Salud, Ciencia y Tecnología - Serie de Conferencias. 2024; 3:562
doi: 10.56294/sctconf2024562

Categoría: Health Sciences and Medicine

REVIEW

Nutrition, obesity and their relationship with liver diseases

Nutrición, obesidad y su relación con las enfermedades hepáticas

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Cite as: Correa Vásconez EA, Guanga Lara VE. Nutrition, obesity and their relationship with liver diseases. Salud, Ciencia y Tecnología - Serie de Conferencias. 2024; 3:562. https://doi.org/10.56294/sctconf2024562

Enviado: 15-07-2023 **Revisado:** 02-12-2023 **Aceptado:** 21-05-2024 **Publicado:** 22-05-2024

Editor: Dr. William Castillo-González

ABSTRACT

Introduction: the frequent consumption of foods high in saturated fat content has been associated with the increasing prevalence of obesity worldwide, especially in developed countries.
Objective: to conduct a literature review on nutrition and its relationship with obesity and the emergence of liver diseases.
Methods: a literature review was conducted in digital libraries such as PubMed, SciELO, and Latindex, meeting inclusion criteria: years between 2019 and 2023, updated dietary guidelines, official documents, scientific articles, and books in English and Spanish.
Results: Non-alcoholic fatty liver disease (NAFLD) is a growing condition, being one of the most relevant chronic liver diseases worldwide, especially in adults, school-age children, and adolescents. It has been associated with obesity, diabetes, and metabolic syndrome, affecting 25-30 % of the adult population, with higher prevalence in countries such as Brazil, Chile, and Colombia in Latin America. NAFLD can lead to serious complications such as liver cirrhosis and liver cancer. Prevention includes lifestyle changes such as a balanced diet and regular physical activity, as well as early identification through nutritional screening tools in medical and nutritional consultations.
Conclusion: there is a direct relationship between nutrient type, dietary habits, lifestyle, and the emergence of obesity and its complications in liver functions, non-alcoholic fatty liver disease, cirrhosis, and alterations in the functions of other organs.

Keywords: Obesity; Hepatic Steatosis; Diabetes.

RESUMEN

Introducción: el consumo frecuente de alimentos altos en el contenido de grasa saturada se ha asociado con el aumento de la obesidad a nivel mundial especialmente en países desarrollados.
Objetivo: efectuar una revisión bibliográfica acerca de la nutrición y su relación con la obesidad y la aparición de enfermedades hepáticas.
Métodos: se realizó una revisión bibliográfica en bibliotecas digitales como Pubmed, SciELO, Latindex, que cumplieron criterios de inclusión: años entre 2019 y 2023, guías de alimentación actualizadas, documentos oficiales, artículos científicos y libros en inglés y español.
Resultados: la enfermedad del hígado graso no alcohólico (EHGNA) es una condición en aumento, siendo una de las enfermedades hepáticas crónicas más relevantes en el mundo, especialmente en adultos, escolares y adolescentes. Se ha relacionado con la obesidad, la diabetes y el síndrome metabólico, afectando al 25-30 %

de la población adulta, con mayor prevalencia en países como Brasil, Chile y Colombia de América Latina. La EHGNA puede conducir a complicaciones graves como la cirrosis hepática y el cáncer de hígado. La prevención incluye cambios en el estilo de vida, como una dieta equilibrada y la actividad física regular, y la identificación temprana mediante herramientas de tamizaje nutricional en consultas médicas y nutricionales. **Conclusiones:** existe relación en el tipo de nutrientes, hábitos alimentarios y estilos vida con la aparición de la obesidad y sus complicaciones en las funciones hepáticas, enfermedad del hígado graso no alcohólico, cirrosis y alterando funciones de otros órganos.

Palabras claves: Obesidad; Esteatosis Hepáticas; Diabetes.

INTRODUCTION

In recent years, malnutrition due to overeating has increased and affects all people regardless of race, skin color or religious beliefs; Malnutrition due to excess, originates from exceeding the energy requirement that the body needs to fulfill the necessary functions of the day, causes alterations in the body such as overweight, obesity type 1, 2, even morbid obesity, causing alterations or non-communicable diseases. such as diabetes, high blood pressure and non-alcoholic liver diseases.[1]

The latter being the one with the highest mortality rate, increasing in recent years, since the data obtained is estimated to affect 28 % of the adult population, specifically 31 % of women and 26 % of men, mainly in developed and developing countries such as the United States, Spain, Germany, etc., followed by developing countries, Latin American countries (Ecuador, Colombia, Peru, Brazil), where excessive consumption of certain foods causes obesity and in turn liver problems.[2,3]

However, in the middle of the last century, a transformation was carried out in the production and process of products, giving rise to ultra-processed products, the invention of current technology. These products are combinations of food materials, treated by companies, rich in sugars, fats, insufficient in vitamins and minerals, fiber, with various additions, to make them more pleasant, with minimal cost and additives; Its creation is related to a relevant increase in chronic diseases such as inflammatory bowel pathologies, cancer (especially colon and breast), obesity and metabolic pathologies.[4]

Weight gain causes several pathological consequences in a specific organ of our body. Excess fat is so harmful that it can negatively affect the human body, leading to the development of a variety of chronic non-communicable diseases such as kidney failure, diabetes, heart disease, stroke, respiratory pathologies and cancer.[5]

For this reason, the objective of this bibliographic review is to carry out a bibliographic review about nutrition and its relationship with obesity and the appearance of liver diseases.

METHODS

A documentary analysis was carried out based on a search of review articles, original articles, systematic reviews, research books, updated dietary guides, official WHO and MSP documents from the databases Elsiever, PubMed, SciELO, Mendeley, Dialnet, and in the Google Scholar search engine. They were evaluated—in Spanish and English—that referred to the topic through the title. The inclusion criteria for the search and selection of the articles: keywords were used such as: obesity, fatty liver, nutrition, diabetes, all published in English and Spanish, from the last 5 years. The exclusion criteria for the selection of information considered: Articles that are from unreliable sources. Of 200 scientific articles, 35 bibliographic references were selected, from which a critical analysis of the information collected was carried out, obtaining this review article.

Epidemiology of nonalcoholic fatty liver disease

Nonalcoholic fatty liver disease today is one of the diseases that are increasing, in recent years it is one of the diseaseschronic liver disease is the most relevant in the world, being more common in the population of schoolchildren and adolescents; however, it has been shown that even three-year-old children can present these conditions due to significant weight gain. On the other hand, the adult population is the most affected with a percentage of 25 to 30 %.[6] People with a history of obesity, diabetes, metabolic syndrome and overweight are those most at risk of developing this pathology, with figures ranging from 60 to 80 %.[7]

In Latin America, especially in developing South American countries, there is NAFLD data of 31 %, with Brazil being one of the most affected countries,(35,2 %) followed by Chile,(23 %) and finally Colombia (26,6 %). According to data obtained in a 2019 study, NAFLD causes between 16 and 23 % of deaths from liver cancer and cirrhosis in Central America, the Andean, Tropical and Caribbean regions. In Honduras, there is little information on the prevalence of this disease; In 2015, according to the statistical study of the ten most frequent causes of death in Honduras, liver diseases, including NAFLD, were in sixth place.(8) Ecuador, despite

having high statistics (40 %)of people with obesity, deaths from diseases related to non-alcoholic fatty liver, is in tenth place of the most relevant causes of the year 2018.[3,9]

This is of utmost importance, since for Latin America and the Caribbean, the World Health Organization (WHO) reported percentages of overweight and obesity at 62,8 and 59,8 % in men and women, respectively. Despite being the obese population with the highest prevalence of having NAFLD, the non-obese population is not free to develop NAFLD either, since in countries like the United States it is known that there is a prevalence of NAFLD of 10 to 20 % in thin people. Other causes of prevalence are attributed to genetic and environmental factors, such as lack of exercise and type of diet consumed.[6,10] Regarding human ancestry, Balakrishnan.[1] demonstrated in their study that populations of Hispanic American ancestry have the highest levels of incidence of NAFLD, confirmed by Oliveira, who observed a higher prevalence of NAFLD in people of Native American origin in Latin American populations.[11] By age and sex, a greater number of cases of NAFLD have been identified in older adults and men. New studies have focused on demonstrating whether it can develop through family inheritance, as was done in a study carried out in 2019 on 60 pairs of twins with NAFLD.[12]

The disease is multisystem and can involve extrahepatic organs, with mortality rates of 2 to 7 %. According to estimates, 50 % of patients with nonalcoholic fatty liver disease develop liver fibrosis, of which 15 % progress to cirrhosis and approximately 3 % progress to liver failure. The probability that a patient with NAFLD will develop hepatocellular carcinoma is approximately 7 % over a 10-year period, with mortality rates of 12 to 36.[12,13]

Nutrition in lifestyles

The science of nutrition is known as the process by which the body obtains the necessary nutrients from food to obtain energy or calories to sustain vital functions, through the process of digestion.[4] Having an inadequate intake of food in quantity or quality and the poor functioning of the digestion process, causes poor nutrition due to both deficiency and excess.[14,15] Overweight or obesity imbalances the calories consumed and those expended during the day's activities. This imbalance causes excessive accumulation of calories in adipose tissue and an increase in body weight.[14]

Prevention

In recent times, the large entities that control world health have suggested to all countries that they create measures or campaigns to prevent eating styles, which cause overweight, obesity, added body consequences that over time appear as a disease. which begins at an early age, which is why countries have gotten to work and one of the most well-known and widely received alternatives has been food labeling (nutritional information, nutritional traffic light), which aims to make known all the elements present in the product and the brand name. This has been one of the prevention alternatives that has been implemented due to the accelerated growth of pathologies due to the more frequent consumption of industrialized products.[16]

One of the countries in Latin America to start with these measures was Chile, which implemented a mandatory national warning system about the quantity and quality of nutrients present in products. Countries such as Peru, Israel, Uruguay and Mexico.[17] Furthermore, for the adequate prevention of NAFLD, there are various studies that show that for correct prevention of these conditions it is necessary to have an adequate weight within the normal BMI ranges (18,5 – 24,9kg/m2), so that This being so, one must lead a life with healthy habits and styles, taking into account nutrition and eating style, adding daily physical activity, low consumption of alcohol, avoiding frequent consumption of processed foods, which are high in in saturated fats, make changes in eating habits, for example frying with oils reused for foods with vegetable oils (salads).[18] It is important to mention that apart from preventions in food consumption both in industrialized food products and changes in people's habits/lifestyles, for this to work people must be aware of the excess consumption of saturated fats, it all depends on them.[17]

Poor nutrition due to excess (Overweight/obesity)

Poor nutrition due to excess is caused by excessive food intake, especially unhealthy products, such as excess saturated fat present in processed products (fries, chitos, doritos, fried plantains, canguil, etc.).[16] Poor nutrition due to excess, which is known to be the accumulation of especially saturated or unsaturated fats in the adipose tissue where fat is reserved in case of prolonged fasting, this tissue can accumulate fat without problems. At the beginning you can only notice an increase in weight in the person, but in the long run complications occur in the body, starting with being overweight followed by obesity, which in turn causes problems in organs.[19,20] This disease is present when there is an excess of calories or energy that the body needs for daily activities. For this condition to arise, an inadequate lifestyle, a sedentary lifestyle and poor diet are the triggering factors. In recent years, relevant data has been obtained on how obesity is increasing in all parts of the world.(twenty-one). However, recent studies revealed that thin people with a normal BMI (18,5 - 24,5kg/m2)can also suffer from this disease.[22]

https://doi.org/10.56294/sctconf2024562

Nonalcoholic fatty liver disease, pathogenesis and progression of NAFLD

The obesity epidemic that is increasing in the world has denoted other diseases from simple steatosis, non-alcoholic hepatitis steatosis, to complications such as liver cirrhosis.[23] NAFLD is a chronic condition due to the increase or fatty infiltration of more than 5 % of the hepatocytes, not explained as hepatitis B, C or autoimmune hepatitis. Generally, the disease does not present symptoms, but in people with a BMI of more than 25kg/m2 should be investigated or under subsequent control. Furthermore, much of the clinical evidence obtained and statistics revealed that NAFLD is not only associated with liver-related morbidity and mortality, but also with an increase in coronary heart disease, alterations in cardiac function and structure (dysfunction), left ventricular hypertrophy and heart failure), coronary valve disease (aortic valve sclerosis) and arrhythmias (atrial fibrillation).[4,10]

NAFLD is characterized by the excessive presence of fatty acids and triglycerides in the area of the liver where they are found in the liver parenchyma (hepatocytes). It is noted in people who have low or little alcohol consumption and its pathogenesis is multifactorial. , the relevant causes are normally divided into two, metabolic and toxic. Metabolic causes are due to congenital causes (Wilson's disease, galactosemia, among others) and acquired causes (diabetes mellitus, obesity, among others). Toxic causes are usually due to the consumption of certain drugs (tetracyclines, estrogens, among others) and exposure to certain heavy metals (chromium, uranium, among others). These causes manifest themselves with insulin resistance, high levels of of free fatty acids and obesity that cause NAFLD.[24]

In a high-resolution analysis prepared by Younossi et al. It was found that 51,3 % of patients with a BMI greater than 32 kg/m2 (obesity) presented NAFLD, making obesity one of its most frequent causes; by increasing the prevalence of obesity in recent years, due to its relationship with NAFLD.[13] This relationship may be due to the accumulation of adipose tissue, mainly visceral, subjected to chronic inflammation where cobblestones (produced by visceral fat) are secreted, establishing a link between the accumulation of free fatty acids and triglycerides that are released into the portal circulation, that the liver receives.[25]

Diagnosis

Proposal for a screening tool in the nutritional clinic

Early detection of NAFLD improves metabolic and histological results, improving the levels of morbidity and mortality. Despite being a tool that is not yet valid, the objective of nutritional screening for nutritionists is to provide evidence-based variables to measure the risk of NAFLD.[27,28]

The screening tool is designed using available parameters, which can be obtained through food history, through biochemical tests. Additionally, it identifies risk factors closely related to NAFLD.[7,25]

Relationship of NAFLD with other diseases

CVD

The relationship with other diseases is crucial in lipid and glucose homeostasis; Therefore, being sick or failing in daily vital functions can have a direct relationship to developing cardiometabolic disease. There is a very multiple relationship between the intestine, visceral and subcutaneous adipose tissue, muscle tissue and the cardiovascular and hepatic systems mechanisms in which NAFLD. As CVD is one of the relevant causes of death in patients with NAFLD, the ability to recognize and modify cardiovascular risks has become a key determinant for treating them. Different studies-analyses have determined the connection between CVD and NAFLD using different diagnostic methods, including ultrasonography, liver biopsy, and increased serum levels of alanine aminotransferase (ALT) and gamma-glutamyl transpeptidase (GGT).[10]

Visceral obesity is directly involved in the production of inflammatory cytokines, causing liver problems that in turn cause problems in the cardio-respiratory system such as the initial factor of tumor necrosis alpha and interleukin, adipokines and macrophage infiltration, resulting in in systematic inflammation and then in the hepatic production of proatherogenic molecules such as C-reactive protein,activated plasminogen inhibitor 1 and fibrinogen, ultimately causing endothelial dysfunction and atherosclerosis.[19,22]

Mellitus diabetes

NAFLD through studies has been shown to be one of the independently high risk factors for the development of DM. In a study carried out called Framingham, it was found that people with NAFLD and a history of obesity or overweight are more susceptible to developing DM2, through glucose tolerance tests where the majority of individuals had a greater range of intolerance to carbohydrates similar to those with an overweight or obese control group without NAFLD.

Liver fat and DM are significantly associated with IR (insulin resistance), suggesting that increased liver fat plays a significant role in the development of DM2. Given the high risk of developing DM in patients with NAFLD, to determine if these people with NAFLD it is important to have a glycosylated hemoglobin test performed.

https://doi.org/10.56294/sctconf2024562

There is a mutation that is associated with adipose tissue dysfunction. NAFLD and the progression of alterations in the presence of glucose tolerance in DM are associated with steatohepatitis and fibrosis in critical states in DM, apparently independent of obesity and linked to the presence of IR.[21]

Chronic kidney disease

CKD often affects people with high metabolic risk factors, which have alterations in blood pressure and DM. New studies revealed that NAFLD is independently associated with an increase in the prevalence of CKD, so it was determined that patients with NAFLD seem to have a high number of CKD compared to those without NAFLD. It was identified in 11,469 American adults with a history of NAFLD who cannot develop CKD proven by ultrasound, despite this recent evidence from a study in adults without CKD confirms that NAFLD is seen as a high value determinant for developing CKD. In addition, it has been documented that NAFLD can extensively damage kidney function. This would cause patients to be carefully monitored for kidney function due to the increased risk of kidney damage in the future. For this reason, CKD screening is recommended. with annual evaluation of eGFRA and microalbumin in patients with NAFLD.[29,30]

Nutrition-diet in NAFLD disease

For obesity and NAFLD, different ways have begun to treat these diseases; one of the methods with the greatest degree of benefits has been diet and the type of eating habits that patients adopt after they find out who have to suffer alterations in their body due to high body weight and even to avoid it, new dietary strategies have been developed in order to treat overweight and obesity based on the eating habits of the new generations. For this reason, the studies carried out to date seek an adequate diet, which results in some meritorious results on these diseases. There is a wide variety of diets or food plans proposed to treat obesity grouped into changing caloric intake and macronutrients, restricting specific nutrients or groups of nutrients, and manipulating time. To date, an adequate pharmacological treatment against NAFLD has not been proven, there is only the intake of vitamin E and pioglitazone, which is recommended by the American Association for the Suddy of Liver Diseases (AASLD), because of this, the most effective treatment is diet therapy and certain lifestyle modifications, especially changing a sedentary lifestyle for daily physical exercise, changing the consumption of junk food (foods rich in sucrose, fructose, saturated fat) for healthy foods (fruits, vegetables, complex carbohydrates), proper control of body weight.[27] The appropriate diet for the treatment of NAFLD should divide the caloric molecule into 50–60 % carbohydrates, 20–25 % lipids and 15 % proteins. The similar type of diet is the Mediterranean Diet, composed mainly of foods of plant origin, especially fruits (nuts and seasonal fruits), vegetables and dried grains, which work as anti-inflammatories and antioxidants.[31] The diet should be very high in unsaturated fatty acids, such as virgin olive oil, fish, avocado. The contribution of calories is the main point in reducing the accumulation of fat in the liver, which is why a hypocaloric diet (reduction of 500 kcal per day) is recommended for patients with NAFLD who, in addition to this condition, have obesity, which will allow them to reduce body weight by 5 % (in turn decreased hepatic steatosis) and 7–10 % body inflammation.[31,32]

Vegetable oils as an essential nutrient in the therapeutic diet treatment of NAFLD

Olive oil

Extra virgin olive oil generates an improvement in the lipid profile and insulin sensitivity, combined with a decrease in transaminases and liver fat deposits. Recent studies have shown that the benefits of extra virgin olive oil at the liver level produce a downregulation of genes associated with hepatic lipogenesis and a decrease in the expression of proinflammatory cytokines. Given this, studies currently confirm or prove that extra virgin olive oil is highly recommended for patients with NAFLD.[33]

Omega 3

A recently conducted study using ultrasound, MRI and biopsy found that omega 3 reduces liver fat to a certain extent and helps the production of liver enzymes. The mechanisms of action by which omega 3 are beneficial can be explained by the participation in the regulation of insulin-sensitizing genes and a reduction of inflammatory pathways, especially those related to nuclear factor kappa.[32,33]

Nuts

Studies carried out on the use of fruits as therapeutic food, especially walnuts, confirmed that they benefit the lipid profile, insulin resistance, and inflammatory markers.[27,3]

Pomegranate peel as a treatment for NAFLD

The pomegranate is a fruit grown in much of North and South America and certain countries in Asia, among which arenative to Central Asia, whose world production is 2 million tons, including India, Iran, China, Turkey, the United States, Argentina and Chile.

https://doi.org/10.56294/sctconf2024562

The agri-food industry generates large tons of waste from different foods every day, so there are different initiatives for the reuse of certain waste, especially the peels, in this case of the pomegranate, providing a beneficial contribution both environmentally and for the health of the population. population. In the certain case of the industry in charge of producing pomegranate juice, it was estimated that 73 % of waste is just peel for each ton of juice that is prepared. For adequate extraction of the polyphenols from the peel, a pretreatment must be carried out that consists of drying it by air, rushed liquids or the use of solvents such as water, methanol, ethanol, acetone and ethyl acetate.

The most abundant phenolic compounds in the entire product are anthocyanins, phenolic acids, and flavonoids; however, the most relevant thing was found in the majority in the peel, this was 80 % ellagittanins, with 10 – 20 % flavonoids. For this reason, this product stands out for being rich in ellagic acid and hydrolyzable tannans, especially punicalagin. As for the amount of toxicity that the pomegranate peel may have, they are very low levels, according to the Food and Drug Administration, which says that it is safe for human consumption, being classified as GRAS (Generally Recognized As Safe), so It was possible to establish a level where adverse effects are observed at 600 mg/kg/day of pomegranate peel extract (ECG). In essence, the ECG is abundant in antioxidants, this foundation of the ECG being supported by food technology experts.

Studies carried out in recent years on ECG and its bioactive compounds in the prevention and treatment of metabolic alterations that originate from NAFLD. These studies mainly highlighted the antioxidant, anti-inflammatory, anti-adipogenic and anti-aesthetic effect. Chukwuma carried out a study on the effect of acetone-extracted ECG on human hepatocytes, especially Chang Liver cells. The cells studied with the ECG at different concentrations resulted in lower levels of substances reactive to thiobartibutric acid and in greater glucose uptake, resulting in an important antioxidant effect that promotes glucose metabolism.[35]

Physical activity

The first line of intervention that should be carried out is weight loss in these patients. Some clinical practice guidelines recommend a minimum of 150 – 200 minutes of physical activity per week, mainly cardio exercises, which can be divided into 3 to 5 sessions, it being important to include resistance exercise in the routine. In studies carried out, there may be a dose-effect, so vigorous physical activity has greater benefit. Tests carried out on overweight or obese patients, who performed physical activity more than 150 minutes a week or those who increased by more than 60 minutes per week, their level of activity performed had a greater decrease in serum aminotransferases, regardless of weight.[33,34]

CONCLUSION

It is concluded that, based on the articles, magazines, books, reviewed and analyzed, there is a direct relationship in the type of nutrients provided by food, in addition to eating habits and styles, with the appearance of obesity and how this disease , in the long run it brings complications in liver functions, causing conditions such as NAFLD, cirrhosis and altering the functions of other organs. Resulting in clinical complications that determine the health of the person suffering from said disease.

BIBLIOGRAPHIC REFERENCES

1. Hidalgo Morales KP, Jácome Cruz MP, NúñezNúñez M, Castillo Mayorga AM. Malnutrition and Cardiovascular Disorders: A Literature Review. Latin Science Multidisciplinary Scientific Magazine. on Sep 6, 2023;7:(4)5797–809.

2. VargasCordova RP, Alexander León HA, Basantes Defaz VM, Valencia Valverde SA, Maldonado Maldonado DA, Sánchez Ordoñez DA. Association between overweight/obesity and post-surgical complications at the San Francisco General Hospital of the Ecuadorian Institute of Social Security. Magazine of the Faculty of Medical Sciences (Quito). 2021;46(1).

3. Caballeria L, Torán P. "Hepatic steatosis epidemic: an analysis from primary care." Aten Primary. 2019;51(9).

4. Lazarus Jeffrey, Crespo Javier, Romero Manuel, SalvadorAgustin, Berenguer Marina, Mestre Jorge, et al. NAFLD. Non-alcoholic fatty liver disease: a comprehensive study Spanish Association for the Study of the Liver Gaspar Casal Foundation-pdf. GASPAR CASAL FOUNDATION. 2021;43–54.

5. Cuellar Fernández Y, Medina Moreno LM, Savino Lloreda P. Considerations of the double and triple nutritional load for a comprehensive approach. Medicine (B Aires). 2023 Jul 31;45(2):247–55.

6. Castro-Sánchez S, Pérez-Giraldo E, Restrepo-Gutiérrez JC, Builes-Montaño CE. Non-alcoholic fatty liver disease in nonobese people: narrative review of the literature. Hepatology. on January 29, 2021;223–35.

https://doi.org/10.56294/sctconf2024562

7. Santiago De Compostela Faculty of Medicine EOdontoloxía U DE, Canosa Mira Titor A, Enrique Domínguez Muñoz Cotitor J, Turnes Vázquez Cotitor J, Pérez Cachafeiro S. Cutaneous pathology and non-alcoholic fatty liver systematic review. Santiago ; 2021.

8. Simão MCSA, Caires CA, De Almeida CJB, Costa IM, Alves IN, Neves I de OR, et al. Approach to therapy for the prevention of complications of non-alcoholic fatty liver disease in obese people: narrative review. Eletrônica Acervo Saúde Magazine. on August 20, 2020;(58):e3881.

9. INEC. National Health and Nutrition Survey ENSANUT. 2019.

10. Velarde-Ruiz Velasco JA, García-Jiménez ES, García-Zermeño KR, Morel-Cerda EC, Aldana-Ledesma JM, Castro-Narro GE, et al. Extrahepatic complications of nonalcoholic fatty liver disease: impact beyond the liver. Rev Gastroenterol Mex. 2019;84(4).

11. Yesmi Arcelia Ortega Rojas Karina Mercedes Aparicio Barrón Advisor Dr Adelina Zarela Lozano Miranda A. PREVALENCE OF NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD) IN LATIN AMERICA AND THE CARIBBEAN: A SYSTEMATIC REVIEW Non-alcoholic fatty liver disease prevalence in Latin American and the Caribbean: A systematic review RESEARCH WORK TO OPT FOR THE PROFESSIONAL TITLE OF PHYSICIAN SURGEON. Lime ; 2021.

12. Calderon Evelyn, Landazuri Samanta, Vilchez Esmeralda, Cantu Raul, Vilches Jose. NON-ALCOHOLIC STEATOHEPATITIS (NASH), LITERATURE REVIEW [Internet]. 2022. Available at: https://revistamedica.com/esteatohepatitis-no-alcoholica/

13. Hepatology. HEPATOLOGY. Magazine of the Colombian Association of Hepatology [Internet]. 2024;5(2711-2330):48–58. Available at: www.revistahepatologia.com

14. Hernández-Corona DM, Ángel-González M, Vázquez-Colunga JC, Lima-Colunga AB, Vázquez-Juárez CL, Colunga-Rodríguez C.Eating habits associated with overweight and obesity in Mexican adults: An integrative review. Science and Nursing. 2021;27.

15. Cuellar Fernández Y, Medina Moreno LM, Savino Lloreda P. Considerations of the double and triple nutritional load for a comprehensive approach. Medicine (B Aires). 2023 Jul 31;45(2):247–55.

16. Villagrán M, Ocampo X, Martínez-Sanguinetti MA,Petermann-Rocha F, Celis-Morales C. Ultra-processed foods and their role in obesity prevention. Vol. 48, Chilean Nutrition Magazine. Chilean Society of Nutrition Bromatology and Toxilogy; 2021. p. 126–8.

17. Pérez-Escamilla R, Vilar-Compte M, Rhodes E, Sarmiento OL, Corvalan C, Sturke R, et al. Implementation of childhood obesity prevention and control policies in the United States and Latin America: lessons for cross-border research and practice. Obesity Reviews. on October 1, 2021;22(S5).

18. Quiroga-Torres E, Delgado-López V, Ramos-Padilla P.Diagnostic value of anthropometric indicators for overweight and obesity. Introduction. Arch Latinoam Nutr. on Mar 1, 2022;72(1):23–30.

19. Ducca José. Obesity: Pathophysiology and Management Strategies. 2021;1–23.

20. Fernandez-Ozcorta EJ, Tornero-Quiñones I, Sierras-Robles Á, Da Silva HM, Afonso Pereira CM, Sáenz-López Buñuel P. Physical activity, obesity, nutrition and body image in schoolchildren in the Guadiana area. e-Motion: Magazine of Education, Motor Skills and Research. 2019;(13).

21. Miranda Manrique G. Non-alcoholic steatohepatitis disease in type 2 diabetic patients: review article. Medical Horizon (Lima) [Internet]. on March 31, 2023;23(2):e1967. Available at: https://www.horizontemedico.usmp.edu.pe/index.php/horizontemed/article/view/1967

22. Mesquina Margalida. MARKERS OF INFLAMMATION AND OXIDATIVE STRESS IN THE PREVENTION AND REVERSION OF OBESITY AND ITS ASSOCIATED COMORBILITIES. Palma de Mollarca; 2022.

23. Morales Bayona M.Dysglycemia and non-alcoholic fatty liver disease in patients with adiposity, Clínica

Internacional, San Borja, 2019 – 2020. Medical interscience. 2022;12(1).

24. Caballeria L, Augustin S, Broquetas T, Morillas RM, Vergara M, Virolés S, et al. Recommendations for the detection, diagnosis and follow-up of patients with non-alcoholic fatty liver disease in primary and hospital care. Med Clin (Barc). 2019 Aug 16;153(4):169–77.

25. WallAbonza J, Martínez Vázquez ES. THE IMPORTANCE OF EARLY DIAGNOSIS OF NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD). Vol. 4, Science and Nutrition REDCieN digital magazine. 2020.

26. López-Almada G, Domínguez-Avila Ja, González-Aguilar Ga, Mejía-León Me, Salazar-López Nj. Preventive Approach In Non-Alcoholic Fatty Liver Disease. Epistemus. 2022;16(32).

27. Cutimbo Mayda. Faculty Of Health Sciences Professional Academic School Of Human Nutrition Critical Review: Effect Of Omega 3 Supplementation On. Lime; 2022.

28. Castro-Sánchez S, Pérez-Giraldo E, Restrepo-Gutiérrez JC, Builes-Montaño CE. Non-alcoholic fatty liver disease in nonobese people: narrative review of the literature. Hepatology. 2021;

29. Velarde-Ruiz Velasco JA, García-Jiménez ES, García-Zermeño KR, Morel-Cerda EC, Aldana-Ledesma JM, Castro-Narro GE, et al.Extrahepatic complications of non-alcoholic fatty liver disease. Journal of Gastroenterology of Mexico (English Edition). 2019;84(4).

30. Rivadeneira Poveda NE, Jurado Melo VC. Updated diagnosis, treatment and complications of nonalcoholic fatty liver disease. Digital Anatomy. 2023;6(1.2).

31. Saavedra Y, Mena V,Priken K. Effect of the Mediterranean diet on histological indicators and imaging tests in nonalcoholic fatty liver disease. Gastroenterol Hepatol. 2022;45(5).

32. García López I. NUTRITIONAL TREATMENT OF NON-ALCOHOLIC FATTY LIVER DISEASE. 2020.

33. Allar de la Fuente Rocio, Angulo Natalia, Roman Daniel. Nutrition in non-alcoholic fatty liver. Clinical Nutrition in Medicine. 2019;8(2):89–98.

34. Celis Eguren A. Tfg Supplementation With Omega 3 Polyunsaturated Fatty Acids Compared To A Mediterranean Diet As A Treatment For Non-Alcoholic Fatty Liver Disease Made By. Santander; 2022.

35. Bustamante A, García-Díaz D, Jiménez P, Valenzuela R, Pando ME, Echeverría F. Potential therapeutic effect for liver steatosis of polyphenols obtained from pomegranate peel. Vol. 49, Chilean Nutrition Magazine. Chilean Society of Nutrition Bromatology and Toxilogy; 2022. p. 89–99.

FINANCING

The authors did not receive financing for the development of this research

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

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https://doi.org/10.56294/sctconf2024562