses (sorghum or cane, be certain no corn syrup in it)

z)Result:

- 1) Same carbohydrates
- 2) More minerals, vitamins
- 3) Alkali excess.

b.Option Two.

x.Reduce meat:

- 1) From 608 calories to 388 calories

y.Substitute:

- 1) 20 calories thin leaf green vegetables (4 oz.cooked)
- 2) 200 " molasses (about 3 Tablespoons)

z.Results:

- 1) Small gain in calcium.
- 2) Large gain in iron and vitamins
- 3) Alkali gain of 77 cc

2.Hawaii

a.Ewa Plantation- native diet for babies, 1929

v.50-60% calories from milk.

w.30-40% " " grain, and small amount meat,fruit, veg.

x.Example:

1)22 lb. baby fed:

- a)24-40 oz. cow's milk.
- b) small amounts vegetables and fruit
- c)30-40% total calories from rice and bread

x) Gave alkali of 5 cc

(1) Urine reaction of child strongly acid.

z.Result:

- 1) Nearly 100% tooth decay in 12-to 15 mos. babies.
- 2) High susceptibility to head colds, pneumonia, skin and other diseases.

b. Jones' Hawaii diet (42, 43)

u. Substitute for babies:

- 1) Poi and sweet potato for grain.
 - a) Result: increase of alkali to 45 cc
 - x) Urine reaction becomes normal or even alkali.

v. Substitute for older children:

- 1) fruits- generous amount
- 2) vegetables " "
- 3) taro (root and top)
- 4) sweet potato
- 5) milk
- 6) meat and egg
- 7) cane syrup for refined sugar (refined sugar is acid in reaction)

w. Substitute for adults:

- 1) above diet.
- 2) Results:
 - a) Improved health
 - b) arrest of tooth decay
 - c) greater resistance to colds.

x. Substitute for pregnant woman:

- 1) above diet.
- 2) Result:
 - a) babies born with better bones and teeth
 - b) better start in life.

3. Sholes and Sato's diet, vs Jones' diet.

a. Diet: (Sholes and Sato's)

x. Milk, vegetable, small amounts meat, egg.

b. Result:

- x) If leaf vegetables and fruit used in excess, could exceed 68 cc alkali excess.
 - 1) If too high in alkali excess, bad for bone if used for weeks or months, unless generous supply of "D".
 - a) Hawaii has 7½ hours tropical sunshine daily.

4. Mellanby diet vs. Jones' diet.

a. Mellanby diets conducted at different times, conditions, on different children and of different composition.

x. In the one experiment in which the incidence of caries was the least recorded, the potential alkali of the diet was the greatest.

y. African sun held nec. by Mellanby, for Vit. "D".

- 1) No reference made by Mellanby to diet, to type of vegetable or fruit eaten by natives.

y) When native children placed in school and clothed, 50% of children developed tooth decay. Therefore Mrs. Mellanby concluded that " even the African sun may not be of great calcifying or protective value when it strikes well-clothed children."

(1) She makes no mention of the introduction of civilized food: cereals and grains as well as clothes.

5. Navy vs Jones' diet.

a. Reduce:

x. Meat --- 300 calories (1/3 pound)
y. Bread--- 100 " (1 slice)
z. Sugar " " (1 3/4 T.)

b. Increase:

x. Milk--- 300 calories (14 oz) (to replace meat)

c. Substitute:

x. Raw vegetables---100 calories (for bread)
y. Molasses - " " (for sugar) 1 1/2 T.

d. Result:

	<u>Navy</u>	<u>Jones</u>
Fat	155.0 grams	150.2
Prot.	136.6	128.8
Carb.	418.1	436.4
Phos.	1.94	2.22
Calc.	0.844	1.5 85
Iron	.027	.029
Vit A	8,075. units	10,959 units
" C	219	326

ALKALI EXCESS 18.86 cc

93.66 cc

6. Average American Diet (Red Cross Nutrition Diet) vs Jones

a. Jones:

x. Reduce: 220 calories meat.

y. Substitute:

1) 20 calories spinach
2) 200 calories molasses (3 T)

z.Result:

	<u>Prot.</u>	<u>Carb.</u>	<u>Phos.</u>	<u>Iron</u>	<u>Alk. Excess</u>
Av.Amer.	104	73	16	.017	0
Jones	93	94	153	.024	<u>77</u>

7.Comparative diets.vs Jones.

a.See chart in Appendix.

IV. CONCLUSION: " The dietary principle involved in the Ewa Plantation feeding experiment is universal in its application. It may be that there is some unknown factor in fruits and vegetables which is specific for dental caries and that the leafy vegetables are particularly potent in this respect. However, until that factor is discovered, the potential alkalinity of an otherwise adequate diet seems to furnish a dependable guide for the control of dental disease. In the words of Aristotle: "If there is one way better than another it is the way of Nature".

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REPORT ON " TEETH

from

PLANTATION HEALTH BULLETIN- July, 1937

Editor: Nils P. Larsen, M.D.

Charles L. Wilbar, Jr. M.D.

Published Ewa, Oahu, T.H. Vol II. No. 1

During the last two years various members of the Ewa Health Center have been asked whether our optimism about correcting tooth decay has continued. One of the bi-products of the Ewa Health Center has been the observation and the attempted finding of the cause of the rampant tooth decay in the children of the Islands. The first survey made in Honolulu showed that practically all the Oriental children in the Islands had tooth decay and many of them had very rampant decay. The common type is a form of enamel decay called "odontoclasia" and occurs principally in the deciduous teeth. Some of our previous publications have shown mouths of four and five year olds with every tooth decayed.

As to the causative factor, our working theory for a long time has been that the acid-base values of the food was the primary cause. This brought forth a great deal of discussion since there is considerable literature indicating that the acid-base values of diet have no demonstrable influence on health. However, there is also considerable evidence that under certain circumstances, and especially if continued for a long period of time, it may have definite effects. Whether the theory is the answer or not is of no importance. The observation, we feel, is the really important thing, and the observation is this, that children on high carbohydrate diet in which the carbohydrate is a cereal (rice) all have bad teeth; whereas children eating a high carbohydrate diet in which the carbohydrate is a tuber (taro or potato) have close to perfect teeth. Perhaps it is incidental that the starch of the cereal leaves an acid-residue, and the starch of the tubers leaves an alkaline residue after it has burned in the body. Nevertheless, this is a known definite factor. We are willing to grant, however, that someday some, as yet unknown vitamin or other factor may be found. If this is found it does not change the observation that children whose starch comes largely from the alkaline foods (fruit, vegetables, tubers) do have good teeth, and children whose starch comes from the cereals have bad teeth.

At present we are stating our observations a little differently, and rather than postulating that the acid-residue diet is associated with bad teeth, we state that an acid-residue diet in which the acid-residue comes largely from cereal (especially polished rice) is associated with bad teeth. The acid-residue diet coming from meat and fish, consumed by the Eskimo, for instance, has been reported as being associated with good teeth. Even on the acid-base theory this can still conceivably be correct since the body, being fed a great excess of meat, can turn much of this protein into ammonia and in this way neutralize other acid radicals.

The flat statement that an excess of acid radicals are always cared for by the body without any damage should be questioned. Aub and Retznikoff showed definitely, in the work on lead poisoning, that an excess of acid radicals cause an out-pouring of calcium from the bones. Hawley, in Rochester, has also recently shown that when vitamin C is ingested with a meat diet, there is considerable out-pouring of vitamin C. The concept we are stressing at the present time is that an excess of acid radicals may cause a non-utilization of necessary factors, even though these are ingested in the diet. We would like to stress the fact that we do not consider the theory as a proven one but an excellent one as a working hypothesis. We would like to again comment (and this has been proven repeatedly by observations made by doctors on the plantations) that poi-fed babies have infinitely better teeth than the rice-fed babies.

To make a gross check on Ewa Plantation as to whether the teaching program had been effective, Dr. Pritchard recently surveyed carefully the teeth of 173 children on the plantation in the same age group as those surveyed in 1931 at the start of the teaching program. The accompanying chart indicates definitely that there has been a marked improvement. You will note that there is about 50% less tooth decay than there was in 1931 at the same age level. But more than this. Dr. Pritchard reports it is the condition of the mouth—the hardness of the enamel and the general improvement—that is striking. This the actual numbers of decayed teeth hardly indicate. A very small cavity in 1936 on the chart receives the same value as a large cavity on a soft tooth in 1931. Hence, he reports, although the table itself is striking, the examination of the teeth is much more striking.

	<u>1931</u>	<u>1936</u>
<u>Babies:</u>		
Total	106	72
% decayed teeth	80%	15%
<u>Two Yr.Olds:</u>		
% decayed teeth	99%	33%

EWING HEALTH CENTER TOOTH SURVEY.

-C*

EWA PLANTATION, EWA DISTRICT
(Exclusive of Ewa Plantation)
Honolulu City.

INFANT MORTALITY

July 1, 1928----- June 30, 1933

	EWA PLANTATION	EWA DIST.	HONOLULU CITY
1929	174.4	111.9	85.3
1930	98.7	98.2	77.9
1931	72.0	90.4	65.5
1932	42.2	85.2	78.5
1933	30.9	102.1	68.5

Ewa Plantation--- causes for death:

- 1 case--- Caesaren section. Age 12 hours
- 1 case - premature birth " 5 hours
- 1 case- whooping cough " 3 months.

Filipinos and others.

	<u>1929</u>	<u>1930*</u> (Health Center started)	<u>1931</u>	<u>1932</u>	<u>1933</u>
<u>Filipinos:</u>					
Babies born:	78	76	56	49	41
" died:	25	10	6	4	2(one a new born)
Mort.rate:	320.5	131.5	107.1	81.6	47.6
<u>All Others:</u>					
born	94	76	69	70	56
died	5	5	3	1	1-new born
Mort.rate:	53.2	65.8	43.5	14.3	17.8

* Health Center death rate was 0. Ewa Plantation included several villages, of which the Health Center was first placed in but one. No deaths in babies during their first year of life, occurred in the Health Center village during the period of 1930-1933. Previously the rate had been one out of every three born, died within the year.

COMPARATIVE DIETS

H. S. P. A. RESEARCH HEALTH PROJECT
Bulletin No.1.

Report of Dietary Observations carried on at Ewa Plantation, 1932,-1933

FINDINGS:

<u>DIET No.1</u>	<u>DIET No.2</u>	<u>DIET No.3</u>
12% cows milk	40% cows milk	40% cows milk
40% womans milk	12% womans milk	12% womans milk
<u>40% grains</u>	<u>40% grains</u>	<u>32% potato and taro</u>
2% meat-eggs	2% meat-eggs	4% grains
5% fruits, veg.	5% fruits, veg.	2% meat-eggs
		10% fruits-veg.

No.Babies: 64

11

42

RESULTS:

Urine
reaction acid

normal

Growth:

Height:
(Stand.29.2") 29."

28.75"

30."

weight:
(Stand.21.5pd) 19.25

18.75

21.25

TOOTH DECAY

% of cases 95%

100%

7%

% of teeth 46%

50%

4%

DISTRIBUTION- CALORIES AND POTENTIAL ALKALINITY.
in relation to Dental Disease as reported from various Institutions.

Place	Institution	No.	Percentage		dur-	tot.	DIET-% cal.		Fowl	fats	sug.	grains	Alk	% child
			age	caries	ation	calories	milk,	tubts.	meat,				ex.	New cav.
					years	per day		tubers	fish					
								fruit, veg.	egg					
Average Amer.	Home-Sherman			96%		3256	8.1%	12.0%	20.8%	10.3%	10.6%	38.2%	0	
						(adult)								
Ill,	Marks-Honoroff	40	9-18	100%	2 yr.	2235	18.4	17.9	15.4			48.2	5	92.5%
"	Mooseheart	264	10-17		1	2805	20.8	16.3	13.2	10.7	14.1	24.8	25	78.0%
"	"	"	11-18		1	2965	17.8	22.1	12.9	10.0	13.0	24.0	55	33.7%
"	(Hanke et)	"	12-19		1	2996	20.2	14.4	12.8	10.2	13.5	28.7	22	83.4%
Mich.	Coldwater	159	?	?	1	2200	32.0	25.0	9.0	13.0		21.0	58	25.0%
"	Hosp.(Bunting)	22	6-13	86.4%	?	2090	31.2	16.3	10.4	16.3	13.1	12.3	36	56.8%
Hawaii-	Ewa Plant.	75	1-15mos		1	1100	53.0	33.0	7.0	3.0		4.0	45	7.1%
"	(Jones) Ewa Plantat..	42	"		1	1000	53.0	0	5.0	3.0		39.0	9	96.0%
Samoa	-Ferguson		adults		life	3200							187	98% alv.
Jungle Sch.		1345	school	3.6	.6	2200	0	50.0	25.0	20.0	5.	0	128	
											s.cane			
Tristan da Bee	Lara-	78	1-21	1.3%	life	2200	20.0	50.0	8.0	22.0			100	
Cunha	shall	85	adults		"	3200	20.0	50.0	8.0	22.0			146	63.6% alv
Southern							s.potato							
U.S.Plant.	Jones		adults		life	3200	0	15.6	18.7		mol.	corn	108	
Negro			1-21		"	2200	0	15.6	18.7		15.6	50.0	74	

- E -

ACID-BASE BALANCE OF MODERATE COST DIET FOR BOY 16-20 YEARS OF AGE.
as issued by the Bureau of Human Nutrition and Home Economics
Agricultural Research Administration, U. S. Dept of Agriculture.
by Martha R. Jones, Ph D.

Kinds and Quantities of Food for One Week.

FOOD		CALORIES		ACID	ALKALI	ACID	ALKALI
Kind	Amt.	Per Lb.	Total	Per 100 Cal.	Total	Total	Total
Milk	6 qts.	314	3768		3.3		124.3
Meat:Av.)	1 $\frac{1}{2}$ lbs.	900	1350	5.5		74.3	
fowl)2 $\frac{1}{2}$	"	750	375	4.6		17.2	
fish)	"	450	225	7.8		17.6	
Eggs (No.)	5	66	330	7.0		23.1	
Cereals(mixed)	6 "	1633	9800	2.9		284.2	
Potato:White	3 $\frac{1}{2}$ "	302	1057		8.7		92.0
sweet	1 "	447	447		5.4		24.1
Citrus fruits	1 "	169	169		11.0		18.6
Tomato	1 "	103	103		24.5		25.2
Green & Yellow Veg.(3 lbs)							
Green veg.							
Lettuce	1 $\frac{1}{2}$ "	72	36		38.6		13.9
St.Beans	1 $\frac{1}{2}$ "	176	88		13.0		11.4
Peas	1 $\frac{1}{2}$ "	251	125		1.2		1.5
Yellow.veg.							
carrots	1 $\frac{1}{2}$ "	159	80		24.0		19.2
Corn	1 $\frac{1}{2}$ "	445	222	1.8		4.0	
Turnip	1 $\frac{1}{2}$ "	124	62		7.0		4.3
Other veg.fruits							
Vegetables							
Asparagus	1 $\frac{1}{2}$ "	101	50		3.6		1.8
Beets	1 $\frac{1}{2}$ "	167	83		23.6		19.6
Cabbage	1 $\frac{1}{2}$ "	120	60		18.0		10.8
Squash	1 $\frac{1}{2}$ "	103	52		6.1		6.2
Fruits							
Apples	1 $\frac{1}{2}$ "	214	157		6.0		9.4
Bananas	1 $\frac{1}{2}$ "	290	145		5.6		8.1
Pears	1 $\frac{1}{2}$ "	256	128		5.6		7.2
Prunes	1 $\frac{1}{2}$ "	1160	580	acid		acid	
Dried Beans,etc							
Lima beans	2 oz.	1586	197		12.0		23.6
White "	2 oz.	1564	195		5.0		9.8
Peas	2 oz.	1612	201		1.5		3.0
Peanuts(sh)	2 oz.	2487	311	0.7	0.	2.2	
Butter	8 oz.	3491	1745				
Lard	12 oz.	4080	3060				
Sugar,jam,etc	12 oz.	1815	1362				
TOTAL PER WEEK			26,563			422.6	431.1
" " DAY			3,795			60.4	61.6

EXCESS OF BASE OVER ACID -----

1.2

SUGGESTED CHANGES BY
MARTHA R. JONES.

in

MODERATE COST DIET FOR BOY 16- 20

as issued by Bureau of Human Nutrition and Home Economics, U.S. Dept of Agriculture.

FOOD	CALORIES		(ccN.Sol)		TOT. ACID	TOT. ALKALI
	Amt.	Per lb.	total	per 100 Cal.		
Cereals-5 1/3 lbs.	1633		8709	2.9	252.6	--
Green Leaf Veg. 3 lbs.	129		387	--	90.0	348.3
Sugar 5 1/2 oz.	1815		624			
Molasses. 24 T. (12 fl.oz)			1464		19.0	278.2
<u>NET CHANGES</u>						
per day			3798		55.9	151.1
EXCESS OF BASE OVER ACID						95.2

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