

The Avocado and Human Nutrition. I. Some Human Health Aspects of the Avocado

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Abstract. Avocado usage is reduced because of negative misconceptions. The avocado has various uses as a natural cosmetic, with advantages in rapid skin penetration, and as a superior natural sunscreen. Avocado oil has several culinary and health benefits. The greater use of whole fruit has important advantages: usefulness in human weight control, high nutritional density, source of major antioxidants, stroke prevention, fruit protein source, fiber source; as baby food, and other dietary benefits. Erroneous public perceptions of avocado calorie content and of cancer influences are noted.

Many people appreciate the delicious flavor of avocado, but are afraid of them for (mistaken) dietary reasons. They therefore avoid avocados or eat less than they could, because of incomplete or erroneous nutritional information. Most of us connected with the avocado industry have encountered such errors in understanding among friends or chance acquaintances. Indeed, on occasion, one even encounters them among "avocado" people.

These errors are diverse and recurrent. One sometimes feels a bit like Hercules of classical mythology battling the ugly Hydra: as soon as one evil head is cut off, two more grow in its place! It seems worthwhile, therefore, to make a summary of the scientific findings concerning the avocado. We will begin with a brief look at cosmetics, then examine the more important food attributes, and close with an analysis of misconceptions in the press and among the public.

Avocado Cosmetics

Increasing recognition of unhealthful consequences from additives, preservatives, processing, and artificial products generally gives the avocado a major advantage as a food and also as a cosmetic. With increasing concern *for* the environment, an added plus *for* avocado cosmetics is that they are biodegradable. Consumers are beginning to favor basic, natural ingredients. Swisher (1988) discusses use of the avocado as a skin moisturizer, cleansing cream, makeup base, sunscreen, lipstick, bath oil, and hair conditioner. Toxicological tests of avocado oil products have provided an official health/safety assessment.

In skin care, the two major advantages of the avocado are its marked softening and soothing nature and its notable absorption. Compared with almond, corn, olive, and soybean oils, avocado oil had the highest skin penetration rate (Swisher, 1988).

In sunscreens, chemicals like PABA have superior effectiveness but cause skin irritation in some people. Because they are synthetic, there are lingering questions about long-term safety. Among eight plant oils, avocado oil proved the most effective sunscreen (Swisher, 1988).

Avocado Oil

Like olive oil, avocado oil is predominantly monounsaturated, a property which is thought to confer distinct health benefits. The avocado as a refined cooking oil has additional advantages (Swisher, 1988).

1. It is unusually light, so it mixes well with other foods.
2. It has a mild, delicate flavor, which enhances and brings out the flavor of other foods, instead of dominating them such as olive oil and other oils.
3. Avocado oil withstands a high cooking temperature before breaking down, i.e., its "smoke point" is about 255C (490F), which is much higher than that of olive oil.

Fried foods presently have an undesirable health reputation, but use of olive and avocado oil could change that.

Whole fruit pulp

This is by far the most important human use of the avocado and will constitute the remainder of this article. We will look at several nutritional qualities which sometimes overlap.

Weight control. Contrary to popular assumptions, the avocado can be a helpful part of a successful weight-management program. It brings several advantages.

1. Its monounsaturated fat speeds up the basal metabolic rate, as compared with saturated fat.
2. Its high fat content gives a quicker feeling of satiation ("fullness"), thus helping to reduce overeating.
3. Its high fat content makes an overall sound diet more palatable, reducing the temptation to binge on foods high in sugars or saturated fats.

4. Its rich supply of vitamins and minerals also makes the diet more wholesome and satisfying and thus more conducive to overall health and to moderation in consumption.

The high fat content of most avocados (up to 90% of its calories) will make some people dubious about its positive effects on weight control. Not only does fat have over twice as many calories per unit weight as does carbohydrate or protein, but also if excess calories are consumed, the body apparently burns about three times as many calories when storing calories from carbohydrate or protein as it burns when calories from fat are stored. Recent evidence, however, suggests that calories are not the whole story for body weight, with timing of both consumption and exercise as factors and with calories from fat also a possible added handicap.

So, what is known from experiments with the avocado? The next part of this article will discuss in detail results from the three studies of known changes in cholesterol resulting from the addition of avocado to the diet. In each of the three studies, there was an average small *weight loss* associated with avocado consumption. In the most pertinent experiment (Grant, 1960), a mean of just over one California avocado a day for a mean of 33 days increased average daily calories by a calculated 24% and fat by 54% but resulted in a weight loss averaging approximately 1 kg (2.2 lbs). This remarkable result (under exceptional and tightly controlled hospital conditions) should not be taken as a universal guarantee; individual results will vary depending upon complex individual metabolic histories and interactions. What can be said is that eating avocado has been shown to be fully compatible with good weight control.

Very few people will have rapid weight loss as a result of increasing their consumption of avocado; however, the more slowly one loses weight, the less likely one is to regain it. It has become clear that an effective solution to the widespread overweight problem will not come from simply eating less. Indeed, such 'dieting' can actually make things worse by causing muscle loss so that the usual 'yo-yo' weight rebound leaves one fatter than ever and subsequent weight loss more difficult to achieve than ever. Goodrick and Foreyt reported in the October, 1991, issue of the *American Dietetic Journal* that even a combination of behavioral self-management training plus sharply reduced calories gave a discouraging 90% eventual relapse level. Part of the reason is genetic: we tend to inherit our body fat amount and distribution. Part of the solution is more exercise which, of course, is good for us for other reasons.

The emerging picture is quite complex. In the February, 1990, issue of the *American Journal of Clinical Nutrition*, Bouchard reported from Canada that women who were small eaters (mean of 1488 calories/day) as compared with similarly exercising 2393 calories/day eaters, actually weighed 10 lbs (22 kg) more on the average, plus having 22% more body fat. The explanation is probably a combination of average differences in both genes and food consumption: i.e., reducing calorie intake can lower an individual's metabolic rate and thus defeat its purpose. We need to eat enough healthful food to keep our metabolism high, and to provide the sated feeling that eliminates binge eating.

Calorie-counting, dieting, advertised gimmicks and quick weight loss are recipes for failure; whereas exercise plus healthy food habits as a permanent way of life can bring success. The situation is analogous to that of personal philosophy: Focus on happiness and it will probably elude you; focus on wholesome living and happiness is a likely by-product. Similarly, focus on weight loss and it will probably elude you; focus on wholesome eating and weight control is a likely by-product.

This insight was expressed years ago by Wood (1983) in a book hailed by one health magazine as the finest method for weight reduction known to them. Wood emphasized 'playful' exercise, but his introduction begins: *"The solution to our national overweight problem is to encourage people to eat more."* He counseled eating fresh plant food "heartily." And his recommended list of "ingredients for a healthy diet" included the avocado.

Americans spent an estimated \$32 billion in 1989 on diet foods and products with the annual amount increasing at a rate that could reach \$50 billion by 1995. It is difficult for me to avoid the conclusion that we would be healthier as a nation if we spent a tiny fraction of that amount to buy more avocados and pocketed most of the remaining money.

High nutritional density. The fourth reason given above for the avocado's role in weight control is its "rich supply of minerals and vitamins." More important than a food's calorie content is its total nutritional contribution to human needs. A good measure is nutrients per calorie. Different avocado analyses have given somewhat variable results. The most detailed publication is that of Slater *et al.* (1973). Their data indicate that one half of a 'Hass' avocado, about 80 g edible fruit, provides a substantial percentage of the daily nutritional needs of a child aged 7 to 10 (adult percentages are generally a little lower, especially iron for females) (Table 1).

Table 1. Percentage of daily nutritional needs of a 7-10 year child supplied by half an avocado (cv. Hass).

Nutrient	% supplied
Calories	7
Vit. A	18
Vit. C	17
Vit. E	13
Folacin	16
Niacin	13
Vit B ₆	15
Iron	15
Magnesium	20

The avocado contains little vitamin B 12 and calcium, limited zinc and modest phosphorus. Its half-a-fruit quota of riboflavin and thiamine for children is about 9.5 and 8%, respectively, hence about equal to its relative calorie contribution. But the striking thing is that no less than eight essential nutrients are apparently present in about a 2: 1 calorie ratio. Nor is that all; three additional nutrients, potassium, copper and pantothenic acid, (for which I could not find precise Recommended Dietary Allowances) are also estimated to be present in avocado at about twice the calorie content. Per calorie, the avocado is indeed remarkably nutritious.

There is not space here to discuss either the human body's uses or the status in typical diets of these various nutrients. Judgments vary; several surveys have concluded that one or another of them is deficient in a considerable portion of American diets. Next we will look briefly at one of the least discussed vitamins in the group of nutrients provided by the avocado.

Vitamin B₆ (pyridoxine) is important for the nervous system, red blood cells, teeth and gums. The Harvard Health Letter for March, 1991, reported 1990 data indicating that most Americans consume too little of vitamin B₆. Among good sources they list watermelon and banana (overlooking avocado). Polansky and Murphy (1966) compared the B₆ content per unit weight of 26 vegetables and fruits. For total chromatographed B₆ banana and avocado had the highest amounts, the remaining 24 vegetables had from 1/5 to 1/25 of the amount of the avocado, with watermelon 1/6. A more recent report by William Sears, M.D., privately printed *Nature's Guide to First Foods* (1988) reports that avocado has three times as much B₆ per g as banana.

Antioxidants and free radicals: cancer, cataracts, and aging. The University of California at Berkeley *Wellness Letter* for October, 1991, discusses the basic role of oxygen for human cellular energy and for life, but notes that an inevitable by-product of this activity is the formation of highly reactive "free radicals." These unstable troublemakers can affect various cell constituents: perhaps artery walls or LDL cholesterol advancing coronary heart disease; eye lens tissue causing cataracts; a critical gene leading to cancer; perhaps arthritis; or DNA (the genetic material) causing gradual deterioration and aging.

The human body has two main defenses against these free radicals: enzymes and other blood compounds that depend on trace minerals and good general nutrition and three potent antioxidants vitamins C, E, and beta carotene (vitamin A precursor). An article in the June, 1991, issue of the *American Journal of Clinical Nutrition* indicates that only about 57% of nonsmokers may be getting enough vitamin C daily (for smokers the deficit is much greater). *Men's Health* (June, 1991) concluded that most of us are not getting enough vitamin E. A number of nutritionists have called for greater consumption of beta carotene.

As we have discussed, the avocado provides about twice as high a proportion of our daily needs for the above three antioxidant vitamins as its calorie proportion. Recall also that the avocado is rich in copper and iron, two mineral constituents of antioxidant

enzymes. Nutritionists usually recommend that we get our needs met from basic food rather than from supplements. And while the risk of colon cancer, for example, has been associated with fat consumption, the *Harvard Health Letter* for March, 1991, reported that while meat indeed increased that risk sharply, there was no association with plant fat. Thus, eating avocados could be an enjoyable way to help protect ourselves against cancer, heart disease, arthritis, and eye cataracts; it may even delay the processes of aging.

Stroke prevention. Heart disease, cancer and stroke are the three leading causes of death in the United States. Additionally, stroke can cause many years of partial or total incapacitation and tragic crippling. The Associated Press, 15 October, 1987, reported an interview with Dr. Louis Tobian of the University of Minnesota on protection from strokes by fruit and vegetable consumption, in particular, by high potassium intake. Dr. Tobian is quoted as suggesting that bachelors may die earlier than married men because they have less balanced diets, specifically insufficient in potassium. As the best sources of potassium, he included strawberry, banana, citrus juice, potatoes, and milk (avocado is not mentioned).

Smith *et al.* (1983) measured potassium in 100 g portions of 10 tropical fruits (including avocado), seven common fruits, nine common vegetables, and eight tropical vegetables. The seven common fruits, including strawberry, banana and orange, ranged from 1/5 to less than half the potassium content of avocado. Similarly, the nine common vegetables ranged from less than 1/4 (summer squash) to less than 2/3 (carrots) the avocado level. The other, lesser used, tropical fruits ranged from 1/2 to just over half the potassium supplied by avocado. Tropical vegetables, which are rare in the United States, ranged upward from 1/5 to about the same potassium richness of avocado.

Prevention magazine for August, 1987, reported the results of a 1 2-year study of stroke entitled "*Potassium was the key.*", conducted jointly by the Schools of Medicine of the University of California San Diego and Cambridge University in England. A 40% reduction in stroke risk was associated with an average daily increase in potassium consumption of about 400 mg, the amount supplied by less than half an avocado! Moreover, blood pressure, a stroke factor, was linked in the same article to potassium-sodium imbalance, namely to a sodium excess. The avocado has about 52 times as much potassium as sodium. For the touted potassium-rich carrot, the potassium to sodium ratio is less than 7 to 1 according to the brochure by Dr. William Sears cited earlier. Moreover, vegetables high in potassium which include the common potato and winter squash, are commonly eaten cooked. Boiling can remove up to 30% of potassium originally present, according to a researcher cited in the above *Prevention* article, giving the avocado an additional advantage.

Finally, avocado and olive oils are the two chief foods that are very high in monounsaturated fats, while being comparatively low in both polyunsaturated and saturated fats. An Italian epidemiological survey of 4,903 people (reported in a press release in February, 1990, based on an article in the *Journal of the American Medical Association*), found that while both monounsaturated and polyunsaturated fat were

associated with lower blood cholesterol as compared with saturated, only monounsaturated fat was also associated with lower blood pressure. The next part of this paper will look at factors contributing to a healthy heart and related to avocado consumption. There is evidence to indicate that eating avocado may reduce the incidence of all three of the major causes of death in the United States.

Protein. Cultivars vary somewhat but the dominant 'Hass' is about 2.4% protein on a fresh weight basis (Slater *et al.*, 1975). This is unusually high for a fruit. Hall *et al.* (1980) compared the essential amino acid content of 15 fruits: the avocado was second only to the rare Tucuma from Brazil which had about three times as much as mango, orange, peach and persimmon, and about six times as much as the two other common fruits listed, apricot and apple. Polansky and Murphy (1966) compared the protein content of 26 more common fruits and vegetables (41 entries counting separate cultivars and years). The avocado was in first place with about two to ten times the protein content of the others. The avocado is a "complete food" in terms of protein, containing all 9 essential amino acids, although not in the ideal proportions.

The fact that the avocado is an excellent source of essential protein is of little interest to most residents of the United States and other industrialized countries who are already consuming more protein than they need. It could be of increasing importance as health concerns move people away from meats and toward more vegetarian dishes, especially for those who do not care to consume many legumes. It could already be of significant benefit in tropical areas where protein consumption is insufficient (Hall *et al.*, 1980).

Fiber. A review paper by Anderson (1990) noted that "fiber has emerged as a leading dietary component in chronic disease prevention. High fiber intake lowers the risk for cardiovascular disease, some cancers, hypertension (high blood pressure), diabetes, and obesity" He gives references for each of these; as well as for therapeutic benefits from fiber treatment of each of these conditions, except cancer, and with the addition of gastrointestinal diseases. For some disorders, a mixture of both soluble and insoluble fiber appears to be most beneficial. He also noted that "most individuals in the West ingest suboptimal amounts of dietary fiber."

Smith *et al.* (1983) compared the fiber content of 16 fruits and 18 vegetables. Of the 34 food sources, only the avocado had large amounts of both soluble and insoluble fiber (it had, respectively, 2.1 % and 2.7% by fresh weight). Guava had the highest fraction of soluble fiber by a wide margin, pears had 2/3 as much as avocado. The others all had less than half as much, with the common fruits ranging from 16% to 30% of the avocado level. Among vegetables, available data indicate that only broccoli surpassed avocado in soluble fiber, the others ranged downward to 21 %. For the complementary benefits of insoluble fiber, no fruit and only peas and among vegetables pigeon peas are listed with levels equal to or greater than avocado, the others ranged downward to 15%.

A frequent recommendation is that the typical American should double his or her fiber intake. The avocado would be a very pleasant means toward that end.

Various dietary benefits. The avocado is a mild-bland, oil-rich, nutrient-rich deliciously-flavored food. This combination gives it an exceptionally diverse range of dietary advantages. Just in terms of usage alone, the avocado can be served as an hors d'oeuvre, soup, salad, dip, sandwich spread, garnish, half-shell spoon-out, entree, dessert, or beverage with various kinds of use in each category. Such eating versatility makes it easy to increase consumption in order to gain greater benefit from its numerous advantages to the human diet.

The blandness, especially of some varieties, has sometimes been denigrated. But this very quality makes it soothing to the alimentary tract. Perhaps that is partly why American Indians for hundred of years have regarded the avocado as especially desirable at times of illness. Linoleic fatty acid is an essential polyunsaturate, i.e., the human body cannot manufacture it. Our analyses (unpublished) indicate that the linolenic oil content of the 'Hass' avocado averages just over 21 %, only the content of the monounsaturate fat oleic acid was higher.

Diabetes. The 27 September, 1988, issue of the *New England Journal of Medicine* reported a 4-week comparison of individuals on the traditional type II diabetic's diet of low fat-high carbohydrate with those on a diet lower in carbohydrates and higher in monounsaturated fat (the dominant kind in avocados). The monounsaturated diet offered better control of blood sugar levels, accompanied by lower triglycerides and higher HDL ("good" cholesterol). However, this needs confirmation, including more careful monitoring. Moreover, there is a report that avocado has an odd sugar type that depresses insulin production. Diabetics probably should consume avocados cautiously.

Baby food. Dr. William Sears (1988) notes that avocado is "one of the first fresh fruits a baby can enjoy." It is a time-saver, served raw. "Low in sodium and cholesterol-free, avocados contain [many] valuable nutrients ". For example, "Ounce for ounce, avocados contain more potassium than 45 other fruits, juices or vegetables... and they are one of the only fruits or vegetables which contain monounsaturated fats, essential for baby's development."

In an interview with the *California Grower* (October, 1989), Dr. Sears stated, "When you think about it, ...avocados are an ideal first food for infants. Avocados have a delicate flavor and a smooth, creamy consistency which makes them a perfect food for babies. ...Avocados provide infants with more vitamin B₁ B₂ niacin, folacin, potassium and magnesium per 1 5 gram serving than any of the other frequently recommended fruits and vegetables [and are second to the highest in several other vitamins and minerals.]"

Seventy years earlier, long before these dietary details were understood, Pasadena nurseryman D. W. Coolidge addressed the annual meeting of what was then the California Avocado Association: "The fruit of the avocado is about the most tasteful and nourishing that grows out of the ground The strongest people physically and mentally, the happiest and most beautiful children, will be those who make the avocado, instead of meat, their daily diet. I have often marveled how babies and very young children take

to the avocado at once. If I have a greater love for anything than the avocado, it is for ruddy, happy children."

Misconceptions

"Avocados are high in fat and therefore bad for the heart"

Right premise, wrong deduction. A number of articles discusses this misconception in detail. A brief answer is given here: avocados have been shown to maintain good cholesterol while reducing bad cholesterol. They are good for your cardiovascular system. For a more complete explanation, please see the Avocado and Human Nutrition part II, Avocados and Your Heart.

"But their high fat content makes them very high in calories"

We have already noted that increased avocado consumption has been shown experimentally to be compatible with good weight control, and we have suggested why the very fact of its high fat content may help in human weight control. Nevertheless, one keeps encountering warnings, even from dieticians, about the avocado being "very high" in calories, so let's look at the facts.

The number of kilocalories per avocado fruit varies with race, variety, size, and season; an average for a California-grown avocado might be 300 (Slater *et al.*, 1975). Number of kilocalories per person per day for normal maintenance varies with weight, age, sex, activity level, and personal metabolic rate. For moderately active individuals aged 19 to 50, a 125 lb (57 kg) woman needs about 2100 kilocalories, and a 157 lb (71 kg) man about 2800 kilocalories (University of California, Berkeley, *Wellness Letter* for May, 1991). Thus, our "average" people, if they were to get all their daily calories from avocado, would have to eat 7 or 9, respectively. That is a lot of avocado! With its high fat content, one would expect pronounced satiation well before the total "allowed" was consumed.

Rinzler (1987) gives a modern comparative food evaluation. The avocado is rated only *moderate* in calories per serving, with such foods as beans, bread, oatmeal, pasta, peas, and rice; less caloric than peanuts, most nuts and seeds, most cheeses, sugar, and butter, etc. Yet, the avocado is high enough in calories to be helpful to the estimated 18% of Americans who are underweight. It is apparently not so high in calories to be of concern to normal individuals as shown by the actual weight results cited earlier. In *Fit* health magazine for August, 1982, an article on the avocado concluded that in the public eye, it has somehow become packed "with fictitious calories, ...avocados have received the undeserved reputation of being fattening."

Why has this happened? One possibility is that even diet specialists tend toward the oversimplification that "fat is fat" , overlooking not only the fact that avocado fat is predominantly monounsaturated, but also that it has a very high nutrient density per fat calorie. Another possibility is the lament that "everything I love is illegal, immoral, or

fattening." Preferred, high-fat foods from steaks to deserts now have deservedly bad reputations, and many people automatically conclude that anything as "sinfully" rich and delicious as avocado must be fattening and cannot be good for us ("Good" for us are rather the foods with little appeal to most people, like carrots, celery, leaf lettuce and spinach). It is an unfortunate irony that two major advantages of the avocado, high monounsaturated fat content and exquisite nutty flavor, are in many people's minds twisted into *disadvantages*.

"I've heard that avocados can cause cancer."

This rumor resulted from some dubious epidemiological findings in Shanghai, China; findings which a few superficial commentators then extrapolated to even more dubious conjecture. The study, by Shun-Zhang *et al.* (1990) was on breast cancer. The authors summarized: "[Our cancer] cases have a significantly increased intake of total calories compared to... controls, this excess primarily coming from monounsaturated fat." This is the basis for the speculation that avocado, which is rich in monounsaturated fats, is somehow linked to breast cancer. There are major logical problems with this speculation.

1. Correlation does not prove causation. (The classic statistical example was the strong correlation between the salaries of Methodist ministers and the price of rum in Jamaica!) Increased breast cancer and higher calorie consumption may both be the result of an unknown third factor. That this may indeed be the case here is indicated by another of their findings: the added breast cancer risk associated with a university education (compared with less than full high school) was more than five times as large as that associated with additional calories or monounsaturated fat!
2. Even if extra calories were to blame for increased risk of cancer, the specific link to monounsaturates may well be entirely spurious. The calculated added risk from added protein is nearly as large as that from added monounsaturated fat, but the lesser variability in protein consumption reduces its statistical significance. Also, both polyunsaturated and saturated fats are relatively minor dietary constituents in this Chinese population. The authors note: "Given these limitations, the primary dietary finding is the positive association with total calorie intake." (Moreover, instead of a gradual dosage response, the statistically significant increase in cancer risk was observed only for the 20% of women with highest consumption a very high 3142 kilocalories per day average.) In addition, the individuals having the highest calories and cancer rate (20% of the group), when compared with the 20% having the lowest of both, averaged 3.6 times more monounsaturated fat, but also 3.9 times more polyunsaturated and 13.2 times more saturated fat!
3. Even if somehow monounsaturated fat were to blame, extrapolating this to the avocado is logically hazardous. Almost none of the monounsaturated fat eaten by this population would be from avocado. Unlike most oils, avocado monounsaturates are usually consumed as part of the total fruit, with its rich supply

of minerals and vitamins (including the antioxidants thought to reduce cancer risk). Any conceivable added cancer risk from monounsaturates could well be real only in the absence of other avocado nutrients.

4. As the authors acknowledge, their hypothesis implicating monounsaturated fat in breast cancer is contrary to results elsewhere: "...this finding contrasts with the relatively low risks seen in Mediterranean populations with high monounsaturated fat intake." and "The present results are inconsistent with the only other reported controlled case study of diet and breast cancer in a low-fat intake, low-risk population, which was carried out in Japan." There have been suggestions elsewhere of possible linkage with total fat, but "...two recent cohort studies... in the United States have failed to find any positive association between fat intake and breast cancer risk."
5. Breast cancer is several times as prevalent in developed countries of Western Europe and North America as in Asia. The authors' Table 1 gives dietary data for Canada and China as representative of the two contrasted risk groups. In seeming contradiction of their primary finding, average calorie consumption is actually a bit *higher* in Chinese women. True, total fat intake averages higher in Canada, but this is a result of Canadian women eating 4.2 times as much saturated fat; polyunsaturated fat is about the same in the two countries, and it is the Chinese, who are known for their lower risk of cancer, who actually averaged more monounsaturated fat! (Canadians get about 44% of their fat calories from monounsaturated fat, Chinese women about 69%).

The total evidence available certainly does not support *any* linkage of monounsaturated fat, let alone avocado, with increased breast (or any other) cancer risk. In fairness, the original authors were very cautious in their conclusion; it is some of the popularizations that went astray.

A much broader Chinese epidemiological survey (Junshi *et al.*, 1990), of environmental and behavioral factors related to mortality, is by far the largest study of its kind, yielding over 100,000 correlations. The authors wisely noted the danger of coincidental correlations being mistaken for cause and effect, and therefore warned against accepting even statistically significant correlations unless they are supported by research and logical explanation, two features that are lacking in the Shun-Zhang *et al.* (1990) report data. Junshi *et al.* (1990) drew only one dietary inference concerning cancer: eat more fresh plant food. (Such as avocado!)

Henderson *et al.* (1991) recently surveyed the literature on cancer and diet. They note the "inconsistent" results from attempts to relate total fat consumption to hormone-mediated cancer risk, but conclude "It is difficult to refute a postulated association between polyunsaturated fat and breast and prostate cancer," because of measurement difficulties. (Unlike monounsaturated fat, polyunsaturated fat is suspected of increasing harmful free radicals). In contrast, the association between *animal* fat (especially red meat) and colorectal cancer seems clear; "These results suggest a 50%

decrease in consumption of animal fat would result in about the same reduction in colon cancer risk." "Consumption of fresh fruits and vegetables has consistently been found to decrease the risk of stomach cancer." In that vein, the December, 1991, issue of *Men's Health* reported a survey of cancer incidence in a sample of over 14,000 people, classified into three categories based on relative consumption of fruits and vegetables such as avocado; for no less than 12 assorted cancers combined, the people with the highest consumption averaged only 43% as much cancer as the third of individuals who consumed the lowest amount. It has been estimated that only 9% of Americans eat the recommended level of fruits and vegetables.

The avocado differs from most plant foods in its high oil (fat) content. Nutritionists commonly recommend reducing total fat consumption including animal and saturated fats, to 30% (or preferably less) of total calories. The December, 1991, issue of *Nutrition Action Healthletter* quotes Frank Sachs, Harvard physician and diet researcher: "The high-fat diets that are associated with cancer in humans are very low in vegetables that are cancer protective. There is no need for total fat to be very low. It could be as high as 35 to 40 percent. Given a calorie intake that will [avoid obesity], I don't think it matters whether calories 'Come from vegetable oils or carbohydrates." The same article quotes physician and epidemiologist Meir Stampfer: "...in the Nurses Health Study, we found virtually no difference in the risk of breast cancer with calorie intake between 29 and 49 percent of calories from fat This country probably would be healthier if we came closer to a vegetarian diet. "

When suitable experiments are eventually run, I expect that dietary avocado will prove to be an effective reducer of cancer risk.

One may hope that this lengthy discussion will lay to rest a particularly distressing public misconception.

Also, it will help us to be "inoculated" against any such future misconception. We must urge investigation and correction of any errors of fact or interpretation. Most food editors are appreciatively open to factual information.

Conclusion

Purseglove (1968), In his authoritative textbook, labeled the avocado "...the most nutritious of all fruits." Noted food writer Gaylord Hauser once said of it: "In this single delectable fruit are combined the protein of meat, the fat of butter [but much more wholesome!], the vitamins and minerals of green vegetables, the flavor of nuts, a six course dinner ". America's greatest plant explorer, David Fairchild is attributed "...the avocado is a food without rival among the fruits, the veritable fruit of paradise." And in 1959, cereal pioneer John H. Kellogg maintained that "of all edible fruits, it stands pre-eminent as a source of concentrated nutriment adapted to human use. For purity, wholesomeness, ease of digestibility, and adaptation to human needs, it has few rivals and none that can fill its place." (Quotation courtesy of J. S. Shepherd).

Anecdotes lack scientific weight, yet sometimes capture reality more effectively than long scientific discourse. In the *Los Angeles Herald Examiner* for November 9, 1969, writer Emily Wilkens had a 4-column article, "How One Woman Keeps a Youthful Look." It tells the story of her friend Lisa, who was "a super traveling saleswoman in the cosmetics field and could buy every known external beauty aid at a fraction of its cost. [Yet] day by day she looked worse even with the most careful skin care and makeup. At the same time, her energy for "just living" was flagging, and she was having a weight problem She consulted eminent diet specialists, ...all to no avail. One day while out west, she invited a very famous movie star to have dinner with her to discuss a special promotion for her company. Lisa watched with wonder as the actress reached into her handbag and produced a luscious *avocado*. On the way home the actress...revealed her [secret] of beauty through healthful eating [emphasizing] fresh fruits and vegetables. The very next day, Lisa embarked on the diet suggested by the actress...Lisa has lost weight and inches. Her eyes sparkle and her skin glows, and she grows...lovelier and more vibrant each year."

Avocado health benefits are gradually becoming more widely recognized. For example, *Prevention* health magazine for June, 1988, had an article on 'Nutritional nuggets from California cuisine' ("with Stanford University"). It speaks of the "light" and the "lean," "sparkling with beauty, flavor and good health," an eating style that "may help prevent heart disease, obesity and cancer, while delighting the senses." A recommended component: avocado. Similarly, *Men's Health Newsletter* for February, 1992, discusses health-conscious sandwiches, to "keep your energy level high, your wallet fat and your stomach lean." They recommend picking one item of bread, condiment and filling from select lists; then "add as many extras as you like" from a list that includes various superior vegetables, low-fat cheese and avocado slices.

Yes, the avocado indeed is "the veritable fruit of paradise."

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