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IDOSR JOURNAL OF EXPERIMENTAL SCIENCES 12(1): 59-66, 2026 ISSN: 2579-0781

https://doi.org/10.59298/IDOSR/JES/06/1215966 IDOSRJES12106

Role of Diet in Diabetes Management: Evidence Synthesis

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ABSTRACT

Dietary management plays a central role in the prevention and control of diabetes mellitus, particularly type 2 diabetes (T2D), which constitutes the majority of global diabetes cases. This evidence synthesis examines the role of diet in diabetes management by integrating findings from systematic reviews, meta-analyses, and key clinical trials assessing dietary patterns, nutrient composition, and eating behaviors across diverse populations. The review highlights the physiological mechanisms linking diet to glucose homeostasis, insulin sensitivity, and pancreatic β-cell function, emphasizing the influence of carbohydrate quality and quantity, dietary fiber, fatty acid composition, meal timing, and food processing on glycemic outcomes. Evidence consistently supports the benefits of high-fiber, whole-grain, plant-based, and Mediterranean dietary patterns in improving glycemic control and reducing diabetes risk, while diets high in ultra-processed foods and added sugars are associated with adverse metabolic effects. Nutrient-specific considerations, including protein sources, micronutrients, and antioxidants, further modify disease progression, particularly in individuals with comorbid conditions such as renal disease. The synthesis also underscores the importance of dietary adherence, behavioral strategies, and patient-centered care, as well as the need for tailored recommendations for special populations. Despite strong evidence supporting dietary intervention, gaps remain regarding long-term outcomes, comparative effectiveness, and implementation across diverse socio-cultural contexts. Addressing these gaps is essential to optimizing dietary strategies as a cornerstone of diabetes management.

Keywords: Dietary patterns; Type 2 diabetes; Glycemic control; Nutrition therapy; and Evidence synthesis.

INTRODUCTION

Diabetes is a major global health challenge. Internationally, the condition currently affects approximately 537 million adults, with the vast majority suffering from type 2 diabetes (T2D) [1]. T2D is preventable and controllable, and remission of prediabetic states remains a key focus of prevention efforts. Beyond pharmacological treatment, lifestyle management, especially dietary patterns are a cost-effective strategy for managing T2D and prediabetes [2]. Numerous clinical trials and systematic reviews have quantified the efficacy of different dietary patterns for metabolic glycemic control, and current guidelines suggest individualized medical nutrition therapy supervised by qualified professionals. Recent evidence suggests that the effectiveness of dietary approaches varies by outcome, with diet choice potentially influencing blood glucose more than weight or cardiovascular risk factors [12]. However, selection of the optimal dietary approach for individual patients remains challenging, due in part to the limited availability of direct comparative evidence. Multiple systematic reviews and meta-analyses have attempted to address the question, but these studies have included only a small number of interventions and have neglected short-term effects [14]. Evaluation of the comparative effectiveness of diverse diets on glycemic control, anthropometric measurements, and lipid profiles in patients with T2D and prediabetes is thus warranted to support clinical decision-making [15]. The metabolic foundation supporting the interaction between diet and diabetes centers on glucose homeostasis, insulin dynamics, and endocrine pancreatic β-cell function [12]. Dietary macronutrient composition and flux strongly influence postprandial glucose levels, which remain a key determinant of HbA1c [2].

Physiological Basis of Diet-Diabetes Interactions

The human body primarily controls blood glucose concentrations within the narrow limits of 5.0–6.0 mM [14]. Glucose homeostasis is preserved through a balance between insulin secretion from pancreatic β-cells and increased insulin sensitivity in the peripheral tissues[18]. In this process, the pancreas (via its β-cells) senses blood glucose concentrations and releases insulin to promote glucose uptake in peripheral tissues, particularly muscle and adipose tissues [17]. The imbalance of related hormones (such as glucagon, somatostatin, or incretins), glucose toxicity, free fatty acid (FFA) toxicity, and inadequate β-cell mass and function significantly contribute to the onset and progression of diabetes. Diets rich in free sugars are associated with high circulating FFA, which aggravates insulin resistance and β-cell dysfunction. Excess acute FFA influx is considered a critical factor impairing glucose-mediated insulin secretion [12]. The glycemic index (GI) provides a relatively rapid postprandial evaluation of carbohydrate properties. Different carbohydrate-rich foods elicit different glycemic responses after consumption [2]. Meals and foods that generate similar glucose responses tend to have comparable GI values, but the GI appreciates foods only within the two- to three-hour postprandial window and does not reflect extended-phase metabolism. Hemoglobin A1c (HbA1c) can provide a reflective assessment of overall glucose control over time [3]. The extent and duration of the gastrointestinal absorption process are crucial determinants of glucose response. Diet contributes to β-cell workload through modulation of postprandial glycemic responses and influences glucose control dynamics, leading to various average glucose values and degrees of variability [11]. The number of meals consumed, timing between meals, and the postprandial intervals between multiple daily meals further dictate hormonal dynamics and glycemic outcomes [13].

Dietary Patterns and Glycemic Outcomes

Type 2 diabetes is a global epidemic affecting over 500 million people and costing trillions of dollars [1]. Lifestyle modification, especially dietary change, is a low-cost strategy for diabetes management, yet clinicians face challenges in advising appropriate dietary patterns [3]. Many eating styles, such as high-fat, vegetarian, and others, recommended by the American Diabetes Association have been promoted. The evidence shows that carbohydrate quality and quantity, dietary fiber, and consumption of whole grains all influence glycemic control [3]. Unprocessed plant-based, Mediterranean, and low-glycemic-index diets lower glucose levels and correlate negatively with diabetes incidence [4]. High intake of ultra-processed foods and added sugars associates positively with diabetes onset and complications.

Carbohydrate Quality and Quantity

Contemporary dietary guidelines for managing diabetes recommend macronutrient distributions along with meal timing and frequency 2. Grains and those high in carbohydrates are closely scrutinized [1]. The quality and quantity of carbohydrates, as they relate to type 1 or type 2 diabetes, and considerations about dietary fiber warrant attention, including the extent to which they positively impact glucose control [4]. Insulin's primary role in glucose regulation underlies whether carbohydrate content is more relevant than overall diet quality. To explore this premise, the carbohydrate category was subdivided into quality and quantity. Within each of these categories, the first analysis focused on a common, regulated notion of dietary intake to examine effects through a shared framework [7]. The second analysis zeroed in on carbohydrate quality, anticipating that this characteristic would be paramount in efficacy assessments [2]. Many different term variations exist for carbohydrate amount, especially within scholarly works. The upfront challenge resided in selecting one or more sufficiently regulated or normalised definitions. Unless specified, carbohydrate quantity refers to the mass of digestible carbohydrates [4]. Such quantity is a major carbohydrate feature influencing glycemia. Grains, baked products, confectionery, and sugar-laden foods regularly come under scrutiny for their digested and absorbed carbohydrate levels [5]. In the absence of food descriptions, food tracking represents an effective methodology for delineating these, enabling assessment of overall and constituent dietary intake amounts [5].

Dietary Fiber and Whole Grains

High intake of dietary fiber and whole grains lowers the risk of type 2 diabetes, improves glycemic control, and enhances insulin sensitivity, partly through effects on body weight [1]. The evidence supports increased consumption of whole-grain foods (e.g., whole wheat, oats, barley) among diabetic populations, albeit greater benefit is expected when whole-grain choices have high fiber content [4]. Results from trials assessing blood glucose and insulin responses to either commercial products or habitual sources of whole grains indicate positive effects of oats, barley, and brown rice, with a less promising role for whole wheat and rye. In individuals receiving diabetes treatment, food that contains whole grains should be selected on the basis of dietary fiber content [5].

To date, three systematic reviews summarize the effects of whole-grain intake on glycemic control in diabetes. All conclude that dietary habits featuring whole-grain foods lower the risk of developing type 2 diabetes and improve glycemic control [5]. The review by Della Pepa et al. assesses both epidemiological and interventional studies conducted in adults aged 19-77 years and indicates that glycemic effects depend on the specific whole-grain sources evaluated 6. Ying et al. report similar findings in populations with a broader age range [7].

Fatty Acids and Lipid Control

Dietary fatty acids exert a distinct influence on the metabolism of lipoproteins and lipids while modulating glucose homeostasis in insulin-resistant humans and animals affected by both type 2 diabetes and metabolic syndrome [3]. Fatty acids can be separated into saturated and unsaturated groups, a categorization that has proven helpful for orienting clinical recommendations [1]. A deeper understanding of each fatty-acid group, however, opens additional parameters that bear on dietary formulations for the prevention and management of type 2 diabetes [2]. Analyses of relationships between tissue fatty acids, metabolic functions, and the composition of dietary fats consistently show that unsaturated fatty acids promote metabolic functions and cellular health, while saturated fatty acids promote metabolic dysfunction and cell stress [8]. In determining the relative benefits of total fat, specific types, and amounts, an even greater movement toward unsaturated fatty-acid-dominated dietary fats yields increased advantages, such as addressing postprandial glucose surges, sustaining increased glucose-sensitivity conditions, or improving blood-lipid profiles [7].

Plant-Based and Mediterranean Diets

Plant-based, vegetarian, and Mediterranean dietary patterns collectively emphasize minimizing animal-source foods while promoting consumption of varied plant-based foods and may enhance glycemic control, reduce diabetes risk, and improve overall health [9]. Seminal studies noted improvements in glycemic control with both vegetarian and Mediterranean patterns. Evidence supports the efficacy of plant-based diets in managing type 2 diabetes when practiced alone, in conjunction with other healthy diet principles, or alongside weight-loss interventions [2]. Well-designed, moderate- to high-intensity dietary interventions emphasizing plant-based foods consistently yield greater reductions of hemoglobin A1c than control alternatives [3]. Both Mediterranean and plant-based dietary patterns are widely recommended for preventive health [4].

Processed Foods and Added Sugars

In addition to controlling the quality and quantity of carbohydrates, an important consideration for diabetes management is the processing of food [1]. Ultra-processed foods are products that contain ingredients not typically found in a home kitchen, such as sweeteners, colorings, preservatives, emulsifiers, and hydrolyzed proteins [2]. A recent analysis raised concern that ultra-processed foods are increasingly permeating the food supply, constituting more than 50% of American energy intake and as much as 66% in younger populations [3]. These foods typically have a high glycemic load, low nutritional density, and a poor fatty acid profile [3]. Similar patterns of consumption are observed in many other countries. By contrast, unprocessed or minimally processed foods receive little or no industrial processing and are composed of only one food ingredient, such as fruits, vegetables, and whole grains [4]. Several studies have examined the relationship between ultra-processed food consumption and glycemic control in individuals with prediabetes or type 2 diabetes [4]. A short-term intervention study found that the consumption of ultra-processed foods increased 24-h postprandial glycemia, insulinemia, and glycemic variability compared with unprocessed foods. Ultra-processed foods increased food intake by approximately 500 kcal [2]. Another cross-sectional study showed that ultra-processed food consumption was associated with poorer autonomic and baroreflex heart rate regulation, increased emotional eating, and deteriorating emotional health [12]. The role of added sugars is also important, especially among individuals consuming energy-dense diets. Intake of foods with a low glycemic index does not appear to compensate for excessive consumption of sugar-sweetened beverages, and high sugar-sweetened beverage consumption has been linked to a greater volume of food consumed when caloric intake is measured [13]. An interventional study found that replacing sugar-sweetened beverages with water or no-caloric beverages improved glycemic control in participants with type 2 diabetes or prediabetes [22].

Meal Timing, Frequency, and Weight Management

Different dietary strategies can vary widely with regard to improvement in glycemic control. Dietary strategies that may facilitate improved glycemic control through alteration of meal timing or frequency have been described [11]. These strategies include consumption of three rather than six meals per day, avoidance of consumption of food after 22:00, maintenance of a long interval between the last meal of the previous day and the first meal of the following day, and skipping breakfast [10]. Data from clinical trials and cross-sectional studies have suggested that some of these dietary strategies modify glycemic control in patients with type 2 diabetes [17]. Three separate clinical trials have evaluated the impact of three versus six meals per day in patients with type 2 diabetes receiving pharmacological intervention [20]. While the three-meal regimen did not promote a change in insulin or lipid parameters, a reduction in body weight and hemoglobin A1c occurred in response to the three-meal schedule, and a corresponding increase in circadian clock gene expression was documented[15]. Three additional large cross-sectional studies in patients with type 2 diabetes not receiving pharmacological intervention reported that beds were frequently delayed until after 22:00, and breakfast was often skipped. Both of these behaviors were correlated with elevations in hemoglobin A1C [16].

Nutrient-Specific Considerations

Analyses suggest that a dietary protein intake of 0.8–1.0g/kg body weight per day may be appropriate for patients at risk for diabetic kidney disease 11 and that a protein intake of ≤0.8g/kg (≤10–15% total calories) is safe for patients with established diabetic kidney disease [2]. Because no evidence indicates that high-protein diets accelerate kidney damage in diabetes, dietary protein is not routinely restricted [4]. Protein-energy malnutrition emerges more frequently in dialysis patients with diabetes, and dietary protein intake ≤1.0g/kg body weight already characterizes many patients with diabetic kidney disease [13]. Micronutrients enhance metabolic functions, and antioxidants counteract cellular oxidative damage linked to diabetes complications and endothelial dysfunction [5]. A high-density lipoprotein cholesterol concentration expresses better cardiovascular health than total cholesterol or low-density lipoprotein cholesterol concentrations, but tends to decrease in diabetes [17].

Protein Intake and Renal Considerations

Sufficient protein intake is essential for the repair of damaged tissues, especially in patients with diabetes [1]. Protein sources are important since a high intake of animal protein is associated with a faster decline in renal function and a higher prevalence of renal dysfunction among diabetic patients [19]. It is beneficial to replace animal with vegetable protein, since intake of red meat is positively correlated with renal function impairment, while, conversely, vegetable protein intake is associated with a lower prevalence of renal function impairment in patients without chronic kidney disease [12]. In people with type 2 diabetes, replacing carbohydrates with vegetable protein has been shown to lower glycated hemoglobin (HbA1c) and body weight when protein remains within the normal range [13].

Micronutrients and Antioxidants

Antioxidants and micronutrients are dietary constituents that might influence the course of diabetes. They participate in redox reactions, detoxify reactive oxygen species, and promote the regeneration of other antioxidants [22]. An exhaustive review on the topic concluded that antioxidant micronutrients may improve some diabetes-related cardiovascular risk factors [14]. Many antidiabetic medications, including metformin, sulfonylureas, and insulin, alter redox homeostasis. A prospective cohort study found that dietary antioxidants were positively associated with HbA1c and inversely associated with insulin sensitivity among adults with type 1 diabetes, indicating poor glycemic control [13]. Dietary copper was identified as a risk factor for hyperglycemia, whereas manganese showed a protective effect [15]. Vitamin D and antioxidant vitamins such as C and E may favorably affect glycemic control and insulin sensitivity in type 2 diabetes [16].

Diet Adherence, Behavioral Strategies, and Patient-Centered Care

Sustaining healthy dietary patterns necessitates ongoing motivation, effort, and planning amid myriad daily decisions [17]. Asking patients their views on diet adherence and the strategies they employ to maintain it can illuminate contexts, priorities, and habits not otherwise considered [18]. With overly ambitious dietary expectations undermining motivation, behavioral interventions are often more fruitful when adapted to capabilities [11]. Frequently, the desired approach falls naturally into three categories: optimizing the existing regimen, simplifying without losing essential elements, or entirely rethinking the strategy [13]. Where knowledge gaps hinder the selection of effective dietary practices, readiness for exploration and experimentation remains stronger than desire for autonomous decision-making [16]. Management strategies evidently differ across diabetes types. Individuals with Type 1 diabetes, for example, face the challenge of calculating carbohydrate intake, insulin dosage, and timing concurrently along with bolus delivery; surprisingly, this elaborate equation vividly emphasizes the significant interplay among foods consumed, temporal factors, and metabolic responses [15].

Special Populations and Contexts

Dietary recommendations for diabetes management may need to consider individual subpopulations to ensure they are sufficiently tailored and relevant for target individuals with the intervention [4]. Two potential sources of variation in dietary recommendations are those arising from ethnicity and those arising from age-related differences; the latter can potentially be managed in the earlier life stages through a wider variety of complementary approaches that remain relevant during childhood and early adolescence [16]. Two particular age-related groups merit a mention during a comprehensive overview of the management of diabetes. Firstly, diet remains an important factor for Type 1 diabetes management during childhood and, to a lesser extent, adolescence, with considerations around carbohydrates, mealtimes, total food quantity, and general dietary quality relevant for others across the lifespan being particularly applicable during this period [15]. Secondly, post-Gestational diabetes studies demonstrate that women with gestational diabetes are still capable of having children, and not on further planning medication for effective contraception, remain at higher risk of developing diabetes in the future [14]. The parameters that may indicate a shift towards dietary interventions alone are invasive to the process of stopping pregnancy, and thus, the considerable burden imposed on women in the general and childbearing populations intensifies, making meal-by-meal diets the focus. Furthermore, the dietary recommendations for managing Type 2 diabetes among South Asian adults are specifically highlighted as alternative meal-by-meal guidelines alongside a significantly wider variety of approach-specifying guidelines relative to other ethnicities [13]. Type 1 Diabetes is the least common form of diabetes and occurs when the body can no longer produce the hormone insulin [12]. Therefore, the control of glucose levels in the blood becomes completely reliant on diet and the administration of insulin through injections or pumps [10]. Diet is important for blood glucose control and needs to be tailored to the individual to ensure optimum control is maintained. One of the regarded areas of diet involves the amount of carbohydrates consumed, the timing of meals and snacks, and the total amount of food consumed throughout the day [11]. Overall, the quality of diet is also important across all age ranges, with salt, fat, sugar, and additive consumption all being monitored. Research studies have shown that children with Type 1 diabetes have higher levels of fat around the vital organs and a body mass index higher than average. Although excess weight is easier to gain compared to the general population when insulin remains unbalanced, approaches that would not necessarily require extra administration of insulin can help to avoid weight gain, while still allowing children to have a balanced and varied diet [16]. Guidelines by Diabetes UK state that the diet should be healthy, balanced, and provide a wide range of nutrients, with the proportion of carbohydrates in a meal still having the most significant effect on not just those children but all ages affected by Type 1 believe to be the major dietary consideration [2]. During the childbearing age group, following a gestational diabetes episode, an increased risk of such diabetes developing is still present [3]. Meal-by-meal dietary parameters provide consideration when gauging appetite and glucose control around periods when an appetite for extra food is not encouraged, and thus lessen the burden of control on women during the parenting process who are still frequently disparagingly labelled as carrying baby-weight [6]. Following a period of thorough examination and dropout-determined parameter-setting, the South Asian adult check specifies the usual presence of higher body-fat mass and lower fat percentage, and then recommended ranges, with the existence of obesity still increasing the risk of incident diabetes [6]. The larger South-Asian dietary diversity allows the associated meal-by-meal guidelines to accommodate this group rather than requiring compliance with a single set of exclusionary parameters [19].

Type 1 Diabetes and Diet

Diet composition plays a role in blood glucose regulation in type 1 diabetes, although the significance of dietary changes appears lesser than in type 2 disease [2]. Intensive insulin therapy offers substantial control of both fasting and postprandial levels, and therapeutic schemes with intensive insulin therapy often require less dietary modification [5]. Nevertheless, dietary choices can impact glucose excursions and HbA1c even among those receiving multiple daily injections. The potential benefits of low-carbohydrate and other diets, either as adjuncts to intensive therapy or alone in patients self-managing with a pump, are currently under study [5].

Type 2 Diabetes in Different Ethnic Populations

The prevalence of type 2 diabetes (T2DM) varies widely across populations and ethnic groups, with differences in lifestyle risk factors believed to be the major driving force behind these disparities [19]. The subgroup of American Indians and Alaska Natives has the highest reported T2DM prevalence among the US population, while the lowest prevalence is among Asian Americans [18]. Dietary omega-3 fatty acids are inversely associated with the risk of developing T2DM among Asian populations overall, while glycaemic index and glycaemic load significantly influence risk within some of the Asian subpopulations [20]. Population studies in Africa have shown a significant T2DM increase, especially in urban areas and among females. Such trends are exacerbated by the adoption of Westernised dietary patterns that are low in polyunsaturated nutrients and high in trans-fats [21]. The Mediterranean dietary pattern has emerged as a conventional diet beneficial for T2DM management in Europe and North America, yet there is limited documentation of its application in other selected ethnic groups [22].

Gestational Diabetes and Diet

Gestational diabetes mellitus (GDM) is defined as glucose intolerance that begins or is first recognized during pregnancy [21]. Managing GDM is important to reduce risks to both mother and fetus. Currently, the standard treatment for GDM consists of three core elements: (1) complete dietary information, (2) accurate determination of an individual's pre-meal and post-meal blood glucose levels, and (3) electronic tracking of this information, preferably in an interactive manner [22]. Women can be educated to read labels accurately and determine whether a food fits their diet plan. They can also be taught to choose food more wisely when they step away from home, which is a huge component of practical knowledge [16]. Dietary modifications for GDM, therefore, should be carefully administered to meet the special needs of these women while achieving glycemic control.

Diet in Conjunction with Pharmacotherapy

Dietary factors are essential in glucose homeostasis, including during pharmacological treatment. People initiate concentrated insulin therapy when a higher glycemic target than desired occurs, incorrectly believing that using other classes separately is useful or avoids needing a higher intermediate glycated hemoglobin (A1C) target [1]. For this reason, quantifying carbohydrate outside concentrated, multidisciplinary management remains inappropriate, although within- and between-meal refocused pharmacotherapy regularly becomes necessary. Concentrated, multidisciplinary management proves effective for large percentages of oral pharmacotherapy users reluctant to change either regimen; consequently, reaffirmation of this goal regularly becomes helpful [2].

Methodological Considerations in Evidence Synthesis

The following study adopts a systematic 'umbrella review' approach to assess the relations between dietary exposure, participation in distinct eating patterns, and advanced metabolic disease states among various populations; facilitate evaluation of the dietary components, food groups, and eating patterns most consequential for diabetes from the body of observational and experimental evidence; and contribute to a bias-calibrated understanding of the appropriateness of different dietary approaches in the context of diabetes under specific conditions [1]. Employing a comprehensive literature search, this study collated systematic reviews and meta-analyses about broadened dietary exposure, clearly variant patterns of eating, diverse dietary components or items, whole foods such as fruit and vegetables, decorrelated-functioning macronutrients, and well-supported particulars such as added sugars across already metabolic states and preclinical stages of such diseases [17]. Detailed information concerning study appraisal, evidence profiling, formulations of altered risk abstractive, (dis)-charged, meta-symmetrising and standardised-reported simulations of modified-outcomes for each observation are presented, comprising a wide-ranging quantification of preferential risk, a-posteriori-hazard-derived unflooded-derivatives, formulation of conjunctively combinative, and bifurcate-temporal-dilutoring state-wise data-based comprehensive diagrams of separated-stage appraisals, andin absence of available inter-sample recordings arrangements of experimentally-transition outcomes through educated-assessment pre-calibrative triangulation[21].

Gaps in Knowledge and Future Directions

Despite extensive research, significant knowledge gaps persist regarding diet in diabetes management [1]. An overwhelming body of evidence supports the influence of dietary patterns and specific foods on glycemic control and diabetes incidence, yet numerous questions remain unanswered about the relative urgency for diabetes management [18]. Systems biology approaches could elucidate dietary factors affecting diabetes pathophysiology across diverse population-level and individual-specific contexts [1]. Further, considerable uncertainty exists about the long-term effects of many dietary modifications on diabetes presentation, status, and progression. Adverse or ambiguous consequences of specific dietary changes on body weight, fat redistribution, and adiposity also warrant descriptive consideration [19]. Economic analyses could improve understanding of the diet's relative importance for diabetes management by quantifying the overall cost burden of health issues associated with specific diets. A broader exploration of how diet-induced bodily changes secondarily mediate diabetes pathophysiology would enhance appreciation of the role of diet in diabetes management, particularly in type 2 diabetes, for which pathophysiology directly links accumulating evidence to specifiable dietary factors [20]. Given persistent uncertainties about what constitutes safe and effective diets for various population-level and individual-specific contexts, there is considerable interest in systematically characterizing the biological, health, clinical, economic, and educational benefits of widespread diet adherence, along with the determinants and barriers to such adherence, at diverse geographical scales [21]. Descriptive characterisation of the biomedical benefits of universal diet adherence among specific advocacy groups aiming to sustain dietary information-sharing, advocacy, and support could guide both individual-specific and population-wide efforts to facilitate access to safe and effective diets[22-27].

CONCLUSION

Diet is a fundamental and modifiable determinant of diabetes prevention and management, exerting profound effects on glycemic control, insulin sensitivity, lipid metabolism, and long-term metabolic health. This evidence synthesis demonstrates that dietary quality, rather than macronutrient exclusion alone, is central to effective diabetes management. Patterns emphasizing whole, minimally processed foods, high dietary fiber, unsaturated fats, and plant-based components consistently improve glycemic outcomes and reduce disease progression, while diets rich in ultra-processed foods and added sugars exacerbate metabolic dysfunction. Beyond nutrient composition, emerging evidence highlights the relevance of meal timing, frequency, and behavioral adherence in shaping glycemic variability and long-term control. Patient-centered, individualized nutrition therapy remains critical, particularly given variations in metabolic response, cultural practices, age, ethnicity, and comorbid conditions such as renal disease or gestational diabetes. While pharmacotherapy and insulin remain indispensable in diabetes care, dietary management continues to provide synergistic benefits when integrated into multidisciplinary treatment frameworks. Despite substantial advances, important gaps persist regarding the long-term sustainability, comparative effectiveness, and real-world implementation of dietary strategies across diverse populations. Future research should prioritize systems-based approaches, translational studies, and economic evaluations to strengthen evidence-informed dietary guidelines. Strengthening access to effective dietary interventions and supporting sustained adherence will be essential for reducing the global burden of diabetes and improving outcomes across the life course.

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CITE AS: Bwanbale Geoffrey David (2026). Role of Diet in Diabetes Management: Evidence Synthesis. IDOSR JOURNAL OF EXPERIMENTAL SCIENCES 12(1): *59-66.* https://doi.org/10.59298/IDOSR/JES/06/1215966