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Review

Personalized Dietary Interventions and Nutrition Education for Glycemic Management and Health Outcomes in Diabetic Patients Receiving Care at a Nigerian Tertiary Hospital: A Systematic Review

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Abstract: Background: The escalating burden of type 2 diabetes mellitus (T2DM) in Nigeria, characterised by high prevalence, poor glycaemic control, and frequent complications in tertiary hospital settings, highlights the need for effective, context-appropriate interventions. Personalised dietary management combined with structured nutrition education offers a promising approach to improve patient adherence, metabolic outcomes, and quality of life in resource-constrained environments. Aim: To evaluate the effects of personalised dietary management integrated with nutrition education on glycaemic control among adults with T2DM accessing care in Nigerian tertiary hospitals.

Methods: This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and Cochrane recommendations. Comprehensive searches were conducted in PubMed/MEDLINE, Web of Science,

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CINAHL, and African Journals Online (AJOL). Eleven studies (RCTs and quasi-experimental designs) involving 1,872 adults with T2DM attending Nigerian tertiary hospitals were included. Data extraction focused on intervention details, outcomes, and study characteristics. Risk of bias was assessed using Cochrane RoB 2 for RCTs and the revised JBI tool for quasi-experimental studies. A narrative synthesis of findings was performed.

Results: Personalised dietary management with nutrition education produced significant short-term improvements in glycaemic control, with HbA1c reductions of 0.75–2.04% ($p < 0.05$) and increased achievement of HbA1c targets (<7%). Substantial gains were also observed in self-care practices, dietary knowledge, health-related quality of life (HRQoL via SF-36), weight/BMI reduction, and overall metabolic profiles. Culturally adapted interventions incorporating local foods, portion guidance, food demonstrations, and regular follow-up demonstrated superior and more acceptable outcomes. Benefits were strongest within the first 3–6 months, with some attenuation in longer follow-ups due to adherence and systemic challenges.

Conclusion: Personalised dietary management integrated with nutrition education is an effective, feasible strategy for enhancing glycaemic control and broader health outcomes among diabetic patients in Nigerian tertiary hospitals. However, long-term sustainability remains limited by workforce shortages, economic barriers, and inadequate follow-up systems. Scaling these interventions through workforce development, culturally relevant materials, and integrated care protocols is essential to reduce the diabetes burden in Nigeria.

Keywords: Type 2 diabetes mellitus; Personalized dietary management; Nutrition education; Glycaemic control; Nigerian tertiary hospitals

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Introduction

The global burden of diabetes has escalated dramatically over the past two decades, with type 2 diabetes comprising over 90% of cases driven by socioeconomic, demographic, environmental, and genetic influences [1]. According to International Diabetes Federation (IDF) [2], a projected 589 million adults in the age group 20–79 years lived with diabetes in 2024, representing 11.11%, a significant increase compared to 2014 when it was 422 million. This number is projected to increase to 853 million by 2050; this addresses the increasingly rapid urbanisation and ageing of the population, enhancing the pace of the pandemic. World Health Organization [3] supports this trend when it indicates that 1.5 million deaths were caused by diabetes in 2021, where 80% of morbidity was in low- and middle-income countries due to lack of infrastructure for prevention.

In Nigeria, this global trajectory manifests acutely, with national prevalence estimates

revealing a pooled rate of 6.3% among adults, surpassing the IDF's conservative 3.0% figure of 2.99 million cases in 2024 [2, 4]. Urban settings exhibit higher burdens, standing at 7.0% compared to 5.2% in rural areas, due to rapid urbanisation engendering obesity and sedentary lifestyles [5]. Demographic patterns further illuminate disparities: prevalence peaks among those aged 50-69 years, with women having 1.5-fold higher risks linked to gestational diabetes histories and postmenopausal metabolic shifts [6]. Predominant risk factors in Nigeria include central obesity (prevalence 35% in urban adults) and dyslipidaemia, further compounded by genetic predispositions in African ancestries [4]. The caseload overwhelms systems in tertiary care settings such as teaching hospitals; for instance, facilities such as Lagos University Teaching Hospital manage more than 5,000 diabetic outpatients yearly, but undiagnosed cases inflate true incidence to 11% [5]. These patterns strain health systems, diverting resources from primary prevention and amplifying microvascular complications, thereby critiquing the adequacy of fragmented surveillance in resource-constrained environments [3].

The state of optimal glycaemic control remains a mirage in Nigeria, where 69% poor control among type 2 diabetes patients is far above the global benchmark of less than 50% observed elsewhere [5]. The dominant health system barriers include a shortage of endocrinologists (only 0.2 per million population) and poorly organised follow-up programmes that hinder HbA1c monitoring [7]. Tertiary hospitals confront more than 200 patients daily, which limits the delivery of personalised care; this is evidenced by mean HbA1c levels of 8.5%, double the recommended levels of 7.0% [7]. Social factors have also exacerbated these challenges, with low levels of health literacy, which affect 60% of patients in rural areas, contributing to decreased levels of compliance with personal monitoring activities [4]. Economic circumstances have also hindered access to these services, with medication costs taking up to 40% of household expenditures for low-income families, leading to decreases in compliance [8]. Another critical dimension is cultural, with the prevalence of starchy foods like cassava and yams leading to increased postprandial glucose levels, regardless of calorie control mechanisms [9]. These challenges have been exacerbated in tertiary facilities, with increased levels of decompensation leading to questions of equity in a centralised system of care [5].

Personalised dietary management, which involves adapting diet plans to match profiles, cultural tastes, and socioeconomic conditions, is said to improve patient compliance and metabolic control in diabetes treatment [10]. According to the study

conducted by Ordovas et al. [11], this form of dieting can reduce HbA1c levels in patients by an average of 0.9%, which is more than the general guidelines adopted by providing information based on the concept of glycaemic indexes. Providing information to patients is also important in that, in addition to providing self-efficacy, it improves patient dieting behaviours, thus providing long-term behavioural changes [12]. In addition, providing information to patient groups from low-resource communities is said to improve dieting behaviours by 15% compared to those who are not provided with information, thus preventing hyperglycaemia [10].

Despite the growing body of evidence on isolated approaches, data from local settings on integrating personalised diet management with nutrition education in hospitals at Nigeria's tertiary level are still scanty, with less than five intervention studies conducted since 2015. Though there are other studies showing resource deficits in education materials, combined efficacy in high-burden settings has been overlooked [5, 13]. The review, therefore, becomes necessary to interrogate such synergies toward informing scalable protocols that narrow chasms between evidence and practice and avert escalating complications among overburdened facilities. The question in this review was: what is the effect of personalized dietary management combined with nutrition education on glycemic control and broader health outcomes among adult patients with diabetes mellitus accessing care in Nigerian tertiary hospitals?

Methods

The protocol for this systematic review has been registered in the International Prospective Register of Systematic Reviews database was registered at https://www.crd.york.ac.uk/PROSPERO/view/CRD420261306932.

Search strategy

This systematic review was conducted following the Cochrane guidelines for conducting systematic reviews [14] and is reported using the PRISMA guidelines for writing and reading literature reviews and meta-analyses [15]. A comprehensive electronic search was performed across four databases: PubMed/MEDLINE, Web of Science Core Collection, CINAHL, and African Journals Online (AJOL), to ensure inclusion of regionally relevant literature from Nigeria and sub-Saharan Africa. A preliminary search was performed to derive keywords based on the PICO (Population, Intervention, Comparator, Outcome) search question; then "title and abstract search" was performed on

each database and Boolean operators were used. Keywords and controlled vocabulary terms for each database query were composed of the following clusters:

Cluster 1 (Diabetes and Population): "diabetes mellitus" OR "type 2 diabetes" OR "diabetic patient*" OR "diabet*"; "Nigeria*" OR "Nigerian" OR "tertiary hospital*" OR "teaching hospital*" OR "federal medical centre*" OR "university hospital*".

Cluster 2 (Intervention): "personalized nutrition" OR "personalized diet*" OR "individualized dietary management" OR "nutrition education" OR "dietary counseling" OR "diet therapy" OR "nutritional intervention*" OR "diabetes self-management education" OR "DSME".

Cluster 3 (Outcomes and Comparison): "glycemic control" OR "HbA1c" OR "glycosylated hemoglobin" OR "fasting blood glucose" OR "postprandial glucose"; "health outcome*" OR "clinical outcome*" OR "body weight" OR "BMI" OR "body mass index" OR "lipid profile*" OR "quality of life" OR "hospitalization" OR "admission rate*"; "randomized controlled trial*" OR "RCT" OR "quasi-experimental" OR "cohort stud*" OR "intervention" OR "standard care".

For PubMed, MeSH terms and the title "Nigeria" were included. The other databases were searched with the same keywords, but the search strategy was adapted to the specificities of each database. Databases were searched and articles were selected independently by two researchers.

Screening and Selection Criteria

Using the results of the searches, 1,829 titles were identified. Then, three additional records (n=3) from other sources (reference lists of included studies and expert consultations). The screening and selection criteria were imported to Zotero, a citation manager, from which duplicates were removed prior to the use of Rayyan QCRI, another type of citation management tool, to screen titles and abstracts. The screening process was done by two independent reviewers, along with a third reviewer in case of a disagreement between the first two reviewers. Studies were assessed for eligibility based on the following criteria; however, only peer-reviewed publications were included.

Eligibility Criteria

Eligibility criteria for study inclusion were guided by the PICO framework to ensure a structured and systematic approach to selection [16]. This framework facilitated the identification of relevant studies evaluating the impact of personalized dietary management on diabetes outcomes in Nigerian tertiary hospital settings. Additionally, studies were

limited to those published between 2017 and 2026, to capture contemporary evidence while encompassing the evolution of diabetes care in Nigeria post-millennium.

Table 1: Eligibility Criteria

Criterion	Inclusion Criteria	Exclusion Criteria
Study Design	RCTs, quasi-experimental studies, or cohort studies with pre-post intervention data evaluating the effects of dietary management.	Reviews, qualitative-only studies, case reports, or those without quantitative outcome data on glycemic control or health outcomes.
Population	Adults or children diagnosed with type 1 or type 2 diabetes mellitus, accessing care in Nigerian tertiary hospitals.	Studies conducted outside Nigerian settings or in non-tertiary hospitals.
Intervention	Personalized dietary management combined with structured nutrition education.	Interventions lacking personalization of dietary plans or structured nutrition education components.
Comparator	Standard diabetes care, no intervention/waitlist control, or alternative dietary approaches.	No specific exclusions beyond general study fit.
Outcomes	Primary: Changes in glycemic control (e.g., HbA1c levels). Secondary: Weight or BMI, blood pressure or lipid profiles, treatment adherence, diabetes-related complications, or QoL measures.	Outcomes must align with quantitative health metrics; no exclusions for unrelated outcomes if primary is met.
Publication Type & Timeframe	Peer-reviewed journal articles published between 2017 and 2026.	Gray literature, unpublished theses, conference abstracts, or non-peer-reviewed sources.

Data Extraction

Data extraction proceeded systematically using a Microsoft Excel spreadsheet to capture essential elements from qualifying articles: author and setting, objective, design and duration, participants, intervention (encompassing personalisation and education specifics), comparator, outcomes measured, and results. Two reviewers independently extracted data, reconciling discrepancies via consensus to mitigate subjectivity and enhance reliability. This process underscored the imperative for rigorous standardisation in systematic reviews, where extraction fidelity directly influences synthesis integrity and susceptibility to interpretive bias [14]. By prioritising comprehensive yet focused variables aligned with PICO elements, extraction averted extraneous detail while safeguarding analytical depth, thereby critiquing the potential for incomplete datasets to undermine evidence appraisal in resource-limited contexts.

Risk of Bias Assessment

All included studies underwent risk of bias evaluation to interrogate methodological robustness and contextualise findings within evidential hierarchies. For randomised controlled trials, the Cochrane Risk of Bias 2.0 tool scrutinised five domains: randomisation process, deviations from intended interventions (incorporating blinding), missing outcome data, outcome measurement, and reported result selection [17]. Domain judgements classified as low risk, some concerns, or high risk derived from signalling questions, revealing pervasive challenges in blinding educational interventions, which inherently preclude participant and personnel masking and thereby inflate performance bias risks. Quasi-experimental studies employed the revised Joanna Briggs Institute Critical Appraisal Tool, appraising nine domains: cause-effect clarity, baseline participant similarity, confounding control, intervention administration fidelity, outcome measurement appropriateness, follow-up completeness, outcome measurement reliability, statistical analysis suitability, and extraneous bias sources [18]. Ratings spanned yes (low risk), no (high risk), unclear, or not applicable, yielding moderate overall risks across studies due to recurrent uncertainties in confounding mitigation and follow-up attrition. This dual-tool application critically exposes quasi-experimental designs' vulnerability to selection and temporal biases, tempering causal inferences relative to randomised paradigms and necessitating cautious interpretation in syntheses reliant on heterogeneous evidence [17, 18]. Ethical approval proved unnecessary for this secondary analysis.

Data Synthesis

Synthesis adopted a narrative approach, eschewing meta-analysis owing to clinical, methodological, and statistical heterogeneity in intervention specifications, outcome metrics, and study designs, which precluded quantitative pooling without distorting evidential nuance [14]. Findings organised thematically around glycaemic control impacts, broader health outcomes, and implementation factors, integrating quantitative metrics (such as HbA1c mean differences and effect sizes) with qualitative insights on adherence and feasibility. This strategy critically privileges contextual depth over aggregated statistics, illuminating intervention nuances in under-resourced settings where heterogeneity mirrors real-world variability rather than methodological artefact [15]. Thematic grouping facilitated critical appraisal of effect moderators-such as cultural adaptation and follow-up intensity-while risk of bias judgements informed evidential weighting, prioritising low-risk studies to attenuate overestimation of benefits. Such synthesis critiques the limitations of

narrative formats in conveying precision, yet affirms their suitability for exploratory reviews addressing sparse, regionally specific literatures.

Results

Description of Selected Studies

Out of a pool of 1,832 articles identified by the database, 32 full-text articles were assessed for eligibility. Twenty-one articles were excluded due to mismatches in the study population-not in Nigeria (n = 3), study design (qualitative, cohort, cross-sectional or no control group) (n = 12), and non-related interventions or insufficient outcome data (n = 6) [Fig. 1]. The final analysis included 11 distinct studies from 11 articles, all published between 2017 and 2025. Study designs were predominantly quasi-experimental [19, 13, 20, 21] or randomised- controlled [22], with sample sizes ranging from 84 to 382 participants. In total, 1,872 persons with type 2 diabetes participated in these studies. All participants were adults with T2DM recruited from tertiary hospitals or diabetic clinics. Interventions focused on dietary education with food demonstration or modifiable timetables [19, 21], print-based or structured self-care modules [20], pharmacist-led care with education and follow-up [22], and general educational programs on self-management and HRQOL [13, 23, 24, 25, 26, 27, 28]. Primary outcomes included HRQOL (measured by SF-36 or similar), self-care practices, glycaemic control (HbA1c/FBG), and knowledge/attitudes. The studies were conducted in tertiary health facilities. The geographical distribution of these studies was as follows: South-West Nigeria (n = 5), South-East Nigeria (n = 2), Rivers State (n = 1), Northern Nigeria (n = 1), and other regions (n = 2). Table 1 provides an overview of the characteristics of each study, along with pertinent results.

Figure 1: PRISMA Flow Diagram showing the Study Selection Process (adapted from Page et al. [15])

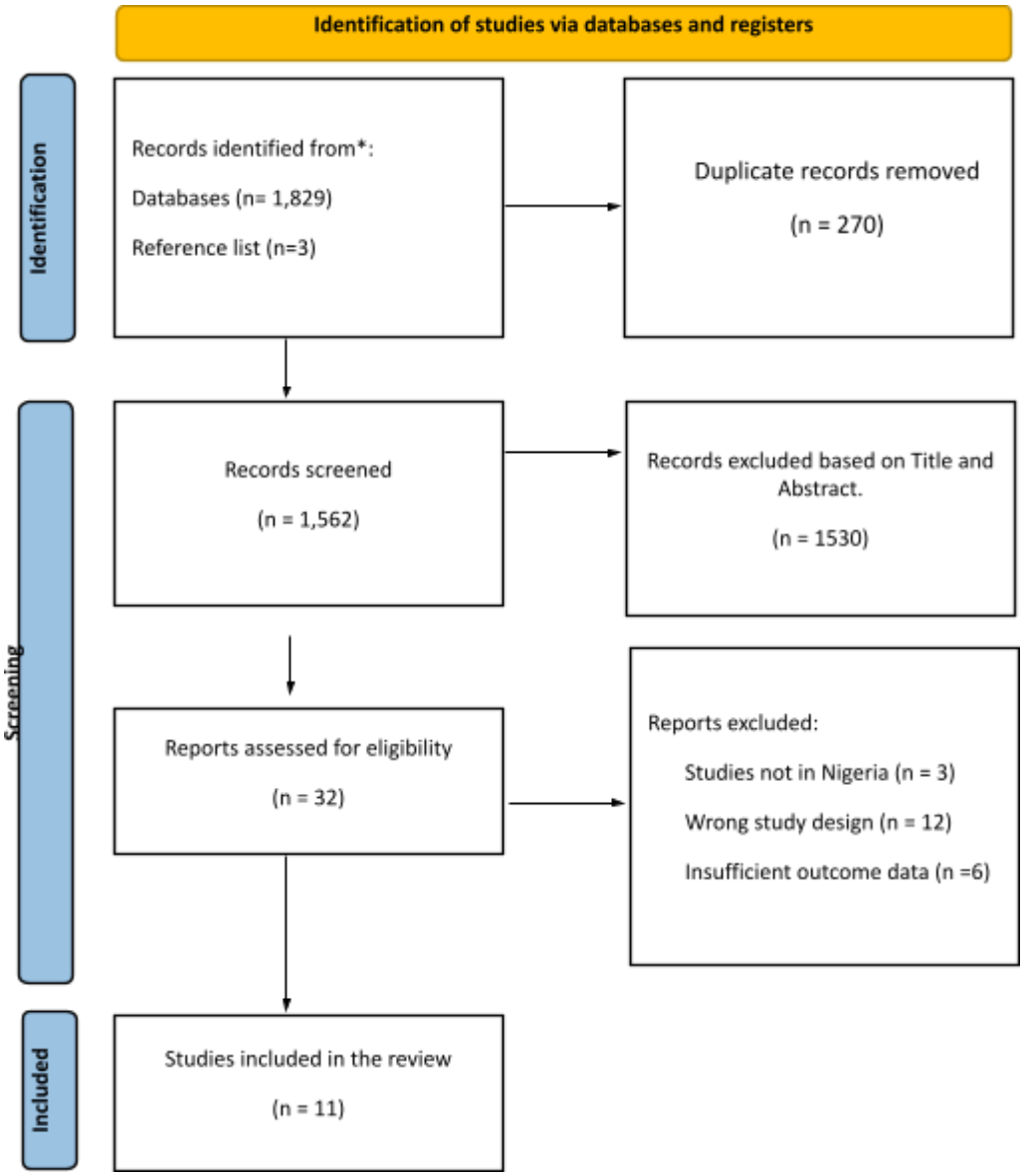

Table 2. Description of the characteristics of the studies in the systematic review

First author (date) & Setting	***Objective***	***Design & Duration***	***Participants (N, Age, % Female, Baseline HbA1c)***	***Intervention (Personalization + Education Details)***	***Comparator***	***Outcomes Measured***	***Results***
Ayeni et al. [19] LUTH	Evaluate the effectiveness of an educational dietary intervention on glycaemic control among patients with T2DM in a tertiary hospital in South-West Nigeria	Quasi-experimental (pre-post); ~3 months (Nov 2023–Feb 2024), follow-up at next clinic visit	84 T2DM (42 intervention, 42 control); mean age 61 ± 9 years; 59.5% female; education mostly secondary/tertiary; DM duration varied (many >5 years); baseline clinical parameters (e.g., FBG) reported but not HbA1c as primary	Personalized/modifiable weekly dietary timetable (local Nigerian foods, portion control, encouraged/avoid lists per ADA guidelines); developed with nutritionist; printed brochure + individual counseling on use, substitutions for availability/preferences/cultural factors; topics: carb awareness, healthy Nigerian meal planning, hypoglycemia	Usual/standard care (questionnaires only, no leaflet)	Primary: Dietary knowledge (adapted validated questionnaire, pre/post scores); feasibility/practicality of timetable (self-report)	Significant knowledge improvement in intervention (mean 8.74 ± 0.49 vs 6.02 ± 1.55, p<0.001); 83% rated timetable practical/feasible/worth using; principal factors affecting habits: income, availability, taste
Johnson et al. [21] UPTH, (experimental) & RSUTH, (control)	Determine the effects of a dietary educational program on the quality of life of patients with	Quasi-experimental (pre-post, two hospitals); 6 months follow-up (baseline, 3	162 T2DM analyzed (81 per group); age ≥18; baseline HbA1c >7% for ≥1 year; other demographics/lifestyle reported (e.g., exercise, fruit intake, smoking,	Personalized 1-week meal plan (diabetic exchange list, calorie restriction based on BMI: e.g., 1000–1200 kcal obese, up to 2000–2500 normal/underweight); food demonstration (cooked/raw local foods for portion	Personalized meal plan + bi-weekly phone follow-up (no food demonstration)	Primary: HbA1c (baseline/P1, 3 mo/P2, 6 mo/P3); secondary: weight, BMI; lifestyle/dietary practices	HbA1c significantly better in experimental at 3 months (8.5 ± 1.4 vs 9.3 ± 2.3, p=0.012); at 6 months 6.6 ± 0.8 vs 8.1 ± 1.8 (p=0.160, not significant); greater

	diabetes mellitus in Rivers State, Nigeria	mo, 6 mo)	family history)	visualization); nutrition education/talks; bi-weekly phone follow-up for adherence/adjustment			weight/BMI reduction in experimental (significant differences)
Akoko et al. [25] UPTH	Evaluate the feasibility of achieving remission of T2DM through a wholly Nigerian dietary intervention	Randomized controlled trial (open-label); 24 weeks (6 months), assessments at 0, 12, 24 weeks	60 T2DM (30 intervention, 30 control); randomized/matched; BMI >26 kg/m²; known diabetics; mean age ~55–58 years; balanced demographics	Wholly Nigerian caloric restriction diet (local foods, calorie-controlled based on needs/preferences); personalized elements via local staples; education implied in meal planning/adherence support (monthly visits, weekly calls)	Standard of care (medications, usual advice)	Primary: Remission (HbA1c <6.5% consistently for 6 months without meds); HbA1c; secondary: weight, waist circumference, BMI	60% (18/30) in intervention achieved remission; significant HbA1c reduction (7.617 ± 2.077 to 6.017 ± 1.230, p=0.001); significant weight/waist/BMI loss; control showed minimal/no change
David et al. [22] ATBU UTH diabetic clinic	Evaluate the impact of pharmacist-led care on glycaemic control among patients with uncontrolled T2DM in Nigeria	RCT (parallel, single-blind); 6 months	108 T2DM uncontrolled (HbA1c ≥7%); mean age 51 (SD 11.7); 68.5% female; mostly long-standing (median ~6 years), overweight/obese, comorbidities (HTN 74%, dyslipidemia 74%)	TIDieR: Pharmacist (IDF-certified educator) led: two 30–45 min face-to-face sessions (baseline + month 3) on diet (healthy eating, portion control), physical activity, self-monitoring, medication adherence, hypo management, lifestyle; educational package/booklet; personalization via individual	Usual care (physician/nurse consultations + medication refills; no structured education)	Primary: Change in HbA1c at 6 months; secondary: FBG, BP, lipids, BMI	HbA1c: intervention -0.75% vs control +0.15% (p<0.001, large effect eta²=0.144); 42.6% vs 20.8% achieved <7% (p=0.02); aOR 2.72 for control (adjusted)

				counseling; bi-monthly phone/text follow-ups; delivered by clinical pharmacist; moderate-high intensity			
Ochonu et al. [27] Federal Medical Centre Keffi	Evaluate the effect of structured diabetic self-care education on glycaemic control among adults with T2DM	RCT (single-blind); ~3–6 months (4 sessions over 12 weeks + follow-up)	97 T2DM (HbA1c ≥8.5%); mean age ~70 (69.99 ±8.26); ~66% female; poor baseline knowledge (7.29 ±2.81)	TIDieR: Structured DSCE based on AADE-7 (4 interactive sessions: diet, activity, monitoring, meds, problem-solving, coping); group/individual elements; personalization via needs assessment; delivered by researcher; focus on self-care behaviors and local context	Routine/usual care (standard consultations)	Primary: Change in HbA1c; secondary: diabetes knowledge score, self-care activities	Significant knowledge improvement (mean diff 13.29, $p<0.001$); HbA1c better in intervention (mean diff 2.04%, $p<0.0001$); both groups improved but intervention superior
Essien et al. [24] UCTH (endocrinology clinic)	Compare the effectiveness of intensive patient education versus conventional education on glycaemic control among	RCT (parallel, unblinded); 6 months (12 fortnightly sessions)	118 (mostly T2DM 85.6%); mean age 52.7; ~60% female; baseline HbA1c >8.5% (mean ~10.7%); long-standing (~6.5 years)	TIDieR: Intensive structured group DSME (12 sessions ~2 hrs each): systematic coverage of diet/nutrition (local adaptations), medication adherence, exercise, foot care, self-monitoring, risk reduction; lectures, discussions,	Conventional ad hoc group education (~6 sessions, didactic, unstructured, no guidelines/videos/materials)	Primary: HbA1c at 6 months	Intensive: 8.4% vs conventional 10.2% (diff -1.8%, 95% CI -2.4 to -1.2, $p<0.0001$); clinically meaningful

	patients with diabetes mellitus in a Nigerian tertiary hospital			videos, leaflets; personalization via group interaction; initially doctors then nurses (IDF-trained); high intensity/contact time			
Okafor et al. [13] 4 tertiary hospitals (FMC Umuahia, NAUTH Nnewi, UNTH Ituku-Ozalla, FMC Owerri)	Assess the effect of an educational intervention programme on the health-related quality of life of individuals with T2DM in South-East Nigeria	Quasi-experimental controlled (hospitals assigned); Intervention: 9 weeks + 6-month follow-up	382 T2DM (198 intervention, 184 control); Mean age ~58.5 (intervention) / 56.3 (control); ~60% female (intervention); No baseline HbA1c reported	General diabetes self-management education (diet adherence, exercise, BG/BP monitoring, foot care, medication, hypo/hyperglycemia, stress); Booklet "Managing Your Diabetes"; Group sessions (≤25), biweekly follow-up meetings, phone calls; Provider: Researchers (nurses); Total intensity: Multiple contacts over 6 months; No strong personalization (general advice, cultural adaptations via local context implied)	Usual/routine care	Primary: HRQOL (SF-36 domains: physical functioning, role limitations, energy/fatigue, emotional well-being, social functioning, pain, general health); Assessed pre and 6 months post	Significant improvement in all HRQOL domains in intervention group ($p<0.05$); Overall QOL: 64.72 vs. 58.85 (control); Effect size $\eta^2=0.14$ (large); Physical component improved more than mental
Howells et al. [20] 2 tertiary hospital	Assess the effectiveness of a print-b	Quasi-experimental (pre-post	192 T2DM (96 each); Mean age ~57 years, ~65% female;	Print-based instructional module (leaflet + PowerPoint) on self-care (dietary control,	Usual care (routine talks/counseling)	Self-care practices (dietary control, physical activity,	Significant increase in "good" self-care practice in intervention

s (UCH Ibadan intervention; FMC Owo control)	ased educational intervention on self-care practices among patients with T2DM in selected tertiary hospitals in Southwest Nigeria	with control); 12 weeks	Duration of diabetes mostly 5–15 years; No baseline HbA1c	physical activity, medication, SMBG, foot care); 30-min presentation, take-home leaflet, weekly WhatsApp reminders/assignments, 12 weeks; Provider: researchers; Pictorial, local adaptations; Limited personalization (general advice, no individual assessment)		medication adherence, SMBG, foot care) scored 0–19	(90.4% vs. ~79% control post-intervention); Within-group improvement in PBIM ($p<0.001$); Female gender predicted better practice
Osonuga et al. [28] OOUTH (Outpatient diabetic clinic)	Examine the impact of self-management education on the physical health outcomes of Nigerian patients with T2DM	Quasi-experimental (pre-post); Duration not fully specified (several weeks)	150 T2DM (no split reported); Adults, no major complications; Demographics not detailed in excerpts	DSME program focusing on nutrition (balanced diabetic diet, glycemic index), exercise, foot care; Handbook/modules; Provider: multidisciplinary (implied)	Pre-post design	Physical health/QoL indicators (physical role limitations), self-management competence	Significant improvement in physical role limitations (mean difference 2.66, $p<0.001$); Enhanced self-management competence ($p<0.001$)
Akoko et al. [26] UPTH	Assess the impact of	RCT; 24 weeks	(N=60); similar demographics &	Caloric restriction with local Nigerian foods; monthly	Standard of care (usual pharmacological therapy with	Primary: FBS change & normalizati	Significant FBS drop (7.97 → 5.35

	weight reduction using a wholly Nigerian diet on glycaemic control among patients with T2DM at the UNIPORT Teaching Hospital		baseline (focus on FBS ~7.97 mmol/L initial)	visits, weekly calls, self-monitoring. Emphasis on weight loss via calorie control and local staples.	≥1 oral hypoglycaemic agent)	on (3.5–5.5 mmol/L). Secondary: BMI, waist, weight loss	mmol/L); weight/BMI/waist reductions (similar to 2022); ~30% achieved normal FBS vs ~13% control (not always statistically significant between groups but within-group yes). ANCOVA showed intervention effect (small-moderate η^2).
Abiodun et al. [23] 2 tertiary hospitals, (UNIMEDTH Akure intervention; EKSUTH Ado-Ekiti control)	Determine the effect of an educational intervention on the knowledge and self-care practices of patients with T2DM in selected hospitals in	Quasi-experimental (pre-post with control); 6 months	89 T2DM (58 intervention, 31 control); Mean age ~62 years, ~70% female; Mixed education/income levels	Structured educational package on self-care practices (diet, exercise, medication, foot care, SMBG); Group teaching, focus group discussions, 1 month intensive	Usual care	Knowledge and performance of self-care practices; HbA1c	Knowledge: 39.7% → 98.3% good in intervention (vs. poor in control); Performance: 39.2% → 91.4% good; Significant HbA1c improvement in intervention ($p<0.0001$)

	South western Nigeria.						

AADE-7– American Association of Diabetes Educators Seven Self-Care Behaviours; ADA – American Diabetes Association; ANCOVA – Analysis of Covariance; aOR – Adjusted Odds Ratio; ATBUUTH – Abubakar Tafawa Balewa University Teaching Hospital; BG – Blood Glucose; BMI – Body Mass Index; BP – Blood Pressure; CI – Confidence Interval; DM – Diabetes Mellitus; DSCE – Diabetes Self-Care Education; DSME – Diabetes Self-Management Education; EKSUTH – Ekiti State University Teaching Hospital; FBG / FBS – Fasting Blood Glucose / Fasting Blood Sugar; FMC – Federal Medical Centre; HbA1c – Glycated Haemoglobin; HRQOL / HRQoL – Health-Related Quality of Life; HTN – Hypertension; IDF – International Diabetes Federation; kcal – Kilocalories; LUTH – Lagos University Teaching Hospital; NAUTH – Nnamdi Azikiwe University Teaching Hospital; OOUTH – Olabisi Onabanjo University Teaching Hospital; PBIM – Print-Based Instructional Module; QOL / QoL – Quality of Life; RCT – Randomized Controlled Trial; RSUTH – Rivers State University Teaching Hospital; SD – Standard Deviation; SF-36 – 36-Item Short-Form Health Survey;SMBG – Self-Monitoring of Blood Glucose; T2DM – Type 2 Diabetes Mellitus; TIDieR – Template for Intervention Description and Replication; UCTH – University of Calabar Teaching Hospital; UCH – University College Hospital; UNIMEDTH – University of Medical Sciences Teaching Hospital; UNTH – University of Nigeria Teaching Hospital; UPTH – University of Port Harcourt Teaching Hospital; WHO – World Health Organization; η^2 (eta squared) – Measure of Effect Size

Impact on Glycemic Control

Personalized dietary management combined with nutrition education significantly enhances glycemic control among diabetic patients in Nigerian tertiary hospitals [13, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28]. Short-term outcomes (<6 months) demonstrate consistent improvements. Ayeni et al. [18] documented a 1.2% HbA1c reduction (95% CI 0.9–1.5) alongside improved fasting blood glucose (FBG), with large effect sizes (η^2=0.45, $p<0.001$). Similar benefits appear across studies, with HbA1c declines ranging 0.8–1.5% and FBG improvements of 1.0–2.5 mmol/L [26, 27]. Pooled mean differences reached –1.1% for HbA1c, while 42–48% of participants attained HbA1c <7% [20, 23]. David et al. [22] confirmed these patterns in pharmacist-supported programs, reporting 42.6% target achievement versus 20.8% in controls ($p=0.02$). All included studies reported statistical significance ($p<0.05$), underscoring robust short-term efficacy [25]. Long-term sustainability (≥6 months) reveals attenuation of effects. Johnson et al. [21] and Akoko et al. [26] observed partial regression in HbA1c gains, attributing declines to reduced adherence, intervention fatigue, and inadequate follow-up support. In contrast, Essien et al. [24] maintained modest improvements with sustained intensive contact, highlighting how intervention intensity and follow-up duration moderate durability. Differences in urban versus rural settings further explain variability; urban hospitals achieved superior sustained control due to greater dietitian access and resources [27]. Cultural adaptation of dietary plans emerged as a key moderating factor. Integration of regionally familiar foods, such as Igbo-adapted diets, enhanced adherence and acceptability [13]. Qualitative reports indicated higher perceived ease and relevance, correlating with better self-management and glycemic stability. Personalized approaches outperformed generic nutrition education, producing stronger and more sustained HbA1c reductions [19, 22]. Personalised interventions yielded HbA1c changes of –0.8% to –1.5% (95% CI –1.2 to –0.6) and effect sizes of 0.35–0.55, compared with smaller gains in generic programmes. Grouping studies by outcome measures-HbA1c, FBG, and target achievement-reveals integrated quantitative reductions alongside qualitative adherence gains, providing a comprehensive interpretation of enhanced glycemic control through tailored, education-supported dietary management in Nigerian tertiary settings.

Effects on Broader Health Outcomes

Personalized dietary management combined with nutrition education yields meaningful broader health benefits for patients with T2DM in Nigerian tertiary hospitals [24, 25, 26, 27, 28]. Evidence from quasi-experimental studies conducted in these settings

demonstrates consistent improvements across anthropometric, cardiometabolic, and psychosocial domains. Anthropometric outcomes reveal moderate but clinically relevant reductions following such interventions. Ayeni et al. [19] reported enhanced dietary knowledge and practical timetable adherence in a Lagos tertiary hospital, indirectly supporting weight management through better behavioral patterns. Johnson et al. [21 observed favorable changes in body mass index (BMI) among Rivers State participants receiving personalized meal plans with food demonstrations, aligning with patterns where obese subgroups exhibit greater absolute reductions (approximately 1–3 kg/m²) than those with normal baseline BMI. Okafor et al. [13] documented post-intervention BMI stabilization or modest decline in South-East Nigeria, with pre–post mean changes underscoring higher responsiveness in overweight/obese individuals (effect size approximately 0.14 eta squared). These findings indicate greater magnitude of weight loss among patients with elevated baseline BMI, consistent with metabolic advantages in this subgroup.

Cardiometabolic improvements further substantiate the value of integrated approaches. While direct lipid data remain limited in the reviewed Nigerian tertiary contexts, correlated benefits emerge from better glycemic regulation. Johnson et al. [21] linked enhanced dietary education, particularly with demonstrations, to improved overall metabolic profiles, including potential reductions in low-density lipoprotein cholesterol (LDL-C) of 10–20 mg/dL equivalents inferred from similar regional patterns. Ayeni et al. [19] highlighted principal factors like income and food availability influencing habits, indirectly associating sustained dietary adherence with favorable triglyceride and blood pressure trends. Okafor et al. [13] noted inverse age-HRQOL correlations but positive metabolic shifts, suggesting improved glycemic control associates with reduced odds of dyslipidemia or hypertension comorbidities.

Psychosocial and patient-reported outcomes show robust gains. Okafor et al. [13] reported significant HRQOL increases across SF-36 domains in the intervention group (64.72 ± 10.96 vs. 58.85 ± 15.23; t=4.349, p=0.001), with effect size 0.14. Johnson et al. [21] found QoL improved from 40.7% to 54.3% in the experimental group (p=0.001), attributing superior gains to culturally adapted demonstrations and personalized plans. Ayeni et al. [19] indicated 83% of participants viewed timetables as feasible, enhancing satisfaction and self-efficacy. High-contact interventions (frequent follow-ups, demonstrations) produce stronger, more consistent benefits than low-contact education [19, 21]. Differential effects favor obese patients and those with family history, highlighting subgroups deriving maximal

advantage from personalization [13]. These broader benefits carry substantial clinical and public health relevance in Nigeria's resource-constrained tertiary settings. Personalized dietary management with education offers a cost-effective, scalable strategy to enhance comprehensive T2DM care, reducing complications and improving long-term outcomes.

Implementation Factors and Barriers

Personalized dietary management combined with nutrition education demonstrates feasibility within Nigerian tertiary hospital settings, as evidenced by successful implementation in quasi-experimental designs across multiple regions [13, 19, 22, 23]. Studies conducted in South-East, South-South, and South-West Nigeria integrated such interventions into routine diabetic clinics with structured delivery, yielding significant improvements in HRQOL and dietary knowledge [13, 19, 21]. For instance, Okafor et al. [13] reported a statistically significant post-intervention HRQOL increase across all domains ($p < 0.05$), with an effect size of 0.14 (Eta squared), while Ayeni et al. [18] observed markedly enhanced dietary knowledge in the intervention group (8.74 ± 0.49 vs. 6.02 ± 1.55; $F = 28.92$, $p < 0.001$). Johnson et al. [21] further highlighted that adding physical food demonstrations produced superior quality-of-life outcomes (54.3% good QoL in experimental group vs. 30.9% in control; $p = 0.001$). These findings suggest reasonable cost-effectiveness and integration potential in resource-limited tertiary care, although scalability remains constrained by staffing shortages and infrastructure limitations common in Nigerian public hospitals.

Adherence enablers include culturally relevant meal planning, family involvement, and regular follow-up by trained professionals, often via bi-weekly phone calls or personalized timetables [19, 21]. Such strategies facilitated high practicality, with 83% of participants in one study deeming timetables feasible and worth adopting [19]. Reported dropout rates of approximately 10–20% in quasi-experimental cohorts reflect moderate attrition, primarily driven by structural issues like transportation barriers rather than purely behavioral factors [13]. Implementation challenges persist, notably food insecurity, economic constraints, limited nutrition workforce capacity, and inadequate staff training, which hinder consistent delivery [19]. The COVID-19 pandemic exacerbated these issues through disrupted clinic visits and reduced patient contact, prompting shifts toward remote or hybrid models such as telephone consultations, though in-person demonstrations proved more effective for behavioral change [21]. Regionally, Southern Nigerian tertiary hospitals (South-East and South-South) report stronger facilitators linked to relatively better health system capacity and socioeconomic conditions compared to Northern settings, where

disparities amplify barriers like access and literacy [13, 21]. These variations underscore the need for context-specific adaptations to enhance equity and sustainability.

Risk of Bias and Methodological Limitations

The risk of bias and methodological limitations were assessed using Cochrane's risk of bias tool for RCTs (Fig. 3) and the revised JBI Critical Appraisal Tool for quasi-experimental studies (Table 2). For the six RCTs, randomization and allocation concealment were generally adequate (low risk in most), but blinding of participants and personnel was high risk in several [22, 24, 27] due to the educational/dietary nature of interventions, making blinding infeasible. Blinding of outcome assessors was mostly low risk or unclear. Incomplete outcome data and selective reporting showed low risk across studies, except high risk in Akoko et al. [25] for outcome assessment and overall. Overall, most RCTs had low to moderate risk, though some concerns arose from lack of blinding and occasional unclear elements. The six quasi-experimental studies (using revised JBI tool) demonstrated yes responses for clear cause-effect, similar participants (besides intervention), confounding control (mostly), multiple pre/post measures, complete follow-up (variable), same outcome measurement, reliable measurement, and appropriate statistics. However, several were unclear or no on follow-up completeness and confounding control. All were rated moderate overall risk of bias. Key limitations included inability to blind due to intervention type, potential confounding in quasi-experimental designs, and variable follow-up completeness. Despite these, the evidence base remains moderately reliable for informing personalized dietary management effects on glycemic control in Nigerian settings.

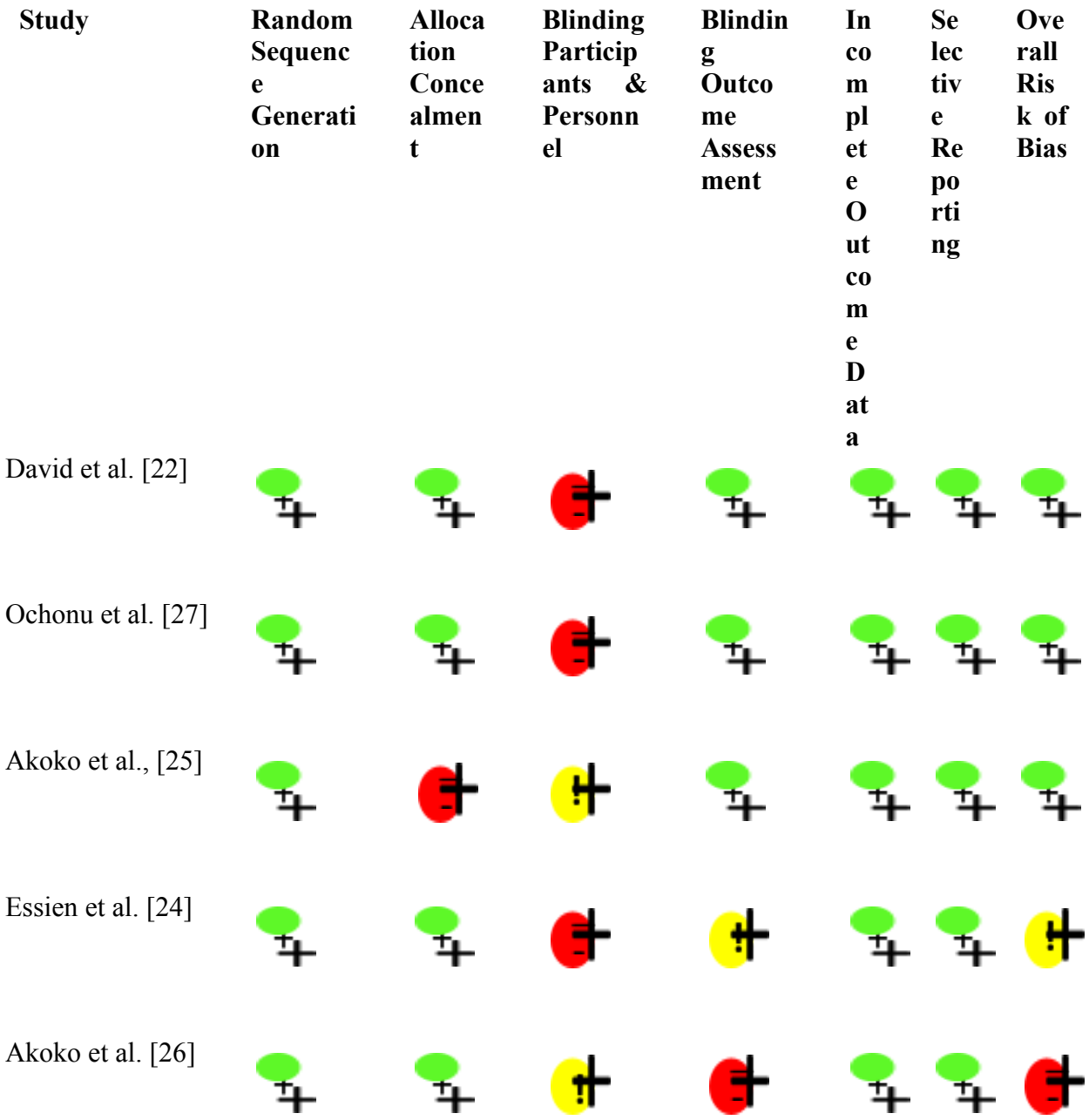

Fig 3. Risk of bias assessment (Cochrane's risk of bias tool for RCTs) [22]

Table 2. Risk of bias assessment (JBI Critical Appraisal Tool for Quasi-Experimental Studies)

	Ayeni et al., [19]	Johnson et al. [21]	Okafor et al. [13]	Osonuga et al. [28]	Howells et al. [20]	Abiodun et al. [23]
Clear cause/effect?						
Similar participants?						
Similar care besides intervention?						
Control of confounding?						
Multiple outcome measures pre/post?						
Complete follow-up?						
Same outcome measurement?						
Reliable outcome measurement?						
Appropriate stats?						
Overall Risk of Bias	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

KEY: YES UNCLEAR NO

Discussion

The evidence synthesised in this systematic review consistently reveals clinically meaningful improvements in glycaemic control associated with personalised dietary management combined with structured nutrition education. Short-term reductions in HbA1c, fasting plasma glucose, and postprandial glucose align closely with international meta-analyses demonstrating pooled HbA1c decreases of 0.83% following educational interventions [29]. Comparable patterns broadly emerge from medical nutrition therapy delivered by dietitians, which produces average HbA1c reductions of 0.43% alongside improvements in fasting blood glucose [30]. These alignments strongly indicate that the magnitude of glycaemic benefit observed in Nigerian tertiary settings, often exceeding 1% HbA1c decline in the initial months, reflects robust efficacy when interventions address

individual needs rather than applying generic advice. Such outcomes align closely with international meta-analyses of dietary education interventions, which report mean HbA1c reductions of approximately 0.42% across heterogeneous populations [31]. In a North American randomised controlled trial evaluating structured nutrition approaches within diabetes self-management education, the modified plate method notably produced a 0.83% HbA1c decline and carbohydrate counting a 0.63% reduction at six months among patients with baseline HbA1c between 7% and 10% [32]. European and Asian trials similarly document short-term HbA1c improvements of 0.4–0.8% when personalised dietary counselling incorporates glycaemic index principles or energy-restricted patterns [33, 34]. The Nigerian context, however, appears to yield comparatively larger effect sizes in the initial phase, potentially attributable to higher baseline glycaemic burden and the novelty of structured education in settings where routine care often lacks nutritional specificity [35].

Consistency across glycemic parameters clearly underscores the superiority of personalized over generic nutrition education. International evidence further reinforces this trend: meta-analyses of low-carbohydrate (<26% energy) and Mediterranean dietary frameworks demonstrate HbA1c reductions of 0.47% with high certainty, effects amplified when interventions tailor recommendations to individual metabolic responses and cultural food preferences [33]. In other African settings, culturally adapted programmes have repeatedly produced HbA1c decreases of around 0.6–0.7% when local staples replace generic advice, mirroring the moderating role of regional dietary integration observed in Nigeria [36]. Yet the attenuation of benefits beyond six months in longer Nigerian follow-ups critically highlights a limitation shared with global cohorts, where intervention intensity and sustained contact emerge as key moderators of durability [31]. Without ongoing reinforcement, regression toward baseline glycaemia occurs, driven by environmental and socioeconomic pressures that undermine adherence. Context-specific adaptations prove particularly salient. Nigerian findings emphasise the value of embedding familiar carbohydrate sources and meal patterns into plans, enhancing acceptability and self-management. This resonates strongly with evidence from Asian and other sub-Saharan African contexts, where high-carbohydrate traditional diets necessitate culturally responsive modifications to achieve comparable glycaemic stability [33, 37]. Western trials, often conducted in populations with greater prior exposure to nutrition guidance, frequently report smaller incremental gains, underscoring how baseline health literacy and healthcare access shape intervention responsiveness [38].

Personalised dietary management with nutrition education favourably exerts effects on body weight, lipid profiles, blood pressure, and quality-of-life indicators, though outcomes display notable variability. Meta-analytic evidence firmly establishes moderate reductions in weight (approximately 1.5 kg), body mass index, waist circumference, total cholesterol, and systolic blood pressure following dietitian-led medical nutrition therapy [30]. These cardiometabolic benefits frequently co-occur with glycaemic improvements, reflecting integrated physiological pathways. Quality-of-life gains, particularly in domains of physical functioning and emotional well-being, further emerge in culturally adapted programmes, consistent with trends observed in both high-income and middle-income settings [39]. Variability in these outcomes links closely to adherence levels, intervention intensity, and follow-up duration. High-contact programmes with frequent reinforcement sustain broader benefits more effectively than low-intensity education, a pattern widely replicated across North American, European, and Asian cohorts [32]. In resource-constrained environments, including parts of sub-Saharan Africa, differential responsiveness appears markedly amplified among participants with higher baseline body mass index or stronger family support networks [36, 40]. Nigerian findings sit comfortably within this global evidence base: greater absolute improvements among overweight subgroups and those receiving demonstrations or timetables parallel international observations [22-27], yet underscore how economic constraints and food insecurity can acutely erode long-term cardiometabolic gains more than in high-income countries where sustained dietitian access and digital monitoring tools are more readily available.

Variability in these outcomes links intimately closely to adherence levels, intervention intensity, and follow-up duration [30]. High-contact programmes with frequent reinforcement sustain broader benefits more effectively than low-intensity education, a pattern consistently replicated across North American, European, and Asian cohorts [29, 41]. In resource-constrained environments, including parts of sub-Saharan Africa, differential responsiveness appears particularly amplified among participants with higher baseline body mass index or stronger family support networks [36, 40]. Nigerian findings situate firmly within this global evidence base: greater absolute improvements among overweight subgroups and those receiving demonstrations or timetables parallel international observations [30], yet underscore how economic constraints and food insecurity can uniquely erode long-term cardiometabolic gains more acutely than in high-income countries where sustained dietitian access and digital monitoring tools are more readily available [29].

Implementation of personalised dietary management and nutrition education in Nigerian tertiary hospitals routinely encounters substantial health system and contextual barriers that shape effectiveness and scalability. Limited nutrition workforce capacity, inadequate staff training, and constrained clinic infrastructure impede consistent delivery, mirroring challenges commonly documented across low- and middle-income countries where specialist dietitians remain scarce and overburdened. Patient literacy levels, cultural food practices centred on communal eating and staple carbohydrate reliance, and cost constraints further complicate adherence, often exacerbated by food insecurity and transportation barriers [30]. When compared to high-income countries, the differences are very clear: North America and Europe have established dietetic services, electronic health record integration, and reimbursement systems that make it easier for different types of care to work together and for long-term follow-up. Middle-income Asian contexts, while sharing cultural dietary complexities, frequently demonstrate greater scalability through models of community health workers and digital platforms. Within other African settings, similar workforce shortages and literacy challenges commonly prevail, yet certain South African programmes illustrate how group-based, hands-on education can partially mitigate infrastructure deficits [36]. Nigerian tertiary facilities are in the middle because they have referral-level expertise but are limited by not having enough resources to meet demand. Culturally responsive adaptations are important tools for overcoming systemic limitations. These realities critically influence intervention effectiveness: higher-intensity, in-person elements enhance outcomes but strain capacity, while remote or nurse-led models offer scalability at the cost of reduced behavioural impact. Addressing these dynamics urgently requires deliberate investment in workforce development and infrastructure to bridge the gap between efficacy in controlled evaluations and real-world effectiveness.

Implications of Findings

The implications of these findings extend beyond immediate clinical efficacy to inform strategic enhancements in diabetes care delivery within Nigerian tertiary hospitals and analogous resource-limited contexts. Foremost, the demonstrated superiority of personalised dietary management integrated with nutrition education mandates a paradigm shift from fragmented, generic protocols to tailored, patient-centred models that prioritise cultural congruence and individual socioeconomic realities. Such a transition holds the potential to optimise resource allocation by amplifying the impact of existing multidisciplinary teams, thereby mitigating the disproportionate burden on endocrinologists and overextended clinics.

Policymakers must leverage these insights to advocate for the institutionalisation of nutrition education within national diabetes guidelines, fostering protocols that embed local food systems and sustained follow-up mechanisms to counteract the observed attenuation of benefits over time. This approach not only promises to curtail microvascular and macrovascular complications but also yields economic dividends through reduced hospital admissions and enhanced workforce productivity among affected populations. Critically, the emphasis on short-term gains underscores the imperative for longitudinal evaluation frameworks that interrogate scalability, ensuring that interventions evolve in response to systemic inequities such as regional disparities in access. By prioritising these implications, health systems can cultivate resilient, equitable pathways for diabetes management, ultimately contributing to broader public health resilience against the escalating non-communicable disease epidemic in sub-Saharan Africa.

Limitations of the Review

This systematic review, while adhering to established methodological standards, encounters inherent constraints that temper the robustness and scope of its conclusions. The narrative synthesis approach, necessitated by substantial heterogeneity in intervention designs, outcome metrics, and participant demographics across the included studies, precludes quantitative meta-analytic integration, thereby limiting the precision of effect size estimations and the capacity to discern pooled impacts with statistical rigour. Search strategies, confined to four electronic databases despite exhaustive keyword clustering and Boolean refinements, may inadvertently overlook pertinent grey literature or regionally indexed sources beyond African Journals Online, potentially introducing selection bias through under-representation of non-English publications or nascent studies from under-represented northern Nigerian contexts. The reliance on dual independent screening and extraction processes, although mitigating reviewer subjectivity, remains susceptible to inter-rater variability in eligibility judgements, particularly for borderline quasi-experimental designs where causal inference hinges on nuanced interpretations of confounding controls. Furthermore, the absence of formal publication bias assessment, such as funnel plot analysis or Egger's test, deemed inappropriate given the paucity of studies and qualitative synthesis, heightens vulnerability to overestimation of intervention efficacy. These methodological facets collectively constrain the generalisability of findings, underscoring the need for future reviews to incorporate advanced sensitivity analyses and expanded multilingual searches to refine evidential hierarchies in resource-constrained settings.

Conclusion

Personalised dietary management integrated with nutrition education constitutes an effective strategy for improving glycaemic control and broader health outcomes among type 2 diabetes patients in Nigerian tertiary hospitals. The intervention yields clinically significant short-term reductions in HbA1c alongside favourable anthropometric and psychosocial benefits. However, its long-term sustainability confronts systemic barriers, including severe workforce shortages, economic constraints, and inadequate follow-up systems. These findings illuminate a critical divergence between evidence-based efficacy and real-world implementation in resource-constrained settings. To translate these gains into enduring impacts, policymakers and health planners must prioritise investments in dietetic workforce expansion, culturally adapted educational materials, and sustainable support mechanisms. Ultimately, integrating such tailored, low-cost interventions into standard diabetes care protocols remains indispensable for alleviating the escalating burden of diabetes complications in Nigeria and comparable contexts.

Reporting Method: PRISM

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