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Impact of avocado-enriched diets on plasma lipoproteins: A meta-analysis

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BACKGROUND: Optimizing plasma lipoproteins is the primary goal of pharmacotherapy and diet interventions in people at risk for cardiovascular diseases. Avocados offer a rich source of monounsaturated fat and may pose beneficial effects on the lipid profile.

OBJECTIVE: We aimed to perform a meta-analysis of randomized clinical trials assessing the impact of avocados on TC, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol, and/or triglycerides (TG).

METHODS: We searched PUBMED, Cumulative Index to Nursing and Allied Health Literature, Index to Nursing and Allied Health Literature, and the Cochrane Database of Systemic Reviews from their inception to February 2015. The weighted mean difference from baseline was calculated for all endpoints. Subgroup analyses were performed to assess heterogeneity, and funnel plots inspected to assess publication bias.

RESULTS: Ten unique studies (n = 229) were included. Avocado consumption significantly reduced TC, LDL-C, and TG by −18.80 mg/dL (95% confidence interval [CI], −24.56 to −13.05; I^2, 46.9%), −16.50 mg/dL (95% CI, −22.91 to −10.10; I^2, 72.5%), −27.20 mg/dL (95% CI, −44.41 to −9.99; I^2, 91.1%) respectively. High-density lipoprotein cholesterol decreased nonsignificantly by −0.18 mg/dL (95% CI, −3.23 to 2.88; I^2, 84.8%).

CONCLUSION: Avocado-substituted diets significantly decrease TC, LDL-C, and TG levels. Substituting dietary fats with avocados versus adding to the free diet should be the primary recommendation strategy. Larger trials looking at the impact of avocados on major adverse cardiovascular events are warranted.

Introduction

Over 15 million Americans are currently diagnosed with coronary heart disease (CHD), the most common preventable cause of death. In 2010 alone, 545,059 deaths were attributed to CHD, with approximately one American dying every minute and 23 seconds.[1] The link between serum cholesterol and cardiovascular mortality has been well established.[2] The preponderance of evidence suggests that having high levels of low-density lipoprotein cholesterol (LDL-C) is a positive indicator of CHD development. Reductions of LDL-C have been shown to reduce mortality and efforts to reduce LDL-C have been the main target of most lipid-lowering medications. In contrast, having elevated levels of high-density lipoprotein cholesterol

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(HDL-C) is considered protective against CHD development.[3–5] Triglyceride (TG) lowering is also an important factor for reducing the risk of atherosclerotic cardiovascular disease.[6] Dietary sources can play a major role toward a beneficiary or unfavorable lipid profile.[7]

Fatty acids in foods typically fall within one of the four categories: saturated fats (SFAs), common in animal sources, trans fats (TFAs), common in processed foods, polyunsaturated fats (PUFAs), and monounsaturated fats (MUFAs), both common in plant-derived sources.[8] Although low-fat diets are generally recommended, studies have indicated that altering the types of fats you consume may further modify the risk of dyslipidemia. Favorable lipid profiles were seen when consumption of SFAs and TFAs were decreased and replaced by PUFAs and/or MUFAs.[2,9] Hu et al. demonstrated an estimated risk reduction of 19% in CHD when the consumption of MUFAs was increased by 5%.[10] Moreno et al. found that a diet rich in MUFAs may have favorable effects on cardiovascular risk by preventing the oxidative modifications of LDL-C, an early event in atherosclerosis.[11] Currently, the Dietary Guidelines for Americans recommend a total fat intake of 20% to 35% of calories for people over the age of 18 years. The guideline promotes consuming less than 7% of calories from SFAs and replacing them with PUFAs and/or MUFAs to reduce blood cholesterol levels and lower the risk of cardiovascular disease.[8] The American Heart Association/American College of Cardiology Guideline on Lifestyle Management to Reduce Cardiovascular Risk recommends a reduction of SFA intake of 5% to 6% of calories.[2] Both guidelines are in agreement in reducing the amount of SFAs consumed and replacing them with PUFAs and/or MUFAs.

Avocados (*Persea Americana*) are rich in MUFAs.[12] The most common type of avocado cultivated in the United States is the Hass avocado. The average Hass avocado provides 136 g of edible fruit whose oil consists of 71% MUFAs, 13% PUFAs, and 16% SFAs.[12] There are additional constituents of the fruit including fiber, B-vitamins and vitamins K_1 and E, magnesium and potassium, and phytochemicals such as carotenoids, phenolics, and phytosterols, which may also contribute to other positive health effects.[12]

The Mediterranean diet has shown to improve lipid profiles and decrease the risk of CHD.[13–15] Although the amount of calories from fat in this diet exceeds the standard recommendations, presumably because of the "healthier" nature of the MUFAs found in olive oil and nuts, mitigating the progression of dyslipidemia. Primary prevention of cardiovascular disease with a Mediterranean diet, a multicenter trial conducted in Spain that randomized patients to a Mediterranean diet consisting of either extra-virgin olive oil (1 liter weekly), mixed nuts (15 g of walnuts, 7.5 g of hazelnuts, and 7.5 g of almonds) or a control diet, showed that among subjects at high risk of cardiovascular events, extra-virgin olive oil or nuts reduced the risk of cardiovascular events by approximately 30%.[16] Avocados may provide a similar benefit. The purpose of this meta-analysis is to examine the use of avocados as an additive or substitute for other sources of dietary fats and the subsequent effect on TC, LDL-C, HDL-C, and TG levels.

Methods

Search strategy and selection criteria

A literature search was performed using the term "avocado" and "*Persea Americana*" limited to clinical trials conducted in human subjects. Three independent reviewers (S.P., B.M., S.S.) performed a literature search using PubMed (1966 to February 21, 2015), Cumulative Index to Nursing and Allied Health Literature (1982 to February 21, 2015), and Cochrane Database of Systemic Reviews (2005 to February 21, 2015). References of relevant primary articles and review articles were hand searched.

An initial screen of all abstracts was conducted followed by a thorough review of full-text publications of trials meeting the following inclusion criteria: randomized, clinical trials, human subjects, and trials evaluating avocado in the diet with reported measures of TC, LDL-C, HDL-C, and/or TG.

Studies were excluded if the intervention was less than 5 days duration or if a pill form of avocado extracts was used. In instances where data were only extractable by estimation of figures, the study was excluded.

The primary outcomes of interest were the mean change in TC, LDL-C, HDL-C, and TG from baseline.

Validity assessment

The following methodologic features to control bias were assessed: randomization, blinding, and withdrawals and/or dropouts. Jadad scores were calculated to aid in the identification of reports with overall weaker study methodologies. The maximum quality score was a total of 5 points with zero being the lowest possible score.[17]

Data abstraction

All data were extracted by three independent investigators (S.P., B.M., S.S.) through the use of a standardized data abstraction tool. Any discrepancy was resolved upon discussion. The following information was retrieved from each article: author identification, year of publication, study size, health status of the patient population (healthy, overweight, patients with dyslipidemia and/or diabetes), type of avocado, avocado dose, source of supplementary MUFA, avocado substituted for dietary fat vs avocado added onto baseline diet, duration of avocado diet, geographical location of the study, and study design (parallel or crossover). Pretreatment values for TC, LDL-C, HDL-C,