Proc. Fla. State Hort. Soc. 47:95-109. 1934.

THE PRICELESS DIATETIC VALUE OF FLORIDA'S TROPICAL FRUITS — THE CITRUS, THE AVOCADO AND THE PAPAYA

Dr. John Harvey Kellogg
Miami-Battle Creek Sanitarium, Miami

Florida's unique climatic and soil conditions adapt it to the cultivation of a very great variety of tropical as well as sub-tropical fruits. In this respect it is unique. South Florida is even more consistently tropical than Cuba. The temperature is much more equable and extremes of temperature less pronounced than in any other part of the United States. This fact adapts it to the cultivation of exotic fruits which thrive nowhere else in continental America. I am informed by Dr. David Fairchild that at the present time there are growing and fruiting in Florida not less than ISO tropical fruits, less than half of which are grown in any other state. Many of these are choice products which possess qualities which in time may give them commercial value. The limits of this paper permit me to discuss only those few of our choice tropical fruits, the production of which has already become a large and growing industry, the citrus, especially the orange, grapefruit and lemon, the avocado and the papaya.

CITRUS FRUITS

The United States possesses the advantage over all other countries of comprising within its own continental borders climatic and soil conditions adapted to the production of the finest food products of both temperate and tropical regions. Thanks to its peculiar relation to weather making factors, a considerable part of the Florida peninsula is like what one would expect to find in a bit of the tropics which had been picked up and transported a few hundred miles to the north. In this circumscribed region the avocado, the papaya and the various varieties of citrus fruits grow and flourish as in countries 10 degrees farther south; in fact, under the magic touch and persevering labors of American horticultural experts, these fruits have been within the short half century during which special attention has been given to their culture here, so greatly developed and improved that they have reached a degree of perfection which they have seldom elsewhere attained.

Through a growing of these choicest of tropical horticultural products Florida is making and will continue to make for ages to come its greatest contribution to the welfare of our country and the world. The climatic advantages enjoyed by the hundreds of thousands who annually seek protection under these sunny skies from the killing Arctic blasts of the North are priceless, but they are small compared with the benefits conferred by the use of its tropical fruits upon millions who are denied the privilege of basking in Florida sunshine and breathing its balmy air while winter storms are devastating every other portion of the United States.

The citrus has saved more human lives than has any other fruit, perhaps more than all other fruits together. Its life saving value is not a new discovery. More than 200 years ago, when scurvy was a scourge to which thousands of sailors, soldiers and others confined to a monotonous diet, annually fell victims, Kramer wrote, "If you have oranges, lemons, citrons or their pulp and juice preserved in whey in a cask, so that you can make lemonade, or rather give to the quantity of three or four ounces of their juice in whey, you will, without other assistance, cure this dreadful disease."*

In 1804, the British government banished scurvy from its navy by issuing rations of lemon juice, and since 1867, British shipmasters have been required by law in provisioning their ships to include an adequate quantity of lime or lemon juice as a protection against scurvy; but only in recent years has it become known that scurvy is not confined to sailors, soldiers, prisoners and other isolated groups of men, but is a widespread disease, a malady, in fact, which in latent form affects more or less whole nations and especially the more civilized portions of the human race.

*"The Vitamins," by Sherman and Smith, the Chemical Catalog Company, New York.

THE DISCOVERY OF VITAMINS

One of the most, brilliant and life saving discoveries ever made in relation to human nutrition and one in which American investigators have played a very prominent part, is the fact that in addition to the starch, protein, fats and food minerals which by the marvelous alchemy of digestion and the miraculous transfiguration called assimilation are converted into human flesh, all wholesome foods contain certain subtle substances known as vitamins, which serve as catalysts, chemical bodies which by their mere presence, even in exceedingly minute quantities, cause changes so striking as to be quite unbelievable without the most incontrovertible proof. It is the absence of one of these chemical prestidigitators, known as vitamin C, which gives rise to scurvy, a disease in which all the vital functions fail, the gums become sore, the teeth loosen and fall out, dropsy develops and terrible ulcers appear at various parts of the body, and finally death occurs.

When vitamin C is present, but in insufficient amount, nutritive disturbances appear, the nature and intensity of which depend upon the degree of the deficiency.

Twenty years ago, Drs. Hess and Fish made a study of the children of an orphan asylum where a large number of the children were suffering from undoubted scurvy caused by the use of sterilized milk. Vitamin C is easily destroyed by heat. The children quickly recovered when given small amounts of orange juice.

MILLIONS OF AMERICANS SUFFER FROM SCURVY

This experience led to extensive and thoroughgoing research which has demonstrated the widespread prevalence of scurvy not only in infants, but in young children and even in adults, due to the use of foods in which vitamin C is naturally lacking or in which it has been largely or wholly destroyed by cooking or other processes. It has been proven that pasteurizing milk lessens its vitamin C content. Pressure cooking destroys vitamin C.

Prolonged fireless cooking greatly lessens the vitamin C content of vegetables. Oatmeal, cornmeal and other cereals contain no vitamin C. The same is true of such dried legumes as peas, beans and lentils. Meats of all sorts, fresh as well as smoked, salted or canned, and also eggs, according to Sherman, contain practically no vitamin C. It is evident, then, that the staple foods in common use in America, bread, meats and breakfast foods, contain practically no vitamin C. It is inevitable that a large part of the population of the United States must be suffering because of this deficiency.

The researches of Hess and many others have shown that a deficiency of vitamin C causes an arrest of growth in infants and young children. An infant that had been fed to the age of nine months on pasteurized milk and gruels gained only half a pound in weight in four months, whereas it should have gained nearly half a pound a week. When given orange juice it began to gain at once and in a month had added two pounds to its weight.

Modern research has thus shown that while the more severe forms of scurvy are very rare, this disease in its mild or incipient form is very common. Not only retarded growth, but loss of appetite and other evidences of malnutrition are due to this cause, also anemia and pain or soreness in the joints or muscles, and so-called growing pains.

Vitamin C is a product of plant growth. Its presence in cow's milk is due to the fact that the cow feeds on greenstuffs rich in this vitamin. Dutcher found that in summer the milk of cows fed on grass contained three times as much vitamin C as in winter. Meats of nearly all sorts are almost wholly lacking in vitamin C. In the Arctic regions, the natives instinctively utilize every available source of vitamin C. They regard as a great delicacy the half digested moss which they find in the stomachs of the muskox and deer which they kill, but get most of their vitamin supply from the liver of the seal which stores vitamins, and which they eat raw and frozen. Knud Rasmussen wrote in reporting his experiences at the end of his trip through the Northwest Passage that when he caught sight of the first ship he was on board in ten minutes and had his teeth sunk in an orange, for which he had the most intense craving after having eaten raw seal livers for a whole year.

The primitive Eskimos seldom suffer from scurvy because they instinctively take the utmost care to avoid the cause. But through ignorance and lack of instinctive guidance millions of American men and women and especially young children are continually suffering from the dwarfing and weakening influence of vitamin C deficiency and various forms of malnutrition, for which Florida offers in its superior citrus fruits a sure and sovereign remedy.

FLORIDA CITRUS FRUITS MAY SAVE AMERICANS FROM BECOMING A TOOTHLESS RACE

Forty years ago, I discovered that people who had lost their teeth had lost their gastric juice as well, and I once greatly amused a convention of dentists by reading a paper in which I presented evidence that decay of the teeth was not a purely local disease, but was a local symptom associated with other evidences of general physical deterioration, and hence that the tooth brush and dentifrices and even dentists could not be expected

to save the race from ultimately becoming toothless. All dental authorities now admit this to be true, and Howe and other eminent investigators have shown by experiments upon animals that the teeth are profoundly influenced by the absence or deficiency of vitamin C.

Mrs. Mellanby, of London, England, a noted physiologist and for many years widely known as a keen investigator of nutrition problems, has recently published a final report and summary of the results of an intensive study of the causes of the decay of teeth extending over more than 16 years, the most exhaustive research of the sort which has ever been undertaken. Examination was made of more than 30,000 teeth in situ and 200 microscopically and dietary studies extending over two years were made involving over 400 children. One of the main conclusions reached and supported by convincing evidence is that errors in diet and especially the too free use of cereals is a definite and potent cause of dental decay. Of course, the injury is not due to anything which cereals contain, but to the absence of the vitamin C which they all lack. And so while the use of the tooth brush may retain its place as a wholesome sanitary measure, the orange and its citrus cousins offer real salvation from threatened toothless ness; and the manufacturers of breakfast foods should put upon every package the legend:

"An orange a day keeps the dentist away."

The curative value of orange juice was demonstrated by Hanke in a research conducted in connection with the Chicago Dental Research Club, The addition to the diet of a pint of orange juice and the juice of one lemon daily was found to cause prompt arrest of decay and marked improvement in cases of pyorrhea with tightening of the loose teeth.

CITRUS FRUITS THE MOST DEPENDABLE SOURCE OF VITAMIN C

Of course, vitamin C is found in other foods besides citrus fruits. Nearly all, fresh fruits, such as apples, peaches, cherries and berries of any sort contain vitamin C, as do also fresh vegetables and especially such leafy vegetables as cabbage, lettuce and greens; but the amount is variable, changing very materially with the season and degree of maturity, some vegetables containing considerable vitamin C when very young, but little when mature. The vitamin content is also influenced by the soil. But careful research has shown that oranges and other citrus fruits are not subject to this variability in vitamin C content so that orange juice and grapefruit juice are stable and thoroughly dependable sources of this precious food factor on which anxious mothers may always depend and certain to afford infants and young children the protection which they require.

ORANGE AND GRAPEFRUIT JUICE CURE ANEMIA

Although dental decay is perhaps the most common manifestation of latent scurvy, another almost equally prevalent condition is anemia or impoverished blood. In a health survey which I made at the first Chicago exhibition, in which the blood of more than 6,000 persons was tested, the average hemoglobin content was found to be only 80 per cent, of the normal, 81 for males and 79 for females, indicating an almost universal anemia. Since "the blood is the life," this means that average citizens are only four-fifths

alive and very large minorities are less than half alive. These half-alive people are a heavy burden which must be largely carried by the few who are possessed of 100 per cent, red blood and are fully alive.

Another study made of 5,000 school children reported at the First Race Betterment Conference held at the Battle Creek Sanitarium in January, 1914, showed nearly all to be anemic. The diet of the average American is deficient in available iron, but the deficiency is not sufficient to account for the almost universal anemia which exists. It is a valid inference that the iron eaten is not well utilized. A group of eminent French scientists recently reported the discovery that by the free use of fruit juices, especially orange, lemon or grapefruit juice, the number of red blood cells and the amount of hemoglobin may be rapidly increased. They very justly attributed the good results observed to the richness of citrus fruits in vitamin C, which, although it contains no iron itself, by the magic of its presence enables the blood making organs to make use of the iron and copper which are needed in the making of blood cells by the bone marrow and other blood making structures. If every anemic person in the United States could be induced to drink daily three glasses of orange juice or an equivalent amount of grapefruit juice or lemonade, the demand for calves' livers would soon fall off and: the number of deaths from nephritis due to poisonous liver protein would likewise diminish.

CITRUS FRUITS AN EFFICIENT REMEDY FOR ACIDOSIS

Another and most important nutritional value of citrus fruits is due to the large percentage of alkaline salts, chiefly potash, which they contain. The body is constantly making acids, the production of which is enormously increased during work, especially during muscular activity. For example, a sprinter produces, when running, a dram of lactic acid per second, or nearly half a pint of this strong acid per minute, in addition to the great volume of carbonic acid gas which is eliminated through the lungs.

To neutralize and carry to the lungs this great amount of acid, it is necessary that the blood should be alkaline and that its alkalinity should be constantly maintained. The necessary alkaline or basic elements must be obtained from our foods. Unfortunately, many of our common foods contain an excess of acids and so, when eaten, lessen instead of increasing the alkalinity of the blood. This is true of all foods which leave an acid ash when burned. In the list of acid-ash foods are found all the meats, eggs, the cereals, and two or three vegetables. Two or three fruits also must be put in this class because of unoxidizable acids which they contain; but with these few exceptions all fruits and vegetables are alkaline or basic-ash and when eaten increase the blood alkalinity. Near the head of the list of alkalinizing foods are found citrus fruits and fruit juices, the most convenient and agreeable mean; of alkalinizing the blood. Each pint of orange juice contains 13 grains of potassium, one of the most powerful and readily soluble alkalies. Lemon juice contains nine grains of alkali to the pint and grapefruit seven grains. Some varieties of citrus are much richer in alkali, the lime containing 24 grains and the sweet lemon 31 grains to the pound.

The potassium of orange juice is combined with citric acid and so does not act as an alkali in the stomach, neutralizing the gastric juice and arresting digestion as do soda and other alkalies. After the orange juice is absorbed into the blood, the acid is oxidized

and used as food the same as starch or sugar, thus setting the alkali free to help alkalinize the blood and tissue fluids. In this way orange juice combats acidosis, one of the most common predisposing causes of both acute and chronic disease. An excess of acids in the blood and tissue fluids lowers resistance to disease and predisposes to colds, which cost the people of the United States many millions of dollars annually. The common practice of dosing with soda to combat acidosis is objectionable. Soda upsets gastric digestion and imposes an unnecessary burden upon the kidneys.

Acidosis leads to rheumatism, Bright's disease, premature old age, arteriosclerosis, high Mood pressure, skin maladies, and various degenerative disorders. Its presence is shown by excessive acidity of the urine, which is an extract of the tissues. Not infrequently the urine is found to be 50 or even 100 times as acid as it should be. A pint or two of orange juice daily will often cause complete disappearance of the excess acidity in four or five days and with the acidity will also disappear a host of disagreeable symptoms, such as headache, loss of appetite, soreness of the muscles, neuralgic pains, nervousness, depression and a host of other miseries.

Every year not less than 500,000 persons in this country die of chronic disorders in which chronic acidosis may be an active or predisposing factor. No doubt the daily use of orange juice might prove the means of saving many thousands of these lives.

Besides a full assortment of vitamins, A, B. C, D and E, which are powerful nerve tonics, real vital stimulants, which actually energize the nerves, orange juice contains a notable amount of actual tissue building nourishment, nearly one per cent, of protein of the choicest sort (.8%) and 11.6% of invert sugar, similar in composition to honey, but absolutely free from contamination of any sort and predigested and so ready for immediate absorption and utilization.

ORANGE AND GRAPEFRUIT JUICE ARE LIQUID FOODS

A glassful (8 oz.) of orange juice contains 120 food units. A few comparisons will give a clearer idea of its food value.

Four glassfuls of orange juice equal in food units three glassfuls of milk.

Two glassfuls of orange juice equal three of skimmed milk in food units.

One pint of orange juice more than equals in food units:

One pint of oysters or clams.

One pint of beef tea, chicken broth, or mock turtle soup.

One pound of egg white.

One pint of red raspberries.

One and one-fourth pints of strawberries.

Three-fourths pint of oatmeal gruel.

One pound of carrots.

One and three-fourths pounds of cabbage.

One and one-half pounds of turnips.

One-half pound of green peas.

One and one-fourth pounds of fresh peaches.

The delicious predigested nourishment afforded by orange juice, together with its rich store of vitamins, explains the remarkably refreshing qualities which make it a favorite beverage the world over. Its remarkable properties entitle it to a higher position than that of a mere palate tickler. It is a life-saver and should replace a long list of harmful beverages which are dispensed at soft drink counters under various alluring titles, some of which promise falsely, "Rest you in five minutes," and only produce a drug euphoria through the poisonous effects of caffeine white destroying the power to rest normally by natural sleep and causing chronic "nerve tire" and insomnia.

ORANGE JUICE SHOULD REPLACE TEA AND COFFEE

Orange juice or lemonade, hot or cold, may well replace those harmful, poison-containing table beverages, tea, coffee, cocoa and maté, all of which contain blood-pressure raising caffeine or its cousin, theobromin. A government bulletin warns the farmers against the use of cocoa residues as a food for cows because it lessened the flow of milk; as food for fowls because it diminished egg production; as fertilizer because it lessened soil fertility. Cocoa is just as bad for children and nursing mothers as for chickens and cows. Caffeine is used medicinally to raise blood pressure. *One* grain is a dose. A cup of tea or coffee or a glass of Coco-Cola contains *four to six grains* of this poisonous drug. Orange juice is not only delectable and harmless, but a powerful nerve stimulant. Its predigested food is ready for absorption and assimilation and its vitamins feed the nerves and aid the digestion of other foods.

COMMON ERRORS ABOUT CITRUS FRUITS

There are several popular errors which undoubtedly to some degree detract from the universal popularity which citrus fruits deserve, to correct which a definite effort should be made. One of the most harmful of these is that fruit acids tend to cause acidosis and rheumatism. This is not only untrue, but the fact is the very opposite. This has long been known to science, but the prejudice against the use of acid fruits in rheumatism is so deeply seated little progress has been made toward its removal. There are still many physicians who advise against the use of lemons, grapefruit and even oranges in rheumatic affections and in all conditions in which acids are known to be present in excess. The use of orange juice to the extent of one or two pints a day is one of the best known means of combating acidosis.

Because milk curdles on the addition of lemon or orange juice, many persons avoid the use of milk and citrus fruit juices at the same meal. This is quite unnecessary, since the curdling of milk by an acid does not in the slightest degree impair its quality or its digestibility. The gastric juice itself is highly acid and coagulation of the milk is the first step in its digestion. I learned many years ago that the digestibility of milk is, in fact, increased by the addition of lemon juice, as by this means fine curds are formed which

are readily dissolved by the gastric juice, whereas the stronger gastric acid, especially in cases of hyperacidity, is likely to produce large tough curds which are long retained in the stomach. The addition of lemon and orange juice to the milk is an excellent remedy in cases in which undigested curds are found in the stools.

MIXTURE OF CITRUS FRUITS WITH STARCHY FOODS NOT UNWHOLESOME

An error which in recent years has become quite prevalent is the idea that oranges and grapefruit should not be eaten at the same meal with starchy foods, such as bread, breakfast foods or potatoes. This error, I think, grew out of an observation made many years ago by Sir William Roberts, an English physiologist, who discovered that certain acids hinder the digestion of starch. He found that one part in 10,000 of oxalic acid, the acid of pie plant, and one part in 2,000 of acetic acid, the acid of vinegar, would completely arrest the salivary digestion of starch. From this the erroneous conclusion was drawn that all food acids hinder starch digestion. Careful laboratory researches have demonstrated that this is not true of the mild normal food acids, such as the citric acid of the lemon and the orange and the malic acid of apples, but only applies to the strong, unwholesome non-food acids, oxalic and acetic. Even lactic acid is free from objection on this ground.

Another erroneous idea is that fruit acids must be avoided in cases of hyperacidity or so-called sour stomach, the supposition being that fruit acids tend to cause fermentation or to excite the excessive secretion of acid by the stomach. The acidity of so-called sour stomach is not due to fermentation. Fruit acids never cause gastric irritation, but when the stomach and duodenum are hypersensitive as the result of irritation from the use of mustard, pepper, pepper sauce, the excessive use of salt, hot sauces and vinegar, the free use of cane sugar, confectionery and other gastric irritants, concentrated acid fruit juices may give rise to temporary discomfort, but they neither cause nor aggravate the diseased condition. In such cases the use of acid fruit juices may be restricted temporarily until the existing irritation is relieved by removal of the cause. Liquids of any sort, either with or without acids, taken freely at meals, as shown by Pavlov, may cause hyperacidity by over stimulating the gastric glands.

ORANGE JUICE EXCELLENT FOR YOUNG INFANTS

Still another popular error is the idea that orange juice should not be given to young infants. Hess has shown that orange juice may be given in teaspoonful doses to infants a month old or even younger not only without injury, but with great benefit. An infant three months old should take regularly at least two tablespoonfuls of orange juice daily.

THE GRAPEFRUIT

Practically all that has been said in the foregoing pages about the orange applies equally to the grapefruit. The latter contains less acid than the lemon, less sugar than the orange, and a smaller amount of solids. The grapefruit also contains a little less of the vitamins A and C, but fifty per cent, more of precious blood-building iron.

The nutritional and refreshing qualities of this excellent fruit entitle it to a place on every breakfast table in America. Its free use would constitute an insurance against rheumatism and other chronic disorders to which acidosis is a predisposing cause.

Many persons prefer the grapefruit to the orange because of its pleasant acid flavor and its appetizing qualities.

THE LEMON

This fruit leads all the members of the citrus family in its richness in iron, of which it contains three times as much as does the grapefruit.

The composition of, lemon juice varies considerably, according to the time of picking and the length of time the fruit has been kept, together with the manner of keeping, The chief constituent of lemon juice is citric acid of which the average lemon contains *7.5* per cent. A lemon picked in April contains only about two-thirds as much acid as one picked in November. From April on the percentage of acid steadily diminishes until in July there is little left, the citric acid being converted into sugar (dextrose) and carbon dioxide. This is due to the vital activities of the living cells of the fruit. If oxygen is excluded, by varnishing the fruit, the change may be prevented, as also to a large extent by cold storage.

Lemon juice also contains a notable amount of salts (2 to 3 per cent.) chiefly potash and phosphorus.

The percentage of potassium in lemon juice is greater than in either apple juice or grape juice. This abundant and unusual supply of food minerals makes the lemon an important source of this highly essential food principle, and brings clearly to view the fact that the nutritive effect of lemon juice is that of an alkali instead of an acid, as superficial knowledge would suggest.

It thus appears that the lemon is worthy of a much larger place in our national dietary than it has heretofore enjoyed.

The lime, the Persian lime, the kumquat, and the various other varieties of the citrus family all share the extraordinary virtues of the orange and the lemon and will increase in usefulness as they become known.

THE PAPAYA

Its delicious, spicy flavor and its wholesomeness entitle the papaya to a prominent place among our breakfast and dessert fruits, but it is hardly to be expected that it will fully meet the expectations of those who have read the enthusiastic accounts of the fruit by some of the earlier writers. Sturtevant's "Notes on Edible Plants" tell us that, according to U. S. Allen, "The fruit is used extensively in South Florida and Cuba for making tough meat tender. The toughest meat is made tender by putting a few leaves .or green fruit of the pawpaw tree into the pot with the meat and boiling. In few minutes the meat will cleave from the bones and be as tender as one could wish." A Mr. Luger stated that "the leaves have the property of making meat wrapped in them tender" and, according to

Brandis, "Meat becomes tender by washing it with water impregnated with the milky juice or by suspending the joint under the tree." According to Williams, the Chinese make use of the fruit "to soften the flesh of ancient hens and cocks by hanging the newly killed birds in the tree or by feeding them upon the fruit beforehand."

It is true that the milky juice of the green fruit or stems of the papaya plant contains a digestive principle, papayotin, which acts upon protein in a manner similar to pancreatin or pepsin; but this digestive action is not displayed under any of the conditions named in the above fantastic descriptions and no just claim can be made for either the ripe fruit or its seeds as a digestant. This property is possessed only by the milky juice of the green fruit. When the rind of the green fruit is incised, a milk-like juice exudes which resembles in appearance the juice of milkweed, which contains a protein digesting ferment; but in the process of ripening, this ferment disappears.

The extravagant claims made by many of those who have undertaken the exploitation of the fruit have no doubt to some degree stood in the way of the progress of this excellent fruit in winning public favor.

Another serious obstacle which remains to be overcome is the lack of standardization of the fruit as regards quality. As in the case with the apple and many other fruits, the papaya is not true to seed. One authority states that from a hundred seeds one may hardly expect to get more than a single plant producing really good fruit. Within recent years considerable advance has been made toward standardization by a few careful growers, some of whom are producing fruit of uniformly excellent quality, and within a few years this obstacle will be overcome. When this is accomplished, the next step will be to educate the fruit consuming public concerning the special food values of this excellent tropical fruit which presents in solid but readily liquefiable form much the same kind of nutriment found in the orange, although it vitamin C content is very considerably less. However, this deficiency is compensated for by the fact that it contains other vitamins lacking in the orange.

THE PAPAYA COMBATS ACIDOSIS

Some years ago, at the suggestion of Prof. Mendel of Yale University, I sponsored a research by Blatherwick for the purpose of determining the alkalizing effects of various fruits by noting their influence upon the urinary acidity. It was soon discovered that while nearly all fruits lessen urinary acidity, the cantaloupe was far more active than any other.

In a recent feeding experiment in which I was efficiently assisted by Maurice Howe, chemist, and Miss Angie Estill and Mrs. Marie Allwardt, dieticians, I found that the papaya is probably equal, if not superior, to the cantaloupe as a means of combating acidosis and is likely to prove more dependable than the spicy melon as a means of combating our national acidosis because of its avaliability at all seasons of the year. In this experiment two subjects were placed upon a fixed dietary and the pH or acidity of the urine accurately determined. No. 1 showed an acidity of 80 times the normal (pH 4.8). The acidity of No. 2 was 100 times the normal (pH 4.7). Each subject ate daily, in addition to the fixed ration, three pounds of papaya, in divided portions. By the third day

the acidity of No. 1 had fallen from 80 times the normal to 12 and of No. 2 from 100 to 1 or normal.

During the last four years in the treatment of several hundred patients suffering from various forms of chronic disease, I have made large use of Florida's tropical fruits and found them invaluable in combating the various nutritive disorders generated by the deficiencies and redundancies of the current American diet.

CITRUS FRUITS CORRECT INJURIOUS EFFECTS OF BREAD AND MEAT DIET

The importance of this property of the papaya will be appreciated when it is realized that practically the whole American nation is suffering seriously from the excessive use of acid-ash foods. McCollum and Sherman have for years been uttering warnings against the ill effects of the too exclusive bread and meat diet of the average American. The fact that the papaya as well as the orange is an efficient antidote for this acid poisoning, ought to give it a large place in the American bill of fare, since the disastrous results of a national endemic of acidosis are becoming more and more evident in the yearly increase of the mortality rates of heart affections, Bright's disease and other degenerative disorders.

THE AVOCADO

Of all edible fruits, the avocado stands pre-eminent as a source of concentrated nutriment adapted to human use. With the exception of vitamin C, the avocado contains every element required for human sustenance, and vitamin C is present in super-abundance in the orange which flourishes beside it in South Florida, and in its luscious fruit provides the needed complementary vitamin, together with the sugar needed to balance the avocado's surplus fat. Half a good hard shell avocado and four or five good sized oranges supply adequate nourishment for a substantial meal and a royal feast.

The avocado contains more fat than any other fruit except the olive, and its fat is of the highest quality, wholly free from the unpleasant butyric acid with which many fats are contaminated, and containing a sufficient amount of vitamin A to maintain high resistance against bacterial infection, a quality possessed by few vegetable fats and lacking in olive oil. Some varieties of the fruit, especially those of Guatemalan origin, contain 25 to 30 per cent, fat, so much, in fact, that they are often used by the natives of Guatemala like butter as a spread for bread. The Cuban varieties of avocados contain only about half as much fat as the rough skin fruits of Guatemalan origin.

The carbohydrate content of the avocado is an invert sugar such as is usually found in fruits and flowers and is gathered by bees to form honey. This sugar needs no digestion, being ready for utilization as soon as absorbed.

The protein of the avocado is the same as thatof the potato and nearly double that of the banana, and is of the finest quality, much superior to the protein of bread and other cereal foods. Its composition is almost identical with that of milk. In fact, the pulp of the fruit is so free from fiber that it forms with water a fine emulsion which closely resembles milk in consistency and appearance, and with the exception of an excess of fat and the

lack of vitamin C may serve as a very satisfactory substitute for dairy milk. Prepared thus, the avocado may be given safely to young infants and to the feeblest invalid.

The gustatory and nutrient properties of the avocado entitle it to a large place in human dietaries. Instead of appearing only on rare occasions as at present and as an expensive luxury except in localities near where it is grown, the avocado should become a staple factor in the American bill of fare. In composition it more nearly resembles a nut than a fruit proper, and like the nut may be properly regarded as a vegetable meat, not as a substitute for meat, but as one of the original and fat rich products which made up the bill of fare of primitive man when, according to Prof. Ami of Montreal, Prof. Elliott of Oxford and other paleontologists, not only man but all other land animals were exclusively plant eaters.

THE AVOCADO IS VEGETABLE MEAT

Prof. H. C. Sherman in his book, "Chemistry of Food and Nutrition," suggests that meat should be regarded as the substitute rather than these fine original food products especially adapted by the low content and high quality of their protein to serve the nutritive needs of *homo sapiens* as well as his forest relatives, the anthropoids, who are held by instinct to the original bill of fare assigned to them and other primates, but from which man, resenting the guidance of instinct, has incontinently wandered away. This is a matter of grave importance in relation to the avocado industry; for if this fruit is to occupy the major place in the American dietary to which its qualities entitle it, room must be made for it. That is, if Americans are to eat more avocados, they must eat less of something else, and the things to be omitted from the menu must naturally be those of similar composition. Meats and dairy products are the only classes of foods of which fats and protein are the chief constituents. It is not suggested that a drive should be made against any class of foods, but the people have a right to full information concerning the merits and the demerits of the various foodstuffs purveyed to them, and when this is brought to them in a campaign of education, they will make such use of it as will create for the avocado a large and growing demand in all the markets of the land. Milk is of course needed for its lime content.

MISLEADING INFORMATION SHOULD BE CORRECTED

In the marked tendency of meats to acidify the blood and tissue fluids is found a strong biologic objection to the free use of flesh foods in the dietary. A full appreciation of the influence of flesh foods upon nutrition and the risks attending their use in general will lead to their elimination from the diet altogether. The strenuous efforts being made recently by the great packing companies to increase the consumption of meat by an "Eat-More-Meat Campaign," although professing an altruistic interest in the physical welfare of the American people, is purely commercial in its aims and must be regarded as an unscrupulous attempt to exploit the ignorance of the public in matters pertaining to human nutrition. Fortunately, the effort thus far has shown no marked evidence of success and it is gratifying to note that it has not received support and encouragement from any physiologist of established standing.

All physiologists are agreed that the highest degree of physical vigor and efficiency may be maintained on a diet which excludes flesh foods and physiologists the world over are unanimous in advising a curtailment rather than an increase in meat consumption. Sherman quotes with approval the statement of Tigerstedt that the extractive substances found in meat—urea, uric acid, ammonia, creatine, etc.—may produce disorders of one kind or another in the body. Says the Scandinavian physiologist, "The metabolism might also take an abnormal or unfavorable form if the fluids of the body were flooded with too much protein," and Professor Sherman adds, "This moderate and conservative warning against too free use of meat as food was written, it is important to remember, in a Scandinavian textbook, and was therefore addressed to those whose average rate of meat consumption was less than half as much as ours."

HIGH FOOD VALUE OF THE AVOCADO

The high food value of the avocado is shown by its calorie content of 73 calories per ounce, nearly three times that of the banana, 50 per cent more than that of an equal weight of beefsteak or sweetbreads, three times that of fish, such as bass, trout, or pickerel, and five times that of oysters.

An ounce of avocado pulp has a calorie value of 73 of which 86 per cent, is fat of the finest quality. This is more than the same weight of egg, more than ten times the food value of an ounce of beef juice, 50 per cent, more than that of round steak, six times the value of clam chowder, more than twice that of chicken broilers or boneless codfish, and nearly twice that of the famous fish, pompano.

In quality the avocado is infinitely superior because of its freedom from bacterial infection, while fresh and smoked meats of all sorts are always swarming with colon germs identical in character with those that are always found in the colon. All slaughtered animals are infected with colon germs during the slaughtering. Not infrequently, in long hung meats, the infection becomes so intense that there may be counted more colon germs in a bit of liver or a Hamburger steak than are found in the fresh droppings of animals. To this source of infection may be traced appendicitis, colitis, duodenitis and other intestinal disorders. No germs at all are to be found in the avocado, and when eaten it resists to a marked degree, as do all vegetable proteins, the attacks of putrefactive and other disease producing bacteria.

Prof. Newburgh of Michigan University has demonstrated that all meats contain a considerable proportion, 25 per cent, or more, of toxic proteins which when fed to mice produce acute inflammation of the kidneys and death. Dr. Hindhede of Copenhagen, Food Commissioner of Denmark, at the Race Betterment Congress held at Battle Creek, Michigan, a few years ago, presented statistical evidence that the death rate of Bright's disease of the kidneys is three times as great in this country as in Denmark, which fact he attributed to the much smaller per capita consumption of meat in Denmark than in this country.

AVOCADO EATERS WILL LIVE LONGER

Dr. Arthur Hunter, actuary of the New York Life Insurance Company, in a work on blood

pressure, shows that the Chinese, who eat little or no meat, have a blood pressure 10 points lower than the average in this country. He referred to the fact that several hundred young women students of Battle Creek College, where meat is not eaten, have blood pressure 10 points lower than that of other young women college students, and expresses the opinion that the lower blood pressure will increase longevity.

The avocado possesses merits of an extraordinary character. For purity, wholesomeness, ease of digestibility and adaptation to human needs, it has few rivals and none that can, fill its place. I fully believe that in the not remote future it will play as important a part in feeding the American people as does' the orange at the present time. It is safe to predict that when this happy era arrives, there will be reported by the Census Bureau a notable lowering of the death rate, an increase of centenarians and a considerable lessening of the mortality from heart disease, which now claims annually more than 300,000 victims and perhaps also a lessening of the mortality from cancer and diabetes. All three of these grave maladies are now claiming annually scores of thousands of victims and the rate of increase is accelerating. The avocado may prove to be a potent factor in solving national health problems which for years have baffled the ablest medical experts.

DIETARY USES OF FLORIDA FRUITS

As dietary foods, citrus fruits with the avocado and the papaya fill a most important place and meet certain important dietetic indications more satisfactorily than do any other products. I will mention briefly some of these and in so doing I am glad to be able to speak from practical experience. For many years I have wished for an opportunity to make use in a large clinical way of the special therapeutic advantages offered by the genial climate of this region as well as of its delicious tropical fruits. Four years ago the opportunity materialized in the establishment of the Miami Battle creek Sanitarium, where I and my colleagues have had a good chance to test the virtues of citrus fruits, papayas and avocados in the treatment of a large variety of acute and chronic conditions, chiefly of the latter sort.

In acute digestive disorders I find the avocado a most excellent remedy. Its blandness is comforting to the hypersensitive surfaces of the stomach and duodenum and its abundant vitamins reanimate the inflamed and crippled cells.

As liquid nourishment the avocado is superior to milk in that it does not form curds, and also because it is absolutely sterile, while milk at the best contains hundreds, often many thousands, of putrefactive and other obnoxious germs.

An orange or two half an hour before retiring and again on rising will in many cases induce a bowel movement night and morning. A third daily movement is desirable. The orange, the papaya and the avocado are efficient aids in changing[1] the intestinal flora to combat autointoxication, colitis and biliousness. They are far superior to any mouth lotion or remedies for "halitosis," by inducing the disappearance of intestinal putrefactions, the real cause of a coated tongue and a bad breath.

In cases of hyperacidity with sour stomach, use well ripened papaya with the avocado as a staple diet, avoiding meats and condiments of all kinds and greatly restricting the

use of salt. When the tongue is coated and the stools highly putrid, as is usually the case, it is necessary to change the intestinal flora, that is, to suppress intestinal putrefaction, by the free use of lactose or Lacto-Dextrin.

In achylia, take several glassfuls of orange juice daily. Always take a glassful half an hour before eating to cleanse the stomach.

In cases of duodenitis, gall bladder disease, and duodenal ulcer, the papaya and the avocado are most appropriate foods because they are bland and soothing to the sensitive membrane and pass quickly into the intestine.

Orange juice is a most excellent vehicle for Lacto-Dextrin when an attempt is being made to change the flora to clear the tongue and to suppress intestinal putrefaction.

The avocado, especially the Guatemalan varieties, is a highly appropriate food for cases of diabetes because of its large fat and small carbohydrate content.

In cases of arteriosclerosis, orange juice may be freely used with advantage because of the pronounced acidosis which usually accompanies this condition.

In case of Bright's disease, orange juice, the papaya and the avocado are all useful, the avocado especially as a staple food because of its small protein content with none of the poisonous extractives always present in flesh foods as shown by Newburgh and others.

As a food beverage in fevers, orange juice has no equal. It supplies exactly the right kind of nourishment in the best possible form. Here is an excellent formula: To two quarts of orange juice add the juice of three lemons and a quart of water. Sweeten with beta-lactose (known commercially also as B-Lac), the improved form of milk sugar, a tablespoonful for each glassful, added just before taking. Give at frequent intervals, usually every hour or half hour when the patient is not asleep.

In infectious fevers, such as measles, whooping cough, scarlet fever, typhoid and flu, orange juice should be used very freely and may be made to serve a useful purpose as a vehicle for lactose, B-Lac or Lacto-Dextrin, excellent means of changing the flora and at the same time supplying the carbohydrates needed to support the patient.

For a person suffering from a hard cold, an attack of flu, pneumonia, malarial or typhoid fever, or an intestinal disturbance, this orange ration affords most admirable nourishment and greatly facilitates recovery. It should wholly displace beef tea, bouillon, chicken, oyster and animal broths of all sorts. The late Dr. Austin Flint discovered that beef tea has the same composition as urine and an eminent French physician describes it as a "solution of poisons." Orange juice is divine nectar concocted by the sunshine which carries healing magic in every drop.

The papaya and orange juice are an excellent combination for use in colds. Twelve or 15 oranges a day with a couple of medium sized papayas will soon dissipate a cold.

In reducing weight, care must be used to supply a liberal amount of vitamins to prevent a nervous breakdown. The papaya is well adapted to such a use and should be used daily in liberal quantities. It is well adapted to the so-called mono-diet plan of feeding in obesity.

In cases of malnutrition, each member of the health building trio, orange juice, papaya and avocado, may contribute actively to the reconstruction process.

In cases of sinusitis, in addition to suitable local treatment, the papaya and the avocado aid in building up the vital resistance and so preventing the disease from becoming chronic. The late Dr. Stucky, of Lexington, Kentucky, demonstrated the curing of sinusitis in the incipient state by changing the intestinal flora. Orange juice with lactose or B-Lac in liberal doses is an excellent means of accomplishing this.

The free use of orange juice is a far better means of combating bad breath, or so-called halitosis, than any of the widely advertised mouth lotions. The source of bad breath is not the mouth, but the colon. Eating six or eight oranges a day or drinking several glasses of orange juice, with the use of three or four ounces of sugar of milk—beta lactose (B-Lac)—and the adoption of a meatless diet will lessen the putrefaction which is the source of the noisome aromas which find exit through the mouth after having been absorbed from the colon and circulated throughout the body.

In Graves' disease or exophthalmic goiter, there is always need for changing the intestinal flora to suppress intestinal putrefactions and hence the value of orange juice, the papaya and the avocado, each of which contributes usefully to this end.

Feeble invalids and elderly persons are greatly profited by the free use of orange juice and papayas because of their superior nutrient properties, the ease with which they are given, and the small demands which they make upon the feeble digestive organs.

The lives of thousands of young infants who are sensitized to milk may be saved by the use of anemulsion prepared from the papaya used with or without soybean milk. Orange juice is of course needed to supply vitamin C.

The avocado, the papaya and the orange are all valuable sources of iron of the highest quality and may render service whenever a blood building diet is indicated. Their rich store of vitamins promotes digestion and assimilation, while the predigested nutriment which they supply is a tissue builder of first quality.

The value of a food as a source of iron does not depend altogether on the amount of its iron content. Two other important factors must be considered, viz., the quality of the iron presented and the amount of iron in proportion to the total food value or calorie content. For example, a pound of beefsteak contains four and a half times as much iron as a pint of orange juice, but the iron of the beefsteak is of inferior quality because it has been once used in animal life and is of the sort which the body throws away. In other words, it is second hand iron and like second hand goods in general is not first class. One can easily drink several pints of orange juice in a day, and so can actually and without inconvenience ingest more iron in this liquid form than could be easily eaten in the form of meat. Orange juice contains almost nothing but an exceptionally wholesome sugar which is ready for immediate absorption and use, whereas the beefsteak is chiefly protein which must be digested and may easily do much harm by overtaxing the liver and kidneys. It has been pointed out by Sherman that animals that have been made anemic by bleeding recover more rapidly when fed foods rich in iron of plant origin than when given an equal amount of iron of muscle meat origin.

The iron of all citrus fruits is of most excellent quality and the free use of oranges,

lemons and grapefruit is a far better means of combating ordinary anemia than are liver and meats of any sort and should always be used in cases of pernicious anemia in connection with the liver extract now universally used in preference to liver. The appended table shows the iron content of Florida's tropical fruits, and for comparison, some of the more common food staples.

From the above facts it is evident that there is a large place on the American table waiting for the papaya and the avocado and a larger place for the Florida orange.

In conclusion, permit me to offer the suggestion that a most convincing argument in behalf of the superior merits of Florida's delicious tropical fruits as well as its incomparable climate would be the example of the great body of people who compose the citizens of this state practicing and profiting by the recommendations made to other people. In other words, let us practice what we preach. And let us in addition respect all the canons of normal, physiologic living. Florida ought to be foremost in the ranks of those who stand for health through temperate, sane or biologic living. The balmy air of Florida will do little good if inhaled through a cigar or a cigarette. Orange juice will render no service if mixed with toddies or cocktails. Papayas and avocados will not antidote the toxic effects of putrescent meats or stomach blistering condiments. Florida's precious contributions to a biologic bill of fare must be supplemented by observance of the whole code of physiologic living to validate their health promoting potencies.

A great drive, persistently pushed, to get Floridians to drink orange juice and eat papayas and avocados as we recommend the people of other states to do and to live temperately and wholesomely, ought to result in the course of a few years in making the people of this state so notably superior to the people of other parts of the country in freedom from disease, vigor, endurance, as well as in physical appearance, that the whole country would be eager to join the Florida procession toward race betterment through eating its choice products and basking in its sunshine.

Member: You mentioned a ration of orange juice and three lemons to a certain amount of orange juice. What was the object of the addition of the lemon, and is the lemon superior in any of its qualities to the orange juice?

Dr. Kellogg: The only reason for the addition of the lemon juice is that the fever patient sometimes gets a little tired of the plain orange juice; it gives a little more flavor, is all. It is not absolutely necessary.

Member: How can we procure a copy of your paper?

Mr. Brooks: Every paper that is given here is published later in the Proceedings of the Horticultural Society, and that is available to every member who pays his dues of $2.00.

Dr. Kellogg: I will deliver the paper to the secretary or his librarian to do whatever he desires with it. And I expect to publish it in Good Health.

Member: What part does orange juice play in the treatment of low blood pressure?

Dr. Kellogg: Low blood pressure is not a matter to be particularly troubled about unless it is connected with heart affection. As a matter of fact, orange juice is of very high value

in the treatment of cases in which the blood pressure has become low because of heart disease. We make very great use in my practice, of it, as helping out persons whose hearts have become so bad they have been ready to give up. A gentleman came in less than a week ago from Venezuela. He was barely able to get here. He had travelled all over Europe, and was steadily getting worse. I was glad last night to find out that he had a broad smile on his face, and we found when we came to examine him that his blood contained poison matters that ought to be eliminated by the kidneys in more than double the amount that they were doing, and we immediately put him on a diet of orange juice. In such cases we find that it accomplishes wonderful results, in removing poison that affects the heart. I have seen cases of this sort almost resuscitated. I feel that orange juice is one of our most efficient means of combating this condition.

PERCENTAGE COMPOSITION AND FOOD VALUE OF SOME OF FLORIDA'S TROPICAL FRUITS

	Water	Protein	Fat	Carbo-hydrate	Acid (Citric)	Minerals	Iron	Food Units Calories per oz.
Orange	87.2	0.9	0.2	10.6	0.7	0.50	.00052	14.4
Orange Juice	90.0			9.0	1.2		.00024	15.0
Grapefruit	89.0	0.5	0.2	10.0	1.2	0.40	.00030	12.5
Grapefruit Juice	90.0			6.7	1.4	0.54		8.8
Lemon	89.3	0.9	0.3	7.8	5.1	0.54	.00060	12.5
Lemon Juice	89.4			2.3	6.0		.00015	8.0
Lemon Peel	87.5						.00075	
Lime	86.0	0.8	0.1	0.5	5.9	0.80		8.4
Lime Juice	91.3	0.1		0.3	7.7	0.40		7.1
Pineapple	85.3	0.4	0.2	13.0	0.7	0.40	.00037	16.6
Pineapple Juice	86.2			11.8	1.0			14.5
Avocado	64.4	1.7	26.4	3.3		1.40	.00057	73.0
Papaya	88.7	0.6	0.1	9.0		0.60		11.3
Mango	81.4	0.7	0.2	16.2	0.5	0.48		21.0
Banana	74.8	1.2	0.2	22.4		0.84	.00064	28.0
Guava	80.6	1.0	0.6	11.0	0.62	0.70		17.0

Member: I understood you to say that the ripe papaya had digestive properties when they are ripe. Does not the seed contain that substance of the ripe fruit?

Dr. Kellogg: I didn't mean to say that the papaya loses any of its essential qualities as it approaches the ripening stage, only that it loses its digestive properties. It contains no digestive properties. It shouldn't be exploited as a food that aids digestion; it is already digested.

Member: You spoke *of* using milk sugar. How will honey compare with that?

Dr. Kellogg: It don't take the place of milk sugar at all. It is sweeter and it is better than ordinary sugar, but it hasn't any digestive properties.

Member: Why is it that orange juice or other citric acids do not agree with some people?

Dr. Kellogg: I explained in my paper that some people that have gotten their stomach into a very irritable condition by the use of pepper and mustard, any strong acid will act as an irritant. It is only for the time being. By correcting the errors in diet, the orange juice will soon become acceptable. I have several pages more which I have not read, which will appear in the paper, and these deal particularly with the dietetic uses of the avocado, which will answer, I think, many of the questions you have in mind.

Member: Is not the avocado very fattening?

Dr. Kellogg: Naturally the avocado is fattening, because it is about 86% fat. It is more than three-quarters fat; it couldn't be recommended to people who want to reduce in weight.

Mr. C. I. Brooks: I might say for the benefit of those who do not know that the College of Agriculture has conducted many tests from various avocado producing sections, and inasmuch as the great quantity of our avocados are of the West Indies varieties, it may be generally stated that our average avocado will not run over *75* to 78 per cent. fat.

Mr. Brooks: I am sure we appreciate the wonderful message Dr. Kellogg has given us. Some of us may not agree with all he has said, but I am sure it takes his sensational way of saying things in order to make us think and bring out the facts on which we can later act. I do believe you will agree with me that in Dr. Kellogg's talk today there is more food for thought in regard to advertising citrus, papayas and avocados than anything else that has ever come up in the history of the State of Florida.