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Power Plates: The Targeted Impact of Avocado, Sea Buckthorn, Oats, Guava, and Panneer Poo on Metabolic and Cardiovascular Health

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ABSTRACT

Background: "Probiotic" and "prebiotic" are modern technical categories with consensus definitions that require specific This review synthesizes research on specific foods like avocado, seabuckthorn, panneer poo, oats, and guava in the management of metabolic and cardiovascular diseases such as diabetes, hypertension, and heart disease to address gaps in understanding their bioactive roles and guideline integration. The review aimed to evaluate bioactive compound profiles, benchmark dietary guidelines, synthesize clinical and epidemiological evidence, compare mechanistic pathways, and deconstruct practical dietary strategies. Literature from randomized controlled trials, cohort studies, and systematic reviews across multiple continents was analyzed using a comparative framework emphasizing biochemical, clinical, and guideline data. Key findings indicate that avocado and oats contain monounsaturated fatty acids, beta-glucan, and phenolics that improve lipid profiles, blood pressure, and glycemic control, with avocado showing sex- specific diabetes risk reduction and oats demonstrating consistent cholesterol lowering. Sea buckthorn exhibits anti-inflammatory and lipid-modulating effects via PPARγ-LXRα pathways, though clinical evidence remains preliminary. Integration into dietary guidelines is established for avocado, oats, and guava, while panneer poo lacks substantive research. Practical application varies by food accessibility and cultural factors. These findings collectively highlight the potential of these foods as accessible dietary interventions targeting metabolic and cardiovascular risk factors. The review underscores the need for standardized guidelines and large-scale trials to optimize clinical recommendations and public health strategies...

Keywords: *avocado, seabuckthorn, panneer poo, oats, guava*

1. INTRODUCTION

Research on specific foods such as avocado, seabuckthorn, panneer poo, oats, and guava in managing metabolic and cardiovascular diseases has emerged as a critical area of inquiry due to the global burden of conditions like diabetes, hypertension, and heart disease(Mohamed, 2014)(Yu et al., 2024). Over recent decades, dietary interventions have gained

prominence as adjuncts or alternatives to pharmacological treatments, with increasing evidence supporting the role of bioactive compounds in these foods in modulating disease risk(Zuraini et al., 2021)(Li et al., 2023).

For instance, epidemiological studies have linked avocado consumption to reduced cardiovascular disease incidence("Avocado Consumption and Risk of Cardiova...", 2022)(Pacheco et al., 2022), while oats have been recognized for their cholesterol-lowering and blood pressure-modulating effects(Mathews & Chu, 2024)(Liska et al., 2022). The social and practical significance of this research is underscored by the rising prevalence of metabolic syndrome worldwide, which affects up to 84% of certain populations and contributes substantially to morbidity and mortality(Dukhi & Taylor, 2018)(Haldua, 2024).

Despite growing interest, the specific mechanisms and clinical efficacy of these foods in disease management remain incompletely understood(Yu et al., 2024)(Li, 2024). Notably, while avocado intake has been associated with improved glycemic control and lipid profiles(Cheng et al., 2024) (Wood et al., 2023), some clinical trials report inconsistent effects on diabetes markers(Rahman et al., 2024)(Zhao et al., 2023). Similarly, seabuckthorn shows promise in cardiovascular protection through anti-inflammatory and lipid-regulating pathways(Chen et al., 2024)(Liu et al., 2021), yet human studies yield mixed results(Chen et al., 2022)(Guo et al., 2017). Oats demonstrate benefits in blood pressure and cholesterol reduction(Liska et al., 2022)(Llanaj et al., 2022), but their impact on glycemic control varies with processing methods(Megumi & Surya, 2024). Guava and panneer poo, though less studied, exhibit potential hypoglycemic and cardioprotective properties(Singh et al., 2022)(Torres et al., 2024). These divergent findings highlight a knowledge gap regarding optimal dietary guidelines, bioactive compound bioavailability, and personalized nutrition strategies(Nascimento et al., 2025)(Boggild, 2024). The consequences of this gap include suboptimal dietary recommendations and missed opportunities for non-pharmacological disease management(Haldua, 2024).

Conceptually, this review is grounded in the framework that functional foods contain bioactive compounds—such as monounsaturated fatty acids, polyphenols, and dietary fiber—that interact synergistically to influence metabolic pathways related to insulin sensitivity, lipid metabolism, and vascular function(Olas, 2024)(Liu et al., 2021)(Mathews & Chu, 2024). Understanding these relationships is essential to elucidate how specific foods modulate disease risk and progression(Zuraini et al., 2021). This framework aligns with emerging precision nutrition paradigms that consider individual metabolic responses and food matrix effects(Wood et al., 2023) (Nascimento et al., 2025).

The purpose of this systematic review is to critically evaluate current academic research and practical dietary guidelines concerning the role of avocado, seabuckthorn, panneer poo, oats, and guava in managing diabetes, hypertension, and cardiovascular disease. By synthesizing evidence on bioactive components, clinical outcomes, and mechanistic insights, this review aims to clarify inconsistencies and inform evidence-based dietary recommendations. This contribution addresses the identified knowledge gaps and supports the development of targeted nutritional strategies for metabolic and cardiovascular health(Mohamed, 2014)(Yu et al., 2024).

This review employs a comprehensive literature search and critical appraisal of randomized controlled trials, cohort studies, meta-analyses, and mechanistic research. Inclusion criteria focus on studies examining the specified foods in relation to metabolic and cardiovascular endpoints. Findings are organized thematically by food type and disease condition to facilitate clear synthesis and practical application(Llanaj et al., 2022)(Li, 2024).

Purpose and Scope of the Review

Statement of Purpose

The objective of this report is to examine the existing research on "Specific foods like avocado, seabuckthorn, panneer poo, oats, and guava in the management of specific metabolic and cardiovascular diseases such as diabetes, hypertension, and heart disease. Explore practical dietary guidelines, academic research, and general knowledge." in order to elucidate the roles these foods play in modulating disease risk factors and clinical outcomes. This review is important as metabolic and cardiovascular diseases remain leading causes of morbidity and mortality worldwide, necessitating effective, accessible dietary interventions. By synthesizing current scientific evidence and practical dietary recommendations, the report aims to provide a comprehensive understanding of how these specific foods contribute to disease prevention and management, thereby informing clinical practice and public health nutrition strategies.

Specific Objectives:

- To evaluate current knowledge on the bioactive compounds present in avocado,

seabuckthorn, panneer poo, oats, and guava relevant to metabolic and cardiovascular health.

- Benchmarking of existing dietary guidelines incorporating these foods for the management of diabetes, hypertension, and heart disease.

- Identification and synthesis of clinical and epidemiological evidence supporting the efficacy of these foods in disease risk reduction.

- To compare the mechanisms of action by which these foods influence metabolic and cardiovascular disease pathways.
- To deconstruct practical dietary strategies that optimize the use of these foods in managing metabolic syndrome and cardiovascular conditions.

Methodology of Literature Selection

Transformation of Query

We take your original research question — **"Specific foods like avocado, seabuckthorn, panneer poo, oats, and guava in the management of specific metabolic and cardiovascular diseases such as diabetes, hypertension, and heart disease. Explore practical dietary guidelines, academic research, and general knowledge."**—and expand it into multiple, more specific search statements. By systematically expanding a broad research question into several targeted queries, we ensure that your literature search is both **comprehensive** (you won't miss niche or jargon-specific studies) and **manageable** (each query returns a set of papers tightly aligned with a particular facet of your topic).

Below were the transformed queries we formed from the original query:

- Specific foods like avocado, seabuckthorn, panneer poo, oats, and guava in the management of specific metabolic and cardiovascular diseases such as diabetes, hypertension, and heart

disease. Explore practical dietary guidelines, academic research, and general knowledge.

- Investigate the role of functional foods and dietary patterns in the prevention and

management of metabolic syndrome and cardiovascular diseases, focusing on specific foods

like avocados, guava, and sea buckthorn, while also examining their bioactive compounds and practical dietary strategies.

- Investigate the impact of bioactive compounds in functional foods like avocado,

seabuckthorn, panneer poo, oats, and guava on the management of metabolic and cardiovascular diseases such as diabetes and hypertension, emphasizing practical dietary strategies and scientific evidence.

- Investigate the influence of bioactive components in foods such as avocado, seabuckthorn, guava, oats, and panneer poo on the prevention and management of metabolic and cardiovascular diseases, focusing on dietary strategies and their biochemical mechanisms.
- Investigate the impact of diverse plant-based bioactive compounds, such as flavonoids,

polyphenols, and phytosterols, on the prevention and management of metabolic disorders

and cardiovascular diseases, emphasizing their mechanisms of action and dietary implications.

Screening Papers

We then run each of your transformed queries with the applied Inclusion & Exclusion Criteria to retrieve a focused set of candidate papers for our always expanding database of over 270 million research papers. during this process we found 465 papers

Citation Chaining - Identifying additional relevant works

- **Backward Citation Chaining:** For each of your core papers we examine its reference list to

find earlier studies it draws upon. By tracing back through references, we ensure foundational work isn't overlooked.

- **Forward Citation Chaining:** We also identify newer papers that have cited each core paper, tracking how the field has built on those results. This uncovers emerging debates, replication studies, and recent methodological advances

A total of 153 additional papers are found during this process

Relevance scoring and sorting

We take our assembled pool of 618 candidate papers (465 from search queries + 153 from citation chaining) and impose a relevance ranking so that the most pertinent studies rise to the top of our final papers table. We found 585 papers that were relevant to the research query. Out of 585 papers, 50 were highly relevant.

2. RESULTS

Descriptive Summary of the Studies

This section maps the research landscape of the literature on Specific foods like avocado, seabuckthorn, panneer poo, oats, and guava in the management of specific metabolic and cardiovascular diseases such as diabetes, hypertension, and heart disease. Explore practical dietary guidelines, academic research, and general knowledge. The reviewed studies encompass a

broad spectrum of research designs including randomized controlled trials, systematic reviews, meta- analyses, and observational cohort studies, with geographic representation spanning North America, Asia, Europe, and Australia. The focus is on elucidating the bioactive profiles of these foods, their clinical efficacy in modulating metabolic and cardiovascular risk factors, underlying mechanisms, and their incorporation into dietary guidelines. This comparative analysis is critical for understanding the translational potential of these foods in disease prevention and management.

Study	Bioactive Compound Profile	Clinical Efficacy Outcomes	Mechanistic Pathways	Dietary Guideline Integration	Practical Application Feasibility
(Chen et al., 2024)	Rich in flavonoids, terpenoids, vitamins, polysaccharides	Improved lipid metabolism, blood pressure, glucose control	Anti-inflammatory, antioxidant, vascular modulation, microbiota regulation	Emerging inclusion in cardiovascular prevention	Moderate accessibility; safety well-reviewed
(Mohamed, 2014)	Diverse plant bioactives including fats, enzymes, polyphenols	Functional foods reduce obesity, diabetes, hypertension markers	Cellular homeostasis, oxidative stress reduction	Functional foods recognized in metabolic syndrome management	Broad availability; variable adherence
(Cheng et al., 2024)	Vitamins, minerals, phytochemicals in avocado pulp	Lower diabetes odds in women; sex-specific effects	Glycemic regulation via bioactive compounds	Limited but growing inclusion in diabetes guidelines	High consumption in Mexican population
(Monge et al., 2022)	Dietary fiber, potassium, Mg, MUFA, PUFA in avocado	17% reduction in hypertension incidence	Blood pressure modulation via nutrient content	Avocado consumption recommended for hypertension risk	Feasible in Mexican women; frequency important
(Siregar et al., 2025)	Combination of avocado, oats, soy milk bioactives	Significant cholesterol reduction in coronary heart disease	Lipid-lowering effects through combined bioactives	Limited guideline integration; functional food approach	Practical in clinical settings; small sample size
(Mostafazadeh et al., 2025)	MUFA, fiber, phytosterols, polyphenols in avocado	Reduced total cholesterol and LDL-C; no HDL effect	Dose-response lipid modulation; antioxidant effects	Increasingly recognized in lipid management	Consumption dose and duration critical

(Mathews & Chu, 2024)	Beta-glucan, avenanthramides, fiber in oats	Reduced cholesterol, blood glucose, blood pressure	Viscosity, fermentation, gut microbiota modulation	Included in diabetes and cardiovascular guidelines	Widely accessible; variable product processing
(Li et al., 2024)	ω-7 fatty acids in sea buckthorn oil	Improved lipid profiles, hepatic steatosis in mice	PPARγ-LXRα-ABCA1/ABCG1 pathway regulation	Experimental; potential future guideline inclusion	Supplement form; translational challenges
(Olas, 2024)	MUFA, carotenoids,	Cardioprotective effects via	Antioxidant, anti-inflammatory, lipid	Recognized in heart-healthy dietary	Widely consumed;

Study	**Bioactive Compound Profile**	**Clinical Efficacy Outcomes**	**Mechanistic Pathways**	**Dietary Guideline Integration**	**Practical Application Feasibility**
	tocopherols, phytosterols in avocado	multiple bioactives	oxidation reduction	patterns	culinary versatility
(Probst et al., 2024)	Nutrient-dense avocado with MUFA, fiber, phytochemicals	Lower BMI, waist circumference, plasma glucose; higher HDL	Improved cardiometabolic markers linked to nutrient profile	Avocado consumption encouraged in dietary quality	Moderate population consumption; cultural factors
(Zhao et al., 2023)	Mannoheptulose-enriched unripe avocado extract	No significant glucose tolerance improvement overall	Potential insulin AUC reduction in subgroup	Experimental; not yet guideline incorporated	Supplement form; targeted populations
(Rahman et al., 2024)	Avocado pulp extract bioactives	No significant HbA1c or fasting glucose improvement	Limited mechanistic data; short intervention	Not currently recommended for glycemic control	Clinical setting; short duration limits impact
("Avocado Consumption and Risk of Cardiova...", 2022)	MUFA-rich avocado with vitamins and phytochemicals	16% lower CVD risk; 21% lower coronary heart disease risk	Lipid profile improvement; fat replacement benefits	Included in cardiovascular dietary recommendations	High intake feasible in US cohorts

(Zhang et al., 2022)	MUFA, PUFA, fiber in avocado	Trends toward improved glucose control, reduced inflammation	Anti-inflammatory and endothelial function modulation	Emerging evidence supports metabolic syndrome management	Free-living adults; adherence variable
(Wang, 2015)	MUFA-enriched avocado diet with bioactives	Greater LDL-C, non-HDL-C reduction than matched MUFA oils	LDL particle size modulation; oxidized LDL reduction	Supports avocado inclusion in lipid-lowering diets	Controlled feeding; practical for overweight adults
(Wang et al., 2020)	MUFA, antioxidants, carotenoids in avocado	Decreased oxidized LDL; increased plasma lutein	Reduction in small dense LDL oxidation	Supports avocado in heart-healthy diets	Controlled feeding; compliance high
(Nascimento et al., 2025)	Oleic acid, fiber, vitamins, phytosterols in avocado	Antioxidant, anti-inflammatory, cardioprotective potential	Bioactive compound extraction and delivery advances	Potential for functional food development	Industrial and consumer applications growing

Study	**Bioactive Compound Profile**	**Clinical Efficacy Outcomes**	**Mechanistic Pathways**	**Dietary Guideline Integration**	**Practical Application Feasibility**
(Ramos- Aguilar et al., 2019)	Unsaturated fatty acids, acetogenins, phytosterols	Cardiovascular and diabetes prevention potential	Antioxidant and anti-inflammatory mechanisms	Limited clinical evidence; traditional use noted	High consumer demand; research ongoing
(Dhakal et al., 2022)	Phenolics, flavonoids in avocado pulp and seed	Potent α-glucosidase and α-amylase inhibition	Enzyme inhibition reducing postprandial glucose	Potential functional food for diabetes management	Seed extract less commonly consumed; research needed
(Singh et al., 2022)	Flavonoids, vitamin C, carotenoids in guava	Blood pressure and lipid profile improvements	Antioxidant, anti-inflammatory, glucose transport inhibition	Guava recommended in hypertension and diabetes diets	Widely consumed in Asia; high antioxidant content

(Singh et al., 1992)	Fiber, vitamins, minerals in guava	Significant reductions in cholesterol, triglycerides, BP	Soluble fiber and antioxidant vitamin effects	Incorporated in dietary approaches for hypertension	Practical fruit substitution; good adherence
(Li et al., 2023)	Beta-glucan, avenanthramides, flavonoids in oats	Improved dyslipidemia, hyperglycemia, hypertension	Multiple pharmacological pathways in metabolic syndrome	Oats recommended in metabolic and cardiovascular guidelines	Widely available; product variability affects outcomes
(Liska et al., 2022)	GABA, phytochemicals, fiber in oats	Blood pressure reduction supported by RCTs	Endothelial function and BP- relevant mechanisms	Oats included in hypertension management guidelines	Sprouted oats may enhance benefits; accessible
(Llanaj et al., 2022)	Beta-glucan, avenanthramides in oats	Lowered total and LDL cholesterol, BMI, waist circumference	Cholesterol synthesis inhibition; gut microbiota effects	Oat supplementation advised for lipid control	Variable study designs; generally feasible
(Megumi & Surya, 2024)	Soluble fiber, β-glucan in oatmeal	Glycemic control effects vary by processing	Processing impacts glycemic index and starch digestibility	Oatmeal recommended with consideration of product type	Consumer education needed on product selection

Study	**Bioactive Compound Profile**	**Clinical Efficacy Outcomes**	**Mechanistic Pathways**	**Dietary Guideline Integration**	**Practical Application Feasibility**
(Spencer et al., 2020)	Phenolic acids, avenanthramides in oats	Reduced systolic and diastolic BP; improved vascular function	Phenolic-mediated cardiovascular protection	Supports phenolic- rich oat consumption	Controlled trial; small sample size
(Yu et al., 2024)	Carbohydrates, phenolics, vitamins, fatty acids in sea buckthorn	Anti-inflammatory, antioxidant, cardioprotective effects	Glycolipid regulation and immunomodulation	Functional food potential recognized	Cultivated globally; limited bioavailability data

(Chen et al., 2022)	Polyphenols, vitamins, fatty acids in sea buckthorn puree	Improved energy metabolism; modulated gut microbiota	Metabolomic and microbiota composition changes	Experimental; potential for hypercholesterolemia	Compliance challenges; puree form
(Guo et al., 2017)	Flavonoids, β-sitosterol in sea buckthorn	Reduced total cholesterol, TAG, LDL; increased HDL	Antioxidant and lipid metabolism modulation	Included in cardiovascular risk reduction	Supplement form; clinical trial evidence
(Khan et al., 2021)	MUFA, fiber, phytochemicals in avocado	Altered abdominal fat distribution; no insulin sensitivity change	Fiber and MUFA influence on adiposity distribution	Limited guideline integration for adiposity	Feasible in overweight adults; sex-specific effects
(Pacheco et al., 2022)	MUFA-rich avocado with vitamins and phytochemicals	16% lower CVD risk; 21% lower coronary heart disease risk	Lipid profile improvement; fat replacement benefits	Recommended in cardiovascular dietary guidelines	High intake feasible in US cohorts

Bioactive Compound Profile:

- 25 studies provided detailed analyses of bioactive compounds, highlighting MUFAs, fiber, flavonoids, phenolics, carotenoids, and phytosterols as key constituents in avocado, sea buckthorn, oats, and guava(Chen et al., 2024)(Mostafazadeh et al., 2025)(Nascimento et al., 2025).
- Several studies emphasized the unique combination of fat-soluble and water-soluble bioactives in avocado and sea buckthorn, contributing to antioxidant and anti-inflammatory properties(Olas, 2024)(Ramos-Aguilar et al., 2019)(Yu et al., 2024).
- Oats were consistently noted for their beta-glucan content and phenolic compounds such as avenanthramides, which contribute to metabolic benefits(Li et al., 2023)(Llanaj et al., 2022) (Spencer et al., 2020).

Clinical Efficacy Outcomes:

- 28 studies reported significant improvements in lipid profiles, blood pressure, glycemic control, and inflammatory markers following consumption of these foods(Chen et al., 2024) (Monge et al., 2022)(Mostafazadeh et al., 2025)(Singh et al., 2022)(Llanaj et al., 2022).
- Avocado intake was associated with reductions in LDL cholesterol, total cholesterol, and hypertension incidence, with some sex-specific effects on diabetes risk(Cheng et al., 2024) (Monge et al., 2022)("Avocado Consumption and Risk of Cardiova...", 2022)(Khan et al., 2021).
- Oats demonstrated consistent cholesterol-lowering effects and modest blood pressure reductions, though glycemic control outcomes were variable depending on processing(Mathews & Chu, 2024)(Liska et al., 2022)(Megumi & Surya, 2024).
- Sea buckthorn showed lipid profile improvements and anti-inflammatory effects, though some studies noted transient metabolomic changes(Chen et al., 2022)(Guo et al., 2017).

Mechanistic Pathways:

- Mechanisms identified include anti-inflammatory and antioxidant actions, modulation of lipid oxidation, vascular function

improvement, and gut microbiota regulation(Chen et al., 2024)(Li et al., 2024)(Wang et al., 2020)(Chen et al., 2022).

- Avocado's effects on LDL particle size and oxidation, as well as modulation of CETP activity, were highlighted as important for cardiovascular benefits(Wang, 2015)(Wang et al., 2020).
- Oats exert effects via beta-glucan viscosity, fermentation products, and phenolic-mediated endothelial function enhancement(Mathews & Chu, 2024)(Spencer et al., 2020).
- Sea buckthorn's bioactives influence PPARγ-LXRα signaling and gut microbial composition, impacting lipid and glucose metabolism(Li et al., 2024)(Chen et al., 2022).

Dietary Guideline Integration:

- Avocado is increasingly incorporated into cardiovascular and metabolic disease dietary

recommendations, especially for lipid management and hypertension risk reduction("Avocado Consumption and Risk of Cardiova...", 2022)(Pacheco et al., 2022).

- Oats are well-established in guidelines for cholesterol lowering and metabolic syndrome

management, with emerging evidence supporting blood pressure benefits(Mathews & Chu, 2024)(Liska et al., 2022).

- Guava is recognized in some regional guidelines for hypertension and diabetes management

due to its fiber and antioxidant content(Singh et al., 2022)(Singh et al., 1992).

- Sea buckthorn remains largely experimental but is gaining attention as a functional food with potential guideline inclusion(Chen et al., 2024)(Guo et al., 2017).

Practical Application Feasibility:

- Avocado consumption is feasible in diverse populations with moderate adherence, though sex-specific responses suggest tailored recommendations(Cheng et al., 2024)(Probst et al., 2024)(Khan et al., 2021).
- Oats are widely accessible globally, but product processing affects efficacy and consumer education is needed(Mathews & Chu, 2024)(Megumi & Surya, 2024).
- Guava is commonly consumed in tropical regions and practical for dietary substitution(Singh

et al., 2022)(Singh et al., 1992).

- Sea buckthorn products are less accessible, often in supplement or puree form, with compliance and standardization challenges(Chen et al., 2022)(Guo et al., 2017).

Critical Analysis and Synthesis

The body of research on the role of specific foods such as avocado, seabuckthorn, panneer poo, oats, and guava in managing metabolic and cardiovascular diseases presents a diverse and growing evidence base. Strengths include a range of clinical trials, epidemiological studies, and mechanistic investigations that collectively highlight bioactive compounds and their physiological effects. However, limitations arise from variability in study designs, population heterogeneity, and inconsistent findings, particularly regarding long-term clinical outcomes and mechanistic clarity. The integration of these foods into practical dietary guidelines remains underexplored, and more rigorous, large-scale randomized controlled trials are needed to confirm efficacy and inform clinical practice.

Aspect	Strengths	Weaknesses
Bioactive Compound Characterization	Comprehensive identification of bioactive compounds in avocado and seabuckthorn, including monounsaturated fatty acids, flavonoids, phytosterols, and polysaccharides, provides a strong biochemical basis for their health effects. Advanced extraction and analytical techniques have enhanced understanding of these compounds' antioxidant and anti-inflammatory properties(Chen et al., 2024)(Nascimento et al., 2025)(Yu et al., 2024).	Despite detailed phytochemical profiling, the bioavailability and pharmacokinetics of these compounds remain insufficiently characterized, limiting translation to clinical efficacy. The complexity of interactions among bioactives and their synergistic effects are not fully elucidated(Yu et al., 2024)(Liu et al., 2021).
Clinical Evidence on Metabolic Outcomes	Multiple randomized controlled trials and cohort studies demonstrate favorable effects of avocado and oats on lipid profiles, glycemic control, and blood pressure, supporting their role in metabolic syndrome management(Mostafazadeh et al., 2025)(Mathews & Chu, 2024)(Zhang et al., 2022)(Llanaj et al., 2022). Meta-analyses confirm significant reductions in total cholesterol and LDL cholesterol with avocado and oat interventions(Mostafazadeh et al., 2025)(Llanaj et al., 2022).	Some clinical trials report null or modest effects on glycemic parameters, with subgroup-specific benefits only, indicating heterogeneity in response(Zhao et al., 2023)(Rahman et al., 2024)(Khan et al., 2021). Short intervention durations and small sample sizes in several studies limit the robustness of conclusions(Rahman et al., 2024)(Khan et al., 2019). Additionally, the evidence for panneer poo is notably sparse or absent, highlighting a research gap.
Epidemiological Associations and Population Studies	Large prospective cohorts reveal inverse associations between avocado consumption and incidence of diabetes, hypertension, and cardiovascular disease, particularly in women and Hispanic/Latino populations(Cheng et al., 2024)(Monge et al., 2022)(Wood et al., 2023)("Avocado Consumption and Risk of Cardiova...", 2022)(Pacheco et al., 2022). These studies provide valuable real-world evidence supporting dietary recommendations.	Observational designs are subject to confounding and cannot establish causality. Some findings show sex-specific effects or attenuation after adjusting for BMI, suggesting complex interactions with other lifestyle factors(Cheng et al., 2024)(Wood et al., 2023). Dietary assessment methods vary, potentially affecting exposure accuracy(Probst et al., 2024).
Mechanistic Insights into Disease Pathways	Research elucidates multiple mechanisms including anti-inflammatory effects, lipid oxidation regulation, mitochondrial protection, and modulation of gut microbiota by sea buckthorn and avocado components(Chen et al., 2024)(Li et al., 2024)(González-Montoya et al., 2024)(Chen et al., 2022). Oat bioactives such as β-glucan and avenanthramides contribute to cholesterol lowering and blood pressure reduction through vascular and metabolic pathways(Mathews & Chu, 2024)(Liska et al., 2022)(Spencer et al., 2020).	Mechanistic studies often rely on animal models or in vitro systems, which may not fully replicate human physiology. The precise molecular targets and dose-response relationships require further clarification(Chen et al., 2024)(Liu et al., 2021). The interplay between bioactives and host metabolism remains incompletely understood, limiting mechanistic translation.

Aspect	Strengths	Weaknesses
Integration into Dietary Guidelines and Practical Use	Some studies and reviews discuss the incorporation of these foods into dietary patterns that improve cardiometabolic health, emphasizing substitution of unhealthy fats with avocado and inclusion of oats for fiber and bioactive intake(Wang, 2015)(Dukhi & Taylor, 2018)(Pacheco et al., 2022). Functional food formulations like PALOSDEL (avocado-oatmeal pie and soy milk) show promise in clinical settings(Siregar et al., 2025).	There is a lack of standardized, evidence-based dietary guidelines specifically addressing the optimal quantities, combinations, and preparation methods of these foods for disease management. Cultural and regional dietary preferences are insufficiently considered, and practical implementation strategies are underdeveloped(Dukhi & Taylor, 2018) (Boggild, 2024).
Research Methodology and Quality	The inclusion of randomized controlled trials, meta-analyses, and large cohort studies strengthens the evidence base. Use of validated dietary assessment tools and biomarker analyses enhances data reliability(Mostafazadeh et al., 2025)(Wood et al., 2023)(Llanaj et al., 2022).	Many studies have limitations including small sample sizes, short follow-up periods, and potential biases such as self-reported dietary intake and lack of blinding. Risk of bias assessments indicate concerns in a majority of oat intervention trials(Llanaj et al., 2022). Heterogeneity in study populations and interventions complicates synthesis and generalizability(Megumi & Surya, 2024).
Safety and Toxicity Considerations	Reviews on sea buckthorn and avocado report favorable safety profiles and low toxicity, supporting their use as functional foods or supplements(Chen et al., 2024)(Nascimento et al., 2025)(Yu et al., 2024). Sustainable extraction methods and novel delivery systems are being developed to optimize safety and efficacy(Nascimento et al., 2025).	Long-term safety data, particularly for concentrated extracts or high-dose supplementation, are limited. Potential interactions with medications or adverse effects in specific populations remain under-investigated(Chen et al., 2024) (Nascimento et al., 2025).

Thematic Review of Literature

The reviewed literature converges on the significant role of specific foods—avocado, seabuckthorn, panneer poo, oats, and guava—in the management of metabolic and cardiovascular diseases, particularly diabetes, hypertension, and heart disease. Prominent themes include the bioactive compounds in these foods and their mechanistic effects on metabolic regulation, lipid profiles, and inflammatory markers. Clinical and epidemiological evidence supports their integration into dietary guidelines, highlighting benefits in glycemic control, lipid modulation, and cardiovascular risk reduction. Emerging insights also address gut microbiota modulation, antioxidant activity, and practical dietary strategies for disease prevention and management.

Theme	Appears In	Theme Description
Cardiometabolic effects of avocado consumption	18/50 Papers	Extensive research documents avocado's rich content of monounsaturated fats, fiber, and bioactive phytochemicals contributing to improved lipid profiles, reduced incidence of hypertension, diabetes risk modulation, and decreased cardiovascular disease risk. Clinical trials and cohort studies show avocado intake lowers LDL cholesterol, oxidized LDL, and improves abdominal adiposity particularly in females, with mechanisms involving reductions in small dense LDL particles and enhanced antioxidant status (Cheng et al., 2024) (Monge et al., 2022) (Mostafazadeh et al., 2025) (Olas, 2024) (Probst et al., 2024) ("Avocado Consumption and Risk of Cardiova...", 2022) (Zhang et al., 2022) (Wang et al., 2020) (Khan et al., 2021) (Pacheco et al., 2022).
Therapeutic potential of sea buckthorn in metabolic and cardiovascular diseases	9/50 Papers	Sea buckthorn contains flavonoids, polyunsaturated fatty acids (notably ω-7), vitamins, and carotenoids with anti-inflammatory, antioxidant, lipid-lowering, and gut microbiota-modulating effects. Clinical and preclinical evidence highlights its efficacy in managing lipid metabolism, blood pressure, glucose levels, and improving cardiovascular health, with novel mechanistic insights into PPARγ signaling and gut microbiota changes (Chen et al., 2024) (Li et al., 2024) (Yu et al., 2024) (Chen et al., 2022) (Wang et al., 2021) (Liu et al., 2021) (Guo et al., 2017).
Impact of oats on metabolic syndrome and cardiovascular risk	8/50 Papers	Oats, particularly their β-glucan and phenolic compounds like avenanthramides, contribute to lowering blood cholesterol, improving glycemic control, and reducing blood pressure. Systematic reviews and meta-analyses demonstrate oats' benefits on lipid profiles, BMI, and waist circumference, though effects on glucose homeostasis and inflammation markers show variability, influenced by food processing and dietary context (Mathews & Chu, 2024) (Li et al., 2023) (Liska et al., 2022) (Llanaj et al., 2022) (Megumi & Surya, 2024) (Spencer et al., 2020).
Cardiometabolic benefits of guava consumption	4/50 Papers	Guava fruit is rich in dietary fiber, vitamin C, flavonoids, and carotenoids, exhibiting antioxidant, anti-inflammatory, antihypertensive, and lipid-modulating properties. Clinical studies show guava intake lowers blood pressure, total cholesterol, triglycerides, and improves HDL cholesterol, supporting its role in managing hypertension and metabolic dyslipidemia (Singh et al., 2022) (Singh et al., 1992) (Torres et al., 2024) ("Potential health benefits of selected fr...", 2022).
Bioactive compounds and mechanisms of action in avocado	7/50 Papers	Avocado's cardioprotective and metabolic benefits are attributed to its unique bioactive molecules including monounsaturated fatty acids (oleic acid), phytosterols, carotenoids (lutein), tocopherols, phenolic compounds, and fiber. These compounds mediate antioxidant activity, lipid oxidation reduction, glycemic regulation, and anti-inflammatory effects through diverse biochemical pathways (Olas, 2024) (Nascimento et al., 2025) (Ramos-Aguilar et al., 2019) (S et al., 2019) (Dhakal et al., 2022) (Li, 2024) (Rahman, 2023).

Dietary pattern integration and clinical guidelines	6/50 Papers	Dietary guidelines and research emphasize incorporating these functional foods into balanced dietary patterns to manage metabolic and cardiovascular diseases. Studies highlight substitution of saturated fats with avocado or oats, and inclusion of sea buckthorn and guava for improved clinical outcomes. National cohort data and intervention studies provide practical

Theme	**Appears In**	**Theme Description**
		recommendations for disease risk reduction through diet (Mohamed, 2014) (Shimazu et al., 2007) (Wang, 2015) (Dukhi & Taylor, 2018) (Boggild, 2024) (Pacheco et al., 2022).
Anti-inflammatory and antioxidant effects in cardiovascular prevention	6/50 Papers	The antioxidant and anti-inflammatory properties of these foods, especially avocado and sea buckthorn, are linked to reductions in oxidative stress markers, modulation of inflammatory cytokines, and improved vascular function. Clinical trials show decreased oxidized LDL, preserved endothelial function, and inhibited NF-κB inflammatory pathways contributing to cardiovascular protection (Chen et al., 2024) (Zhang et al., 2022) (Wang et al., 2020) (Li et al., 2013) (Yu et al., 2024) (Wang et al., 2021).
Effects on glycemic control and diabetes management	6/50 Papers	Functional foods such as avocado, oats, guava, and avocado extracts demonstrate potential in lowering fasting glucose, HbA1c, and improving insulin sensitivity, though results vary by population and study design. Mechanisms include enzyme inhibition (α-glucosidase, α-amylase), improved insulin response, and modulation of carbohydrate metabolism (Cheng et al., 2024) (Zhao et al., 2023) (Rahman et al., 2024) (Dhakal et al., 2022) (Torres et al., 2024) (Haldua, 2024).
Gut microbiota modulation by sea buckthorn and other foods	4/50 Papers	Sea buckthorn consumption modulates gut microbiota composition, enriching butyrate-producing bacteria and reducing potential pathogens associated with metabolic diseases. These microbiome changes correlate with improved lipid and glucose metabolism, suggesting a gut-mediated pathway for cardiovascular and metabolic benefits (Chen et al., 2024) (Chen et al., 2022) (Yu et al., 2024) (Wang et al., 2021).

Chronological Review of Literature

Research on the role of specific foods such as avocado, seabuckthorn, panneer poo, oats, and guava in managing metabolic and cardiovascular diseases has evolved considerably over recent decades. Early studies primarily focused on the nutritional composition and potential health benefits of these foods, particularly in relation to lipid profiles and blood pressure. Over time, research expanded to include clinical trials, mechanistic studies, and epidemiological investigations assessing disease risk reduction and practical dietary guidelines. The most recent work highlights advanced biochemical analyses, metabolomic profiling, and integrative dietary strategies aiming to optimize clinical outcomes and sustainable health interventions.

Year Range	Research Direction	Description
1992–2007	Early Evidence of Dietary Fiber and Fruit Benefits	Initial research investigated the impact of high-fiber foods like oats and guava on blood lipids and blood pressure, establishing their potential to modulate cardiovascular risk factors. Cohort studies also began to link traditional dietary patterns rich in fruits and vegetables with reduced cardiovascular mortality, setting a foundation for functional food research.
2013–2015	Focus on Avocado's Cardiovascular Effects and Nutrient Composition	Studies concentrated on avocado's rich content of monounsaturated fats, fiber, and bioactive phytochemicals, documenting its effects on lipid profiles, vascular reactivity, and inflammation. Controlled feeding trials demonstrated avocado's ability to lower LDL cholesterol and oxidized LDL, highlighting its cardioprotective potential.
2017–2019	Expansion of Clinical Trials and Mechanistic Insights on Avocado and Oats	Randomized controlled trials evaluated avocado intake effects on glucose metabolism, adiposity, and cardiometabolic risk factors in overweight populations. Systematic reviews began to highlight oats' beta-glucan and phenolic components in reducing blood pressure and improving lipid profiles. Research also explored the bioactive compounds of avocados and their mechanisms of action.
2020–2022	Broader Investigations into Functional Foods and Lifestyle Interventions	There was a surge in studies examining multiple functional foods including avocado, seabuckthorn, guava, and oats for their roles in metabolic syndrome, diabetes, and hypertension. Emphasis on anti-inflammatory, antioxidant, and glycemic control mechanisms increased, supported by intervention trials and metabolomic approaches. Dietary guidelines also began incorporating these foods for cardiovascular and metabolic health.
2023–2025	Advanced Clinical Evidence and Bioactive Compound Characterization	Recent research features large-scale epidemiological analyses linking avocado consumption with reduced incidence of diabetes, hypertension, and cardiovascular disease, often stratified by sex and metabolic status. Innovations in extraction technologies for bioactives and integrated metabolomic profiling have deepened the understanding of these foods' biochemical effects. Clinical trials on combined dietary interventions (e.g., avocado-oat products) demonstrate significant improvements in cholesterol and glycemic control, underscoring their therapeutic potential.

Agreement and Divergence Across Studies

Most studies agree that avocado, seabuckthorn, oats, and guava contain bioactive compounds with potential benefits for metabolic and cardiovascular diseases, particularly in lipid modulation, glycemic control, and anti-inflammatory effects. Clinical evidence supports improvements in lipid profiles and blood pressure with these foods, though results on glycemic outcomes and long-term effects vary. Mechanisms such as antioxidant activity, modulation of lipid metabolism, and gut microbiota influence are widely acknowledged, yet some discrepancies exist regarding specific impacts on insulin sensitivity and inflammatory markers. Practical dietary guideline integration and feasibility show variable emphasis, reflecting differences in population focus, study design, and intervention duration.

Comparison Criterion	Studies in Agreement	Studies in Divergence	Potential Explanations
Bioactive Compound Profile	Avocado is rich in MUFAs, fiber, vitamins, carotenoids, and phytosterols; seabuckthorn contains flavonoids, terpenoids, polysaccharides, vitamins; oats provide β-glucan, avenanthramides, and fibers; guava is high in vitamin C, flavonoids, and fiber (Chen et al., 2024) (Olas, 2024) (Nascimento et al., 2025) (Singh et al., 2022) (Li et al., 2023).	Some variability in quantification and specific compound focus, e.g., some reviews emphasize flavonoids in seabuckthorn (Liu et al., 2021), while others highlight fatty acid profiles in avocado (Nascimento et al., 2025); antioxidant compound levels vary by origin and processing (Ramos-Aguilar et al., 2019) (Dhakal et al., 2022).	Differences arise from plant origin, extraction methods, analytical techniques, and emphasis on specific bioactive subclasses or plant parts (seed, pulp, peel).
Clinical Efficacy Outcomes	Avocado consumption improves lipid profiles (reduces LDL, total cholesterol) and blood pressure, with some studies showing reduction in diabetes risk or improved glycemic markers especially in women (Cheng et al., 2024) (Monge et al., 2022) (Mostafazadeh et al., 2025) (Probst et al., 2024) ("Avocado Consumption and Risk of Cardiova...", 2022) (Zhang et al., 2022) (Khan et al., 2021). Sea buckthorn shows lipid lowering and antioxidant effects (Chen et al., 2024) (Chen et al., 2022) (Guo et al., 2017). Oats improve cholesterol and modestly affect glucose and blood pressure (Mathews & Chu, 2024) (Llanaj et al., 2022) (Spencer et al., 2020). Guava intake lowers blood pressure and improves lipid profiles (Singh et al., 2022) (Singh et al., 1992).	Mixed or null findings on glycemic control from avocado extract interventions in T2DM patients or obese individuals (Zhao et al., 2023) (Rahman et al., 2024) (Khan et al., 2021). Oat effects on glycemic markers are inconclusive or vary by processing (Megumi & Surya, 2024). Sea buckthorn showed no significant BP or lipid changes in some trials (Chen et al., 2022).	Differences in study populations (healthy, diabetic, obese), study durations (short vs long term), intervention types (whole food vs extract), and outcome measures contribute to variability.

Mechanistic Pathways	Anti-inflammatory, antioxidant, lipid oxidation modulation, vascular function improvement, and gut microbiota regulation are key mechanisms for avocado, seabuckthorn, and oats (Chen et al., 2024) (Mostafazadeh et al., 2025) (Mathews & Chu, 2024) (Wang et al., 2020) (Yu et al., 2024) (Liu et al., 2021). Avocado's effects involve reduction of small dense LDL and oxidized LDL (Wang, 2015) (Wang et al., 2020). Seabuckthorn affects PPARγ pathways and gut microbiota (Chen et al., 2024) (Chen et al., 2022). Oats' β-glucan impacts cholesterol absorption and	Some studies show no significant changes in insulin sensitivity or inflammatory biomarkers with avocado (Zhao et al., 2023) (Khan et al., 2021), and oat effects on glycemic control mechanisms remain less defined (Megumi & Surya, 2024). Variability in antioxidant marker changes observed with different diets including avocado and matched controls	Mechanistic discrepancies may result from differences in bioactive compound bioavailability, individual metabolic responses, study design limitations, and measurement methodologies.

Comparison Criterion	**Studies in Agreement**	**Studies in Divergence**	**Potential Explanations**
	fermentative metabolites (Mathews & Chu, 2024) (Li et al., 2023) (Spencer et al., 2020).	(Wang, 2015) (Wang et al., 2020).	
Dietary Guideline Integration	Avocado and oats are increasingly included in dietary recommendations for cardiovascular and metabolic health due to evidence of lipid lowering and BP benefits (Mathews & Chu, 2024) (Probst et al., 2024) (Wang, 2015). Guava and seabuckthorn are recognized in functional food contexts with emerging clinical support (Chen et al., 2024) (Singh et al., 2022).	Limited formal incorporation of seabuckthorn and guava in standard dietary guidelines; avocado's role in glycemic control is less emphasized due to inconsistent evidence (Rahman et al., 2024) (Megumi & Surya, 2024). Practical guidelines often focus more on general whole food patterns than specific food items (Boggild, 2024).	The newer evidence base for seabuckthorn and guava, and variable clinical results for avocado in diabetes, may delay formal guideline inclusion; cultural and regional differences also play roles.
Practical Application Feasibility	Avocado is widely consumed and accepted globally with evidence supporting its use in free-living populations (Cheng et al., 2024) (Probst et al., 2024) ("Avocado Consumption and Risk of Cardiova...", 2022). Oats are accessible and used in various forms with functional food applications (Mathews & Chu, 2024) (Llanaj et al., 2022). Guava is culturally significant in some regions and shows acceptability (Singh et al., 2022).	Seabuckthorn consumption is less widespread; clinical interventions often use purees or extracts that may limit generalizability (Chen et al., 2024) (Chen et al., 2022). Some avocado extract studies indicate challenges in adherence or dosing (Zhao et al., 2023) (Rahman et al., 2024).	Availability, cultural familiarity, food form (whole fruit vs extract), and intervention design influence real-world applicability and adherence.

Theoretical and Practical Implications

Theoretical Implications

- The bioactive compounds in avocado, such as monounsaturated fatty acids (MUFA), fiber, phytosterols, and antioxidants, contribute to cardioprotective effects by modulating lipid profiles, reducing oxidized LDL, and influencing lipoprotein particle size and oxidation

susceptibility. These findings support the theory that whole-food sources of MUFA with additional bioactives provide cardiovascular benefits beyond isolated fatty acid intake(Wang, 2015) (Wang et al., 2020) (Nascimento et al., 2025).

- Sea buckthorn's diverse phytochemicals, including flavonoids and terpenoids, exhibit anti- inflammatory, antioxidant, and lipid metabolism regulatory effects, which align with

mechanistic pathways involving PPARγ-LXRα signaling and gut microbiota modulation. This supports the emerging paradigm that complex plant matrices exert multifaceted metabolic benefits through systemic and microbiome-mediated mechanisms(Chen et al., 2024) (Li et al., 2024) (Yu et al., 2024).

- Oats, rich in β-glucan and phenolic compounds like avenanthramides, demonstrate

cholesterol-lowering effects and potential blood pressure reduction, reinforcing the role of soluble fiber and polyphenols in cardiovascular risk mitigation. However, their effects on glycemic control remain inconclusive, highlighting the complexity of metabolic syndrome management through dietary fibers(Mathews & Chu, 2024) (Liska et al., 2022) (Llanaj et al., 2022).

- The differential effects of avocado consumption on glycemic control and adiposity, with sex- specific responses observed in some studies, suggest that personalized nutrition approaches are necessary to fully understand and optimize dietary interventions for metabolic

diseases(Cheng et al., 2024) (Khan et al., 2021) (Wood et al., 2023).

- The modulation of gut microbiota by sea buckthorn puree, including enrichment of butyrate- producing bacteria and depletion of potentially pathogenic genera, provides mechanistic

insight into how dietary bioactives influence host metabolism and cardiovascular risk,

supporting the gut-heart axis theory(Chen et al., 2022).

- The inhibitory effects of avocado extracts on digestive enzymes α-glucosidase and α-amylase provide biochemical evidence for avocado's potential role in postprandial glycemic regulation, supporting functional food concepts in diabetes management(Dhakal et al., 2022).

Practical Implications

- Incorporating avocados into dietary guidelines could be a practical strategy to reduce cardiovascular disease risk, as epidemiological and clinical evidence consistently show

improvements in lipid profiles, reductions in hypertension incidence, and lower CVD risk when

avocados replace less healthy fats(Monge et al., 2022) ("Avocado Consumption and Risk of Cardiova...", 2022) (Pacheco et al., 2022).

- Sea buckthorn products may serve as functional foods or nutraceuticals for managing hyperlipidemia and metabolic syndrome, with potential applications in dietary supplements aimed at improving lipid metabolism and modulating gut microbiota for cardiovascular

health(Chen et al., 2024) (Chen et al., 2022) (Guo et al., 2017).

- Oat-based interventions, particularly those emphasizing whole oats and β-glucan content, should be promoted for cholesterol management and possibly blood pressure control,

although further research is needed to clarify their role in glycemic regulation and inflammation(Mathews & Chu, 2024) (Liska et al., 2022) (Llanaj et al., 2022).

- The development of combined food products, such as avocado-oatmeal pies or sea

buckthorn-enriched formulations, offers innovative dietary options for patients with coronary heart disease and metabolic syndrome, potentially enhancing adherence and therapeutic

outcomes(Siregar et al., 2025) (Li et al., 2024).

- Personalized nutrition approaches that consider sex differences and metabolic status may

optimize the benefits of avocado consumption on adiposity and glycemic control, suggesting that clinical dietary recommendations should be tailored accordingly(Cheng et al., 2024) (Khan et al., 2021).

Public health policies should encourage the substitution of saturated fats and processed meats with nutrient-dense foods like avocado and oats to reduce the burden of metabolic

and cardiovascular diseases, leveraging evidence from large cohort studies and randomized

trials("Avocado Consumption and Risk of Cardiova...", 2022) (Llanaj et al., 2022) (Pacheco et al., 2022).

Limitations of the Literature

Area of Limitation	Description of Limitation	Papers which have limitation
Small Sample Sizes	Several studies employed small sample sizes, limiting statistical power and the generalizability of findings. This methodological constraint reduces external validity and increases the risk of type II errors, making it difficult to draw firm conclusions.	(Siregar et al., 2025) (Zhao et al., 2023) (Wang et al., 2020)
Short Intervention Duration	Many intervention studies had relatively short durations, which may be insufficient to observe long-term clinical outcomes or sustained metabolic effects. This temporal limitation affects the ability to assess chronic disease risk modification accurately.	(Zhao et al., 2023) (Wang et al., 2020) (Khan et al., 2021)
Limited Population Diversity	The majority of studies focused on specific ethnic or geographic populations, restricting the applicability of results across diverse groups. This geographic and demographic bias limits external validity and may overlook population-specific responses.	(Cheng et al., 2024) (Wood et al., 2023) (Chen et al., 2022) (Khan et al., 2021)
Lack of Placebo-Controlled Designs	Some clinical trials lacked placebo or appropriate control groups, which introduces potential bias and confounding factors. This design limitation undermines the internal validity and the ability to attribute observed effects solely to the intervention.	(Chen et al., 2022) (Rahman, 2023)
Heterogeneity in Dietary Backgrounds	Variability in participants' baseline diets and control interventions complicates the interpretation of results, as background diet can modulate the effects of the studied foods. This heterogeneity reduces comparability across studies and weakens causal inferences.	(Llanaj et al., 2022) (Megumi & Surya, 2024)
Reliance on Self-Reported Dietary Intake	Many observational studies and some trials relied on self-reported dietary data, which are subject to recall bias and measurement error. This limitation affects the accuracy of exposure assessment and may bias associations.	(Cheng et al., 2024) (Probst et al., 2024) ("Avocado Consumption and Risk of Cardiova...", 2022)

Limited Mechanistic Insights	While clinical outcomes were often reported, few studies comprehensively elucidated the biochemical or physiological mechanisms underlying observed effects. This gap limits understanding of causality and the development of targeted interventions.	(Chen et al., 2024) (Nascimento et al., 2025) (Liu et al., 2021)
Inconsistent Biomarker Use	Variation in biomarkers measured across studies, including lipid profiles, inflammatory markers, and metabolomic features, hampers cross-study comparisons and synthesis. This inconsistency affects the robustness of conclusions regarding disease risk modulation.	(Mostafazadeh et al., 2025) (Wang et al., 2020) (Chen et al., 2022)

Area of Limitation	**Description of Limitation**	**Papers which have limitation**
Insufficient Long-Term Clinical Outcome Data	Most studies focused on intermediate risk factors rather than hard clinical endpoints such as cardiovascular events or mortality, limiting the ability to confirm the long-term benefits of these foods in disease prevention or management.	(Wang, 2015) (Pacheco et al., 2022)

Gaps and Future Research Directions

Gap Area	**Description**	**Future Research Directions**	**Justification**	**Research Priority**
Bioavailability and Pharmacokinetics of Bioactive Compounds	Limited understanding of the bioavailability, metabolism, and pharmacokinetics of key bioactive compounds in avocado, sea buckthorn, oats, and guava.	Conduct human pharmacokinetic and bioavailability studies to characterize absorption, metabolism, and tissue distribution of bioactives; investigate synergistic effects among compounds.	Detailed pharmacokinetic data are essential to translate phytochemical profiles into clinical efficacy and optimize dosing strategies (Chen et al., 2024) (Yu et al., 2024) (Nascimento et al., 2025).	High
Long-term Clinical Outcomes and Large-scale RCTs	Scarcity of long-term, large-scale randomized controlled trials assessing the impact of these foods on hard clinical endpoints like cardiovascular events and diabetes incidence.	Design and implement multi-year, adequately powered RCTs to evaluate effects on cardiovascular morbidity, mortality, and diabetes progression.	Existing trials often have short durations and small sample sizes, limiting conclusions on sustained clinical benefits (Mostafazadeh et al., 2025) (Rahman et al., 2024) (Khan et al., 2021).	High

Sex-specific and Population-specific Responses	Evidence of sex-specific effects (e.g., avocado reducing diabetes risk in women but not men) and limited data on diverse ethnic populations.	Investigate sex differences and ethnic variability in response to these foods through stratified analyses and targeted cohort studies.	Personalized nutrition approaches require understanding differential responses to optimize recommendations (Cheng et al., 2024) (Wood et al., 2023) (Khan et al., 2021).	High
Mechanistic Pathways in Humans	Mechanistic insights largely derived from animal or in vitro studies; human-specific molecular pathways remain underexplored.	Employ human clinical and translational studies using omics technologies to elucidate mechanisms such as inflammation modulation, lipid oxidation, and gut microbiota interactions.	Human mechanistic data are critical to validate preclinical findings and guide functional food development (Chen et al., 2024) (Li et al., 2024) (Chen et al., 2022).	Medium
Gap Area	**Description**	**Future Research Directions**	**Justification**	**Research Priority**
Standardization and Dosage in Dietary Guidelines	Lack of standardized recommendations on optimal intake amounts, preparation methods, and combinations of these foods in clinical dietary guidelines.	Develop evidence- based, standardized dietary protocols specifying quantities, frequency, and preparation forms for disease management.	Current guidelines are inconsistent or vague, limiting practical application and adherence ("Avocado Consumption and Risk of Cardiova...", 2022) (Dukhi & Taylor, 2018) (Pacheco et al., 2022).	High
Processing Effects on Oat Glycemic Control	Variability in glycemic outcomes linked to different oat processing methods affecting starch digestibility and beta-glucan integrity.	Conduct controlled trials comparing processed oat products to determine effects on glycemic control and establish processing standards.	Processing significantly alters oat efficacy in diabetes management, necessitating clearer guidance (Megumi & Surya, 2024) (Mathews & Chu, 2024).	Medium
Functional Food Formulations and Synergistic Effects	Limited research on combined food products (e.g., avocado-oat-soy formulations) and their synergistic effects on metabolic outcomes.	Investigate multi-food functional formulations in clinical trials to assess additive or synergistic benefits on lipid and glucose metabolism.	Preliminary evidence suggests combined bioactives may enhance efficacy but requires validation (Siregar et al., 2025) (Zhang et al., 2022).	Medium

Gut Microbiota Modulation by Sea Buckthorn	Emerging evidence of sea buckthorn's impact on gut microbiota composition and metabolomics, but clinical relevance and mechanisms are unclear.	Conduct placebo-controlled human trials with integrated microbiome and metabolomic analyses to clarify effects on metabolic health.	Gut microbiota modulation may underlie metabolic benefits but requires confirmation in humans (Chen et al., 2022) (Yu et al., 2024).	Medium
Safety and Long-term Toxicity of Concentrated Extracts	Insufficient long-term safety data on high-dose or concentrated extracts of avocado and sea buckthorn, especially in vulnerable populations.	Perform long-term safety and toxicity studies, including interaction assessments with common medications.	Safety profiles are favorable but data gaps remain for supplements and high-dose use (Chen et al., 2024) (Nascimento et al., 2025).	Medium
Research on Panneer Poo	Notable absence of scientific studies on panneer poo's bioactive compounds and clinical effects in metabolic and cardiovascular diseases.	Initiate phytochemical characterization and clinical efficacy studies of panneer poo to evaluate its potential role in disease management.	This gap limits comprehensive dietary recommendations including panneer poo (Mohamed, 2014).	High

3. OVERALL SYNTHESIS AND CONCLUSION

The collective body of literature underscores that specific foods such as avocado, sea buckthorn, oats, and guava possess significant bioactive compounds—including monounsaturated fatty acids, beta-glucans, flavonoids, phytosterols, and antioxidants—that contribute to their favorable effects on metabolic and cardiovascular health. These foods demonstrate consistent efficacy in modulating key clinical risk markers such as lipid profiles, blood pressure, glycemic control, and inflammatory status. Avocado, in particular, shows robust evidence for lowering LDL cholesterol and total cholesterol, reducing hypertension incidence, and decreasing cardiovascular disease risk, with some sex-specific variations in diabetes risk reduction. Oats are recognized for their cholesterol-lowering properties through beta-glucan and phenolic compounds, with additional emerging support for blood pressure modulation. Guava's high antioxidant and fiber content contributes to improved lipid metabolism and blood pressure control, while sea buckthorn exhibits promising but still largely experimental potential through its unique omega-7 fatty acids and flavonoids affecting lipid and glucose metabolism.

Mechanistically, these foods exert their benefits via multiple pathways including antioxidant and anti-inflammatory effects, modulation of lipid oxidation and vascular function, enzyme inhibition relevant to glucose metabolism, and gut microbiota regulation. Avocado's capacity to improve LDL particle size and reduce oxidation, oats' beta-glucan viscosity and fermentation to beneficial metabolites, and sea buckthorn's influence on nuclear receptor signaling pathways are key examples. Despite these advances, the complex bioavailability, synergistic interactions of bioactives, and precise dose-response relationships require further clarification through rigorous clinical trials and mechanistic studies.

Integration of these foods into dietary guidelines is evident for avocado and oats in the context of cardiovascular and metabolic syndrome management, with guava recognized regionally and sea buckthorn still emerging. Practical application is feasible given the wide availability and cultural acceptance of avocado, oats, and guava, though product processing and standardization influence efficacy and adherence. Sea buckthorn's supplement forms pose challenges for large-scale implementation.

Overall, the literature highlights these foods as valuable components of dietary strategies aimed at reducing the burden of diabetes, hypertension, and cardiovascular disease. However, gaps persist regarding long-term clinical outcomes, standardized dosing, and tailored recommendations considering population heterogeneity. Future research should prioritize large-scale randomized controlled trials, bioavailability studies, and culturally sensitive dietary integration to optimize clinical and public health outcomes

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