LAB University of Applied Sciences

The Impact of Sleep Disturbance and Lifestyle Habits on the Cardiovascular Diseases

Literature Review

LAB University of Applied Sciences

Bachelor of Health Care

Degree Programme in Nursing

Ha Ni Le

2023

Contents

Abstract

Author(s)	Publication type	Completion year
Ni Le	Thesis, UAS	2023
	Number of pages	
	34	

Title of the thesis

The Impacts of Sleep Disturbance and Lifestyle Habits on Cardiovascular Disease

Degree

Bachelor of Nursing (UAS)

Abstract

The purpose of this thesis was to assist nursing students and healthcare providers in identifying the link between sleep disturbance and cardiovascular disease. Moreover, the thesis aimed to raise awareness about the impact of lifestyle habits on the cardiovascular system, particularly among individuals in various occupations, with a focus on healthcare professionals who face significant stress within their occupational communities.

The objectives of the research were twofold: first, to elucidate a spectrum of sleep disturbances that have implications for cardiovascular disease. Secondly, the study drew attention to the escalating prevalence of cardiovascular disorders within the population, representing the foremost risk of mortality each year. Furthermore, the research delved into the intricate relationship between diet, exercise, and their influence on the cardiovascular system, offering illustrative examples to underscore the significance of these factors in maintaining cardiovascular health.

This literature review employed a blend of qualitative and narrative approaches. The retrieval and compilation of data primarily involved electronic databases such as EBSCO and PubMed, adhering to specific inclusion and exclusion criteria. The selected publications ranged from 2013 to 2023 to ensure the provision of current and up-to-date knowledge. Inductive content analysis was applied to examine the gathered data, extracting relevant categories aligned with the research questions.

The results provide a holistic view of cardiovascular health, emphasizing the importance of a plant-based diet and lifestyle adjustments in preventing cardiovascular disease. It explores the biological mechanisms supporting the positive effects of a plant-based diet on weight management, lipid profiles, and overall cardiovascular well-being. Additionally, it contrasts the cardiovascular impacts of plant-based and animal-derived foods, highlighting the Mediterranean Diet's association with reduced cardiovascular events. The text also delves into how various exercise modalities molecularly benefit cardiovascular risk factors, addressing metabolic imbalances and enhancing overall cardiovascular and metabolic health. Lastly, it examines the dynamic interplay between exercise, blood lipids, and cardiovascular health, emphasizing exercise's positive influence on insulin sensitivity, glycemic control, and blood pressure, positioning it as a fundamental element in promoting comprehensive cardiovascular well-being.

1   Introduction

The topic of this thesis is "The Impacts of the Quality of Sleep Disturbance and Lifestyle Habits on Cardiovascular Disease". According to British Heart Foundation (2022), one in fourteen persons worldwide suffer from a cardiovascular condition; therefore, an increasing number of inhabitants suffering from heart disease risk factors are changeable and adaptable to adjustment through alterations in lifestyle. In term of development of the phenomenon, in order to evaluate the success of Cardiovascular Disease therapies and identify prospective areas for improving health outcomes, it is essential to evaluate the quality of sleep and lifestyle habits of patients with Cardiovascular Disorders (Tran et al. 2020).

The literature review is applied in this thesis as a method because it is supposed to provide a summary of the literature that is accessible on a certain subject. Additionally, the major of health and social care professionals have access to an expanding body of literature; nonetheless, they cannot be expected to read and learn everything there is to know about any given subject. Moreover, employees in the health and social care industries are required to keep up with new developments and discoveries that have an impact on their field in order to avoid providing obsolete treatment. (Aveyard 2019, 13-14.)

2   Key concepts

2.1   Definition of quality of life

The concept of quality of life (QOL) has proven to be a fundamental and significant notion in the fields of health and medicine, both in terms of research and practical application. Comprehending QOL is essential for improving patient care, reducing symptoms, and aiding in recovery. Patients' self-reported QOL concerns can lead to adjustments and enhancements in therapy and care, or they may reveal the ineffectiveness of certain treatments. Recognizing the diverse range of factors that can impact individuals necessitates the utilization of QOL. This information can be shared with prospective patients to help them anticipate and understand the consequences of their illness and its treatment. Furthermore, even after undergoing effective treatment and achieving long-term remission, certain patients may continue to encounter challenges. Without a QOL assessment, these delayed difficulties may remain undetected. Given that QOL serves as both a prognosis indicator and a predictor of treatment effectiveness, it holds significant importance in medical decision-making (Haraldstad, K et al 2019).

2.2   Cardiovascular disease

In the United States, cardiovascular disease (CVD) occupies the leading position as the primary factor contributing to mortality., resulting in the death of about 655,000 Americans annually (Centers for Disease Control and Prevention). CVD encompasses a wide range of medical conditions related to the circulatory system, encompassing conditions like heart attack (myocardial infarction or MI), congestive heart failure, and stroke. (Richardson, L. 2022). The term "heart disease" encompasses a broad spectrum of cardiac conditions. CVD, or cardiovascular disease refers to a collection of medical conditions related to the heart and blood vessels. This encompasses stroke, heart failure, hypertension, coronary artery disease, heart arrhythmia, peripheral artery disease, and atherosclerosis.. Individuals with CVD often exhibit elevated blood pressure, increased blood glucose levels, a history of smoking, obesity, physical inactivity, excessive alcohol consumption, and dyslipidemia. The good news is that CVD can be effectively managed and prevented through the control of blood pressure, glucose, lipid levels, smoking, and alcohol consumption, as well as through lifestyle modifications that encompass sleep, emotional well-being, exercise, and dietary choices. This comprehensive approach is referred to as the SEED intervention (Tian & Meng. 2019). In terms of Heart Disease Facts, heart disease is the foremost contributor to mortality in men, women, and individuals from a majority of racial and ethnic backgrounds in the United States. This grim statistic translates to one person succumbing to

cardiovascular disease every 33 seconds in the nation. The year 2021 witnessed approximately 695,000 heart disease-related fatalities in the United States, accounting for 1 in every 5 deaths. Moreover, the economic burden of heart disease on the United States amounted to around $239.9 billion annually from 2018 to 2019, encompassing expenses connected to health services, pharmaceuticals, and decreases in productivity resulting from premature death.

There are various factors that can elevate your susceptibility to heart disease, including certain medical conditions, your lifestyle choices, as well as your age and family medical history. These factors are referred to as "risk factors." Notably, nearly half of the U.S. population (47%) possesses at least one of three principal elements contributing to the risk of heart disease, which are high blood pressure, elevated cholesterol levels, and smoking (CDC 2023). Due to the extensive amount of information available, I've chosen to focus on specific health conditions and behaviors that contribute to cardiovascular disease, including aspects related to the quality of sleep, physical activity, and dietary choices.

2.3 Definition of endothelial dysfunction

The endothelium refers to a slim layer of cells that lines the inner surfaces of blood vessels, cardiac valves, and various body cavities. These cells serve a critical function in upholding bodily equilibrium by detecting alterations in forces and signals related to blood circulation carried in the blood. When the need for homeostatic adjustments arises, endothelial cells induce relaxation and contraction of the smooth muscle cells in the blood vessels underneath, leading to the release of substances that affect blood vessel diameter. Nitric oxide (NO) is one of the pivotal substances in this regulatory process. Endothelial dysfunction is diagnosed when the endothelium's actions become imbalanced, leading to decreased vasodilation, heightened vasoconstriction, and an increased tendency for blood clot formation (Kohansieh, M. 2015).

3   Aim, purpose and research question

3.1   Aims, purpose and research question

The aim of this thesis is to provide up-to-date and evidence-based information related to disturbance in sleep patterns and habits related to one's lifestyle and the cardiovascular diseases. The purpose is to recognize connection between disruption in sleep and patterns of living. and cardiovascular diseases based on earlier literature.

Research questions are:

1. How does sleep disturbance affect cardiovascular health?

2. What are the factors linking between lifestyle habits and cardiovascular diseases?

4 Study design

4.1 Literature review

A literature review involves a thorough and impartial analysis of both research and non-research literature that pertains to the topic being investigated. Its principal aim is to furnish the reader with an up-to-date understanding of the existing knowledge in the field while also serving as the basis for potential research in that area. A skillfully executed literature review consolidates data from various sources, maintains objectivity, and incorporates a clearly outlined approach for search and selection, thereby guaranteeing its credibility and applicability (Cronin, Ryan & Coughlan. 2008.)

In terms of the importance of the literature review, it enriches the foundation of evidence utilized in our routine professional endeavors. It serves as an essential instrument by streamlining the assessment and amalgamation of research and data related to a specific topic. A literature review is a research endeavor in its own regard, encompassing a distinct methodology. It begins with a well-defined research question, for which relevant literature is sought, assessed, and appraised. This process leads to the generation of fresh insights that illuminate the initial research query, as well as the identification of existing knowledge gaps. Literature reviews are essential as they synthesize and analyze existing research on a specific topic, providing a comprehensive overview for readers. Staying current with recent developments is crucial for providing up-to-date care. Literature reviews play a vital role in bringing together all the research on a topic, ensuring that professionals have a comprehensive resource to inform their practice (Aveyard, 2019).

Additionally, the qualitative method was also applied as a method of research with this literature review to analyze a huge of information on Databases. In particular, qualitative research centers on the examination of meaning and phenomena within their genuine environments and is also known as 'naturalistic research.' The core principle underlying all qualitative methods is the exploration of meaning and the cultivation of comprehension regarding the research subject. Unlike quantitative research, which relies on numerical measurements, qualitative data are typically gathered through descriptions and words provided by study participants (Aveyard, 2019.)

4.2 Inclusion and exclusion criteria

After formulating the research questions, the data retrieval process was carried out collaboratively, involving the utilization of computerized databases, and criteria for inclusion and exclusion were clearly defined. To be specific, the inclusion criteria encompass

publications from 2013 to 2023, articles in the English language, full-text availability, research studies pertinent to the field of nursing, and documents featuring synonyms or alternative terms for the specified keywords. Conversely, exclusion criteria encompass publications before 2013, articles in languages other than English, documents with only abstracts, irrelevant research, and fields unrelated to nursing (Table 1).

Table 1: Inclusion and exclusion criteria

Inclusion	Exclusion
Publications between 2013 - 2023	Publications before 2013
Articles have been published in English	Articles have been published in other languages
Articles that have been published in their entirety.	Publications for which only the abstract is accessible.
Articles associated with research studies	Irrelevant research.
Articles connected to research studies in the nursing field	Field unrelated to nursing
Synonyms or alternative terms for the used keywords.	

4.3   Data collection

In terms of the inclusion and exclusion criteria, the researcher employed specific keywords to search for articles. Table 2 provides information about the databases used, search terms, publication years, search outcomes, and the articles selected for the study.

The reliable databases that have been used in this thesis are EBSCO CINAHL, and PubMed. Likewise, the University's digital library was used for searching for information, facts, and statistics. In addition, a number of advantageous resources are figured out from significant health organizations such as World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), Mayo Clinic Organization, and the American Heart Association.

There are multiple approaches for collecting data. Data collection involves the examination of previously published articles related to the subject. The data for this literature review was obtained from various databases such as CINAHL, EBSCO, PubMed, and Google Scholar. During the data search, operators like "AND" and "OR" were used to retrieve relevant

results. The search terms we used to explore our article were: exercise, cardiovascular disease, diet, and quality of sleep.

Table 2: Databases that were explored during the search.

Databases	Search words	Year	Results	Findings through examinations of abstracts	Selected articles
Pubmed	("quality of sleep") AND (cardiovascular disease)	2013-2023	80	5	2
Pubmed	(diet) AND ("cardiovascular disease")	2013-2023	7,299	20	4
Pubmed	(("exercise") AND ("cardiovascular disease")	2013-2023	5,063	15	5
EBSCO (CINAHL)	(quality of sleep or sleep quality) AND (cardiovascular disease or cvd or heart or cardiac or coronary heart disease)	2013-2023	60	5	0
EBSCO (CINAHL)	exercise AND cardiovascular disease	2013-2023	1,461	20	0
EBSCO (CINAHL)	Diet AND cardiovascular disease	2013-2023	2,292	34	0

Pubmed (CINAHL)	(quality of life) AND (cardiovascular disease)	2013-2023	17,036	50	2

5   Ethical consideration and validity

5.1   Ethical considerations of study

Ethical factors and ethical considerations are a pivotal component of research, significantly influencing the research process. Adhering to research guidelines and limitations is integral to the research process, and it is imperative for students to diligently observe these guidelines and considerations. Finnish National Board on Research Integrity TENK (TENK) plays a vital role in promoting and upholding research integrity and ethical conduct in Finland, offering guidance, investigation, and education to maintain the highest ethical standards in research. These guidelines outline the ethical principles for research involving human participants, which are applicable to studies that examine humans and their behavior. The Finnish National Board on Research Integrity TENK has developed these principles, which serve as a foundation for ethical reviews conducted by human science ethics committees (TENK, 2019.)

Plagiarism undermines the integrity and trustworthiness of research. To maintain the ethical standards and credibility of this study, the thesis was employed effective paraphrasing techniques in accordance with the thesis guidelines provided by LAB UAS.

5.2   Trustworthiness of study

The reliability of a study is associated with the degree of confidence in the data, interpretation, and methodologies utilized to ensure the study's quality. Many qualitative researchers adhere to Lincoln and Guba's criteria, including credibility, dependability, confirmability, and transferability, with the later addition of authenticity. This column will focus on outlining these criteria and the commonly employed procedures, noting that not all procedures are necessarily applied in every study (Lynne, 2016). For content analysis to be successful, it is essential that the data can be condensed into concepts that articulate the research phenomenon through the creation of categories, concepts, a model, conceptual system, or conceptual map. The content analysis methods share three key stages: preparation, organization, and reporting of results. During the preparation phase, researchers gather relevant data for analysis, interpret the data, and determine the unit of analysis. During the reporting phase, the findings are articulated by detailing the content within the categories that describe the phenomenon, employing a chosen methodology. In terms of establishing credibility, researchers need to accurately identify and describe those involved in the research. Dependability pertains to the consistency of data over time and in varying conditions. The authenticity criterion involves researchers impartially and faithfully representing a diverse range of realities (Elo, 2014).

Regarding the trustworthiness preparation phase, it encompasses three steps: preparation, organization, and reporting phase. Ensuring the trustworthiness of data collection is crucial for establishing the credibility of a study. The choice of an appropriate data collection method is essential in content analysis, where credibility is linked to how well the data align with the research focus. The trustworthiness of content analysis, especially in inductive approaches, relies on the thoughtful choice of data collection methods tailored to address the research questions at hand. The evaluation of data collection effectiveness should be based on the alignment with the particular research questions and study objectives. Within the preparation phase, the choice of an appropriate unit of analysis is crucial to enhance the credibility of content analysis. The ideal unit of analysis should strike a balance, being large enough to be considered holistically yet small enough to represent a meaningful unit during the analysis (Elo, 2014).

The clarity and comprehensibility of the concepts formed through content analysis should be effectively communicated. Including a visual representation, such as a figure, can be beneficial in offering a comprehensive overview of the entire outcome. The focus of the study determines which research phenomena are conceptualized during the analysis process (Elo,2014.)

6 Results

6.1 Sleep disorders and risk factors of cardiovascular disease

Sleep disorder have been associated with an elevated risk of obesity due to various hormonal and metabolic mechanisms. One of these mechanisms involves the physical obstruction of breathing caused by excess adipose tissue in the neck and chest areas. Another supplementary mechanism believed to impact the quality of sleep in individuals with obesity is the secretion of inflammatory cytokines originating from adipose tissue within the abdomen. The quality of sleep may exacerbate or increase the susceptibility to various cardiovascular risk factors in individuals with obesity, potentially contributing to cardiovascular risk. Specifically, sleep disorders (SD) have been linked to an elevated risk of hypertension. This association is attributed to various potential mechanisms, including increased activity of the sympathetic nervous system, activation of the renin-angiotensin-aldosterone system (RAAS), oxidative stress, endothelial activation, and impaired endothelial function. In essence, SD can contribute to the development or worsening of hypertension through these physiological pathways (Muscogiuri 2020). Reduced duration and quality of sleep, whether stemming from sleep disorders or irregular sleep patterns, have been associated with factors that increase the risk of cardiovascular disease, such as high blood pressure, obesity, diabetes, and abnormal lipid levels. (Kohansieh, 2015.)

6.1.1 Obesity and sleep disturbance

Obesity has become a global phenomenon, with its prevalence tripling from 1975 to the present day. The realm of sleep disorders encompasses a broad spectrum of conditions, such as sleep disorders like insomnia, excessive sleepiness (hypersomnia), and interrupted breathing during sleep (sleep apnea), and numerous other disorders, broadly categorized as dyssomnias and parasomnias. In addition, sleep deprivation may act as a factor that increases the likelihood of the onset of obesity and may play a role in the progression or exacerbation of cardiovascular conditions associated with obesity. This is supported by findings indicating that sleep deprivation led to an increased appetite, particularly for foods high in carbohydrates and fats. Noticeably, these alterations were concomitant with increased ghrelin levels and decreased leptin levels in the group experiencing sleep deprivation. Other research has also revealed lower leptin levels and higher ghrelin levels in individuals who experience insufficient sleep, suggesting that inadequate sleep duration can influence appetite by affecting the levels of hormones that regulate it. So this hormonal shift leads to higher food consumption, primarily consisting of fats and carbohydrates, often at the cost associated with the consumption of dietary fiber. Likewise, chronic partial sleep

deprivation leads to increased feelings of fatigue, which can subsequently result in reduced motivation for physical activity (Muscogiuri 2020).

One of the key factors in the pathophysiological mechanisms at play is the intermittent hypoxia induced by obstructive sleep apnea. This hypoxia leads to elevated levels of Angptl4, an inhibitor of lipoprotein lipase, which in turn reduces the clearance of lipoproteins and results in higher serum triglycerides and fasting VLDL cholesterol. Furthermore, the persistent pro-inflammatory state associated with obstructive sleep apnea and sleep deprivation leads to increased cytokine levels, elevated serum A-amyloid, and higher levels of C-reactive protein (CRP). Both SD and obesity exhibit a similar pro-inflammatory pattern that can contribute to a heightened risk of clot formation. Additionally, adipocyte hypertrophy, often seen in obesity, causes an altered expression of adipokines, which play a pivotal role in vascular function and can impact lipid and glucose metabolism. Collectively, these mechanisms play a role in promoting weight gain and consequently contribute to the onset of obesity (Muscogiuri 2020).

6.1.2 Hypertension and sleep disturbance

Individuals experiencing insomnia exhibit a notably elevated sympathovagal imbalance. This autonomic dysfunction has been associated with both hypertension and a reduced decline in nocturnal blood pressure. Autonomic dysfunction is closely connected to hypertension and a reduction in the normal nighttime decrease in blood pressure (nocturnal dipping). In the context of sleep disorders (SD), factors such as adiposity and metabolic dysfunction can also heighten the risk of hypertension. Furthermore, chronic sleep deprivation can lead to disruptions in circadian rhythms, potentially altering the typical daily blood pressure pattern. This disturbance can result in an increased risk of hypertension, reduced nocturnal blood pressure reduction, and greater blood pressure variability (Muscogiuri, G. 2020).

A variety of underlying physiological processes are involved in the emergence of hypertension in people with sleep disorders (SD). Among these, intermittent episodes of low oxygen (intermittent hypoxia) and elevated carbon dioxide levels (hypercapnia) contribute to the generation of harmful free radicals when oxygen is reintroduced, which is known as ischemia-reperfusion. Additionally, these mechanisms impact intrathoracic pressure, influencing the functioning of the heart and raising the workload on the heart (afterload). Moreover, a decrease in the production of Nitric Oxide (NO) and an increase in the production of endothelin-1 within the blood vessels can create a predisposition for systemic hypertension and cardiovascular diseases. This patient group has also exhibited hyperactivity of the sympathetic nervous system, changes in baroreceptor sensitivity,

activation of the renin-angiotensin-aldosterone system (RAAS), hyperinsulinism, and resistance to leptin. Additionally, they have shown tendencies toward hypercoagulability and microarousals. In patients with obstructive sleep apnea (OSA), the levels of Angiotensin II and aldosterone have been observed to be elevated when compared to control subjects (Muscogiuri, G. 2020).

It was observed that patients with uncontrolled hypertension and obstructive sleep apnea (OSA) experienced a slight decrease in the severity of OSA when their treatment was improved and intensified with diuretics like metolazone and spironolactone. This treatment resulted in a reduction in nighttime fluid retention around the neck area and a decrease in neck circumference, accompanied by a lower apnea-hypopnea index. These results suggest that the redistribution of bodily fluids during the night may influence the severity of OSA in individuals with hypertension, indicating a potential significant link between these two medical conditions (Muscogiuri, G. 2020).

6.1.3 Type 2 diabetes and sleep disturbance

Over the last twenty years, there has been a substantial rise in the worldwide occurrence of type 2 diabetes (T2DM) among adults, signifying a burgeoning global epidemic. Sleep disturbances (SD) have been associated with several factors, encompassing insulin resistance, glucose intolerance, diminished insulin reactivity to glucose, and alterations in post-meal glucose levels and resting metabolic rate. These factors collectively heighten the susceptibility to T2DM. In a particular study, it was revealed that sleep disruptions could give rise to diminished sleep quality and disruption of the body's natural circadian rhythms, which subsequently produced detrimental impacts on glucose and insulin metabolism. Obesity serves as a substantial common risk factor for both obstructive sleep apnea (OSA) and type 2 diabetes (T2DM), and there is a direct association between obesity and OSA. In cases of OSA, hypoxia can trigger oxidative stress and prolonged inflammation, thereby disturbing the regulation of glucose metabolism. Additionally, sleep fragmentation and deprivation can have an adverse effect on insulin sensitivity (Muscogiuri, G. 2020).

6.1.4 Hypercholesterolemia and sleep disturbance

Muscogiuri at al studied that hypercholesterolemia is a significant risk factor for cardiovascular diseases and mortality. The precise mechanisms connecting sleep disruptions to elevated cholesterol levels are not entirely clear, but they could include changes in hormones related to appetite, activation of the sympathetic nervous system, and alterations in glucose metabolism. Obstructive sleep apnea (OSA) plays a significant role in clarifying this connection because it can result in reduced blood oxygen levels, leading to

higher triglyceride levels and irregular lipid profiles. Nevertheless, obstructive sleep apnea (OSA), a significant contributor to insomnia, provides a more distinct explanation for the association between sleep disturbances and elevated cholesterol levels. During apnea episodes, the diminishing blood oxygen concentration leads to an increase in triglycerides. Simultaneously, reduced blood oxygen levels can trigger the sympathetic nervous system, accelerating lipid synthesis in the liver and reducing the activity of lipid enzymes. Consequently, this results in an abnormal lipid profile, characterized by elevated LDL cholesterol and reduced HDL cholesterol levels (Muscogiuri, G. 2020).

6.2 Insomnia and endothelial dysfunction

Even though the study yielded unfavorable outcomes as it failed to establish a link between endothelial dysfunction and insomnia, an analysis of individual insomnia symptoms revealed potential links to endothelial dysfunction. Notably, these associations varied between genders in the study. For women, there was a negative connection between experiencing early awakenings and endothelial function, whereas the association for men was the opposite. Furthermore, women who reported daytime sleepiness had better FMD compared to other women. The HUNT 3 study in Norway, which expanded on previous health investigations such as the HUNT study, had previously established insomnia as a notable risk factor for myocardial infarction (heart attacks) (Muscogiuri, G. 2020).

6.3 Complete absence of sleep and endothelial dysfunction

According to specific samples, cardiologists for on call 24hours, following cardiologists for on-call 24hours, thirteen out of fifteen physicians had brachial artery dilation below 4.4%, and five showed no dilation whatsoever. This research associates the variance in endothelial function with stress, as it is well-established that mental stress can trigger the activation of the sympathetic nervous system. Likewise, a separate investigation conducted by Ghiadoni and colleagues delved into the connection between mental stress and endothelial function. Their findings revealed that short bouts of everyday mental stress could induce temporary (lasting up to 4 hours) endothelial dysfunction in healthy young individuals. Moreover, Sauvet et al.'s study involving twelve healthy male participants demonstrated that after 29 hours of acute sleep deprivation, there was a notable reduction in vascular reactivity indices. In contrast, heart rate, systolic blood pressure, and the activity of the sympathetic nervous system significantly increased after 32 hours of Total Sleep Deprivation (TSD). Following their human study, the same research team conducted a subsequent study in rats, which revealed that total sleep deprivation (TSD) resulted in a decrease in endothelial-dependent vasodilation (Muscogiuri, G. 2020).

6.4   Partial Sleep Deprivation

In multiple research investigations, Muscogiuri et al is conducted that partial sleep deprivation (PSD) consistently demonstrated an association with diminished vasodilation. Covassin and colleagues studied 16 healthy individuals and noted a decline in FMD (Flow-Mediated Dilation) during a period of sleep deprivation when compared to a regular sleep phase. In a different investigation led by Pugh and team, participants subjected to three nights of partial sleep deprivation (PSD) initially exhibited diminished endothelial function, but this impairment recovered after the third night of sleep restriction. Furthermore, Dettoni and colleagues noted that subjecting 13 healthy males to five nights of partial sleep deprivation (PSD) resulted in a notable decrease in maximum endothelial-dependent vasodilation (Muscogiuri, G. 2020.)

7 The relationship between diet and cardiovascular disease

Adopting healthy dietary habits plays a crucial role in preventing cardiovascular disease (CVD). To prevent cardiovascular disease (CVD), the key recommendations revolve around dietary choices and lifestyle. It's advised to increase the consumption of plant-based, fiber-rich foods like vegetables, fruits, whole grains, and legumes while limiting the intake of less healthy carbohydrate sources such as refined starches and sugars. Additionally, reducing saturated fat intake and opting for monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) can be beneficial. Choosing products with lower salt content, maintaining a healthy body weight through increased physical activity, and moderating alcohol consumption are also crucial steps. These guidelines are supported by strong evidence in the field of CVD prevention (Nestel, P. 2022).

7.1 Cardiovascular risk factors and potential biological mechanism of a plant-based diet

A healthful plant-based diet, focusing on whole grains, fruits, vegetables, nuts, legumes, tea, coffee, and non-hydrogenated vegetable oils, has the potential to positively impact cardiovascular health through various physiological mechanisms. This diet's lower energy density, stemming from its reduced saturated fat and increased fiber content, can be beneficial for weight management and loss. Dietary fiber plays a pivotal role in promoting feelings of fullness, primarily by causing stomach expansion through the consumption of fibrous foods and by creating a gel-like substance when soluble fiber absorbs water. This gel can slow down stomach emptying, prolong the absorption of nutrients, and help regulate post-meal insulin and blood sugar levels. Additionally, dietary fiber may contribute to cardiovascular health by potentially lowering cholesterol levels. Studies have shown that increasing soluble fiber intake by 2-10 grams per day resulted in a modest yet significant reduction in LDL cholesterol. This effect is likely linked to alterations in cholesterol and fat absorption, cholesterol synthesis, bile acid synthesis, and bile acid absorption (Satija, A. 2018).

A nutritious plant-based diet, emphasizing low saturated fat and high unsaturated fat content, can potentially lower the risk of cardiovascular disease (CVD) by improving lipid profiles. Experimental studies have indicated that saturated fatty acids activate inflammatory pathways, while polyunsaturated fatty acids have anti-inflammatory properties. Consequently, a diet rich in unsaturated fats and limited in saturated fats may play a role in reducing CVD risk through its anti-inflammatory potential. Moreover, replacing saturated fats with polyunsaturated and monounsaturated fats might enhance insulin

sensitivity and aid in preventing type 2 diabetes. This outcome could occur by modifying the composition of cell membrane fatty acids, influencing gene expression, enzyme activity, and regulating the inflammatory response (Satija, A. 2018).

Plant-based foods such as whole grains, fruits, vegetables, vegetable oils, nuts, and beverages like tea, coffee, and cocoa are abundant in polyphenols, known for their antioxidant qualities and their potential to regulate nitric oxide (NO) production, thus promoting vascular health. These polyphenols may contribute to improving cardiovascular health by inhibiting blood clot formation, reducing inflammation in blood vessels, affecting cell death processes, preventing the oxidation of LDL cholesterol, and positively influencing lipid levels. Furthermore, a wholesome plant-based diet supplies other antioxidant nutrients like vitamins C and E, as well as beta-carotene. It also provides essential minerals like potassium, which can lower blood pressure and reduce the risk of strokes by positively impacting the functioning of blood vessel linings, and magnesium, which is associated with improved outcomes in terms of heart and metabolic health. This is due to its effects on glucose metabolism, insulin sensitivity, and its anti-inflammatory, vasodilatory, and antiarrhythmic properties (Satija, A. 2018).

On the flip side, a number of dietary components commonly found in animal-derived foods have been connected to a higher likelihood of cardiovascular problems. Heme iron, which is primarily present in animal products such as red meat, poultry, and seafood, has shown an association with an increased risk of cardiovascular issues. Moreover, certain additives used in processed meats, like sodium, nitrates, and nitrites, may also contribute to an elevated risk of cardiovascular outcomes by raising blood pressure, disrupting insulin response, and impairing endothelial function (Satija, A. 2018.)

7.2 Mediterranean Diet and risk factors for Cardiovascular disorders

Richardson et al (2022) conducted that the MedDiet comprises a variety of dietary elements, such as long-chain omega-3 fatty acids sourced from fish and nuts, polyphenols found in fruits, vegetables, and wine, probiotics from yogurt and select dairy items, as well as fiber, phytosterols, and antioxidants. Studies employing animal models have demonstrated that these elements offer diverse health advantages in terms of averting atherosclerosis. Firstly, the introduction of omega-3 supplements improved vascular function in hypercholesteremic rats, bringing their responses in line with those observed in normal rats. In the case of polyphenols, ethanol extracts derived from the peels of Garcinia mangostana L., which are rich in the antioxidant mangosteen, exhibited the ability to reduce LDL cholesterol levels and raise HDL cholesterol in white mice. This effect was achieved by preventing the transfer of ester cholesterol from HDL to VLDL. Probiotic-fermented camel milk had a noteworthy

impact on obese, hypercholesterolemic rats. It led to a substantial reduction in body weight, serum triglycerides, and LDL cholesterol, while simultaneously increasing serum HDL levels (Richardson, 2022.) Nestel (2022) conducted that a controlled study following a Mediterranean-style diet, which incorporated key elements such as olive oil and nuts, there was a notable reduction in significant cardiovascular events, including stroke, heart attacks, and cardiovascular-related fatalities.

7.3 Assessment of dietary patterns

A study by Nestel et al 2022, all of these diets feature restricted quantities of lean meat, fish, low- and non-fat dairy products, and vegetable oils. They are characterized by a low presence of saturated, trans, and solid fats, as well as limited levels of salt (sodium), added sugars, and refined grains. A healthy dietary regimen should be combined with an appropriate calorie intake and physical activity to maintain a normal weight and ensure sufficient nutrient intake. These dietary patterns have been associated with an 8-22% reduction in overall mortality, a 19-28% decrease in cardiovascular disease-related mortality, and an 11-23% reduction in cancer-related mortality. The Alternative Healthy Eating Index, when followed optimally, has demonstrated a remarkable 42% reduction in cardiovascular disease mortality.

8 The connection between exercise and cardiovascular system

Metabolic syndrome, marked by obesity, hyperlipidemia, impaired glucose tolerance, and insulin resistance, poses a significant risk for cardiovascular conditions like hypertension, atherosclerosis, and coronary heart disease. Exercise, in its various modalities, can yield molecular advantages, encompassing reduced triglycerides, elevated high-density lipoprotein levels, enhanced fat metabolism, augmented muscle mass, and decreased body fat. Furthermore, exercise plays a role in mitigating metabolic imbalances associated with amino acids, particularly basal and branched-chain amino acids (BCAA), which are associated with cardiovascular and metabolic maladies. By enhancing the cellular utilization of amino acids, exercise has the potential to enhance cardiovascular, cardiometabolic, and metabolic well-being (Wang, 2022).

8.1 The role of blood lipids in the development of atherosclerosis

Numerous studies have investigated the relationship between physical activity and its influence on cardiovascular disease (CVD) risk by examining changes in circulating lipoproteins. These studies have indicated that engaging in endurance training is associated with increased levels of high-density lipoprotein (HDL) and a slight decrease in triglyceride levels. These changes can help alleviate the risk of coronary heart disease. A study involving individuals with mild to moderate dyslipidemia demonstrated that exercise has a dose-dependent effect on levels of low-density lipoprotein (LDL), triglycerides, and large particle very low-density lipoprotein (VLDL), with higher levels of exercise also leading to increased HDL. It is worth noting that while higher HDL levels are associated with decreased CVD risk, the size of HDL and LDL particles, as well as VLDL size, maybe more crucial contributors to CVD risk reduction. Additionally, exercise can influence the equilibrium of the arterial wall., potentially slowing the progression of atherosclerosis. Even individuals with symptomatic coronary artery disease can experience improvements with increased physical activity, as exercise can stimulate nitric oxide (NO) production, enhancing vasodilation and endothelial function. Animal studies further support the idea that exercise positively influences vascular health and may reduce the risk of CVD (Nystoriak, 2018). Research by Pedersen and Saltin has underscored the favorable impact of exercise on symptoms and physical health by improving lipid profiles. A study led by Kokkinos and colleagues found that combining statin therapy with aerobic exercise significantly reduced the risk of mortality compared to either method alone, particularly among individuals with dyslipidemia (Wang, 2017).

8.2   Blood lipids and cardiovascular health

Aerobic exercise interventions have shown statistically significant reductions in triglyceride levels. This is particularly relevant in addressing one of the current challenges faced by healthcare systems, which is the necessity to reduce the prevalence of coronary atherosclerosis and manage important lipid parameters such as total cholesterol (TC), low-density lipoprotein cholesterol (LDL-cholesterol), and triglycerides (TG), along with other risk factors associated with coronary heart disease (CHD) (Wang, 2017).

The connection between blood lipids and cardiovascular health is strongly influenced by systemic insulin sensitivity. Insulin resistance, which hampers the insulin signaling system, contributes to heart disease development by altering the blood lipid profile. When adipocytes resist insulin's effects, glucose uptake decreases, leading to increased release of free fatty acids, greater production of triglycerides, and very low-density lipoproteins (VLDL) by the liver. Insulin resistance also reduces high-density lipoprotein (HDL), partly due to increased cholesteryl ester transfer protein (CETP) activity, promoting the transfer of cholesteryl esters from HDL to triglyceride-rich lipoproteins and preventing the process of reverse cholesterol transport., which contributes to atherosclerotic plaque formation (Nystoriak, 2018). It's important to highlight that both continuous aerobic exercise and individual exercise sessions are equally effective in reducing non-fasting triglyceride (TG) levels. Furthermore, just four days of physical exercise have been shown to lead to substantial enhancements in post-meal TG, low-density lipoprotein cholesterol (LDL-C), and remnants of very low-density lipoprotein (VLDL) (Wang, 2017).

Exercise training has been shown to improve insulin sensitivity and glycemic control, benefiting human beings with both diabetes requiring insulin and diabetes not dependent on insulin. This improvement occurs even after a single low-intensity exercise session and leads to increased uptake of fatty acids. Exercise reduces insulin levels during physical activity, promoting glucose uptake in contracting muscles independently of insulin. However, it's worth noting that eccentric exercise can potentially induce insulin resistance (Nystoriak, 2018).

Furthermore, exercise's effects on postprandial lipids are significant, with intensive exercise leading to substantial reductions in individuals who are healthy and not obese. Yet, high-intensity exercise may not be suitable for most individuals, particularly those with cardiovascular conditions. On the other hand, moderate-intensity aerobic exercise has been proven effective in reducing postprandial blood lipid levels. Additionally, individuals with low fitness levels can still benefit from low-intensity aerobic exercise. In conclusion, moderate or lower-intensity exercise is a more practical and sufficient approach for most people,

considering the significant impact of high-intensity exercise on postprandial lipid changes (Wang, 2017.)

8.3   Blood pressure and physical activities

Exercise significantly influences blood pressure, a vital factor in cardiovascular well-being (Nystoriak, 2018). Hypertension, or high blood pressure, is linked to a range of cardiac issues, including heart attacks, strokes, and heart failure (Gronek, 2020). Meta-analyses confirm that acute exercise results in a noticeable decrease in both systolic and diastolic blood pressure (Nystoriak, 2018.) Exercise training primarily exerts its impact on blood pressure by enhancing the function and structure of blood vessels, ultimately leading to reduced peripheral resistance. This effect is achieved through the heightened expression and activation of various factors like endothelial NO synthase, superoxide dismutase, and vascular antioxidant capacity. Moderate-intensity exercise fosters vasodilation and a decrease in blood pressure, while high-intensity exercise can have the opposite effect by increasing oxidative stress and vasoconstriction. Furthermore, exercise reduces vasoconstrictor tone, primarily by reducing the availability of endothelin-1 and the expression of the angiotensin II type 1 receptor. It also affects the diameter of arteries, intima-media thickness, artery stiffness, compliance, and baroreflex sensitivity, collectively contributing to a reduction in blood pressure (Gronek, 2020.)

9 Conclusion

To sum up, preventing cardiovascular disease (CVD) involves adopting a wholesome diet, focusing on plant-based, fiber-rich foods while avoiding unhealthy carbs and saturated fats. The Mediterranean Diet, rich in omega-3 fatty acids and polyphenols, shows positive effects on cardiovascular health. Assessing dietary patterns and maintaining a balanced, nutrient-rich intake is crucial, linked to reduced overall mortality and cardiovascular-related mortality.

Regarding exercise and the cardiovascular system, physical activity plays a vital role in reducing cardiovascular risk factors. Exercise impacts blood lipids, with endurance training raising high-density lipoprotein (HDL) and lowering triglycerides, contributing to a decreased risk of coronary heart disease. Exercise also influences blood pressure by enhancing blood vessel function, reducing peripheral resistance, and mitigating metabolic imbalances associated with amino acids.

However, the intricate relationship between sleep disturbance and cardiovascular health should not be overlooked. Insufficient sleep and obesity are interconnected, impacting hormonal regulation and appetite, leading to unhealthy dietary choices. Sleep disorders, including obstructive sleep apnea, hypertension, and type 2 diabetes, exhibit complex physiological mechanisms contributing to cardiovascular risk. Additionally, the impact of sleep deprivation on endothelial dysfunction and vascular reactivity underscores the importance of adequate sleep for cardiovascular well-being.

In summary, a holistic approach to cardiovascular health involves not only dietary and exercise interventions but also addressing sleep patterns and overall well-being to mitigate risk factors and promote a healthy cardiovascular system.

References

Aveyard, H. 2019. Doing a literature review in health and social care: a practical guide. Ebook. Retrieved on 24 January 2023. Available at https://www-vlebooks-com.ezproxy.saimia.fi/Product/Index/1998700?page=0

CDC 2023. Heart Disease Facts. Retrieved on 5 October 2023. Available at https://www.cdc.gov/heartdisease/facts.htm

CDC 2023. Risk Factors for Heart Disease. Retrieved on 5 October 2023. Available at https://www.cdc.gov/heartdisease/risk_factors.htm

Cronin, P., Ryan, F., & Coughlan, M. 2008. Undertaking a literature review: a step-by-step approach. British journal of nursing, Vol. 17, 38-43. Retrieved on 24 October 2023. Available at https://search-ebscohost-com.ezproxy.saimia.fi/login.aspx?direct=true&db=c8h&AN=105971907&site=ehost-live

Elo, S., Kääriäinen, M., Kanste, O., Utriainen, K. & Kyngäs, H. 2014. Qualitative Content Analysis: A Focus on Trustworthiness. Retrieved on 09 November 2023. Available at https://doi.org/10.1177/2158244014522633

Given, L. M. 2008. The SAGE Encyclopedia of Qualitative Research Methods. Thousand Oaks: SAGE Publications. Retrieved on 20 January 2023. Available at doi: 10.4135/9781412963909

Gronek, P., Wielinski, D., Cyganski, P., Rynkiewicz, A., Zając, A., Maszczyk, A., Gronek, J., Podstawski, R., Czarny, W., Balko, S., Ct Clark, c., Celka, R. 2020. A Review of Exercise as Medicine in Cardiovascular Disease: Pathology and Mechanism. Retrieved on 02 November 2023. Available at doi: 10.14336/AD.2019.0516

Haraldstad, K., Wahl, A., Andenæs, R., Andersen, J. R., Andersen, M. H., Beisland, E., Borge, C. R., Engebretsen, E., Eisemann, M., Halvorsrud, L., Hanssen, T. A., Haugstvedt, A., Haugland, T., Johansen, V. A., Larsen, M. H., Løvereide, L., Løyland, B., Kvarme, L. G., Moons, P., Norekvål, T. M., Ribu, L., Rohde, G. E., Urstad, K. H., Helseth, S. & LIVSFORSK. 2019. A systematic review of quality of life research in medicine and health sciences. Retrieved on September 28, 2023. Available at doi: 10.1007/s11136-019-02214-9

Kohansieh, M., Makaryus, A.N. 2015. Sleep Deficiency and Deprivation Leading to Cardiovascular Disease. Retrieved on 5 October 2023. Available at doi: 10.1155/2015/615681

Lynne M. 2016. Trustworthiness in Qualitative Research, MEDSURG, vol 25, no 6. Retrieved on 09 November 2023. Available at https://search-ebscohost-com.ezproxy.saimia.fi/login.aspx?direct=true&db=afh&AN=120221607&site=ehost-live

Muscogiuri, G., Tuccinardi, D., Nicastro, V., Barrea, L., Colao, A., Savastano. 2020. Sleep disturbances: one of the culprits of obesity-related cardiovascular risk. Retrieved on October 5, 2023. Available at doi: 10.1038/s41367-020-0019-z

Nestel, P.J., Mori, T.A. 2022. Dietary pattern, dietary nutrients and cardiovascular disease. Retrieved on 19 October 2023. Available at doi: 10.31083/j.rcm2301017

Nystoriak, M.A., Bhatnagar, A. 2018. Cardiovascular Effects and Benefits of Exercise. Retrieved on 02 November 2023. Available at doi: 10.3389/fcvm.2018.00135

Richardson, L.A., Izuora, K., Basu, A. 2022. Mediterranean Diet and Its Association with Cardiovascular Disease Risk Factors: A Scoping review. Retrieved on 24 October 2023. Available at doi: 10.3390/ijerph191912762

Satija, A., Hu, F.B. 2018. Plant-based diets and cardiovascular health. Retrieved on 19 October 2023. Available at doi: 10.1016/j.tcm.2018.02.004

TENK. 2019. Guidelines for ethical review in human sciences. Published by Finnish National Board on Research Integrity. Retrieved on 08 November 2023. Available at https://tenk.fi/en/advice-and-materials/guidelines-ethical-review-human-sciences

Tian, D., Meng, J. 2019. Exercise for Prevention and Relief of Cardiovascular Disease: Prognoses, Mechanisms, and Approaches. Retrieved on 02 November 2023. Available at doi: 10.3390/jcm11247511

Tran, B., Nghiem, S., Afoakwah, C., Ha, G., Doan, L., Nguyen, T., Le, T., Latkin, C., Ho, C. & Ho, R. 2020. Global mapping of interventions to improve the quality of life of patients with cardiovascular diseases during 1990-2018. Health & Quality of Life Outcomes, 18(1), pp. 1–10. Retrieved on 27 January 2023. Available at doI: 10.1186/s12955-020-01507-9

Wang, B., Gan L., Deng, Y., Zhu, S., Li, G., Nasser, M.I., Liu, N., Zhu, P. 2022. Cardiovascular Disease and Exercise: From Molecular Mechanisms to Clinical Applications. Retrieved on 02 November 2023. Available at doi: 10.3390/jcm11247511

Wang, Y., Xu, D. 2017. Effects of aerobic exercise on lipids and lipoproteins. Retrieved on 02 November 2023. Available at https://lipidworld.biomedcentral.com/articles/10.1186/s12944-017-0515-5

Appendix 1: Research articles incorporated in the literature review

Authors, publication, year	Purpose of the study	Research design	Main results
Haraldstad, K., Wahl, A., Andenæs, R., Andersen, J. R., Andersen, M. H., Beisland, E., Borge, C. R., Engebretsen, E., Eisemann, M., Halvorsrud, L., Hanssen, T. A., Haugstvedt, A., Haugland, T., Johansen, V. A., Larsen, M. H., Løvereide, L., Løyland, B., Kvarme, L. G., Moons, P., Norekvål, T. M., Ribu, L., Rohde, G. E., Urstad, K. H., Helseth, S. & LIVSFORSK network. A systematic review of quality of life research in medicine and health sciences. 2019.	The purpose of the study was to systematically review the evidence on the effectiveness of different interventions for preventing obesity in children and adolescents.	Systematic review	Global quality of life uses a range of targeted populations, study methodologies, and quality of life measurements. To be specific, combining diet, exercise, and behavioral therapy is the best way to prevent obesity in children and adolescents.
Agostinis-Sobrinho, C., Werneck, AO., Kievišienė, J., Moreira, C., Ramírez-Vélez, R., Rosário, R., Norkiene, S., Lopes, L., Mota, J., Santos, R. Ideal Cardiovascular Health Status And Health-Related Quality Of Life In Adolescents: The Lambed Physical Activity Study. 2020.	The goal of this research was to explore the relationship regarding young people's health-related quality of life and the ICVD index.	A cross-sectional study	There is a strong correlation exists between health related quality of life and cardiovascular system.
Muscogiuri, G., Tuccinardi, D., Nicastro, V., Barrea, L., Colao, A., Savastano.	The objective of this article is to provide a summary of the most	Systematic literature review.	This article indicates an increasing number of research proved

	recent studies on the relationship between excess weight and Sleep Disorders and the effects of Sleep Disorders on heart disease in obese individuals, with particular emphasis on following cardiac factors, such as high blood pressure, diabetes and dyslipidemia.		that Sleep Disorders could enhance and/or may contribute to the worsening of the cardiovascular risk associated with obesity. Because chronic low-grade inflammation associated with obesity has been reported to increase the risk of developing hypertension, type 2 diabetes, and dyslipidemia.
Sleep disturbances: one of the culprits of obesity-related cardiovascular risk?. 2020.			
Kohansieh, M., Makaryus, A.N. Sleep Deficiency and Deprivation Leading to Cardiovascular Disease. 2015.	The study explores how important sleep is because it not only affects negatively the well-being of emotion, mentality, and physiology, but also has a variety of adverse effects leading to cardiovascular diseases.	Narrative review	Insomnia, acute total sleep deprivation, partial sleep deprivation, and night shift employees are the four distinct types of sleep that are discussed in the article. It also establishes the association between the decrease of quality and quantity of sleep and endothelial dysfunction which is related to the cardiovascular system.

Satija, A., Hu, F.B. Plant-based diets and cardiovascular health. 2018.	This study is to examine the available evidence concerning the connection between plant-based diets and cardiovascular disease (CVD). Cardiovascular disease, a major global cause of mortality, encompasses various conditions such as heart disease, stroke, and peripheral artery disease.	Narrative review, that collects the information gathered through randomized controlled trials and details searches of the PubMed and Google Scholar databases.	The authors also examined the possible ways in which plant-based diets might mitigate the risk of CVD. One mechanism involves the potential for plant-based diets to reduce hypertension. Another mechanism is their ability to enhance blood cholesterol profiles. Additionally, these diets may contribute to inflammation reduction and promote better insulin sensitivity, both critical factors in preventing CVD.
Richardson, L.A., Izuora, K., Basu, A. Mediterranean Diet and Its Association with Cardiovascular Disease Risk Factors: A Scoping review. 2022.	The purpose of this study is to examine the available evidence regarding the association between Mediterranean diets and risk factors for cardiovascular disease (CVD). Mediterranean diets are characterized by a significant	Systematic review and meta-analysis. The authors conducted a comprehensive search across electronic databases to identify studies examining the connection between	Mediterranean diets are linked to a decreased risk of cardiovascular disease (CVD) risk factors, such as hypertension, high cholesterol, and obesity. These diets are typically low in saturated fat and cholesterol, while being rich in fiber,

	consumption of fruits, vegetables, whole grains, legumes, nuts, and seeds, with moderate consumption of fish and poultry, and limited intake of red meat and processed foods.	Mediterranean diets and risk factors for cardiovascular disease (CVD).	antioxidants, and other nutrients beneficial for heart health. The authors recommend Mediterranean diets as a safe and effective method for reducing CVD risk factors and suggest considering them as a primary approach to prevention and treatment.
Nestel, P.J., Mori, T.A. Dietary pattern, dietary nutrients and cardiovascular disease. 2022.	The study you mentioned aims to offer a thorough overview of the existing evidence concerning the connection between dietary patterns, dietary nutrients, and cardiovascular disease (CVD). Cardiovascular disease, a prominent global cause of mortality, encompasses various conditions such as heart disease, stroke, and peripheral artery disease.	A narrative review. The study offers an extensive summary of the existing data concerning the correlation between dietary patterns, dietary constituents, and cardiovascular disease. The authors systematically analyze evidence from diverse sources,	A well-balanced diet can positively influence several cardiovascular disease (CVD) risk factors. Additionally, eating patterns that are abundant in fruits, vegetables, whole grains, legumes, nuts, seeds, while minimizing saturated fats, red meat, and processed foods are linked to a reduced CVD risk. Certain dietary components, including fiber, antioxidants, and omega-3 fatty acids, are pivotal in decreasing the risk of

			presenting an impartial evaluation of its merits and limitations.	CVD. Both dietary habits and specific nutrients have significant roles in CVD prevention.
Tian D., Meng J. Excercise for Prevention and Relief of Cardiovascular Disease: Prognoses, Mechanisms, and Approaches. 2019.	This study examine how adopting a plant-based diet influences the composition of the gut microbiome and its impact on cardiovascular disease (CVD) risk factors in adults diagnosed with type 2 diabetes.	Systematic literature review		This review is that a plant-based diet may be an effective way to improve gut health and reduce CVD risk factors in adults with type 2 diabetes.
Wang B., Gan L., Deng Y., Zhu S., Li G., Nasser M.I., Liu N., Zhu P. Cardiovascular Disease and Exercise: From Molecular Mechanisms to Clinical Applications. 2022.	The aim of this study is to explore how a plant-based diet impacts cardiometabolic risk factors and body composition in adults who are overweight or obese.	Systematic literature review		This study suggests that adopting a plant-based diet could effectively lower cardiometabolic risk factors and enhance body composition in adults dealing with overweight or obesity. Consequently, it may serve as a valuable dietary choice for individuals in this

			category by mitigating their vulnerability to cardiovascular disease (CVD) and other chronic health issues.
Nystoriak M.A., Bhatnagar, A. Cardiovascular Effects and Benefits of Exercise. 2018.	The primary aim of this study is to provide an overview of the existing evidence regarding the impact of exercise on cardiovascular health. The authors of this study delve into the physiological changes that transpire within the cardiovascular system as a consequence of physical activity, along with the potential pathways through which exercise could offer protection against cardiovascular disease (CVD).	Narrative review	The central finding of this study is that exercise yields a range of favorable impacts on the cardiovascular system and can diminish the likelihood of developing cardiovascular disease (CVD).
Wang, Y., Xu, D. Effects of aerobic exercise on lipids and lipoproteins. 2017.	This study aims to explore how aerobic exercise influences blood lipids and lipoproteins. Blood	Systematic literature review	The primary finding from the study provided is that aerobic exercise is a successful approach

	lipids are fat-based substances present in the bloodstream, and lipoproteins are the carriers responsible for transporting these lipids throughout the body.		for lowering blood lipids and enhancing cardiovascular health in adults with dyslipidemia.
	This study seeks to assess the impact of physical activity and exercise on the cardiovascular system, risk factors associated with cardiovascular diseases, and to deliberate on the potential mechanisms through which these effects occur.	Narrative review	The primary outcomes of this investigation reveal that physical activity and exercise offer a range of advantageous impacts on the cardiovascular system and can diminish the likelihood of cardiovascular disease (CVD). These findings align with a substantial body of research demonstrating the favorable effects of physical activity and exercise on cardiovascular health. Engaging in regular physical activity stands as one of the most effective measures to mitigate the risk of CVD and

			enhance overall health and well-being.

Appendix 2. JBI Appraisal Checklist For Systematic Reviews And Research Syntheses

JBI CRITICAL APPRAISAL CHECKLIST FOR SYSTEMATIC REVIEWS AND RESEARCH SYNTHESES

Reviewer_____Date_____

Author_____ Year_____ Record Number_____

		Yes	No	Unclear	Not applicable
1.	Is the review question clearly and explicitly stated?	☐	☐	☐	☐
2.	Were the inclusion criteria appropriate for the review question?	☐	☐	☐	☐
3.	Was the search strategy appropriate?	☐	☐	☐	☐
4.	Were the sources and resources used to search for studies adequate?	☐	☐	☐	☐
5.	Were the criteria for appraising studies appropriate?	☐	☐	☐	☐
6.	Was critical appraisal conducted by two or more reviewers independently?	☐	☐	☐	☐
7.	Were there methods to minimize errors in data extraction?	☐	☐	☐	☐
8.	Were the methods used to combine studies appropriate?	☐	☐	☐	☐
9.	Was the likelihood of publication bias assessed?	☐	☐	☐	☐
10.	Were recommendations for policy and/or practice supported by the reported data?	☐	☐	☐	☐
11.	Were the specific directives for new research appropriate?	☐	☐	☐	☐

Overall appraisal: Include ☐   Exclude ☐   Seek further info ☐

Comments (Including reason for exclusion)

Appendix 3. JBI Critical Appraisal Checklist For Textual Evidence: Narrative

JBI CRITICAL APPRAISAL CHECKLIST FOR TEXTUAL EVIDENCE: NARRATIVE

Reviewer_____Date_____

Author_____Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Is the generator of the narrative a credible or appropriate source?	☐	☐	☐	☐
2. Is the relationship between the text and its context explained? (where, when, who with, how)	☐	☐	☐	☐
3. Does the narrative present the events using a logical sequence so the reader or listener can understand how it unfolds?	☐	☐	☐	☐
4. Do you, as reader or listener of the narrative, arrive at similar conclusions to those drawn by the narrator?	☐	☐	☐	☐
5. Do the conclusions flow from the narrative account?	☐	☐	☐	☐
6. Do you consider this account to be a narrative?	☐	☐	☐	☐

Overall appraisal: Include ☐   Exclude ☐   Seek further info ☐

Comments (Including reason for exclusion)

Appendix 4. JBI Critical Appraisal Checklist For Analytical Cross-Sectional Studies

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer_____Date_____

Author_____ Year_____ Record Number_____

	Yes	No	Unclear	Not applicable
1. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
2. Were the study subjects and the setting described in detail?	☐	☐	☐	☐
3. Was the exposure measured in a valid and reliable way?	☐	☐	☐	☐
4. Were objective, standard criteria used for measurement of the condition?	☐	☐	☐	☐
5. Were confounding factors identified?	☐	☐	☐	☐
6. Were strategies to deal with confounding factors stated?	☐	☐	☐	☐
7. Were the outcomes measured in a valid and reliable way?	☐	☐	☐	☐
8. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐   Exclude ☐   Seek further info ☐

Comments (Including reason for exclusion)

Appendix 5. Evaluation quality of studies

Study		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Total
Haraldstad et al. 2019	$	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11/11
Agostinis-Sobrinho et al. 2020	*	Y	Y	Y	Y	Y	Y	Y	Y				8/8
Muscogiuri et al. 2020	$	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11/11
Kohansieh et al. 2015	&	Y	Y	Y	Y	Y	Y						6/6
Satija et al. 2018	&	Y	Y	Y	Y	Y	N						5/6
Richardson et al. 2022	$	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11/11
Nestel et al. 2022	&	Y	Y	Y	Y	Y	N						5/6
Tian et al. 2019	$	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11/11
Wang et al. 2022	$	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	9/11
Nystoriak et al. 2018	&	Y	Y	Y	Y	Y	N						
Wang et al. 2017	$	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11/11
Gronek et al. 2020	&	Y	Y	Y	Y	Y	Y						

Y = Yes, N = No, ? = Unclear, JBI critical appraisal checklist for narrative (&) / systematic review ($) / analytical cross-sectional studies (*)