Consumption of Vegetable Oils of *Persea americana* L., and *Vitis vinifera* L., as Part of Nutritional Support in Non-Communicable Diseases in the Population of the State of Oaxaca, Mexico: Pretest–Postest Intervention Study without Control

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**Summary** Lifestyle plays an important role in the development of noncommunicable diseases such as diabetes, hypertension, dyslipidemia, and obesity, in addition to a poor diet loaded with simple carbohydrates and saturated fats. This was a trial with a randomized, analytical, longitudinal, and prospective quasi-experimental design, which was divided into 2 phases: the first with healthy subjects with an age range between 18 to 30 y and normal BMI (18.5–24.9). The second phase was subjected with familial hypercholesterolemia aged between 18 to 45 y and overweight (25–29.9). For those subjects who frequently consumed vegetable oil of both *Vitis vinifera* L., or *Persea americana* L. (10 mL), they presented a significant reduction in anthropometric measures and in biochemical variables such as capillary glucose and increased HDLc. The vegetable oils of *Persea americana* L., and *Vitis vinifera* L., can act as adjuvants for the treatment of noncommunicable diseases.

**Key Words** noncommunicable diseases, obesity, *Persea americana* L., vegetable fatty acids, *Vitis vinifera* L.

Dyslipidemias are multifactorial diseases and determinants of cardiovascular risk, the food transition from regional-local models to Western models of dietary, environmental, genetic, social habit and lifestyle changes, has facilitated the expression of these pathologies. The population is not important in the detection and preventive treatment of fatal cardiovascular events; insufficient diagnosis and treatment deficiency are two of the main challenges to be solved, dyslipidemias are not among the priorities of health systems for the prevention of cardiovascular diseases; access to laboratory resources and drugs is insufficient in primary care units despite the proven cost-benefit of treating lipid disorders. That is why one of the pillars in the treatment of non-communicable diseases is diet through lifestyle modifications, which include weight loss, diet, and physical activity, which are strategies for reducing major cardiovascular risk (1–7). Based on the above, the objective of this study was to evaluate the consumption of *Vitis vinifera* L., and *Persea americana* L., oil in healthy subjects and subjects with familial hypercholesterolemia.

It was a trial with a randomized, analytical, longitudinal and prospective quasi-experimental design, divided into two phases. The sample was divided into two periods: the first period included healthy subjects with an age range between 18 and 30 y. In the second period, subjects with overweight and hypercholesterolemia, aged between 18 and 45 y, were included. The following were considered as inclusion criteria: First phase: Healthy subjects with an age range between 18 to 30 y, male and female, with normal BMI (18.5–24.9); who were willing to take biochemical samples and anthropometric measurements and who agreed to participate in the study by signing the informed consent; second phase: Subjects with an age range between 18 to 45 y old, male and female, with overweight BMI (25–29.9); who were willing to take biochemical samples and anthropometric measurements and who agreed to participate in the study by signing the informed consent. The following were considered as exclusion criteria: First phase: Subjects who presented a BMI less than 18.5 and greater than 25, whose age range is greater than 30 y and less than 18 y, and alcohol and tobacco intake; Second phase: Subjects who presented a BMI less than 24.9 and greater than or equal to 30, whose age range is greater than 45 y and less than 18 y, and alcohol and tobacco intake. As elimination criteria, those subjects who did not comply with the established diet, who did not accept to participate in the study, and who did not continue their nutritional treatment were considered. The process of assigning the subjects in each group for the corresponding oil intake and for each phase was randomized, carried out through Excel, with an intervention period of 4 wk. The
first one had a sample of 18 healthy subjects between 18 and 30 y (men and women) and normal BMI (18.5–24.9), which were integrated into two groups as follows: group *Persea americana* L., and group *Vitis vinifera* L. The second phase consisted of a sample of 10 subjects aged between 18 to 45 y (men and women) and overweight BMI (25–29.9), they were integrated into two groups as follows: group *Persea americana* L., and group *Vitis vinifera* L. The Institutional Review Board of the Master of Science Program in Regional and Technological Development; of the National Technology of Mexico/Technological Institute of Oaxaca, Mexico, approved the study (MCDRT-01-2020), in addition to obtaining the written informed consent of all partici-
pH test. The amount (1 g/d) was determined based on the recommendations of the American Heart Association, equivalent to 10 mL of oil that was supplied daily to the study subjects. Measurements were made before and after the intervention, determining the nutritional status of the participants through anthropometric measurements: weight, height, waist circumference, and hip circumference; metabolic state through biochemical indicators such as: glucose, HDLc, and LDLc; to evaluate food consumption and habitual diet, the 24-h recall (R24h) and the frequency of food consumption were performed to evaluate the quantity and quality of food consumed by the subjects, all with the purpose to establishing an individualized nutritional treatment, including the intake of Persea americana L., and Vitis vinifera L., in addition to the inclusion of physical activity (Table 1). The fatty acid and vitamin composition of Persea americana L., and Vitis vinifera L., was determined by gas chromatography coupled to mass spectrometry and by HPLC respectively, at the Laboratory Control Center (CENCON), SA de CV, in Mexico City, Mexico (Table 2), both oils presented a high proportion of unsaturated fatty acids, specifically linoleic and oleic acids. The information obtained was analyzed by ANOVA to determine which of the two treatments had a greater impact on the parameters evaluated with a confidence level of 95% and a significance level of 0.05 (p=0.05) and was out using the software package Minitab.

In the results obtained, significant changes were observed in seven parameters in subjects with hypercholesterolemia after consuming 10 mL of Persea americana L., oil per day: weight, BMI, waist, hip, glucose, LDLc and HDLc; with the consumption of Vitis vinifera L., weight, BMI, waist, hip, glucose, HDLc and LDLc decreased. There were changes in four parameters in healthy subjects after ingestion of Vitis vinifera L., and 4 parameters for Persea americana L., these results can be attributed to the content of omega-6 and omega-9 unsaturated fatty acids in the oils used. Based on the data analysis carried out, we can say that the two oils favor the reduction of parameters and therefore it is indistinct which one wants to consume. The oleic fatty acid contained in avocado oil has been reported by several studies to demonstrate the beneficial effects on health with its intake, among which are: reduction of oxidative stress in the mitochondrial membrane and cardiovascular diseases, in addition to diabetes. Persea americana L., oil is a source of bioactive compounds such as phytosterols, unsaturated fatty acids, antioxidant vitamins (tocopherols and carotenoids) and polyphenols. A study was conducted that evaluated the hypocholesterolemic effect of avocado oil in male Sprague-Dawley rats induced by hypercholesterolemia, in which it was observed that the dysfunction of metabolism induced by hypercholesterolemia can be partially recovered mainly through the metabolism of lipids, energy, amino acids and intestinal microbiota, thanks to its components such as β-sitosterol, which is a bioactive phytochemical with a hypocholesterolemic effect.

Vitis vinifera L., has organic acids, mainly malic acid, oxalic acid and tartaric acid, polyphenolic compounds that have a classification in six subgroups among which we can find: flavonols, flavones, isoflavones, anthocyanins, flavanones and flavonoids, highlighting mainly the so-called flavan-3-ols, particularly catechin and epicatechin, these are associated with inhibition of arterial thrombosis, anti-inflammatory activity, reduction of total cholesterol and low-density lipoproteins in vivo as part of their antioxidant capacity. A decrease in LDL cholesterol was observed in subjects with hypercholesterolemia, in greater quantity in subjects who ingested Vitis vinifera oil, results that are similar to that presented in several studies, where it has been shown that Vitis vinifera oil lowers cholesterol due to its content of fatty acids, a high amount of tocopherol and tocotrienols such as α-tocotrienol and γ-tocotrienol, it has been seen that these inhibit HMG-CoA reductase and improve the lipid profile. Furthermore, the effects of tocotrienols on inflammation have been recorded in 3T3-L1 adipocytes, showing a reduction in inflammatory factors and the activation of nuclear factor B (NF-B) suppressed by tocotrienol (9–11). Additionally, the oil contains resveratrol; it is well known that resveratrol inhibits the nuclear factor κB, involved in the toxicity of β-amyloid, responsible for causing Alzheimer’s disease (12). Seeds of Vitis vinifera L., have been studied for their active properties that contain phenolic compounds, flavonoids, and phenolic acids; grape seed extract has prevented neuronal death in oxidative stress induced by H2O2 by increasing the production of IL-6 in astrocytes, in addition, the role of phytosterols is to reduce the absorption of cholesterol in the intestine and, consequently, the decrease in plasma cholesterol levels (13). As final considerations, we can say that the research presented shows that vegetable oils, in addition to their nutritional properties, may play a role in reducing the development of cardiovascular diseases, favoring the reduction of anthropometric parameters such as weight, BMI, and waist circumference, and hip circumference, in addition to biochemical parameters such as glucose, LDLc and increase in HDLc, however, the study design presented in this study shows limitations, such as the non-inclusion of a placebo group that could demonstrate this participation of more clearly; in addition to the above, it is required to test it in a larger population for a longer period of time to achieve much more precise results, the nutritional properties of vegetable oils may have an impact on reducing the development of cardiovascular diseases due to the antioxidant properties they present, making it an alternative to protect against the harmful effects of ROS.

Authorship
IAGM and CCPT, participated in the concept of study, design, writing and critical review of the manuscript.

Disclosure of state of COI
The authors declare that they have no conflicts of interest.
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REFERENCES
1) Riccardi G, Vaccaro O, Costabile G, Rivelles A. 2016. How well can we control dyslipidemias through lifestyle modifications? Curr Cardiol Rep 18(7): 66.
2) Mathur P, Mascarenhas L. 2019. Lifestyle diseases: Keeping fit for a better tomorrow. Indian J Med Res 149(S1): 129–135.
3) Anagnostis P, Paschou S, Goulis D, Athyros V, Karagiannis A. 2018. Dietary management of dyslipidaemias. Is there any evidence for cardiovascular benefit? Maturitas 108: 45–52.
4) Volpe M, Battistoni A. 2018. Lifestyle and cardiovascular disease: Barefooting through the guidelines. Int J Cardiol 263: 156–157.
5) Durán S, Torres J, Sanhueza J. 2015. Aceites vegetales de uso frecuente en Sudamérica: características y propiedades. Nutr Hosp 32(1): 11–19.
6) Berasategi I, Barriuso B, Ansorena D, Astiasarán I. 2012. Stability of avocado oil during heating: Comparative study to olive oil. Food Chem 132: 439–446.
7) Natarajan S, Hwang J, Kim Y, Kim E, Park P. 2017. Ocular promoting activity of grape polyphenols—A review. Environ Toxicol Pharmacol 50: 83–90.
8) Tan C, Chong G, Hamzah H, Ghazali H. 2018. Effect of virgin avocado oil on diet-induced hypercholesterolemia in rats via 1 H NMR-based metabolomics approach. Phytother Res 32(11): 2264–2274.
9) Kim D, Jeon G, Sung J, Oh SK, Hong HC, Lee J. 2010. Effect of grape seed oil supplementation on plasma lipid profiles in rats. Food Sci Biotechnol 19: 249–252.
10) O’Byrne D, Grundy S, Packer L, Devaraj S, Baldenius K, Hoppe PP, Kraemer K, Jialal I, Traber MG. 2000. Studies of LDL oxidation following alpha-, gamma-, or delta-tocotrienyl acetate supplementation of hypercholesterolemic humans. Free Radical Biol Med 29: 834–845.
11) Matsumaga T, Shoji A, Gu N, Joo E, Li S, Adachi T, Yamazaki H, Yasuda K, Kondoh T, Tsuda K. 2012. γ-Tocotrienol attenuates TNF-α-induced changes in secretion and gene expression of MCP-1, IL-6 and adiponectin in 3T3-L1 adipocytes. Mol Med Report 5: 905–909.
12) Borai I, Ezz M, Rizk M, Aly H, El-Sherbiny M, Matloub A, Fouad G. 2017. Therapeutic impact of grape leaves polyphenols on certain biochemical and neurological markers in AlCl3-induced Alzheimer’s disease. Biomed Pharmacother 93: 837–851.
13) Fujishita K, Ozawa T, Shibata K, Tanabe S, Sato Y, Hismoto M, Koizumi S. 2009. Grape seed extract acting on astrocytes reveals neuronal protection against oxidative stress via interleukin-6-mediated mechanisms. Cell Mol Neurobiol 29(8): 1121–1129.