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Nutritious Value of Avocado

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Abstract. Wrong ideas about the avocado are reducing its consumption. Avocados have high nutrient density-per calorie, they are rich in important human nutrients. This, with their giving a feeling of fullness, plus their palatability that reduces the urge to over-indulge in excess sugars and saturated fats, plus other suggested advantages, makes them useful in weight control. There is recently increasing recognition of our need for antioxidants for good health; the avocado is rich in three of the most important: vitamins E, C, and beta-carotene. It may help to prevent strokes; it is high in potassium and low in sodium. Among fruits, it is exceptional for the quantity and quality of its protein. It provides exceptional quantities of both types of dietary fiber. It makes a superior first solid food for babies. The avocado fat consists predominantly of monounsaturated oleic acid, which has been found to reduce harmful (LDL) cholesterol while maintaining beneficial cholesterol (HDL), performing better than the usual low-fat diet. Four current misconceptions about the avocado and human nutrition are noted.

Nutrient Density

It is now widely recognized that the number of calories per unit weight is not a very good measure of a food's status in human nutrition. Much more important is the food's contribution *per calorie* of essential human nutrients-particularly those that are likely to be deficient in typical diets. Unlike foods that are well described as providing mostly "empty calories," the avocado is nutrition-rich.

The detailed analyses of Stater *et al.* (1975) indicated that for no less than eight essential nutrients-vitamin A (beta-carotene), vitamin C, vitamin E, folacin, niacin, vitamin B6, iron, and magnesium-the avocado provides about twice as high a proportion of daily human needs as it does daily calorie needs. Moreover, for three additional essential nutrients for which there is no established United States Recommended Dietary Allowance- copper, potassium, and pantothenic acid-the avocado is also estimated to provide about twice as high a proportion as its calorie contribution. *The avocado is remarkably nutritious per calorie.* Survey results vary between countries, regions, and individuals; but even in prosperous "advanced" societies, significant deficiencies of these 11 avocado-supplied nutrients have been reported.

Weight Control

It is unfortunate for both avocado growers and the consumer public that weight-conscious people often shun the avocado because of the mistaken idea that eating it will tend to increase one's weight. In fact, three experiments that tested this possibility all found that adding avocado to the diet resulted in a small average weight *loss* (see Cholesterol section later in this paper).

For weight stabilization, the avocado appears to have several benefits:

- 1) Its high nutrient density (preceding section) can make the diet more wholesome and better balanced, thus promoting better general health and well-being, which can minimize fattening food cravings.
- 2) Furthermore, its high fat content makes the diet more palatable, which encourages filling up on the wholesome food in such a sound diet.
- 3) Its high fat content gives a quicker feeling of satiation, which (especially when accompanied by bulky vegetables and fruits) helps reduce overeating.
- 4) Avocado weight control appears to extend beyond the above explanations; a speeding up of the human basal metabolic rate has been hypothesized (D. Colquhoun, M.D., private communication).

Fat is now the great evil in popular nutritional advice on weight control: over twice the calories of carbohydrate or protein, less calories burned up in storing it, possibly other weight detriments of fat, *per se*. And up to 90 % of avocado calories come from fat. Yet, every controlled experiment that I know of has found that mean weight *decreased* a bit with increased avocado consumption. How such is to be reconciled with the dire warnings about dietary fat is not clear. Perhaps there is a parallel with cholesterol- the type of fat matters, with saturated fat being bad and monounsaturated (the major constituent for avocado oil) being good. Perhaps the avocado has some weight-control feature that is as yet unknown.

However, different health groups and even dietitians keep warning about the avocado's high calorie content. How valid is that concern? The number of kilocalories in an avocado fruit vary with its botanical origin, variety, size, and degree of maturity; in California, the average is about 300 Cal (Slater *et al.*, 1975). Also varying with several factors are the number of calories that a person needs per day; for an age of 19-50 and a "moderate" activity level, a 71 kg man needs about 2800 Cal and a 57 kg woman about 2100 Cal (UC Berkeley *Wellness Letter*, 5/91). That calculates at 9 and 7 avocados each-so much that satiation is likely well before the daily calorie "allowance" is reached.

Among the many foods (Rinzler, 1987), avocados have been rated as *only moderate* in calories per servings, with such items as beans, bread, pasta, rice-less caloric than most nuts and seeds, most cheeses, sugar, butter, etc. A lengthy analysis in *Fit* health

magazine (8/82) concluded that somehow the avocado has gotten blamed for "fictitious calories ... avocados have received the undeserved reputation of being fattening"

Contributing to this misconception has been the tendency of even some nutritionists to accept the "fat is fat" oversimplification, overlooking both the avocado's predominance of monounsaturated fat and its very high nutrient density. Contributing further is the public's tendency to accept the oversimplification that "if it tastes rich, it's bad for you;" what's "good" for us is supposedly only the less appealing foods like carrots, lettuce, spinach.

In any case, it has been repeatedly found that increased avocado consumption did *not* cause weight gain.

Antioxidants

Oxygen is essential to life processes, but an inevitable by-product of its essential activities is the formation of dangerously reactive "free radicals." These can cause harm to various body cells and organs (University of California *Wellness Letter*, 10/91): eye tenses, causing cataracts; cell mutation, contributing to cancer, or advancing the aging process; arthritis; cholesterol molecules on the artery wall; contributing to heart disease.

There are three antioxidant vitamins that are effective in disarming the free radicals: E, C, and beta-carotene (vitamin A precursor). Various surveys have turned up deficiencies of all three in America. As we have seen, for each of the three and for any given daily calorie proportion, the avocado provides about twice that proportion of the nutrient. Now, the avocado is high in fat, and fat consumption has been associated with added risk for certain cancers, particularly of the colon. But, the *Harvard Health Letter* (3/91) concluded that although meat fat indeed markedly increases cancer risk, there appears to be no connection with plant fat.

Hence, eating more avocado could be a delightful way to get more of the antioxidants that help protect us against such things as arthritis, cancer, cataracts, heart disease, even aging in general.

Stroke Prevention

The Associated Press (15 Oct. 87) printed an interview with nutritionist Dr. Louis Tobian of the University of Minnesota on the protection against strokes provided especially by potassium. As best K sources, he listed strawberry, banana, citrus juice, potatoes (overlooking the avocado). Smith *et al.* (1983) determined the K content of some 34 fruits and vegetables: the avocado was outstanding, with strawberry, banana, and orange having less than half as much K per unit weight, and potatoes just over half as much. *Prevention* (8/87) reported on a 12-year stroke study conducted jointly by the Schools of Medicine of Cambridge and UC San Diego: "Potassium was the key." Strokes were reduced 40% by an increased daily K consumption of about 400 mg-the amount in less than half an avocado.

The same *Prevention* article linked blood pressure as a stroke factor with excess sodium in relation to potassium. The avocado is as low in Na as it is high in K-with about 52 times as much of the latter.

Protein

The leading 'Hass' cultivar is about 2.4% protein on a fresh weight basis- where most of its weight is water (Slater *et al.*, 1975). Polansky and Murphy (1966) reported that the avocado had from two to ten times as much protein as 25 other fruits and vegetables that they analyzed. A more recent study in Florida found that the avocado had three to six times as much as six other common fruits. (However, the avocado still supplies a lower proportion of daily protein needs than its calorie contribution; it is not nutrient-dense for protein). The avocado protein contains all amino acids essential for humans- unlike most plant sources, it is "complete," like the egg standard.

Most people in affluent societies are already consuming more protein than they need. Avocado protein may be valuable for two classes of people: the impoverished, especially in tropical regions, who often are protein deficient; and people in industrial societies who, for health reasons, are reducing meat consumption and becoming more vegetarian. For the latter, the complete nature of avocado protein makes it a good complement to other plant sources.

Fiber

Anderson (1990) pointed out 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..., diabetes..., and obesity..." A combination of both soluble and insoluble fibers may be most effective. "Most individuals in the West ingest suboptimal amounts of dietary fiber."

Smith *et al.* (1983) compared 34 fruits and vegetables. Only the avocado was listed with large amounts of both soluble and insoluble forms (2.1% and 2.7%, respectively, by fresh weight). Considering the two forms separately, most other fruits and vegetables had less than half as much as the avocado, down to 1/6 or so. Nutritionists suggest that we should double our average fiber consumption; eating more avocados would be an enjoyable way to do so.

Miscellaneous Dietary Advantages

Our bodies cannot make linoleic fatty acid, the "essential" polyunsaturate. Slater *et al.* (1975) reported that it constituted 7.2 % of avocado oil; Bergh (unpublished) found a still higher proportion, in the 'Hass' cultivar.

The bland nature of avocado pulp makes it soothing to the alimentary tract. This helps explain why Native Americans have, for many generations, recommended avocados especially for the ill.

The exceptional nature of the avocado makes it suitable for a remarkable wide range of food uses: hors d'oeuvre, soup, salad, garnish, sandwich spread, dip, in the half-shell, entree, dessert, beverage. And, there are many variations of each. This versatility facilitates increased consumption so as to obtain increased benefits from its remarkable advantages for the human diet.

Baby Food

William Sears, M.D., author of several books on infant nutrition, was interviewed by *California Grower* (10/88): "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 gram] than any of the other frequently recommended fruits and vegetables, [plus a rich supply of other vitamins and minerals]." In a brochure privately printed the year before, 'Baby's Garden: Nature's Guide to First Foods.' Dr. Sears analyzed several infant foods, with statistics that confirm and extend his avocado comments above. He noted several additional advantages as infant nutrition, including "[The avocado is one of the very few] fruits or vegetables that contain monounsaturated fats, [so beneficial] for baby's development."

Avocado producers can be pleased that their product is so valuable for the "little people." Moreover, there is potential economic gain for the avocado industry far beyond the moderate added market demand from a greatly increased number of babies eating avocado. Little people become big people-and eat many times as much food.

The avocado, unique in many fortunate ways, is unfortunate in the unique degree of difficulty that many adults have in developing enough fondness for the fruit to keep buying it. A few adults like it immediately. Most adults describe their first taste of avocado as something like "disappointing" or even "distasteful." Some keep trying it, and their attitude can change to "tolerable" then to "quite acceptable," and finally it can become for them also a "prized flavor delight." But too many adults just give up on it, and decide that avocado is not for them.

How very much easier it is to introduce the fruit to infants. Frequently, when talking to adults in regions where the avocado has recently been introduced, one hears: "No, I don't care for avocado-but my children love it." When infants eat avocados, nearly all will grow up into adults who like them and eat a lot more of them. By encouraging avocado consumption in baby food, we are laying the foundation for a larger and more profitable future industry.

Cholesterol

People in most of the modern affluent societies average about twice as high blood serum cholesterol levels as is considered healthy. The excess contributes to blockage in our arteries ("atherosclerosis"), a major-cause of the leading killer in such societies-heart disease. Hence, heart disease can be reduced by reducing blood levels of harmful cholesterol, the low density lipoprotein (LDL); but high density lipoprotein (HDL) is considered heart-protective, so it is "good" cholesterol. Similarly, while the fats we

consume are a major determinant of our blood cholesterol levels, these fats also are of significantly different kinds: saturated fats increase the harmful LDL cholesterol, while unsaturated fats reduce it.

Unsaturated fats are classified as monounsaturated or polyunsaturated. Grundy (1987) reviewed experiments comparing different levels of different kinds of dietary fat. Compared with the typical diet high in saturated fat, diets high in monounsaturated, or high in polyunsaturated, or low in all fats and high in complex carbohydrate, all reduced the level of harmful LDL; but only the high-monounsaturate diets consistently maintained the level of the beneficial HDL. Moreover, the other two LDL-reducing diets sometimes increased the level's of blood triglycerides-recently of increasing concern for cardiovascular health. Moreover, polyunsaturated fats are problematic because of linkage with oxidized "free radicals" and other health concerns. Moreover, only recently have polyunsaturates been used on a large scale in human diets, so that their long-range effects are little known. Monounsaturates, on the other hand, have been an important part of the diet of Mediterranean peoples for thousands of years. The *Australian Medical Observer*, 17 Aug. 90, quoted David Colquhoun, M.D.: "For example, in Greece, which spends less money per capita on health care.... people live longer and are healthier, even though they smoke a lot and do less physical work ... their diet seems to be protective ... high in monounsaturates..." These monounsaturated fats come primarily from olive oil.

Fat analysis varies with different factors; a typical olive oil breakdown is 77% mono, 9% poly, 14% saturated; nearly all the mono is oleic acid. One other commonly consumed plant fat has an analysis that averages quite similar to olive oil-avocado oil. In California, Slater *et al.* (1975) obtained an overall 'Hass' average of 82 % mono, 8 % poly, 10 % saturated; and the mono was 95 % oleic. Bergh and co-workers (unpublished) found that cultivars combining genes of both the Mexican and Guatemalan horticultural races had a higher proportion of monounsaturates than "pure" cvs. of either race.

What have been the results of actual blood-monitored experiments with' avocado?

Colquhoun, Australia

David Colquhoun, M.D., is Consulting Cardiologist at Wesley Medical Centre in Brisbane, Australia. He has shared some of his thinking (private communication): "The traditional diet propounded by [heart organizations] has been based on a moderate reduction of total fat with a mild increase in polyunsaturates... Foods which have been high in monounsaturated fatty acids, such as avocado, have in fact been advised against. This has been based on the simplistic notion that avocados are high in fat."

Dr. Colquhoun used 15 subjects to compare a typical diet (fairly high total fat, much of it saturated), with a low fat (20% of calories)-high carbohydrate diet, with a diet that included an avocado a day (fairly high total fat, much of it monounsaturated). Result: The "avocado-enriched diet had ... a significant (7.2 %) decrease in total cholesterol with preservation of the HDL level. In contrast, the low-fat diet was less effective in lowering the LDL lipoprotein and also had the disadvantage of lowering the protective

HDL." Thus, the avocado appears to have cardiac benefits via blood serum cholesterol changes at least as significant as those found for the more extensively tested olive.

Indeed, Dr. Colquhoun found that avocado enrichment had greater cholesterol benefits than could be expected from just reducing saturated fat. He noted further that the avocado-added diet was "nutritionally balanced," and its good flavor encouraged "excellent compliance." It was associated with a weight loss of about 1 kg, hence, "...avocados are an important addition to cholesterol-lowering diets. The inclusion of this versatile food ... should improve long-term compliance with a healthy diet... A cholesterol-lowering diet does not have to [be] a very low fat diet, which is often unpalatable."

Moreover, Dr. Colquhoun's subjects were on each diet for only 3 weeks. A longer period with added avocado may well have given greater benefits (see Steele).

Steele, Australia

Dietitian M. G. Steele of the La Mancha Health Centre at Wollongbar, New South Wales, Australia, conducted this research in 1987 and had it privately printed with the title 'Avocados, cholesterol, and heart disease.'

Substituting avocado for butter, margarine, and cheese significantly reduced blood cholesterol, as was expected. In a second experiment, subjects who had been on a low-fat diet were "encouraged to eat as many avocados as possible." This sharp increase in fat consumption, up to triple previous levels, led to fears of increase in both weight and blood cholesterol. And, after 4 weeks, average total cholesterol had *increased 6 %*. Suspecting that this was a temporary "hiccough" caused by the suddenness of the fat increase, Mr. Steele persuaded subjects to continue with avocado enrichment. After another 4 weeks, all participants had total cholesterol below their initial level, and, even more important, average HDL ("good" cholesterol) had increased by 16%. Noted Steele, "For those...who were following the [very low fat] Pritikin diet, the avocado was a welcome addition " And, contrary to subject fears, not only did the Pritikin-diet, people actually improve their cholesterol by adding avocado, they -also lost a little weight on the average.

Grant, Florida, USA

Grant (1960) researched before it was understood that there is "good" and "bad" cholesterol, and that there are important differences between the kinds of unsaturated fats; hence, he did not collect certain data that we now know would be of much interest. Nevertheless, his study remains highly useful.

He worked in a Veterans' Hospital, which gave him excellent dietary compliance; but at the same time his experimental setup had the limitation of discharges leading to a treatment period as short as 9 days, and also some of his subjects had metabolic diseases that could well affect their fat metabolism and so interfere with the experimental result. In fact, of 12 analyzable subjects given extra avocado, five had metabolic diseases (including three diabetics)-all five had their cholesterol decreased,

but none to a degree that was statistically significant; seven had non-metabolic illnesses-and all had a cholesterol decrease that was highly significant statistically.

There was no breakdown of cholesterol into LDL and HDL, a breakdown that, as we have seen, would be expected to make the avocado benefits considerably more striking. Also, the average number of days of treatment- just over a month-n-tight be too short to overcome the initial *increase* in blood cholesterol when there is a sudden increase in oil intake, as Steele showed. In spite of these effect-diluting factors, the overall averages are as follows (first row includes all 12, second row in parentheses, includes only the seven without metabolic disease):

<u>Avocados/day</u>	<u># of days</u>	<u>Calorie</u>	<u>Fat</u>	<u>Blood Cholesterol</u>	<u>Weight</u>
1.04	33.2	+23.9%	+53.7%	-19.3% (-55)	-1.1 kg
		(+30.0)	+76.9	-26.5)	

Nutritionists tell us that we should reduce our calorie intake if we wish to reduce our weight, and that we should reduce our fat intake to reduce both our weight and our cholesterol. Yet, an exceptional but carefully controlled experiment, that *increased* calories by an average of almost one- quarter, and fats by over one-half, actually *decreased* serum cholesterol by nearly one-fifth-and even weight by a bit. The avocado is remarkable nutrition!

Some Current Misconceptions

1. "Fat is fat and fat is bad"

Heart associations in the U.S.A., Australia, and presumably elsewhere, are campaigning for a desirable reduction in our consumption of the saturated fat that is clogging our arteries by recommending that we eat less fat. And it is true that as total fat consumption goes down, so does consumption of the harmful saturates and the dubious polyunsaturates. But, so also may consumption of the beneficial monounsaturates, by discouraging the consumption of olive oil-and avocados. Perhaps these "authorities" believe that trying to make distinctions among fat sources will confuse the public; if so, I think they underestimate our capabilities. A similar oversimplification is, "cholesterol is bad"-but people who are interested quickly learn that HDL cholesterol is *good*.

Other authorities counseling that "fat is bad" may be judging avocados superficially by their high fat content, and therefore assuming harmful excess calories. Thus, a 10/10/90 letter from the Food Program Manager of the National Heart Foundation of Australia states that "our dieticians and home economists often promote avocados as a very good substitute for butter or margarine as a spread on bread." But, "The reason why we list avocados in the 'foods to limit' category is ... their high fat content... Excess fat consumption is one of the leading reasons why more than half of all Australians are overweight' " Similarly, a 26/10/90 letter from the president of Pritikin Lifestyle Association (Brisbane) notes that "unfortunately avocados have a high fat content. It is our contention that fat is extremely dangerous..."

It is my contention, based on the actual research results surveyed earlier in this paper, that “*unfortunately* avocados have a high fat content.” This is largely monounsaturated and so cardiovascular-protective, and this oil is part of a remarkably nutrient-dense fruit that has consistently been shown to assist excellent weight control. The speculative objections to the avocado founder on the rock of demonstrated fact.

However, the last letter quoted above continued, “the Pritikin Society has indeed altered its advice ... the suggested amount being one-half avocado per day.” Coming from an organization that has built a solid reputation for making people healthier by reducing indiscriminate fat consumption to a very low level, this is a most encouraging and courageous concession. And, if the average American ate 1/2 an avocado a day, our industry would fall far short of meeting the demand!

2. Fat per day vs. fat per food

The American Heart Association is conducting a vigorous campaign to reduce our fat consumption from the present 40 % or so of total calories to no more than 30%. As we have seen, even a 20% fat level may not give as favorable blood cholesterol as 40% of calories from fat *if* the predominating fat is the oleic monounsaturate that the avocado is so rich in; but if our fat consumption balance continues heavily to saturated especially, plus polyunsaturated, then an overall reduction to 30% or less can only be beneficial.

A recent survey in the U.S.A. showed that 2/3 of Americans think that such a 30% limit would apply to every food we eat-thus discarding the avocado. Notes the *Mayo Clinic Health Letter* (12/90): “That’s a common mistake. Limiting fat to about 30 % of daily caloric doesn’t mean eliminating fatty foods. It means balancing high-fat options with low-fat choices.” They illustrate this by balancing out among all three meals combined.

3. “Avocados may cause cancer”

Perhaps this rather silly speculation has not surfaced in Australia, and with that hope it will be dealt with only briefly here (I have published a detailed analysis elsewhere). A 1990 study on breast cancer in Shanghai, China, found that increased cancer was associated with increased calorie intake which was due primarily to increased monounsaturated fat. On that tenuous connection, there actually was newspaper speculation that avocados might increase cancer risk.

1) Correlation does not prove causation. Often two consequences are related only through their joining caused by a third factor. In fact, in this study, the added cancer risk of a University education (compared with less than high school) was five times as large as the added caloric-monounsaturated risk!

2) The authors themselves questioned the calories-monounsaturate connection. And the added cancer risk was associated with a greater percentage increase in polyunsaturates and especially saturated fat than monounsaturates.

3) Even in the highly unlikely event that monounsaturates were somehow to blame, extending this to the avocado is still more logically questionable. Very little of the

Shanghai monounsaturates would be from avocado, which as whole fruit supplies a rich spectrum of nutrients including antioxidants.

4) The authors themselves point out that any hypothesized cancer risk from monounsaturates is contrary to results obtained elsewhere, notably in Japan and in Mediterranean countries.

5) China has a very low breast cancer risk compared with Caucasian countries generally. The authors used Canada as an example, and their data show that the high-risk Canadian women consume four times as much saturated fat as the Chinese, but average actually less monounsaturated fat.

The overall evidence in this paper does not support any causative linkage of monounsaturated fat, let alone that in the avocado, with added cancer risk. The U.S. *Nutrition Action Newsletter* (12/91) quoted physician and epidemiologist Meir Stampfer, "...in the Nurses Health Study, we find virtually no difference in the risk of breast cancer with fat intake between 29 and 49 percent of calories...." Added Frank Sachs, physician and diet researchers, in the same issue, "The high fat diets that are associated with cancer in humans are very low in [plant foods],.... Given a calorie intake that will [avoid obesity], I don't think it matters whether calories come from vegetable oils or carbohydrates."

When the needed expensive and long-range experiments are eventually run, I expect that avocado consumption will prove to be a significant reducer of the risk of most, if not all, cancers.

4. Misinterpretations

Sometimes newspaper reports misunderstand or overstate research results. In the present "anti-fat" nutritional climate, we avocadoans need to be watchful, and quick to point out errors to Food Editors or general newspaper editors. More serious is when researchers themselves are biased by the anti-fat propaganda so that they mis-state their own findings.

An example was provided by a four-column headline in my local newspaper: 'Extra monounsaturated fats not beneficial.' That was surprising, and the accompanying article merely reinforced the headline, so I tracked down the original publication: Ginsberg *et al.* (1990)-nine co-authors. They compared three diets: typical American (high fat, much saturated); Heart Associations Step I (low fat); high fat, much monounsaturated. The authors concluded (as my newspaper headline stated) that "enrichment of the Step 1 diet with monounsaturated fat does not [improve on] the [blood cholesterol] beneficial effects of the Step 1 diet" The first surprise in their actual article was the admission that "Our study, however, was not between the effects of the Step I diet and those of the Mono diet...." That shoots down the headlined claim right there. It gets worse. Their actual results show that, compared with the typical diet, the Mono reduced total cholesterol about 30 % more than did the Step I (low fat). Triglycerides decreased about twice as much with Mono as with Step 1. "Good" cholesterol (HDL) was unchanged with Mono, reduced with Step 1. "Bad" cholesterol (LDL) was reduced to a statistically

significant degree by Mono, not by Step 1. The most meaningful ratio, of total cholesterol to HDL, was reduced insignificantly by Step 1, more than four times as much and highly significantly by Mono. And yet the authors concluded as quoted above! And my newspaper (and presumably many others) simply accepted their wrong conclusion.

With humans, variable both genetically and in previous food consumption, research results will sometimes vary and even be contradictory. And with research procedures also variable, we have added reason to expect contrary results at times. These we can accept cheerfully, keeping in mind the overall weight of evidence. What we should not tolerate is careless researchers, prejudiced by biases such as the present anti-fat fad, who twist their results into untruth.

Concluding Quotations

Purseglove (1968) in his authoritative textbook, described the avocado as "the most nutritious of all fruits." In 1959, cereal nutrition pioneer John H. Kellogg declared 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 ... none that can fill its place." Summarized America's greatest plant explorer, David Fairchild, "...the avocado is a food without rival among the fruits, the veritable fruit of paradise."

Literature Cited

Anderson, J. W. 1990. Dietary fiber and human health. *HortScience* 25: 1488-1494.

Ginsberg, H. N., S. L. Barr, A. Gilbert, W. Karmally, R. Deckelbaum, K. Kaplan, R. Ramakrishnan, S. Holleran, and R. B. Dell. 1990. Reduction of plasma cholesterol levels in normal men on an American Heart Association Step 1 diet or a Step 1 diet with added monounsaturated fat. *New Eng. J. of Med.* 322: 575-579.

Grant, W. C. 1960. Influence of avocados on serum cholesterol. *Proc. Soc. Exper. Biol. Med.* 104: 45-47.

Grundy, S. M. 1987. Monounsaturated fatty acids, plasma cholesterol, and coronary heart disease. *Amer. J. Clin. Nutr.* 45: 1168-1175.

Polansky, M. M., and E. W. Murphy. 1966. Vitamin B₇, components in fruits and nuts. *J. Amer. Dietetic Assoc.* 48: 109-111.

Purseglove, J. W. 1968. *Tropical crops: dicotyledons*. Wiley, New York.

Rinzler, C. A. 1987. Avocados, p. 16-17. In: *The complete book of food: a nutritional medical, and culinary guide*. World Almanac, New York.

Slater, G. C., S. Shankman, J. S. Shepherd, and R. B. Alfin-Slater. 1975. Seasonal variation in the composition of California avocados. *J. Agr. Food Chem.* 23: 468-474.

Smith, J., S. Goidweber, M. Lamberts, R. Tyson, and J. S. Reynolds. 1983. Utilization potential for semi-tropical and tropical fruits and vegetables in therapeutic and family diets. Proc. Fla. State Hort. Soc. 96: 241-243.