

World Macadamia Organisation Scientific Research Literature List, January 2025

| Ref # | Topic/Category                 | Citations   | Results Summary   | Key Take-away  | Study Links   |
|-------|--------------------------------|---|---|--|---|
| 1     | General Nutrition Benefits     | Xing-Hao Tu, et al. "A Comprehensive Study of Raw and Roasted Macadamia Nuts: Lipid Profile, Physicochemical, Nutritional, and Sensory Properties." <i>Food Science &amp; Nutrition</i> , vol. 9, no. 3, Mar. 2021, pp. 1688-97.  | Results:<br>84% Unsaturated fatty acids<br>59% - 61% Oleic acid (brand and roasting variance)<br>18-19% Palmitoleic acid<br>2%-3% Linoleic acid (essential fatty acid)  | Roasting improves taste sensation of macadamia nuts and does not diminish nutrition quality  | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC10096892/">https://pmc.ncbi.nlm.nih.gov/articles/PMC10096892/</a>   |
| 2     | General Nutrition Benefits     | Boiling, Bradley W., et al. "Tree Nut Phytochemicals: Composition, Antioxidant Capacity, Bioactivity, Impact Factors. A Systematic Review of Almonds, Brazils, Cashews, Hazelnuts, Macadamias, Pecans, Pine Nuts, Pistachios and Walnuts." <i>Nutrition Research Reviews</i> , vol. 24, no. 2, Jan. 2011, pp. 244-75. | Macadamias are a source of plant sterols (which can lower cholesterol in the blood) and polyphenols (antioxidants). Also a source of flavonoids, another potent antioxidant.  | Macadamias are a source of plant sterols (which can lower cholesterol in the blood) and polyphenols (antioxidants). Also a source of flavonoids, another potent antioxidant.   | <a href="https://pubmed.ncbi.nlm.nih.gov/22153059/">https://pubmed.ncbi.nlm.nih.gov/22153059/</a>   |
| 3     | General Nutrition Benefits     | Ni, Dongdong, et al. "Exploring Relationships between Satiation, Perceived Satiety and Plant-based Snack Food Features." <i>International Journal of Food Science &amp; Technology</i> , vol. 56, no. 10, Oct. 2021, pp. 5340-51.   | Shown that macadamia had the highest residual fullness, followed by avocado and chickpea.   | Eating macadamia nuts keeps us full and satisfied longer than other plant-based snack foods.   | <a href="https://www.researchgate.net/publication/351377667_Exploring_relationships_between_satiation_perceived_satiety_and_plant-based_snack_food_features">https://www.researchgate.net/publication/351377667_Exploring_relationships_between_satiation_perceived_satiety_and_plant-based_snack_food_features</a>   |
| 4     | General Nutrition Benefits     | Schwingshackl, L., and B. Strasser. "High-MUFA Diets Reduce Fasting Glucose in Patients with Type 2 Diabetes." <i>Annals of Nutrition &amp; Metabolism</i> , vol. 60, no. 1, Jan. 2012, pp. 33-34.  | Study subjects put on the high-MUFA (monounsaturated fatty acid) diet had lower blood glucose levels than those on the other diets in the study. This does not prove MUFAs lower blood glucose, but it is a start.  | Diets high in MUFA seem to reduce blood glucose/blood sugar in people with Type 2 Diabetes. More research is needed.   | <a href="https://pubmed.ncbi.nlm.nih.gov/22212514/">https://pubmed.ncbi.nlm.nih.gov/22212514/</a>   |
| 5     | General Nutrition Benefits     | Tim J. O'Hare and Hung Hong Trieu, et al. Assessing Fatty Acid Profiles of Macadamia Nuts (various species)" <i>Hortiscience</i> 54(4):633-637. 2019  | Tested fatty acid content of many macadamia lines. Potential exists to develop a reduced-saturated fat macadamia by combining characteristics found in different lines.   | By testing the fatty acid content of several macadamia varieties, the possibility exists to develop a macadamia with even less saturated fat, thus improving the health profile of macadamia.  | <a href="https://pubmed.ncbi.nlm.nih.gov/32784511/">https://pubmed.ncbi.nlm.nih.gov/32784511/</a>   |
| 6     | Cardio-vascular                | Griel, Amy E., et al. "A Macadamia Nut-Rich Diet Reduces Total and LDL-Cholesterol in Mildly Hypercholesterolemic Men and Women." <i>The Journal of Nutrition</i> , vol. 138, no. 4, Jan. 2008, pp. 761-67.   | The present study's results indicate that including 1.5 ounces of macadamia nuts reduces serum TC and LDL-C concentrations in hypercholesterolemic men and women when substituted for SFA in the diet. The reduction in LDL-C concentration was similar to that observed for other tree nuts, including walnuts and almonds.  | Macadamia nuts can be included in a heart-healthy dietary pattern that reduces lipid/protein CVD risk factors. Total cholesterol and potentially harmful LDL was reduced in the MAC diet group, while the beneficial HDL was not reduced (as in some low-fat diets). Substituting nuts like macadamia for foods high in saturated fat lowers CVD risk.   | <a href="https://pubmed.ncbi.nlm.nih.gov/18356332/">https://pubmed.ncbi.nlm.nih.gov/18356332/</a>   |
| 7     | Cardio-vascular                | Maguire, L. S., et al. "Fatty Acid Profile, Tocopherol, Squalene and Phytosterol Content of Walnuts, Almonds, Peanuts, Hazelnuts and the Macadamia Nut." <i>International Journal of Food Sciences and Nutrition</i> , vol. 55, no. 3, Jan. 2004, pp. 171-78.   | BMI reduced after 4 wk macadamia nut intervention 26.24 > 26.08 TC, LDL both reduced after intervention; HDL increased  | These results allow prudent recommendation for macadamia nuts as part of a heart-healthy diet. This study saw an increase in HDL along with a decrease in LDL and total cholesterol, which is not seen in some other studies.  | <a href="https://pubmed.ncbi.nlm.nih.gov/17127473/">https://pubmed.ncbi.nlm.nih.gov/17127473/</a>   |
| 8     | Cardio-vascular                | Hiraoka-Yamamoto, Junko, et al. "Serum Lipid Effects of a Monounsaturated (Palmitoleic) Fatty Acid-Rich Diet Based on Macadamia Nuts in Healthy, Young Japanese Women." <i>Clinical and Experimental Pharmacology and Physiology</i> , vol. 31 Suppl 2, Dec. 2004, pp. S37-38.  | Significant decrease in LDL, TC, and decrease but not as significant in BMI on a macadamia-enriched diet; young, healthy women were studied; bread was made with coconuts, butter, or macadamia nuts and given to participants blindly.   | The cholesterol-lowering effects of MUFA rich macadamia nuts were seen in healthy young women as well as older adults with elevated blood lipids.  | <a href="https://onlinelibrary.wiley.com/doi/10.1111/j.1440-1681.2004.04121.x">https://onlinelibrary.wiley.com/doi/10.1111/j.1440-1681.2004.04121.x</a>   |
| 9     | Cardio-vascular                | Curb, J. D., et al. "Serum Lipid Effects of a High-Monounsaturated Fat Diet Based on Macadamia Nuts." <i>Archives of Internal Medicine</i> , vol. 160, no. 8, Apr. 2000, pp. 1154-58  | Compared a macadamia nut based diet (37% total fat) to a "typical American" diet (37% total fat) and a "Step 1" diet (30% total fat). Both the macadamia-based diet and the Step 1 diet reduced TC (5%, 4%; P, 0.01), LDL-C (4%, 5%; P, 0.05), and HDL-C concentrations (4%; P, 0.01, 6%; P, 0.001), respectively. Although TC concentrations were higher with the Step 1 diet (8%; P, 0.05) compared with the typical American diet, the macadamia nut diet reduced TG concentrations (9%; P, 0.05). | The macadamia nut-based diet high in monounsaturated fat did as well as the low-fat diet (Step 1), lowering total cholesterol and low-density lipoprotein (LDL) cholesterol levels compared to a typical American diet. It supports existing research and the regulatory stance that Macadamia nuts can be included in a heart-healthy diet.   | <a href="https://www.researchgate.net/publication/12526978_Serum_Lipid_Effects_of_a_High-Monounsaturated_Fat_Diet_Based_on_Macadamia_Nuts">https://www.researchgate.net/publication/12526978_Serum_Lipid_Effects_of_a_High-Monounsaturated_Fat_Diet_Based_on_Macadamia_Nuts</a>   |
| 10    | Cardio-vascular                | Nishi, S. K., Paz-Graniel, I., Ni, J., Valle-Hita, C., Khoury, N., Garcia-Gavilan, J. F., Babio, N., Salas-Salvado, J. (2024). "Effect of Nut Consumption on Blood Lipids: An updated Systematic Review and Meta-analysis of Randomized Controlled Trials."   | A study of over 113 trials assessing the effect of consuming nuts, including macadamias, with a median daily dose of 45.5g/day compared to a non-nut control group showed moderate reductions in total cholesterol, LDL "bad" cholesterol, triglycerides, and apolipoprotein B. There was no significant impact on HDL "good" cholesterol. Evidence supports current recommendations for consuming nuts for cardiovascular risk reduction by favorably affecting the blood lipid profile in adults.   | Including nuts like macadamia in the diet improves cholesterol levels in the blood, supporting the claim that macadamia nuts are a heart-healthy food.   | <a href="https://pubmed.ncbi.nlm.nih.gov/36771303/">https://pubmed.ncbi.nlm.nih.gov/36771303/</a>   |
| 11    | MUFAs & Inflammation           | Sujatha Rajaram, et al. "Macadamia Nut Consumption May Decrease Inflammation Markers." <i>Geriatrics</i> , vol. 62, no. 6, June 2007, p. 12.  | This meta-analysis came to the conclusion that including macadamia nuts in the diet of geriatric patients appeared to lower their markers of inflammation.  | Macadamia nut consumption appeared to reduce markers of inflammation. More research is needed to confirm.  | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC1005658/">https://pmc.ncbi.nlm.nih.gov/articles/PMC1005658/</a>   |
| 12    | MUFAs & Inflammation           | Patel, Alok, et al. "Futuristic Food Fortification with a Balanced Ratio of Dietary [Omega]-3/[Omega]-6 Omega Fatty Acids for the Prevention of Lifestyle Diseases." <i>Trends in Food Science &amp; Technology</i> , vol. 120, Feb. 2022, p. 140.  | This study presents the argument that adding omega-3 fatty acids to food will lower our risk of diseases such as cardiovascular disease and type-2 diabetes.  | We need to eat a more balanced omega-3 to omega-6 ratio to reduce inflammation and protect our health.   | <a href="https://www.researchgate.net/publication/357589505_Futuristic_food_fortification_with_a_balanced_ratio_of_dietary_omega-3-to-omega-6_omega_fatty_acids_for_the_prevention_of_lifestyle_diseases">https://www.researchgate.net/publication/357589505_Futuristic_food_fortification_with_a_balanced_ratio_of_dietary_omega-3-to-omega-6_omega_fatty_acids_for_the_prevention_of_lifestyle_diseases</a> |
| 13    | MUFAs & Inflammation           | Kalogeropoulos, Nick, et al. "Unsaturated Fatty Acids Are Inversely Associated and N-6/n-3 Ratios Are Positively Related to Inflammation and Coagulation Markers in Plasma of Apparently Healthy Adults." <i>Clinica Chimica Acta</i> , vol. 411, no. 7/8, Apr. 2010, pp. 584-91.                                     | Unsaturated fatty acid intake is beneficial to our health. When the ratio of omega-3 to omega-6 fatty acids was more balanced, some blood markers of inflammation improved.   | Both MUFA and PUFA intake were associated with lower inflammatory markers in the blood; a lower ratio of omega-3 to omega-6 was beneficial but no ideal ratio was identified.  | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC7693622/">https://pmc.ncbi.nlm.nih.gov/articles/PMC7693622/</a>   |
| 14    | MUFAs & Cognitive Brain Health | Prinelli, Federica, et al. "Specific Nutrient Patterns Are Associated with Higher Structural Brain Integrity in Dementia-Free Older Adults." <i>NeuroImage</i> , vol. 199, Oct. 2019, pp. 281-88.   | Mixed nuts are part of a Mediterranean dietary pattern, and their intake was associated with better brain health and a lower risk of dementia.  | A Mediterranean-style diet was associated with better brain health and less dementia. Macadamia nuts specifically were not mentioned, just nuts in general as part of the eating pattern.  | <a href="https://pubmed.ncbi.nlm.nih.gov/30591381/">https://pubmed.ncbi.nlm.nih.gov/30591381/</a>   |
| 15    | MUFAs & Cognitive Brain Health | Jiang, Yi-Wen, et al. "Midlife Dietary Intakes of Monounsaturated Acids, n-6 Polyunsaturated Acids, and Plant-Based Fat Are Inversely Associated with Risk of Cognitive Impairment in Older Singapore Chinese Adults." <i>Journal of Nutrition</i> , vol. 150, no. 4, Apr. 2020, pp. 901-09.                          | Substitution of total carbohydrate or SFAs with MUFAs and PUFAs, particularly n-6 PUFAs, was related to a lower risk of cognitive impairment in elderly Chinese participants. In addition, an inverse association with cognitive impairment was found for plant-based fat.  | Replacing saturated fatty acids, usually from animal sources, with unsaturated fatty acids from plant sources during mid-life was associated with less cognitive decline and better brain health. The more plant-based fats in the diet, the lower the risk of cognitive decline. Both omega-3 and omega-6 fatty acids had this effect. You are never too old to improve your diet and protect your brain. | <a href="https://pubmed.ncbi.nlm.nih.gov/31875477/">https://pubmed.ncbi.nlm.nih.gov/31875477/</a>   |
| 16    | MUFAs & Cognitive Brain Health | Naqvi, Asghar Z., et al. "Monounsaturated, Trans, and Saturated Fatty Acids and Cognitive Decline in Women." <i>Journal of the American Geriatrics Society</i> , vol. 59, no. 5, May 2011, pp. 837-43.  | More women than men suffer from Alzheimer's Disease and dementia. This study demonstrated that choosing monounsaturated (MUFA) fats instead of saturated or trans fats was associated with less cognitive decline in women.   | Greater MUFA intake was associated with less cognitive decline   | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC3098039/">https://pmc.ncbi.nlm.nih.gov/articles/PMC3098039/</a>   |
| 17    | MUFAs & Cognitive Brain Health | Theodore, Lauren E., et al. "Nut Consumption for Cognitive Performance: A Systematic Review." <i>Advances in Nutrition</i> , vol. 12, no. 3, May 2021, pp. 777-92.  | Mixed nut intake was associated with better cognitive performance. Unfortunately, macadamia nuts were not included in this study. However, when macadamia nuts are included in studies, their effect is consistent with nut intake in general.  | Nut consumption in general was associated with better cognitive performance, although macadamias were not included in this study.  | <a href="https://pubmed.ncbi.nlm.nih.gov/33330927/">https://pubmed.ncbi.nlm.nih.gov/33330927/</a>   |
| 18    | Omega-7 / Palmitoleic Acid     | Sasagawa, Masa, et al. "Omega-7 Mixed Fatty Acid Supplementation Fails to Reduce Serum Inflammatory Biomarkers: A Placebo-Controlled, Double-Blind Randomized Crossover Trial." <i>NUTRIENTS</i> , vol. 13, no. 8, Aug. 2021, p. 2801.  | Supplementing the diet with omega-7 fatty acids (palmitoleic acid) was no better than a placebo in reducing inflammation markers.   | Supplemental omega-7 palmitoleic acid was no better than placebo in reducing inflammation.   | <a href="https://pubmed.ncbi.nlm.nih.gov/34444963/">https://pubmed.ncbi.nlm.nih.gov/34444963/</a>   |
| 19    | Omega-7 / Palmitoleic Acid     | Weir, N. L., et al. "Circulating Omega-7 Fatty Acids Are Differentially Related to Metabolic Dysfunction and Incident Type II Diabetes: The Multi-Ethnic Study of Atherosclerosis (MESA)." <i>Diabetes &amp; Metabolism</i> , vol. 46, no. 4, Sept. 2020, pp. 319-25.   | Higher levels of omega-7 fatty acids in the blood were associated with higher rates of Type 2 Diabetes in some ethnic groups. They did not measure omega-7 levels in the diet, just levels in the blood. Since humans make omega-7 fatty acids, blood levels do not correlate to dietary intake.  | Palmitoleic acid positively correlated with Type-2 Diabetes in some ethnic groups. This does not mean that omega-7 fatty acids caused the Diabetes.  | <a href="https://pubmed.ncbi.nlm.nih.gov/31706030/">https://pubmed.ncbi.nlm.nih.gov/31706030/</a>   |
| 20    | Omega-7 / Palmitoleic Acid     | Akio NAKAMURA, et al. Effects of Omega-7 Palmitoleic Acids on Skeletal Muscle Differentiation in a Hyperglycemic Condition. no. 9, Jan. 2021, p. 1369.  | This is preliminary research and had some promising results on palmitoleic acid (omega-7 fatty acid) and potential antioxidant effects.   | Preliminary research, palmitoleic acid may have antioxidant properties. More research is needed but this is promising  | <a href="https://pubmed.ncbi.nlm.nih.gov/34248106/">https://pubmed.ncbi.nlm.nih.gov/34248106/</a>   |

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| 21 | <b>Omega-7 / Palmitoleic Acid</b> | Wei Hu, et al. "A Review of Biological Functions, Health Benefits, and Possible de Novo Biosynthetic Pathway of Palmitoleic Acid in Macadamia Nuts." <i>Journal of Functional Foods</i> , vol. 62, no., Nov. 2019.  | Macadamia oil has high smoke and flash points (200 C and 300 C). Palmitoleic acid may possibly increase insulin sensitivity and reduce the risk of Type-2 Diabetes.   | Macadamia oil can be used in moderate-to-high-heat cooking without degrading. There was some evidence palmitoleic acid (omega-7) was associated with improved insulin sensitivity, which would reduce the risk of developing Type-2 Diabetes.  | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC7958573/">https://pmc.ncbi.nlm.nih.gov/articles/PMC7958573/</a>   |
| 22 | <b>Omega-7 / Palmitoleic Acid</b> | Domenico Trico, Alessandro Mengozzi, Lorenzo Nesti, Mensud Hatunic, Rafael Gabriel Sanchez, Thomas Konrad & Katarina Lalic, Nebojsa M. Lalic & Andrea Mari & Andrea Natali & for the EGIR-RISC Study Group. "Circulating palmitoleic acid is an independent determinant of insulin sensitivity, beta cell function and glucose tolerance in non-diabetic individuals: a longitudinal analysis". <i>Diabetologia</i> (2020) 63:206–218 | Higher levels of omega-7 fatty acids (palmitoleic acid) in the blood were associated with improved insulin sensitivity, reducing the risk of developing Type-2 Diabetes. This does not mean the palmitoleic acid had this effect; it was just seen at the same time.  | Having more omega-7 fats in the blood may be associated with improved insulin sensitivity.   | <a href="https://pubmed.ncbi.nlm.nih.gov/31676981/">https://pubmed.ncbi.nlm.nih.gov/31676981/</a>   |
| 23 | <b>Omega-7 / Palmitoleic Acid</b> | Eoesu Cetin, et al "Protocol for a randomized placebo-controlled clinical trial using pure palmitoleic acid to ameliorate insulin resistance and lipogenesis in overweight and obese subjects with prediabetes". <i>Frontiers for Endocrinology</i> 2024  | The study authors hypothesize they can mimic the rescue mechanism of adipose tissue against obesity by supplementing high dose POA exogenously, which will improve whole-body insulin sensitivity. This study has not been completed, we will update when it is published.  | This published paper provides the protocol the study authors are using to test pure palmitoleic acid, without any palmitic acid, and the effect on insulin resistance and diabetes. The results will be interesting for macadamia and we will watch closely for any updates as the research is conducted. This is one of the first human studies of POA. | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC10835623/">https://pmc.ncbi.nlm.nih.gov/articles/PMC10835623/</a>   |
| 24 | <b>Satiety &amp; Weight Gain</b>  | Cesarettin Alasalvar <sup>1</sup> and Bradley W. "Review of nut phytochemicals, fat-soluble bioactives, antioxidant components and health effects". <i>Bolting British Journal of Nutrition</i> (2015), 113, S68–S78  | This study reviews other published research (included here), coming to the same conclusions regarding the health benefits of nuts in general, including macadamia nuts.   | This study provides more evidence supporting the heart-health and other benefits of eating macadamia nuts.   | <a href="https://pubmed.ncbi.nlm.nih.gov/26148924/">https://pubmed.ncbi.nlm.nih.gov/26148924/</a>   |
| 25 | <b>Satiety &amp; Weight Gain</b>  | Julie L. Jones, et al., School of Public Health, Loma Linda University, Loma Linda, CA, USA, "Macadamia nut effects on cardiometabolic risk factors: a randomised trial". <i>Journal of Nutritional Science</i> (2023), vol. 12, e65.   | Daily consumption of macadamia nuts does not lead to gains in weight or body fat under free-living conditions in overweight or obese adults; non-significant cholesterol lowering occurred without altering saturated fat intake of similar magnitude to cholesterol lowering seen with other nuts.<br><br>Adding macadamia nuts to the diet did not result in weight gain; other results were not significant however the study was only 8 weeks long. | Further evidence that macadamias do not cause weight gain if eaten in moderation. "Macadamia nuts may be suggested as a nutrient-dense food even among the overweight/obese population without fear of weight gain." There were even some cholesterol-lowering benefits for the most obese subjects, suggesting macadamia nuts can improve their health. | <a href="https://pubmed.ncbi.nlm.nih.gov/37180485/">https://pubmed.ncbi.nlm.nih.gov/37180485/</a>   |
| 26 | <b>Mac Nut Oil</b>                | Xixiang Shuai, Taotao Dai, Mingshun Chen, Cheng-mei Liu, Roger Ruan, Yuhuan Liu, Jun Chen - "Characterization of lipid compositions, minor components and antioxidant capacities in macadamia ( <i>Macadamia integrifolia</i> ) oil from four major areas in China". <i>Food Bioscience</i> 50 (2022) 102009  | Each region was slightly different in the nutrient content of the oil. However, all nuts provided good antioxidant and fatty acid content.  | Macadamia nut oil provides the same healthy, good fats and antioxidants as the whole nuts do.  | <a href="https://www.sciencedirect.com/science/article/abs/pii/S2212429222004692">https://www.sciencedirect.com/science/article/abs/pii/S2212429222004692</a>   |
| 27 | <b>Mac Nut Oil</b>                | Tafadzwa Kaseke, Olanjyi Amos Fawole, and Umezuruike Linus Opara. "Chemistry and Functionality of Cold-Pressed Macadamia Nut Oil". <i>Processes</i> 2022, 10, 56  | A review of cold-pressed macadamia oil's nutrition content. Further evidence cold-pressed macadamia oil contains monounsaturated fatty acids in (oleic acid and palmitoleic acid) also contains a significant concentration of bioactive phytochemicals including, β-sitosterol, α-tocopherol, α-tocotrienols, p-hydroxybenzoic acid, and caffeic acid. Moreover, the oil has good oxidative stability.   | The healthy fats in macadamia are not diminished by cold-pressing the oil. This study demonstrates that cold-pressed macadamia oil has the same healthy fats and other nutrients as the whole nut.   | <a href="https://www.researchgate.net/publication/357368189_Chemistry_and_Functionality_of_Cold-Pressed_Macadamia_Nut_Oil">https://www.researchgate.net/publication/357368189_Chemistry_and_Functionality_of_Cold-Pressed_Macadamia_Nut_Oil</a>   |
| 28 | <b>Mac Nut Oil</b>                | Roberta Tardugno, Nicola Cicero, et al., "Exploring Lignans, a Class of Health Promoting Compounds, in a Variety of Edible Oils from Brazil". <i>Foods</i> 2022, 11, 138  | Macadamia nut oil is a rich source of Lignans, which are a type of polyphenol. Lignans sometimes act like a fiber, providing healthy food for our gut microbiota, and sometimes act like an anti-inflammatory compound.   | Macadamia nut oil contains Lignans, which are health-promoting polyphenol compounds.   | <a href="https://www.researchgate.net/publication/360532381_Exploring_Lignans_a_Class_of_Health_Promoting_Compounds_in_a_Variety_of_Edible_Oils_from_Brazil">https://www.researchgate.net/publication/360532381_Exploring_Lignans_a_Class_of_Health_Promoting_Compounds_in_a_Variety_of_Edible_Oils_from_Brazil</a>                         |
| 29 | <b>Mac Nut Oil</b>                | Xixiang Shuai, et al. "Effect of different oleogelation mechanisms on physical properties and oxidative stability of macadamia oil-based oleogels and its application". <i>LWT - Food Science and Technology</i> 198 (2024) 115978  | Macadamia oil may be a good substitute for cocoa butter for heat-resistant chocolates.  | Macadamia oil can be substituted for cocoa butter in chocolates, with a possibly better outcome for candy manufacturers and a healthier fat content.   | <a href="https://www.sciencedirect.com/science/article/pii/S0023643824002408?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S0023643824002408?via%3Dihub</a>   |
| 30 | <b>Mac Nut Oil</b>                | Suvimol and Wantida Chaiyana, "Clinical Efficacy in Skin Hydration and Reducing Wrinkles of Nanoemulsions Containing Macadamia integrifolia Seed Oil". <i>Nanomaterials</i> 2024, 14, 724   | Both conventional emulsions of macadamia oil and nano-emulsions enhanced skin hydration and reduced skin wrinkles in human volunteers, while the nano-emulsion was outstanding in skin hydration enhancement.   | Macadamia oil may improve skin hydration and reduce wrinkles when applied to the skin. This is good evidence that applying macadamia oil topically is beneficial.  | <a href="https://pubmed.ncbi.nlm.nih.gov/38668218/">https://pubmed.ncbi.nlm.nih.gov/38668218/</a>   |
| 31 | <b>Mac Nut Oil</b>                | Yao Liu, et al. "Effect of macadamia oil cake on blood lipid characteristics and intestinal microbiota in hyperlipidemic rat" (animal study). <i>Food Sci Nutr.</i> 2023;11:5318–5324   | This is an animal study, so of lesser quality than human studies. Macadamia oil had the same cholesterol-lowering effects in rats as the nuts have shown in humans. This can pave the way for studies showing health benefits of macadamia nut oil in addition to whole nuts.   | Macadamia nut oil may have the same cholesterol-lowering effects of whole nuts.  | <a href="https://www.researchgate.net/publication/371582020_Effect_of_macadamia_oil_cake_on_blood_lipid_characteristics_and_intestinal_microbiota_in_hyperlipidemic_rat">https://www.researchgate.net/publication/371582020_Effect_of_macadamia_oil_cake_on_blood_lipid_characteristics_and_intestinal_microbiota_in_hyperlipidemic_rat</a> |
| 32 | <b>Mac Nut Milk</b>               | Victor Jonas da Rocha Esperança, Caroline Corrêa de Souza Coelho, Renata Tonon, Renata Torrezan, and Otniel Freitas-Silva. "A review on plant-based free nuts beverages: technological, sensory, nutritional, health and microbiological aspects". <i>INTERNATIONAL JOURNAL OF FOOD PROPERTIES</i> 2022, VOL. 25, NO. 1, 2396–2408  | Plant-based drinks like nut milks can be healthier than dairy milks. This study reviews ways to overcome some of the astringent or bitter flavors sometimes associated with these beverages.  | Macadamia nut milk can be a healthy alternative to dairy milk.   | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC10650231/">https://pmc.ncbi.nlm.nih.gov/articles/PMC10650231/</a>   |
| 33 | <b>Mac Nut Milk</b>               | Winston J. Craig and Cecilia J. Brothers., "Nutritional Content of Non-Dairy Frozen Desserts". <i>Nutrients</i> 2022, 14, 4150  | Many non-dairy frozen desserts are high in saturated fat due to substituting dairy milk with coconut milk. Using macadamia nut milk instead of coconut milk can offer a healthier fat content without sacrificing taste or quality.   | Macadamia nut milk is a good option for non-dairy frozen desserts, and is healthier than coconut milk.   | <a href="https://pubmed.ncbi.nlm.nih.gov/36235801/">https://pubmed.ncbi.nlm.nih.gov/36235801/</a>   |
| 34 | <b>Manganese</b>                  | Sareen S Tropper, Jack L Smith, James L Groff – "Advanced Nutrition and Metabolism of Manganese". Textbook, published by Wadsworth  | Manganese is an essential mineral for humans. Over 100 enzymes require it to function properly. Thus, adequate manganese intake is essential for strong bones, healthy immune responses, good cognitive function, making our sex hormones, and metabolizing carbohydrates and fats for energy.  | Macadamia nuts are an excellent source of Manganese, an essential mineral necessary for nearly every body system to function well.   | <a href="https://dokumen.pub/advanced-nutrition-and-human-metabolism-7nbsped-9781305627857.html">https://dokumen.pub/advanced-nutrition-and-human-metabolism-7nbsped-9781305627857.html</a>   |

## Additional Studies Not Included in the Report

| Study/Author  | Results Summary and Key Takeaways   |
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| <p>Garg, Manohar L., et al. "Macadamia Nut Consumption Lowers Plasma Total and LDL Cholesterol Levels in Hypercholesterolemic Men." <i>The Journal of Nutrition</i>, vol. 133, no. 4, Apr. 2003, p. 1060. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=97fbfe7d-c271-38cf-bd8f-5c5c33f5f0a2">discovery.ebsco.com/linkprocessor/plink?id=97fbfe7d-c271-38cf-bd8f-5c5c33f5f0a2</a>.</p>   | <p>Plasma total cholesterol and LDL cholesterol concentrations decreased by 3.0 and 5.3%, respectively, and HDL cholesterol levels increased by 7.9% in hypercholesterolemic men after macadamia nut consumption</p> <p>This study demonstrates that macadamia nut consumption as part of a healthy diet favorably modifies the plasma lipid profile in hypercholesterolemic men despite their diet being high in fat.</p>  |
| <p>Hu, Wei, et al. "Fatty Acid Diversity and Interrelationships in Macadamia Nuts." <i>LWT</i>, vol. 154, Jan. 2022. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=8e675598-43c4-3e05-8886-4541df5522f9">discovery.ebsco.com/linkprocessor/plink?id=8e675598-43c4-3e05-8886-4541df5522f9</a></p>   | <p>Fatty acid differences between varieties and possible reasons for those differences.</p>   |
| <p>Somerset, S. M., et al. "Isoenergetic Replacement of Dietary Saturated with Monounsaturated Fat via Macadamia Nuts Enhances Endothelial Function in Overweight Subjects." <i>E-SPEN Journal</i>, vol. 8, no. 3, June 2013, pp. e113–19. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=8e29c625-d471-37e4-93ad-97ebc4261704">discovery.ebsco.com/linkprocessor/plink?id=8e29c625-d471-37e4-93ad-97ebc4261704</a>. No PDF available</p>   | <p>A significant increase in brachial artery flow-mediated dilation (<math>p &lt; 0.05</math>) was seen in the monounsaturated diet group at week 10 compared to baseline. This corresponded to significant decreases in waist circumference, total cholesterol (<math>p &lt; 0.05</math>), plasma leptin and ICAM-1 (<math>p &lt; 0.01</math>)</p> <p>In patient subgroups where adherence to dietary energy-reduction is poor, isoenergetic interventions may improve endothelial function and other coronary risk factors without changes in body weight</p> <p>Keeping calories the same but eating MUFA from macadamia instead of sat fat improved health.</p> |
| <p>Cao, Yumei, et al. "Lipid and Lipoprotein Responses to a Cholesterol-Lowering Macadamia Nut-Rich Diet Are Reduced in Mildly Hypercholesterolemic Men and Women with Higher Baseline C-Reactive Protein (CRP) Levels." <i>FASEB JOURNAL</i>, vol. 21, no. 5, Apr. 2007, p. A698. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=46cbb570-eaf5-3005-a9ad-ff178fb406a8">discovery.ebsco.com/linkprocessor/plink?id=46cbb570-eaf5-3005-a9ad-ff178fb406a8</a>.</p>                  | <p>Nothing noteworthy</p>   |
| <p>MUKUDDER-PETERSEN, Janine, et al. "A Systematic Review of the Effects of Nuts on Blood Lipid Profiles in Humans." <i>The Journal of Nutrition</i>, vol. 135, no. 9, Jan. 2005, pp. 2082–89. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=fffece73-0b1c-3a21-a3f6-23cf6ca9e92d">discovery.ebsco.com/linkprocessor/plink?id=fffece73-0b1c-3a21-a3f6-23cf6ca9e92d</a></p>   | <p>This meta-analysis shows the evidence for nuts as part of a heart-healthy diet, however is was done in 2005 and does not include the more convincing data on macadamia nuts.</p>   |
| <p>Apgar, Barbara. "Serum Lipid Levels and a Diet of Macadamia Nuts." <i>American Family Physician</i>, vol. 62, no. 8, Oct. 2000, pp. 1882–84. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=7c48ae84-a922-3e2d-9183-c10911bc1729">discovery.ebsco.com/linkprocessor/plink?id=7c48ae84-a922-3e2d-9183-c10911bc1729</a></p>  | <p>Editorial on findings of Curb study</p>  |
| <p>Del Gobbo, Liana C., et al. "Effects of Tree Nuts on Blood Lipids, Apolipoproteins, and Blood Pressure: Systematic Review, Meta-Analysis, and Dose-Response of 61 Controlled Intervention Trials1–3." <i>The American Journal of Clinical Nutrition</i>, vol. 102, no. 6, Dec. 2015, pp. 1347–56. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=f62193b1-ceae-3092-88d1-173559c33394">discovery.ebsco.com/linkprocessor/plink?id=f62193b1-ceae-3092-88d1-173559c33394</a></p> | <p>tree nut intake lowered total cholesterol and LDL cholesterol in a nonlinear fashion (<math>P</math>- nonlinearity , 0.001); stronger effects were observed in trials providing doses of <math>\geq 60</math> g nuts/d</p> <p>Our findings showing that nut intake significantly improves the lipid profile, lowering LDL cholesterol, ApoB, and triglycerides, provide critical mechanistic evidence to support a causal link between nut intake and lowered CVD risk.</p> <p>Two servings a day of nuts, including macadamia nuts, offers more cholesterol-lowering benefits</p>   |
| <p>Mohammadifard, Noushin, et al. "The Effect of Tree Nut, Peanut, and Soy Nut Consumption on Blood Pressure: A Systematic Review and Meta-Analysis of Randomized Controlled Clinical Trials1-3." <i>The American Journal of Clinical Nutrition</i>, vol. 101, no. 5, May 2015, pp. 966–82. EBSCOhost, <a href="https://www.ebsco.com/linkprocessor/plink?id=479e98ff-b154-3253-8d1c-d5f9c1d999b2">discovery.ebsco.com/linkprocessor/plink?id=479e98ff-b154-3253-8d1c-d5f9c1d999b2</a>.</p>         | <p>No significant difference in blood pressure, macadamia nuts were not specifically studied in this study.</p>   |

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| Woolf, Peter J., et al. "VProtein: Identifying Optimal Amino Acid Complements from Plant-Based Foods." PLoS ONE, vol. 6, no. 4, Apr. 2011, p. e18836. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=6827c135-79e5-3f23-8b1f-1e2944198679">discovery.ebsco.com/linkprocessor/plink?id=6827c135-79e5-3f23-8b1f-1e2944198679</a>   | Macadamia nuts were the most deficient in lysine and methionine+cysteine   |
| Wood, Katie E., et al. "Incorporating Macadamia Oil and Butter to Reduce Dietary Omega-6 Polyunsaturated Fatty Acid Intake." Nutrition & Dietetics, vol. 70, no. 2, June 2013, pp. 94–100. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=581703b1-87fd-3852-b207-d7d592fe4e2a">discovery.ebsco.com/linkprocessor/plink?id=581703b1-87fd-3852-b207-d7d592fe4e2a</a> .  | Study clearly shows that it is possible to substantially reduce dietary LA intake by simply replacing the oils and spreads commonly used in food preparation with macadamia oil and butter<br>it is possible to use macadamia butter in the place of polyunsaturated margarines while still adhering to recommendation of no more than 10% E saturated fat.<br>These products are commonly available in Australia, but not in the US. An opportunity for growth in the market. |
| Nash, SD, and M. Westfal. "Cardiovascular Benefits of Nuts." AMERICAN JOURNAL OF CARDIOLOGY, vol. 95, no. 8, Apr. 2005, pp. 963–65. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=c4be32fc-12de-390a-b2f0-1868c3f93056">discovery.ebsco.com/linkprocessor/plink?id=c4be32fc-12de-390a-b2f0-1868c3f93056</a> .   | Basic editorial on nuts and lower LDL, TC levels   |
| Bernadette P. Marriott, et al. "Impact of Fatty Acid Supplementation on Cognitive Performance among United States (US) Military Officers: The Ranger Resilience and Improved Performance on Phospholipid-Bound Omega-3's (RRIPP-3) Study." Nutrients, vol. 13, no. 1854, May 2021, p. 1854. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=8b01f185-e9fe-3837-a3ed-89221fc45c81">discovery.ebsco.com/linkprocessor/plink?id=8b01f185-e9fe-3837-a3ed-89221fc45c81</a> | No significant findings, study participants had to take 8 capsules of either krill or macadamia oil each day, which led to poor compliance.  |
| O'Neil, Carol E et al. "Tree Nut consumption is associated with better adiposity measures and cardiovascular and metabolic syndrome health risk factors in U.S. Adults: NHANES 2005-2010." <i>Nutrition journal</i> vol. 14 64. 28 Jun. 2015, doi:10.1186/s12937-015-0052-x  | This study showed that those consuming tree nuts had better weight/adiposity measures and a lower risk of obesity, overweight/obesity, and elevated WC than non- consumers. Tree nut consumers also had lower SBP and higher levels of HDL-C.  |
| Elia N. Aquino-Bolaños, Laura Mapel-Velazco, Sandra T. Martín-del-Campo, José L. Chávez-Servia, Armando J. Martínez & Iñigo Verdalet-Guzmán (2017) Fatty acids profile of oil from nine varieties of Macadamia nut, International Journal of Food Properties, 20:6, 1262-1269, DOI: 10.1080/10942912.2016.1206125  | Fatty acid components of different species of macadamia nuts   |
| Janet C. King, Jeffrey Blumberg, Linda Ingwersen, Mazda Jenab, Katherine L. Tucker, Tree Nuts and Peanuts as Components of a Healthy Diet, The Journal of Nutrition, Volume 138, Issue 9, September 2008, Pages 1736S–1740S, <a href="https://doi.org/10.1093/jn/138.9.1736S">https://doi.org/10.1093/jn/138.9.1736S</a>   | The positive data here is nuts in general; the nutrition claims they make (excellent source of magnesium and protein, for example) do not apply to macadamia nuts.<br><br>Nuts are nutrient-rich foods, and make healthy snacks.   |
| Ros, Emilio. "Health benefits of nut consumption." Nutrients vol. 2,7 (2010): 652-82. doi:10.3390/nu2070652  | Nuts are nutrient-rich foods; regular consumption can decrease risk of CVD and possibly Type-2 Diabetes<br><br>Nuts, including macadamia nuts, are nutrient-rich foods. As part of a healthy diet they can reduce the risk of heart disease.   |
| Wang, J.; Wang, S.; Henning, S.M.; Qin, T.; Pan, Y.; Yang, J.; Huang, J.; Tseng, C.-H.; Heber, D.; Li, Z. Mixed Tree Nut Snacks Compared to Refined Carbohydrate Snacks Resulted in Weight Loss and increased Satiety during Both Weight Loss and Weight Maintenance: A 24-Week Randomized Controlled Trial. Nutrients 2021, 13, 1512.   | Nuts can be part of an effective weight loss diet. Their higher fat content does not contribute to losing less weight.   |
| Sasagawa, Masa, et al. "Omega-7 Mixed Fatty Acid Supplementation Fails to Reduce Serum Inflammatory Biomarkers: A Placebo-Controlled, Double-Blind Randomized Crossover Trial." NUTRIENTS, vol. 13, no. 8, Aug. 2021, p. 2801. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=00c42e47-d018-301a-a936-e769e05ab938">discovery.ebsco.com/linkprocessor/plink?id=00c42e47-d018-301a-a936-e769e05ab938</a> .  | Supplemental omega-7 palmitoleic acid was no better than placebo.  |

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| <p>Weir, N. L., et al. "Circulating Omega-7 Fatty Acids Are Differentially Related to Metabolic Dysfunction and Incident Type II Diabetes: The Multi-Ethnic Study of Atherosclerosis (MESA)." <i>Diabetes &amp; Metabolism</i>, vol. 46, no. 4, Sept. 2020, pp. 319–25. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=6db806d9-06cb-3f92-976a-074b0e7e8d74">discovery.ebsco.com/linkprocessor/plink?id=6db806d9-06cb-3f92-976a-074b0e7e8d74</a>.</p>   | <p>Palmitoleic acid positively correlated with type-2 diabetes in some ethnic groups.</p>   |
| <p>Akio NAKAMURA, et al. Effects of Omega-7 Palmitoleic Acids on Skeletal Muscle Differentiation in a Hyperglycemic Condition. no. 9, Jan. 2021, p. 1369. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=8a736a9b-412e-3f55-bbfc-b66e513da235">discovery.ebsco.com/linkprocessor/plink?id=8a736a9b-412e-3f55-bbfc-b66e513da235</a>.</p>   | <p>Preliminary research, palmitoleic acid may have antioxidant properties</p>   |
| <p>Lutgarda Bozzetto, Anna Prinster, Giovanni Annuzzi, Lucia Costagliola, Anna Mangione, Alessandra Vitelli, Raffaella Mazzarella, Margaret Longobardo, Marcello Mancini, Carlo Vigorito, Gabriele Riccardi, Angela A. Rivellese; Liver Fat Is Reduced by an Isoenergetic MUFA Diet in a Controlled Randomized Study in Type 2 Diabetic Patients. <i>Diabetes Care</i> 1 July 2012; 35 (7): 1429–1435. <a href="https://doi.org/10.2337/dc12-0033">https://doi.org/10.2337/dc12-0033</a></p>  | <p>Replacing saturated fat with MUFA improved Non-alcoholic Fatty Liver Disease in patients with Type 2 Diabetes</p> <p>Substituting foods rich in MUFA for foods high in saturated fats (ex: macadamias or macadamia butter for butter or bacon) benefits our health.</p>                  |
| <p>Isabel Errazuriz, Simmi Dube, Michael Slama, Roberto Visentin, Sunita Nayar, Helen O'Connor, Claudio Cobelli, Swapan Kumar Das, Ananda Basu, Walter Karl Kremers, John Port, Rita Basu, Randomized Controlled Trial of a MUFA or Fiber-Rich Diet on Hepatic Fat in Prediabetes, <i>The Journal of Clinical Endocrinology &amp; Metabolism</i>, Volume 102, Issue 5, 1 May 2017, Pages 1765–1774, <a href="https://doi-org.libproxy.chapman.edu/10.1210/jc.2016-3722">https://doi-org.libproxy.chapman.edu/10.1210/jc.2016-3722</a></p> | <p>A diet rich in MUFA reduced fat accumulation in the liver.</p>   |
| <p>Bozzetto, Lutgarda, et al. "Reduction in Liver Fat by Dietary MUFA in Type 2 Diabetes Is Helped by Enhanced Hepatic Fat Oxidation." <i>Diabetologia</i>, vol. 59, no. 12, Dec. 2016, pp. 2697–701. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=b4902666-319e-352e-b585-99ddcfa1ebd8">discovery.ebsco.com/linkprocessor/plink?id=b4902666-319e-352e-b585-99ddcfa1ebd8</a>.</p>   | <p>Analysis of previous study, same conclusions</p>   |
| <p>Schwingshackl, L., and B. Strasser. "High-MUFA Diets Reduce Fasting Glucose in Patients with Type 2 Diabetes." <i>Annals of Nutrition &amp; Metabolism</i>, vol. 60, no. 1, Jan. 2012, pp. 33–34. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=9dd6595b-2c62-3cc1-a88f-99e357b48402">discovery.ebsco.com/linkprocessor/plink?id=9dd6595b-2c62-3cc1-a88f-99e357b48402</a>.</p>  | <p>Letter to the editor reviewing research on MUFA and blood glucose after nut consumption.</p> <p>Diets high in MUFA seem to reduce blood glucose/blood sugar in people with Type 2 Diabetes. More research is needed.</p>   |
| <p>Strik, Caroline M., et al. "No Evidence of Differential Effects of SFA, MUFA or PUFA on Post-Ingestive Satiety and Energy Intake: A Randomised Trial of Fatty Acid Saturation." <i>Nutrition Journal</i>, vol. 9, Jan. 2010, pp. 24–35. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=a71c487f-a522-3bcd-98a8-77bcd22810db">discovery.ebsco.com/linkprocessor/plink?id=a71c487f-a522-3bcd-98a8-77bcd22810db</a>.</p>  | <p>Different fatty acids did not have any effect on post-prandial satiety; no data on longer-term satiety</p>   |
| <p>Patel, Alok, et al. "Futuristic Food Fortification with a Balanced Ratio of Dietary [Omega]-3/[Omega]-6 Omega Fatty Acids for the Prevention of Lifestyle Diseases." <i>Trends in Food Science &amp; Technology</i>, vol. 120, Feb. 2022, p. 140. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=51f46934-49ca-3289-82be-a58aa4f86652">discovery.ebsco.com/linkprocessor/plink?id=51f46934-49ca-3289-82be-a58aa4f86652</a>.</p>  | <p>Essential paper on the ratio of omega-3 and omega-6 fats with takeaway - We need to eat a more balanced omega-3 to omega-6 ratio to reduce inflammation and protect our health.</p>  |
| <p>U.S. Department of Agriculture (USDA), Agricultural Research Service. FoodData Central: Foundation Foods. Version Current: April 2021. Internet: <a href="https://fdc.nal.usda.gov">fdc.nal.usda.gov</a>.</p>  | <p>Fatty acid composition of macadamia nuts, ratio of omega-3 to omega-6</p>  |
| <p>Helda Tutunchi, Alireza Ostadrahimi, Maryam Saghafi-Asl, The Effects of Diets Enriched in Monounsaturated Oleic Acid on the Management and Prevention of Obesity: a Systematic Review of Human Intervention Studies, <i>Advances in Nutrition</i>, Volume 11, Issue 4, July 2020, Pages 864–877, <a href="https://doi-org.libproxy.chapman.edu/10.1093/advances/nmaa013">https://doi-org.libproxy.chapman.edu/10.1093/advances/nmaa013</a></p>   | <p>Review of published studies; oleic acid (MUFA) seems to positively help achieve and maintain a healthy body weight</p>   |
| <p>Gaetan Ravaut, et al. "Monounsaturated Fatty Acids in Obesity-Related Inflammation." <i>International Journal of Molecular Sciences</i>, vol. 22, no. 330, Dec. 2021, p. 330. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=24584ada-0ff1-3966-8db1-49274443ad94">discovery.ebsco.com/linkprocessor/plink?id=24584ada-0ff1-3966-8db1-49274443ad94</a>.</p>  | <p>Substitution of SFA by MUFA activates beneficial anti-inflammatory mechanisms (M2 macrophage polarization, adipocyte IL-10 secretion, inhibition of NLRP3 inflammasome) and reverses the deleterious effect of SFAs on adipose tissues, hepatic tissue and <math>\beta</math> cells.</p> |

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| <p>Gomez-Delgado, Francisco, et al. "Telomerase RNA Component Genetic Variants Interact With the Mediterranean Diet Modifying the Inflammatory Status and Its Relationship With Aging: CORDIOPREV Study." <i>Journals of Gerontology Series A: Biological Sciences &amp; Medical Sciences</i>, vol. 73, no. 3, Mar. 2018, pp. 327–32. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=73ac9b24-2adc-37b9-9afa-e9db1ae4ef21">discovery.ebsco.com/linkprocessor/plink?id=73ac9b24-2adc-37b9-9afa-e9db1ae4ef21</a>.</p> | <p>MUFA intake and effect on certain SNPs regarding obesity and metabolic syndrome.</p>   |
| <p>BLADBJERG, Else-Marie, et al. "Effects on Markers of Inflammation and Endothelial Cell Function of Three Ad Libitum Diets Differing in Type and Amount of Fat and Carbohydrate: A 6-Month Randomised Study in Obese Individuals." <i>British Journal of Nutrition</i>, vol. 106, no. 1, Jan. 2011, pp. 123–29. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=cc48e6ac-8352-345c-b9e9-6e0c33254407">discovery.ebsco.com/linkprocessor/plink?id=cc48e6ac-8352-345c-b9e9-6e0c33254407</a>.</p>                     | <p>No difference between PUFA, MUFA, and low fat diets; only 9 total subjects</p>   |
| <p>Cândido, Flávia Galvão, et al. "Impact of Dietary Fat on Gut Microbiota and Low-Grade Systemic Inflammation: Mechanisms and Clinical Implications on Obesity." <i>International Journal of Food Sciences &amp; Nutrition</i>, vol. 69, no. 2, Mar. 2018, pp. 125–43. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=23b9ae76-963c-3b32-a568-2acfb22308a">discovery.ebsco.com/linkprocessor/plink?id=23b9ae76-963c-3b32-a568-2acfb22308a</a>.</p>   | <p>MUFA and PUFA are more conducive to a healthy microbiome than SFA in obese patients; diets high in total fat promote some dysbiosis so diets should be balanced</p>  |
| <p>Jamar, Giovana, et al. "High-Fat or High-Sugar Diets as Trigger Inflammation in the Microbiota-Gut-Brain Axis." <i>Critical Reviews in Food Science &amp; Nutrition</i>, vol. 61, no. 5, Mar. 2021, pp. 836–54. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=e1ddd138-9b92-3c69-ba51-a9b050908638">discovery.ebsco.com/linkprocessor/plink?id=e1ddd138-9b92-3c69-ba51-a9b050908638</a>.</p>  | <p>MUFA and PUFA are better than SFA, but high fat diets do not improve the microbiome.</p>   |
| <p>Petersson H, et al. "Effects of Dietary Fat Modification on Oxidative Stress and Inflammatory Markers in the LIPGENE Study." <i>British Journal of Nutrition</i>, vol. 104, no. 9, Nov. 2010, pp. 1357–62. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=4ad22d7a-dbd8-3696-b080-d56050e17e13">discovery.ebsco.com/linkprocessor/plink?id=4ad22d7a-dbd8-3696-b080-d56050e17e13</a>.</p>   | <p>No difference between PUFA, MUFA, and low fat diets; larger study of over 400 people</p>   |
| <p>Custers, et al. "Dietary Lipids from Body to Brain." <i>Progress in Lipid Research</i>, vol. 85, Jan. 2022. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=bfa8dd08-530b-3e31-9e3c-3a0adb380334">discovery.ebsco.com/linkprocessor/plink?id=bfa8dd08-530b-3e31-9e3c-3a0adb380334</a>.</p>  | <p>Diets rich in MUFA and Omega-3 PUFA <u>may</u>, through their anti-inflammatory properties, positively impact brain health</p>   |
| <p>Teng, Kim-Tiu, et al. "Effects of Exchanging Carbohydrate or Monounsaturated Fat with Saturated Fat on Inflammatory and Thrombogenic Responses in Subjects with Abdominal Obesity: A Randomized Controlled Trial." <i>Clinical Nutrition</i>, vol. 36, no. 5, Oct. 2017, pp. 1250–58. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=f7283a09-d64b-31c7-93f7-75b9d1788c01">discovery.ebsco.com/linkprocessor/plink?id=f7283a09-d64b-31c7-93f7-75b9d1788c01</a>.</p>  | <p>the evidence presented in this study suggests that the replacement of SFA with MUFA or refined carbohydrates may not improve inflammatory and thrombogenic markers in abdominally overweight individuals</p> |
| <p>Desroches, Sophie, et al. "Baseline Plasma C-Reactive Protein Concentrations Influence Lipid and Lipoprotein Responses to Low-Fat and High Monounsaturated Fatty Acid Diets in Healthy Men." <i>Journal of Nutrition</i>, vol. 136, no. 4, Apr. 2006, pp. 1005–11. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=82f596c0-f16a-3ce9-b9cb-f52ddca121f3">discovery.ebsco.com/linkprocessor/plink?id=82f596c0-f16a-3ce9-b9cb-f52ddca121f3</a>.</p>   | <p>the low-fat diet and the high-MUFA diet did not affect plasma CRP concentrations.</p>  |
| <p>Kalogeropoulos, Nick, et al. "Unsaturated Fatty Acids Are Inversely Associated and N-6/n-3 Ratios Are Positively Related to Inflammation and Coagulation Markers in Plasma of Apparently Healthy Adults." <i>Clinica Chimica Acta</i>, vol. 411, no. 7/8, Apr. 2010, pp. 584–91. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=e91383bf-2e2d-3bd9-aa80-da4b8f2a0c0e">discovery.ebsco.com/linkprocessor/plink?id=e91383bf-2e2d-3bd9-aa80-da4b8f2a0c0e</a>.</p>   | <p>Both MUFA and PUFA were associated with lower inflammatory markers; lower ratios of omega-6 to omega-3 fats were associated with the lowest markers; no recommended ratio was determined in this study.</p>  |
| <p>Solfrizzi, Vincenzo, et al. "Dietary Fatty Acids in Dementia and Predementia Syndromes: Epidemiological Evidence and Possible Underlying Mechanisms." <i>Ageing Research Reviews</i>, vol. 9, no. 2, Jan. 2010, pp. 184–99. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=8ee2fc75-9992-3534-bd1f-7a60283660ea">discovery.ebsco.com/linkprocessor/plink?id=8ee2fc75-9992-3534-bd1f-7a60283660ea</a>.</p>  | <p>MUFA and PUFA supplementation may help in early stage dementia, but not once the disease has taken hold.</p>   |
| <p>Wrzosek, Małgorzata, et al. "Impact of Fatty Acids on Obesity-Associated Diseases and Radical Weight Reduction." <i>Obesity Surgery</i>, vol. 32, no. 2, Feb. 2022, pp. 428–40. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=67b6a426-3b82-369f-a744-488ad2f5ce44">discovery.ebsco.com/linkprocessor/plink?id=67b6a426-3b82-369f-a744-488ad2f5ce44</a>.</p>  | <p>High PUFA is favorable for the extremely obese; certain genetic SNPs were studied here</p>   |

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| <p>Rocha, Daniela Mayumi, et al. "The Role of Dietary Fatty Acid Intake in Inflammatory Gene Expression: A Critical Review." <i>Sao Paulo Medical Journal = Revista Paulista de Medicina</i>, vol. 135, no. 2, Mar. 2017, pp. 157–68. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=a72fecda-95ec-39bc-92c2-e6067a662fda">discovery.ebsco.com/linkprocessor/plink?id=a72fecda-95ec-39bc-92c2-e6067a662fda</a>.</p>   | <p>Both high-MUFA and high-PUFA diets showed anti-inflammatory profiles, or at least a less pronounced pro-inflammatory response than did SFA consumption. However, the results concerning the best substitute for SFAs were divergent because of the large variability in doses of MUFA (20% to 72% of energy intake) and n3 PUFA (0.4 g to 23.7% of energy intake) used in interventions.</p>  |
| <p>Enos, Reilly T., et al. "Reducing the Dietary Omega-6:Omega-3 Utilizing <math>\alpha</math>-Linolenic Acid; Not a Sufficient Therapy for Attenuating High-Fat-Diet-Induced Obesity Development Nor Related Detrimental Metabolic and Adipose Tissue Inflammatory Outcomes." <i>PLoS ONE</i>, vol. 9, no. 4, Apr. 2014, pp. 1–11. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=30075efd-668b-3596-b8dd-eb13c48c3ec9">discovery.ebsco.com/linkprocessor/plink?id=30075efd-668b-3596-b8dd-eb13c48c3ec9</a>.</p> | <p>Lowering the omega 6: omega 3 ratio did to help in this study; the diets were too high in fat to have a positive effect</p>   |
| <p>WOLTERS, M. et al. Dietary fat, the gut microbiota, and metabolic health - A systematic review conducted within the MyNewGut project. <i>Clinical nutrition (Edinburgh, Scotland)</i>, [s. l.], v. 38, n. 6, p. 2504–2520, 2019. Disponível em: <a href="https://discovery.ebsco.com.libproxy.chapman.edu/linkprocessor/plink?id=5bad63b4-b2c0-36ae-8aee-3cd01c3efe6e">https://discovery.ebsco.com.libproxy.chapman.edu/linkprocessor/plink?id=5bad63b4-b2c0-36ae-8aee-3cd01c3efe6e</a>. Acesso em: 23 mar. 2022.</p>                  | <p>High MUFA diets may negatively affect gut microbiota whereas PUFA do not seem to negatively affect the gut microbiota or metabolic health outcomes. However, data are not consistent and most RCT and observational studies showed risks of bias.</p>   |
| <p>Custers, et al. "Dietary Lipids from Body to Brain." <i>Progress in Lipid Research</i>, vol. 85, Jan. 2022. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=d77c0927-9fb5-3ad3-8049-43b3340ba85b">discovery.ebsco.com/linkprocessor/plink?id=d77c0927-9fb5-3ad3-8049-43b3340ba85b</a>.</p>  | <p>Diets rich in MUFA, n-3 PUFA and SL are known for their beneficial effects on the host. These dietary components may reduce adiposity, intestinal permeability, CVD risk and increase microbiota diversity, leading to reduced neuroinflammation and cognitive impairment.</p> <p>This is not original research, and these claims are a little bit of a stretch given the research they referenced. However, it looks promising for future study.</p> |
| <p>Sakurai, Keisuke, et al. "Consumption of Oleic Acid on the Preservation of Cognitive Functions in Japanese Elderly Individuals." <i>Nutrients</i>, vol. 13, no. 2, Jan. 2021. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=1655bff5-37d8-3038-ad05-3ee40b89d484">discovery.ebsco.com/linkprocessor/plink?id=1655bff5-37d8-3038-ad05-3ee40b89d484</a>.</p>  | <p>Suggested that fat intake, especially oleic acid intake, may be effective for both cognitive and memory functions.</p>  |
| <p>Prinelli, Federica, et al. "Specific Nutrient Patterns Are Associated with Higher Structural Brain Integrity in Dementia-Free Older Adults." <i>NeuroImage</i>, vol. 199, Oct. 2019, pp. 281–88. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=4e88b295-c812-3a4e-ba5d-8a2bd010f6fd">discovery.ebsco.com/linkprocessor/plink?id=4e88b295-c812-3a4e-ba5d-8a2bd010f6fd</a>.</p>   | <p>A Mediterranean-style diet was associated with better brain health and less dementia. Macadamia nuts specifically were not mentioned, just nuts in general as part of the eating pattern.</p>   |
| <p>Assmann, Karen E., et al. "Unsaturated Fatty Acid Intakes During Midlife Are Positively Associated with Later Cognitive Function in Older Adults with Modulating Effects of Antioxidant Supplementation." <i>Journal of Nutrition</i>, vol. 148, no. 12, Dec. 2018, pp. 1938–45. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=f241c50f-c1ed-3b3f-b29b-2b744836512a">discovery.ebsco.com/linkprocessor/plink?id=f241c50f-c1ed-3b3f-b29b-2b744836512a</a>.</p>   | <p>Higher total MUFA and n–6 PUFA intakes may be generally beneficial for maintaining cognitive health during aging, a higher consumption of n–3 fatty acids may only be beneficial among individuals with an adequate antioxidant status. These findings underline the importance of not only focusing on specific nutrients for dementia prevention, but also considering the complex interaction between consumed nutrients.</p>                      |
| <p>Edwards, Caitlyn G., et al. "Effects of 12-Week Avocado Consumption on Cognitive Function among Adults with Overweight and Obesity." <i>International Journal of Psychophysiology</i>, vol. 148, Feb. 2020, p. 13. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=934635cd-a8ca-3f65-8005-4df3daef4471">discovery.ebsco.com/linkprocessor/plink?id=934635cd-a8ca-3f65-8005-4df3daef4471</a>.</p>   | <p>12 weeks of daily avocado intake was beneficial to cognitive function, but researchers weren't sure which nutrients in avocado were responsible.</p>  |
| <p>Mao, Xiao-Yuan, et al. "Dietary Nutrition for Neurological Disease Therapy: Current Status and Future Directions." <i>Pharmacology &amp; Therapeutics</i>, vol. 226, Oct. 2021. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=b8cfe0c8-8d85-3fbf-bba8-608f366861aa">discovery.ebsco.com/linkprocessor/plink?id=b8cfe0c8-8d85-3fbf-bba8-608f366861aa</a>.</p>  | <p>Nothing of note for MUFA or PUFA.</p>   |
| <p>Jiang, Yi-Wen, et al. "Midlife Dietary Intakes of Monounsaturated Acids, n-6 Polyunsaturated Acids, and Plant-Based Fat Are Inversely Associated with Risk of Cognitive Impairment in Older Singapore Chinese Adults." <i>Journal of Nutrition</i>, vol. 150, no. 4, Apr. 2020, pp. 901–09. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=03c5a86f-1e10-3b1c-bfde-a250a48fe133">discovery.ebsco.com/linkprocessor/plink?id=03c5a86f-1e10-3b1c-bfde-a250a48fe133</a>.</p>                                      | <p>Substitution of total carbohydrate or SFAs with MUFAs and PUFAs, particularly n–6 PUFAs, was related to a lower risk of cognitive impairment in elderly Chinese participants. In addition, an inverse association with cognitive impairment was found for plant-based fat.</p>  |

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| <p>Kyrozis, A., et al. "Dietary Lipids and Geriatric Depression Scale Score among Elders: The EPIC-Greece Cohort." <i>Journal of Psychiatric Research</i>, vol. 43, no. 8, Jan. 2009, pp. 763–69. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=a89a662b-4487-30a7-afc1-b8300d3b74ae">discovery.ebsco.com/linkprocessor/plink?id=a89a662b-4487-30a7-afc1-b8300d3b74ae</a>.</p>                                | <p>Among Attika elders, lower intake of seed oils and higher intake of olive oil prospectively predict a healthier affective state. Olive oil intake, in particular, predicts a lower chance of scoring in the highest part of the geriatric depressive scale.</p>  |
| <p>Karazurna, Nicole A., et al. "Associations between Dietary Fatty Acid Patterns and Cognitive Function in the Hispanic Community Health Study/Study of Latinos." <i>The British Journal of Nutrition</i>, Aug. 2021, pp. 1–35. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=627a3c6c-77e8-30eb-b6fd-4c42462eb9e8">discovery.ebsco.com/linkprocessor/plink?id=627a3c6c-77e8-30eb-b6fd-4c42462eb9e8</a>.</p> | <p>Nothing useful for us.</p>   |
| <p>Zhang, Tianying, et al. "Dietary Fatty Acid Factors in Alzheimer's Disease: A Review." <i>Journal of Alzheimer's Disease</i>, vol. 78, no. 3, Dec. 2020, pp. 887–904. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=610814c7-db84-392e-a831-4469705e41dc">discovery.ebsco.com/linkprocessor/plink?id=610814c7-db84-392e-a831-4469705e41dc</a>.</p>   | <p>Nothing new</p>  |
| <p>Naqvi, Asghar Z., et al. "Monounsaturated, Trans, and Saturated Fatty Acids and Cognitive Decline in Women." <i>Journal of the American Geriatrics Society</i>, vol. 59, no. 5, May 2011, pp. 837–43. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=10446942-2376-3bc9-b060-22236863be81">discovery.ebsco.com/linkprocessor/plink?id=10446942-2376-3bc9-b060-22236863be81</a>.</p>                         | <p>Greater MUFA intake was associated with less cognitive decline</p>   |
| <p>Leigh Gibson, E., et al. "Habitual Fat Intake Predicts Memory Function in Younger Women." <i>Frontiers in Human Neuroscience</i>, vol. 7, Dec. 2013, pp. 1–12. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=bc62305f-3d23-3dde-b7c9-a104f1f1b7e3">discovery.ebsco.com/linkprocessor/plink?id=bc62305f-3d23-3dde-b7c9-a104f1f1b7e3</a>.</p>  | <p>High fat diets impaired memory function; all fats had a negative consequence, not just SFA</p>   |
| <p>SOLFRIZZI, V., et al. "High Monounsaturated Fatty Acids Intake Protects against Age-Related Cognitive Decline." <i>Neurology</i>, vol. 52, no. 8, Jan. 1999, pp. 1563–69. EBSCOhost, <a href="https://discovery.ebsco.com/linkprocessor/plink?id=9cd9249d-5017-3f24-85f6-3e90fa10a62d">discovery.ebsco.com/linkprocessor/plink?id=9cd9249d-5017-3f24-85f6-3e90fa10a62d</a>.</p>   | <p>In an elderly population of Southern Italy with a typical Mediterranean diet, high MUFA intakes appeared to be protective against age-related cognitive decline. Prospective clinical trials are needed to evaluate the impact of specific dietary macronutrient intakes on the age-related changes of cognitive functions.</p>  |
| <p>Pawan Kumar Ojha, et al., "Chemical Compositions and Essential Fatty Acid Analysis of Selected Vegetable Oils and Fats". <i>Compounds</i> 2024, 4, 37–70</p>  | <p>Study reinforces the claims for healthy fats. The macadamias studied were grown in Brazil, which may not be the most common. Fat content is similar but not identical between varieties. Review of research on palmitoleic acid and similar fatty acids; available research is mostly in mice and human cells - not live human beings.</p>   |
| <p>Damián Maestri. "Groundnut and tree nuts: a comprehensive review on their lipid components, phytochemicals, and nutraceutical properties". <i>Critical Reviews in Food Science and Nutrition</i> 2024, VOL. 64, NO. 21, 7426–7450</p>   | <p>Results were mixed; benefits shown regarding glucose metabolism and lipids in the blood; correlated with obesity though - researchers are not sure what that means</p> <p>Overview of health benefits of all tree nuts, including macadamia. Author would like to see more research on the health benefits of macadamia polyphenols.</p>   |
| <p>Xinling Lou, et al., "Timing and Nutrient Type of Isocaloric Snacks Impacted Postprandial Glycemic and Insulinemic Responses of the Subsequent Meal in Healthy Subjects". <i>Nutrients</i> 2024, 16, 535</p>  | <p>Another study on the health benefits of nuts in general, including macadamia. This is more evidence that the polyphenols in macadamia are worth investigating further.</p> <p>A snack of macadamia nuts did not reduce blood sugar or insulin response after the next meal. Snacks of apple and chicken breast performed a little better. The high fat content of macadamia nuts were in this case a hindrance.</p> <p>This study has some limitations, and did not measure the blood sugar response after eating macadamia. It merely looked at snacks with different nutrient profiles and if they changed the insulin response after the next meal. Macadamia was the high-fat snack, and did not perform as well as the others, however, macadamia will perform better than a less-healthy high-fat snack.</p> |



Jiale Zhang, et al., "A Review of Phytochemicals and Bioactive Properties in the Proteaceae Family: A Promising Source of Functional Food". *Antioxidants* 2023, 12, 1952

Overall, Proteaceae fruit (macadamia is included) is promising as a food that can contribute to food consumption, environmental sustainability, and socioeconomic development, but further studies are needed to provide safety information.

This study provides more evidence of the healthy nutrients in macadamia, although in an unusual way. The entire proteaceae family of foods was studied, including macadamia. There isn't much to take away here, but this is research to watch in the future.

Lindokuhle Simelane, et al., "Removal of antiretroviral drugs from wastewater using activated macadamia nutshells: Adsorption kinetics, adsorption isotherms, and thermodynamic studies". *Water Environ Res.* 2024;96:e11020

Macadamia nut shells were successfully modified and applied as an easily accessible and low-cost adsorbent for the removal of Anti-RetroViral Drugs in real samples.

This is an environmentally-friendly way to use empty macadamia shells. Getting retro-viral drugs out of the water supply is often difficult, and macadamia shells performed well at this task in this study.

Md Sefat Khan, et al., "Exploring the Prospects of Macadamia Nutshells for Bio-Synthetic Polymer Composites: A Review". *Polymers* 2023, 15, 4007

Explored the potential of natural fibers and fillers, such as macadamia nutshells, in the development of functional and structural composite materials to replace aluminum and other non-environmentally friendly fillers.

Here is another environmentally-friendly use for macadamia shells; using them as a strong filler instead of aluminum and other metals that do not degrade easily in landfills.

Yao Liu, et al., "Effect of macadamia oil cake on blood lipid characteristics and intestinal microbiota in hyperlipidemic rat". *Food Sci Nutr.* 2023;11:5318–5324

A high-fat diet significantly damaged the intestinal microbiota of rats, and Macadamia Oil Cake intake effectively reduced the negative effects of a high-fat diet on the intestinal microbiota of rats.

The subject of the microbiome and how it impacts our health is very popular with researchers, and this is an interesting study on macadamia oil cakes and rat microbiota. Hopefully, it will provide impetus to conduct human trials in this area.

Fatima A. Jaber, et al., "Effect of dietary supplementation of macadamia oil on the growth, immune function, physio-biochemical components and thyroid activity of growing rabbits." *J Anim Physiol Anim Nutr.* 2024;1–13.

Supplementing rabbits diets with macadamia oil improved their health, thyroid function and immunity.

This is a new area of research, macadamia oil and the thyroid. While this study was done on rabbits, there is potential for human trials in the future.

Hitomi Yoshizaki, et al., "Unveiling the Threat of Maternal Advanced Glycation End Products to Fetal Muscle: Palmitoleic Acid to the Rescue (in rats)". *Nutrients* 2024, 16, 1898

The maternal intake of palmitoleic acid during pregnancy may have implications for fetal health of rats.

Palmitoleic acid is becoming more interesting to researchers, and animal studies such as this are paving the way for potential human trials in the future. This one studied the impact of POA on pregnant rats and their babies.

Xin Guo, et al., "The Role of Palmitoleic Acid in Regulating Hepatic Gluconeogenesis through SIRT3 in Obese Mice". *Nutrients* 2022, 14, 1482

In a high-fat diet, palmitoleic acid decreased gluconeogenesis by reducing enzymatic activities in obese mice.

The most interesting potential effect of palmitoleic acid is how it may be protective of cells exposed to a diet high in unhealthy fats. This study in mice saw some positive effects, and may pave the way for human trials.

Junhui Zhang, et al., "Palmitoleic Acid Ameliorates Metabolic Disorders and Inflammation by Modulating Gut Microbiota and Serum Metabolites (in mice)". *Mol. Nutr. Food Res.* 2024, 68, 2300749

The results suggest that supplementing with palmitoleic acid can improve metabolic disorders and inflammation in High Fat Diet-fed mice.

This is another study looking at a possible protective effect of palmitoleic acid when exposed to a high fat diet. This study was done in mice, and may lead to human trials in the future.

Haruka Okami, et al., "Maternal n-7 Unsaturated Fatty Acids Protect the Fetal Brain from Neuronal Degeneration in an Intrauterine Hyperglycemic Animal Model". *Nutrients* 2023, 15, 3434

Yiwei Chen, et al., "Dietary palmitoleic acid reprograms gut microbiota and improves biological therapy against colitis". *Gut Microbes* 2023, Vol. 15, No. 1, 2211501

Qingting Yu, et al., "Palmitoleic acid protects microglia from palmitate-induced neurotoxicity in vitro (cells in a petri dish)". *Plos One*, open access, January 2024

Yeong-Seon Won, et al., "7-MEGA inhibits adipogenesis Lipids in Health and Disease in 3T3-L1 adipocytes and suppresses obesity in high-fat-diet-induced obese C57BL/6 mice". *Lipids in Health and Disease* (2024) 23:192

Jun Tang, Bo Yang, Yinkun Yan, Wenfeng Tong, Renke Zhou, Junhui Zhang, Jie Mi, and Duo Li., "Palmitoleic Acid Protects against Hypertension by Inhibiting NF-xB Mediated Inflammation". *Mol. Nutr. Food Res.* 2021, 65, 2001025

Yuko Akazawa<sup>1,9\*</sup>, Tomohito Morisaki<sup>2,9</sup>, et al., "Significance of serum palmitoleic acid levels in inflammatory bowel disease". [www.nature.com/scientificreports](http://www.nature.com/scientificreports)

Domenico Tricò, Alessandro Mengozzi, Lorenzo Nesti, Mensud Hatunic, et., & for the EGIR-RISC Study Group. "Circulating palmitoleic acid is an independent determinant of insulin sensitivity, beta cell function and glucose tolerance in non-diabetic individuals: a longitudinal analysis". *Diabetologia* (2020) 63:206–218

Miguel A. Bermúdez, Laura Pereira, Cristina Fraile, Laura Valerio, María A. Balboa, Jesús Balsinde. "Roles of Palmitoleic Acid and Its Positional Isomers, Hypogeic and Sapienic Acids, in Inflammation, Metabolic Diseases and Cancer". *Cells* 2022,11,2146.

Trans-palmitoleic acid helped protect fetal rats brains from a high sugar diet.

This study used trans-palmitoleic acid rather than the healthier cis-palmitoleic acid (what we typically call just palmitoleic acid). This will most likely not translate into human studies, since trans-fats are so toxic to humans.

This study demonstrated in vivo and in vitro effects of palmitoleic acid (POA) on selectively increasing the abundance of beneficial gut bacteria in rats with colitis.

This is another study regarding the microbiome, this time studying palmitoleic acid instead of macadamia as a whole. In rats with colitis it seemed to help, and this may lead to human trials in the future.

Palmitoleic acid alleviates Palmitic acid-induced damage to nerve cells by inhibiting inflammation and programmed cell death.

An interesting study using palmitoleic acid to combat the harmful effects of palmitic acid on nerve cells (in a petri dish). An exciting area of research and worthy of following for future studies.

This is a study 7-MEGAT uses to promote their supplement of palmitoleic acid. It showed anti-inflammatory and anti-obesity effects in rats.

This is a marketing-type study for a palmitoleic acid supplement. It was done on rats and cannot be translated to humans. Possibly human trials will be conducted in the future.

Measured palmitoleic acid in circulating red blood cells of humans and mice, and compared amounts in those with and without hypertension. More palmitoleic acid was found in the blood cells of those with lower blood pressure; this does not mean it lowers blood pressure or causes lowered BP. Observational study, no significant results resulting in potential claims.

Levels of Palmitoleic acid were measured in those with inflammatory bowel disease and compared with subjects who do not have IBD. High levels of palmitoleic acid in the blood could be a marker for Crohn's Disease but not Ulcerative Colitis. Levels were higher in the blood for those with CD. Observational study, no significant results resulting in potential claims.

Investigated the role of palmitoleic acid in the blood in insulin sensitivity, insulin production, and blood glucose levels in humans. Those with higher levels of palmitoleic acid in the blood also had better insulin sensitivity, insulin production, and lower blood glucose levels. This study does not prove there is a relationship between them, just that they are both there

Review of research on palmitoleic acid and similar fatty acids; available research is mostly in mice and human cells - not live human beings. Results were mixed; benefits shown regarding glucose metabolism and lipids in the blood; correlated with obesity though - researchers are not sure what that means.

No FDA approved claims - only for Omega-3's  
Benefits on blood glucose, insulin sensitivity, and cholesterol consistent with other studies

Possible Claims: Some studies of Omega-7's have shown to have a positive effect on blood glucose, insulin and cholesterol

Palmitoleic and Dihomo- $\gamma$ -Linolenic Acids Are Positively Associated With Abdominal., *Frontiers in Pediatrics*, April 2021 | Volume 9 | Article 628496 Obesity and Increased Metabolic Risk in Children

Fatty Acid Profile and Desaturase Activities in 7–10-Year-Old Children Attending Primary., *Int. J. Mol. Sci.* 2020, 21, 3899; doi:10.3390/ijms21113899 School in Verona South District: Association between Palmitoleic Acid, SCD-16, Indices of Adiposity, and Blood Pressure

Supplementation with Seabuckthorn Oil Augmented in 16:1n–7t Increases Serum Trans-Palmitoleic Acid in Metabolically Healthy Adults: A Randomized Crossover Dose-Escalation Study., *J Nutr* 2020;150:1388–1396.

Trans-palmitoleic acid (trans-9-C16:1, or trans-C16:1 n-7): Nutritional impacts, metabolism, origin, compositional data, analytical methods and chemical synthesis. A review ., *Biochimie* 169 (2020) 144e160

"Is there something special about palmitoleate?"; *Current Opinion in Clinical Nutrition and Metabolic Care* 16(2):p 225-231, March 2013.

A review of biological functions, health benefits, and possible de novo biosynthetic pathway of palmitoleic acid in macadamia nuts., *Journal of Functional Foods* 62 (2019) 103520

Circulating omega-7 fatty acids are differentially related to metabolic dysfunction and incident type II diabetes: The Multi-Ethnic Study of Atherosclerosis (MESA) ., *Diabetes Metab.* 2020 September ; 46(4): 319–325

Chemical characterization of a variety of cold-pressed gourmet oils available on the Brazilian market., *Food Research International* 109 (2018) 517–525., *Processes* 2022, 10, 56

Chemistry and Functionality of Cold-Pressed Macadamia Nut Oil., *Processes* 2022, 10, 56

In Vitro Digested Nut Oils Attenuate the Lipopolysaccharide Induced Inflammatory Response in Macrophages., *Nutrients* 2019, 11, 503; doi:10.3390

Exploring Lignans, a Class of Health Promoting Compounds, in a Variety of Edible Oils from Brazil., *Foods* 2022, 11, 138

Circulating levels of palmitoleic acid and other fatty acids were measured in children with obesity and those without obesity.

Higher levels of palmitoleic acid were found in the blood of children who were obese. Attempted to find a correlation between fatty acids in the blood and metabolic health of children.

No significant results were found, however in this study palmitoleic acid seemed to be more abundant in the healthy children

Investigated if supplementing with Sea Buckthorn Oil increased levels of palmitoleic acid in the blood

Supplements with increased palmitoleic acid as well as regular Sea Buckthorn Oil increased levels of palmitoleic acid in the blood; no other significant effect were seen

Attempted to find correlations to improved health from the trans-fat form of palmitoleic acid; trans-palmitoleic acid

No significant correlations were found. The trans-fat version of palmitoleic acid is found in meat and milk in small amounts

Review of current research on palmitoleic acid and humans

No evidence of effects in humans, however further study is warranted  
Review of current research on palmitoleic acid and how it works in the body; human and animal research included.

Higher levels of palmitoleic acid in the blood were correlated with better insulin sensitivity; no cause/effect relationship has been shown to date

Circulating levels of palmitoleic acid and a trans-fat fatty acid, vaccenic acid were measured and correlated with markers of insulin resistance. Vaccenic acid was correlated with better insulin resistance in some races, and palmitoleic acid correlated with worse insulin resistance in certain races.

Compared nutrient content of popular oils in Brazil

Some of the nutritional data was different than industry values - Mac oil was low in manganese, avocado oil was almost as high as Mac oil in omega-7.

Explored potential health benefits from cold pressed macadamia oil

CPMO has higher oxidative stability due to its high presence of MUFA's and natural antioxidants. Diets higher in oleic and palmitoleic acid may be seen as beneficial with more research.

States that CPMO contains bioactive constituents such as tocopherols, phytosterols and squalene which have antioxidant properties

Investigated the anti-inflammatory effects of nut oils on intentionally inflamed cells in a petri dish

The fats in nut oils, especially oleic acid, had anti-inflammatory effects in the cells; Mac nuts were in the middle of the pack

Measured the amounts of lignans in popular oils in Brazil, including Mac oil

Mac oil had the most lignans of the nut oils tested, and was behind olive and grapeseed oils only. There is potential for good messaging here.

Review of nut phytochemicals, fat-soluble bioactives, antioxidant components and health effects., *British Journal of Nutrition* (2015), 113, S68–S78

Assessment of the Safe Consumption of Nuts in Terms of the Content of Toxic Elements with Chemometric Analysis., *Nutrients* 2021, 13, 360

*Advanced Nutrition and Metabolism.*, Textbook, published by Wadsworth

Beneficial components of most tree nuts, including macadamia

Confirms health benefits of nuts regarding satiety, lowered insulin resistance, heart health; Mac nuts have lowest amounts of studied nutrients

Nuts were tested for their arsenic, cadmium, lead and mercury content

Levels varied between samples; Mac nuts were lowest in mercury, high in lead, and mid-level for arsenic and cadmium

Manganese - what it does in the body

Manganese is necessary for many enzymes to work in: building collagen and connective tissue; protein metabolism; gluconeogenesis (making glucose when our blood sugar is low); antioxidant activity (both making antioxidants like glutathione and preventing free radical formation in our cells); cellular signaling (cells communicating); and calcium metabolism