SYSTEMATIC REVIEW/META ANALYSIS

Dietary Interventions for NCD Prevention in BRICS Countries: A Systematic Review with Emphasis on Nudge-Based RCT-Approaches

Sreelakshmi VR[1], Sriram G[2*]

[1,2]Department of Social Sciences, School of Social Sciences and Languages, Vellore Institute of Technology, Vellore, Tamil Nadu, India

DOI: 10.55489/njcm.170320266085

ABSTRACT

Background: Non-communicable diseases (NCDs) are rising rapidly in BRICS nations, yet evidence on context-specific dietary interventions, particularly nudge-based randomized controlled trials (RCTs), remains fragmented. This study synthesized RCT evidence on dietary interventions for adult populations in BRICS countries.

Methods: A systematic review was conducted following PRISMA guidelines. PubMed, Scopus, and Web of Science were searched for RCTs (2015-2024) involving adults (≥18 years) in Brazil, Russia, India, China, and South Africa. Twenty-seven RCTs were included. Data on intervention type, outcomes, and risk of bias (Cochrane RoB 2) were narratively synthesized due to heterogeneity.

Results: Of 27 RCTs, 41% were from China and 26% from India; 66% had high risk of bias. Interventions improved fruit and vegetable intake (+23.4 g/day; p=0.008), reduced systolic blood pressure (-10.0 mmHg; 95% CI -12.1, -7.9), and lowered HbA1c (-0.69%; 95% CI -0.99, -0.39; p<0.001). Digital interventions achieved significant reductions in BMI (-1.61 kg/m^2; p<0.001) and energy intake (-331 kcal). Nudge-based strategies (15%) demonstrated reductions in sodium intake (-21%) and improved healthy food selection, but evidence was limited.

Conclusion: Dietary interventions in BRICS countries improve diet quality and cardiometabolic outcomes; however, high risk of bias and scarcity of nudge-based trials limit definitive conclusions. Rigorous, age-specific RCTs are needed to strengthen NCD prevention strategies.

Keywords: Noncommunicable Diseases, Randomized Controlled Trials, BRICS Countries, Nudge, Dietary Interventions

ARTICLE INFO

Financial Support: None declared

Conflict of Interest: The authors have declared that no conflict of interest exists.

Received: 15-10-2025, **Accepted**: 16-02-2026, **Published**: 01-03-2026

***Correspondence:** Sriram G (Email: sriram.g@vit.ac.in)

How to cite this article: Sreelakshmi VR, Sriram G. Dietary Interventions for NCD Prevention in BRICS Countries: A Systematic Review with Emphasis on Nudge-Based RCT-Approaches. Natl J Community Med 2026;17(3):169-181. DOI: 10.55489/njcm.170320266085

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

Non-communicable diseases (NCDs) are a significant global health challenge, accounting for a substantial majority of deaths worldwide, which are from a combination of genetic, physiological and behavioral factors.[1] Among all risk factors globally, suboptimal diet is responsible for more deaths than any other risk, including tobacco smoking.[2] Thus, diet plays a critical role in maintaining health across the lifespan, reducing disease burden and improving quality of life.[3,4] Evidence suggests that one in five deaths worldwide could be prevented through dietary improvements[2], which underscores the urgent need for effective nutritional interventions targeting adult populations.

Dietary interventions comprise of diverse approaches, from intense counselling and instruction that necessitates active engagement to subtle environmental changes that nudge individuals toward healthier choices without limiting their options.[5,6] Nudge-based interventions, which modify choice architecture through methods like food labelling, default options, strategic placement or portion control can influence adult food purchasing decisions, highlighting methods that are scalable and impose minimal burden on participants.[7,8] These approaches are particularly promising because they require minimal active decision-making from participants.[9,10] However, nudges are just one part of a wider array of dietary intervention strategies, each with unique mechanisms, implementation requirements and effectiveness profiles.[11]

The BRICS nations- Brazil, Russia, India, China, and South Africa- collectively accounts for 40% of the world's population[12] and are experienced by rapid demographic, epidemiological transitions and economic transformations[13,14]. These populations are shifting from communicable diseases to NCDs, driven by contributing factors such as economic inequalities, population growth and unequal allocation of healthcare resources.[15] As these nations experience increases in life expectancy and NCD burden, understanding diverse dietary intervention approaches becomes critical for public health strategies.[16]

Despite extensive research in high-income countries, BRICS nations face unique dietary transition patterns driven by rapid economic growth, urbanization and higher income elasticity, where populations exhibit greater shifts toward high-value foods such as meat and dairy compared to wealthier nations.[17] These economic and lifestyle transformations, along with rapid population aging, have accelerated the prevalence of NCDs in BRICS countries, underscoring an urgent need for context-specific dietary interventions.[18] However, dietary intervention trials in BRICS nations remain scarce, creating a critical evidence gap that hinders the development of contextually appropriate NCD prevention strategies. Therefore, synthesizing available evidence across all adult age groups (≥18 years) is essential to understand effective dietary interventions in BRICS contexts and identify critical research gaps.

This systematic review synthesizes evidence from randomized controlled trials (RCTs) on dietary interventions targeting adult populations within BRICS nations published between 2015-2024, with particular attention to nudge-based approaches and their potential for NCD prevention. Included studies varies across young adults, middle-aged adults, older adults and mixed-age populations to maximize evidence synthesis while acknowledging varying applicability across age groups.

The aim of this systematic review was to identify and characterize dietary interventions tested in BRICS adult populations; to assess the intervention effectiveness on dietary behaviors and cardiometabolic health outcomes; and evaluate the methodological quality of the included studies.

METHODOLOGY

This systematic review was performed by following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews and meta-analyses[19], guidelines mentioned in the Cochrane Handbook for Systematic Reviews of Interventions[20] and the Centre for Review and Dissemination (CRD) guidelines for systematic reviews[21].

Data sources and literature search strategy: For identifying pertinent papers published between 2015 and 2024, a thorough literature search was carried out using three major electronic databases: PubMed, Scopus and Web of Science. This 10-year period was chosen to maintain a manageable yet relevant body of evidence while capturing contemporary dietary intervention strategies that reflect the current health promotion programs, digital health initiatives, food-based interventions and public health contexts in the BRICS countries.

A combinations of Medical Subject Headings (MeSH) terms and keywords associated with the following were used in the search strategy: (1) theoretical terms related to nudge (nudge OR nudging OR choice architecture OR behavioral intervention OR default option OR health promotion OR behavior) (2) terms related to dietary interventions (eating habit OR eating behavior OR dietary habit OR food choice OR healthy eating OR dietary OR diet) (3) terms related to adult and aging populations (adult, middle age, older adults, elderly, senior, aging, ageing, geriatric) (4) terms related to BRICS nations (Brazil OR Russia OR India OR China OR South Africa OR BRICS OR emerging economy OR low-middle income). (5) terms related to intervention study designs (randomized controlled trial OR RCT OR randomized OR controlled trial OR clinical trial OR intervention study OR controlled study). Search Execution month:

December.

To improve search accuracy, initial database-specific filters were used, including English language, document type limited to articles with full-text availability, publication dates (2015-2024) and study design filters for RCTs when available. Before exporting the results, these filters were implemented within the databases.

Eligibility criteria: This review aimed to search for dietary intervention studies that promote healthier eating habits among adults in BRICS countries. Two authors conducted a systematic search in the databases from September 2025 to October 2025 and additional search and modifications were performed in December 2025.

Inclusion criteria: The review included original, peer-reviewed research articles published in English between 2015 and 2024. Eligible studies were RCTs, including parallel-group, cluster-randomized, and crossover designs. The population of interest comprised adults aged 18 years and above, including middle-aged adults (40-59 years) and older adults (>60 years or ≥55/≥65 years according to individual study definitions). Studies involving mixed adult age groups spanning multiple categories were also considered. Participants of any sex or gender and with any health status—healthy, at-risk, or diagnosed with medical conditions—were eligible. Studies conducted in BRICS countries were included; multi-country studies were considered only when results specific to BRICS nations were reported separately. Interventions of any duration (ranging from single-session to multi-year programs) and intensity (minimal to intensive) were eligible.

Exclusion criteria: Studies were excluded if they focused exclusively on children or adolescents (<18 years), were conducted outside BRICS countries without disaggregated BRICS data, or employed non-randomized designs, including observational, clinical (non-randomized), pilot, or protocol studies. Editorials, commentaries, letters, and conference abstracts were also excluded. Articles published outside the predefined time frame (before 2015 or after 2024) and those without accessible full text were not considered.

Study selection criteria: The study selection process was conducted based on PRISMA guidelines[19]. All records identified through the databases were imported into Excel for screening and deduplicate purpose. Duplicates were removed by sorting records by author name, title and publication year in excel, with manual checking to ensure accuracy.

The titles and abstracts of every filtered record were individually screened by the two authors in accordance with the inclusion criteria. The authors retrieved the complete texts of the studies and evaluated them independently using the same inclusion and exclusion criteria. Any disagreements by the authors on the screening stages were resolved through discussion. The age heterogeneity across included studies was anticipated and accepted at the screening stage itself. During data extraction, the authors systematically recorded the age composition of each study population to enable transparent reporting and interpretation of findings across different age groups.

Thus, the total number of studies met all inclusion criteria were included in the Figure 1 PRISMA flow diagram.

The authors performed data extraction after selecting relevant studies. The following essential information was extracted from the selected studies using Excel: Author, Design of Study, Country, Age of the Participants, Population, Number of participants, Duration of study intervention, Intervention type, Outcome and Quality rating.

Risk of bias assessment: The authors evaluated the methodological quality of the included studies using the Cochrane Risk of Bias 2 (ROB-2) tool[22]. Design-specific versions of ROB-2 were used: the standard ROB-2 tool for individually randomized trials, ROB-2 for cluster-randomized trials, and ROB-2 for crossover trials. The following five domains were assessed: (1) bias resulting from the randomization process; (2) bias resulting from deviations from intended interventions; (3) bias resulting from missing outcome data; (4) bias in outcome assessment; and (5) bias in the selection of the reported result. The ROB-2 algorithm assigned each domain a rating of "low risk of bias", "some concerns", or "high risk of bias". The ROB-2 guidelines were used to determine the overall risk of bias judgments.

Data Synthesis: The study outcome was included in Table 1. Due to its substantial heterogeneity in interventions, a narrative synthesis was employed after synthesis without meta-analysis. Studies are grouped and synthesized based on study interventions by giving importance to the study quality and contextual factors relevant to adults in BRICS countries.

RESULTS

Search Result: Figure 1 presents the PRISMA flow diagram depicting the study selection process. The database literature search identified 15089 records. After applying database filters for publication period (2015-2024), language as English, document type limited to articles with full-text availability and study type (RCTs), 1299 relevant records were identified. After removing 334 duplicates, 965 unique records were screened at the title and abstract level.

The authors independently screened the titles and abstracts of all 334 records against the inclusion criteria, where 670 records were excluded as they did not meet the inclusion criteria and the remaining 295 recorded proceeded to full text review.

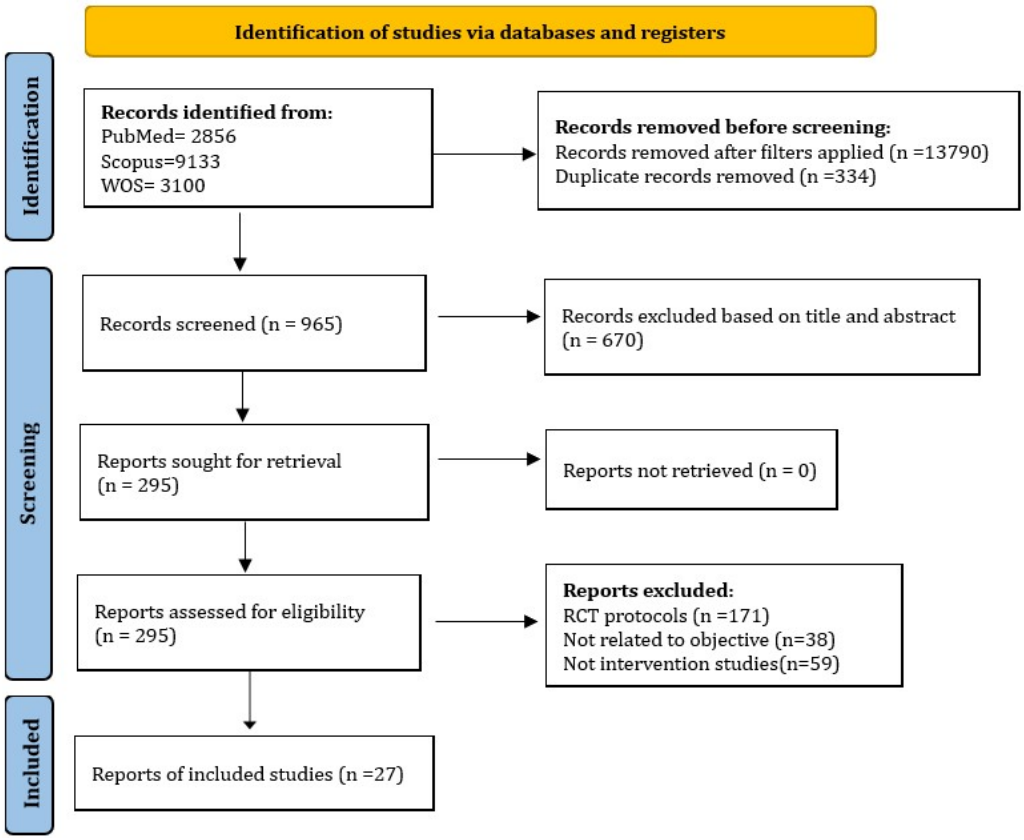

Figure 1: PRISMA flow diagram of the study selection

During review, studies were excluded with the reason of protocol papers (n=171), did not involve dietary interventions (n=59) and not related to the study objective(n=38). Thus, a total of 27 RCTs met all inclusion criteria and were included for the systematic review. The characteristics of included studies are presented in Table 1.

Characteristics of Included Studies: This review identified 27 RCTs, published between 2015-2024, of dietary behavior change interventions for adult populations across BRICS nations, with particular emphasis on nudge-based approaches and relevance for healthy aging. Studies consisting of BRICS Countries, including Brazil (n=5)[23-27], Russia (n=1)[28], India (n=7)[29-35], China (n=11)[36-46] and South Africa (n=3)[47-49], despite the notable disparity in geographic representation. This regional distribution reflects both the current state of research in the BRICS countries and possible language bias, as the review was restricted to English-language publications only.

Among the studies were published between 2015 and 2024, twenty-two studies[23-27,29-32,34,36-41,43-48] (81%) were published from 2020 onwards, reflecting growing research interest in dietary interventions in BRICS contexts. Only five studies[28,33,35,42,49] (19%) were published before 2020 (2015-2019), suggesting that this is a relatively recent research focus in these rapidly transitioning populations.

All 27 studies comprise of RCT only, where 20 studies are individual RCT[23-31,34,36-38,41,43-47,49], 6 are cluster RCT[32,35,39,40,42,48] and 1 are crossover RCT[33]. The sample sizes ranged from 57[47] to 3,906 participant[49].

The evidence base included diverse dietary intervention modalities including, digital enabled lifestyle interventions (n=9,33%)[26,29,32,37,38,41,44-46], food manipulation or substitution interventions (n=7,26%)[28,31,33,39,40,42,47], behavioral or dietary pattern interventions (n=8,30%)[23-25,27,30,35,36,48] and policy, labelling and financial incentive interventions (n=3,11%)[34,43,49].

Age composition varied substantially, only 7 studies[30,38,44-48] (26%) exclusively recruited older adults (>60 years), while 16 studies[23-25,27-29,31-33,36,37,39-42,49] (59%) enrolled mixed-age populations (spanning broad age ranges, typically including ≥60 and younger adults) and 4 studies[26,34,35,43] (15%) targeted young adults and middle-aged adults (Maximum age ≤60 years) addressing metabolic health relevant to aging. The minimum age reported as 18 years for inclusion in several studies[23,25,26,34,41,43,49] and the maximum age for participants was 80 years[38,45].

The duration of interventions examined across the studies varied widely. The shortest period was a simulated food shopping platform choice set for 3 days in the study on Multiple Traffic Lights (MTL) labelling[43] and an in-person randomized experiment evaluating Front-of-Package Labels (FOPLs)[34]. The shortest sustained continuous intervention documented was 4 weeks[36]. The longest intervention consists of involved a one-year RCT followed by a two-year scale-up intervention, totalling a three-year intervention and follow-up period[39].

Majority of the studies discussed enrolled participants with specific health conditions or who were at high risk for developing chronic conditions. The primary focus of participant enrolment across the studies was often related to managing or preventing diabetes (type 2 diabetes, pre-diabetes or high risk)[24,26,27,29,32,33,35,37,38,41,45,46,48], cardiovascular or hypertension (including general CVD risk)[28,31,36,39,42,44,49], obesity or overweight[23,24,27,33,48] and cognitive decline or geriatric health[30,47]. The details of characteristics of included studies and their key findings are presented in Table 1.

Risk of Bias in Included Studies: Figure 2 presents the overall risk of bias assessment for RCT studies included 27 studies using the Cochrane Risk of Bias 2 tool. Among the 20 individual RCT studies[23-31,34,36-38,41,43-47,49], 3 studies (15%) were judged to have a low risk of bias[25,28,36], 4 studies (20%) raised some concerns[30,31,37,43], and 13 studies (65%) were to have a high risk of bias[23,24,26,27,29,34,38,41,44-47,49]. In the risk of bias assessment for 6 cluster-randomized studies[32,35,39,40,42,48], none of the studies were judged to be at low risk of bias, 4 studies show high risk of bias[32,35,39,48] and 2 studies showed some concern[40,42]. In case of one crossover randomized study[33] , where study doesn't judged to be at low risk and some concern, and the studies show high risk of bias. The high overall risk of bias (100%) is driven by problems in the randomization process and deviations from intended interventions, whereas low risk for outcome measurement, selection of reported results, period and carryover effects.

Figure 3 summarizes the risk of bias. Among the included studies, 4 studies had low-risk bias[25,28,31,36], 5 had some concerns[30,37,40,42,43] and 18 had high-risk bias[23,24,26,27,29,32-35,38,39,41,44-49]. Thus, the domain-specific assessment revealed notable heterogeneity across bias categories. Most studies demonstrated adequate methodological rigor in randomization processes (52% low risk)[23,25,27-32,36,39,40,42,44-47], missing outcome data handling (85% low risk)[23-31,34-37,40-49], and deviations from intended interventions (70% low risk)[23-26,28-32,34,35,37-40,42,43,45-48]. However, outcome measurement emerged as the primary methodological concern, with 18 studies rated as high risk in this domain.

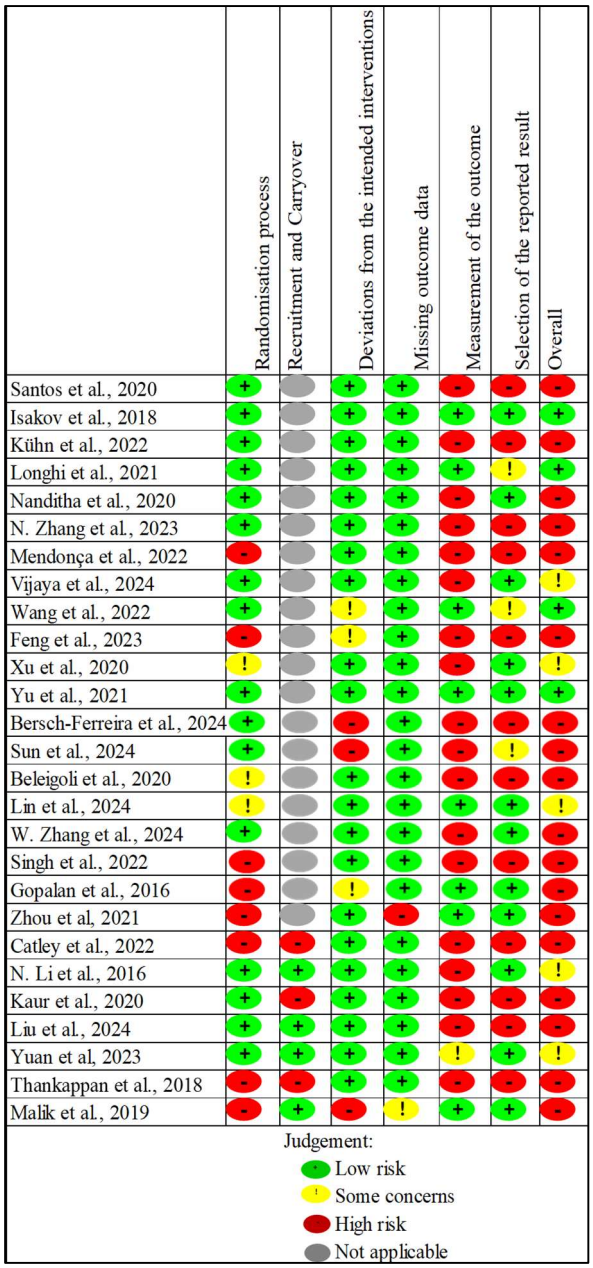

Figure 2: RoB 2 Traffic-light plot of included randomized trials

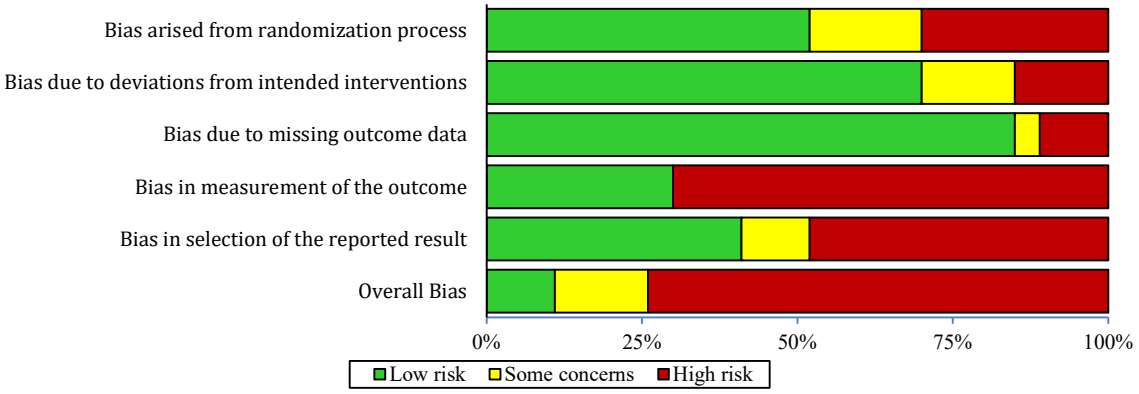

Figure 3: RoB 2 Summary plot of included randomized trials

Table 1: Overview of included studies

Authors, Year, Citation	Study Design	Country	Age Composition	Population	Sample Size	Duration of intervention	Intervention type	Outcome	Quality rating
Gopalan A et al., 2016[49]	Individual RCT	South Africa	Mixed-age (aged ≥18years)	Adults with T2DM	3906	1 month	5 arms of email messaging strategies aimed at increasing Healthy Food program enrolment.	Diabetes-specific message + Enhanced Active Choice (EAC) arm	High
Li N et al., 2016[42]	Cluster RCT	China	Mixed-age (mean age is 55 years)	Adults in rural northern China, where average sodium intake is high, drawn from 120 townships (villages)	2,566	18 months	Community-based health education, availability of reduced-sodium, added-potassium salt substitute	Potassium excretion in urine over a 24-hour period, the ratio of urinary sodium to potassium, systolic and diastolic blood pressure and the percentage of individuals with hypertension.	Some concern
Isakov VA et al., 2018[28]	Individual RCT	Russia	Mixed-age (aged 40-70 years)	Generally healthy adults with habitually low fruit/vegetable intake (Recommended Food Score <12)	120	8 weeks	Multivitamin, multimineral, phytonutrient supplementation	Muscle mass, strength, functional capacity	Low
Thankappan KR et al., 2018[35]	Cluster RCT	India	Young adults and middle-aged adults (aged 30-60 years)	Adults with high diabetes risk (IDRS ≥60) but diabetes-free on OGTT	1,007	12 months with 24 months of follow-up	Low-cost peer-support lifestyle intervention with 15 group sessions and community activities focused on physical activity and healthy eating	The Incidence of type 2 diabetes at 24 months	High
Malik VS et al., 2019[33]	Crossover RCT	India	Mixed-age (aged 25-65 years)	Overweight adults (BMI ≥23 kg/m^2)	166	3 months	Brown rice substitution for white rice	Fasting glucose, HbA1c, lipid profile	High
Beleigoli A et al., 2020[26]	Individual RCT	Brazil	Young adults and middle-aged adults (aged 18-60 years)	Adults with overweight or obesity (BMI ≥ 25 kg/m^2)	1298	24 weeks	3 arms: computerized feedback,12 weeks dietitian coaching, minimal intervention	Improvement in multiple dietary habits	High
Kaur J et al., 2020[32]	Cluster RCT	India	Mixed-age (aged 35-70 years)	Adults responsible for meal preparation	732	6 months	IT-enabled-SMART Eating-health promotion	Dietary salt intake, fruit/vegetable consumption	High
Nanditha A et al., 2020[29]	Individual RCT	India	Mixed-age (aged 35-55 years)	Adults with prediabetes (HbA1c ≥6.0 and ≤6.4%)	2062	24 months	Mobile technology for lifestyle changes	Diabetes Progression, Cardiovascular Risk,	High
Santos et al., 2020[23]	Individual RCT	Brazil	Mixed-age (aged 18-65 years)	Adults with severe obesity (BMI ≥35 kg/m^2)	149	12 weeks	Intervention with 52 mL/day Extra Virgin Olive Oil (EVOO), or traditional Brazilian diet (DieT-Bra) or both combined	Change in LDL-c levels, HDL-c, triglycerides (TG), blood glucose and HbA1c	High

Authors, Year, Citation	Study Design	Country	Age Composition	Population	Sample Size	Duration of intervention	Intervention type	Outcome	Quality rating
Xu Z et al., 2020[37]	Individual RCT	China	Mixed-age (aged 23-67 years)	Adults with high risk for diabetes (ADA screening score ≥5) with smartphone access	79	6 months	Mobile-based dietary and physical activity intervention	Diabetes risk score, lifestyle behaviors	Some concern
Longhi R et al., 2021[25]	Individual RCT	Brazil	Mixed-age (aged 18-65 years)	Adults with body mass index ≥ 35 kg/m^2	149	12 weeks	Nutritional intervention with DietBra and EVOO	NLR, LMR, leukocytes and CRP	Low
Yu J et al., 2021[31]	Individual RCT	India	Mixed-age (mean age is 61.6 years)	Adults with hypertension	502	3 months	Salt substitute intervention	Systolic BP, Diastolic BP, Urinary biomarkers, Salt satisfaction	Low
Zhou M et al, 2021[38]	Individual RCT	China	Older adults only (aged 60-80 years)	Adults with BMI ≥24 kg/m^2, not physically active and who are mobile phone users	750	3 months	Mobile-based lifestyle intervention	Body weight, BMI, waist circumference	High
Catley D et al, 2022[48]	Cluster RCT	South Africa	Older adults only (mean age is 68 years)	Adults with BMI ≥25 kg/m^2, who are members of social support groups or NGO health clubs	494	7 to 9 months	Adapted Diabetes Prevention Program	Body weight, HbA1c, diabetes incidence	High
Kühn L et al., 2022[47]	Individual RCT	South Africa	Older adults only (mean age is 72 years)	Elderly adults (living alone or as couples) with low monthly income (≤$223 per person)	57	12 weeks	DASH Intervention for Neurodegenerative Delay (MIND) diet	Cognitive function, nutritional status	High
Mendonça RDD et al., 2022[24]	Individual RCT	Brazil	Mixed-age (mean age 57.2 years)	Adult users of Brazilian Primary Health Care	3,414	7 months	Nutritional intervention to promote Fruit and Vegetable (FV) intake using group sessions, motivational cards and informational materials	Change in FV intake and knowledge on FV.	High
Singh SK et al., 2022[34]	Individual RCT	India	Young adults and middle-aged adults (aged 18-60 years)	Adults involved in grocery decision making (involved ≥50% of grocery purchase decisions)	2869	Single-session in-person experiment	Randomized comparison of five Front-of-Package Labels (FOPLs)	Label Comprehension	High
Wang Y et al., 2022[36]	Individual RCT	China	Mixed-age (aged 25-75 years)	Adults with systolic blood pressure (SBP 130-159 mm Hg)	265	4 weeks	Cuisine-based Chinese Heart-Healthy Diet	Blood pressure, sodium intake	Low
Feng Y et al., 2023[41]	Individual RCT	China	Mixed-age (aged 18-79 years)	Adults with uncontrolled (T2DM)	228	1 year	eHealth family-based intervention program delivered via WeChat	Enhanced Glycated haemoglobin (HbA1c) level	High
Yuan Y et al,	Cluster	China	Mixed-age	Adults aged ≥55 years	1612	24 months	Progressive Salt Reduction	Salt supply, 24-hour urinary sodi-	Some

Authors, Year, Citation	Study Design	Country	Age Composition	Population	Sample Size	Duration of intervention	Intervention type	Outcome	Quality rating
2023[40]	RCT		(aged ≥55 years)	with blood pressure measurement				um	concern
Zhang N et al., 2023[45]	Individual RCT	China	Older adults only (aged ≥ 60 years)	Older adults with overweight or obesity (BMI ≥24 kg/m^2)	750	3 months	Remote management system via smartphone app	benefited in potential weight control	High
Bersch-Ferreira AC et al., 2024[27]	Individual RCT	Brazil	Mixed-age (aged ≥30 years)	Adults with poorly controlled T2D and HbA1c ≥7%, who were users of a public health system	371	6 months	Multicomponent nutritional strategy with targeted nutritional advising	Change in Glycated haemoglobin (HbA1c, %) and glycaemic control	High
Lin J et al., 2024[43]	Individual RCT	China	Young adults and middle-aged adults (mean age of 21 years)	College students who use prepackaged food products	100	Short-term choice (purchases for 3-day consumption)	Multiple Traffic Light (MTL) labelling system on food choices in a simulated shopping environment	Change in intake of calories, fat, carbohydrates and sodium	Some concern
Liu M et al., 2024[39]	Cluster RCT	China	Mixed-age (aged 18-75 years)	Adults with stable residency (lived locally >6 months, no relocation plans)	2693	3 years	Comprehensive salt reduction strategy	The variation in salt consumption measured by 24-hour sodium excretion in the urine	High
Sun T et al., 2024[44]	Individual RCT	China	Older adults only (aged >60 years)	Older adults with hypertension (or on antihypertensive medication) who are smartphone or WeChat proficient	68	12 weeks	(HBDIHP) utilizing WeChat and an Intelligent System	Improvements in systolic BP (-7.36 mm Hg), SEVR, weight, exercise time, medication adherence,	High
Vijaya S et al., 2024[30]	Individual RCT	India	Older adults only (aged ≥ 60 years)	Older adults at risk of malnutrition (MNA <24) and cognitively intact (MMSE <24)	68	3 months	Dietary Intervention	Change in the nutritional status	Some concern
Zhang W et al., 2024[46]	Individual RCT	China	Older adults only (aged ≥ 60 years)	Older adults with T2DM (HbA1c ≥7%, diagnosed >6 months) from endocrinology or diabetes clinics and smartphone users	130	3 months	SDM -informed dietary intervention using a digital health system and face-to-face meetings	HbA1c, diastolic blood pressure (DBP), and fasting plasma glucose (FPG) and enhanced diabetes	High

Abbreviations: T2DM/T2D = Type 2 Diabetes Mellitus, EAC = Enhanced Active Choice, BMI = Body Mass Index, IDRS = Indian Diabetes Risk Score, OGTT = Oral Glucose Tolerance Test, HbA1c = Glycated Haemoglobin, IT = Information Technology, SMART = Self-Monitoring and Regulation Technology, EVOO = Extra Virgin Olive Oil, DieTBra/DietBra = Traditional Brazilian Diet, LDL-c = Low-Density Lipoprotein Cholesterol, HDL-c = High-Density Lipoprotein Cholesterol, TG = Triglycerides, ADA = American Diabetes Association, NLR = Neutrophil-to-Lymphocyte Ratio, LMR = Lymphocyte-to-Monocyte Ratio, CRP = C-Reactive Protein, BP = Blood Pressure, NGO = Non-Governmental Organization, DASH = Dietary Approaches to Stop Hypertension, MIND = Mediterranean-DASH Intervention for Neurodegenerative Delay, FV = Fruits and Vegetables, FOPL/FOPLs = Front-of-Package Label(s), SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure, mm Hg = Millimetres of Mercury, eHealth = Electronic Health, MTL = Multiple Traffic Light, SEVR = Subendocardial Viability Ratio, MNA = Mini Nutritional Assessment, MMSE = Mini-Mental State Examination, SDM = Shared Decision-Making, FPG = Fasting Plasma Glucose, HBDIHP = Home-Based Digital Intelligent Hypertension Progra

Effects of Interventions: Given the heterogeneity and variation in methodological quality, we opted for a narrative synthesis rather than a meta-analysis[50]. Thus, this method enables thorough interpretation of results while taking into consideration differences in population characteristics, intervention types and study quality among the various BRICS contexts.

The digital health interventions represented the most common modality (n=9)[26,29,32,37,38,41,44-46], spanning smartphone applications, web-based platforms and social media-based programs (particularly WeChat in China). These interventions demonstrated varying degrees of success, ranging from significant weight loss and improved clinical biomarkers.

Several digital platform studies demonstrated effective weight management, with intervention groups achieving greater mean weight loss than controls (platform plus dietitian: -1.57 kg; platform only: -1.08 kg; control: -0.66 kg)[26]. Additional benefits included lower haemoglobin (HbA1c) values (-.69, 95% CI -0.99 to -0.39; p<.001)[41], larger reductions in BMI (-1.61 kg/m^2, p<.001)[45] and waist circumference (p<.001)[37] and improvement in hip circumference[38]. However, there are studies which shows no significant reduction in prediabetes toT2DM progression (HR 0.89; p=0.22), with no differences in secondary outcomes like body weight, waist circumference and BMI between groups[29].

However, most digital interventions enrolled mixed-age populations and elderly populations, demonstrated that mobile technology, when tailored for the elderly, can significantly improve chronic disease management, particularly T2DM and hypertension[44-46,48]. For younger and middle-aged adults, digital interventions leveraging high smartphone penetration achieved significant reductions in energy, fat and carbohydrate intake including -331 kcal, -12.5 g fat, -46.9 g carbs[32] and exp[β] = 0.66 (energy), 0.71 (fat), 0.83 (carbohydrates) vs controls[37]. The studies shows that remote health management is feasible for older adults when interfaces are visually clear and easy to operate[45]. While digital interventions effectively overcome geographical and labour constraints, some studies noted declining adherence over time (e.g. after 7 weeks), suggesting the need for dynamic strategies to address user fatigue[44].

Despite being our primary research interest, nudge-based interventions were scarce, comprising only 4 of 27 studies (15%). The four studies provided different behavioral and structural strategies to promote healthier dietary choices, were framing of choices and systematic changes to the food environment are often more effective in driving healthy eating behaviors. The interventions guided consumers toward "Green" (low-level) nutrient options[43] and purchases of healthy foods (like fruits and vegetables)[49]. While there are studies that did not find a significant immediate change in purchase intentions, but it significantly improved identification of high-sugar, high-sodium and high-fat products which has the potential to effectively lower blood pressure[34,40].

The messaging-based nudge study in South Africa is notable for its significance where the diabetes-specific "Enhanced Active Choice" message generated the greatest enrolment rate of 12.6%, demonstrating how well-crafted digital nudges can significantly boost the participation of people with diabetes in healthy-eating initiatives[49]. The intervention that involved a stepwise reduction of the salt supply showed the potential to effectively lower Systolic BP by -3.0 mmHg and Diastolic BP by -2.0 mmHg[40]. Notably, these are the only nudge studies exclusively targeting older adults and demonstrated the feasibility and effectiveness.

The use of MTL Labels on prepackaged foods significantly reduced unhealthy product selection and improved the healthy eating behaviour without increasing economic costs, with a decreases of 21% in calorie intake, 25% in fat, 18% in carbohydrates and 30% in sodium[43]. The warning labels helped the customers to identify unhealthy products, which is identified as more effective than Health Star Rating and Traffic Lights[34]. This demonstrates the effectiveness of nudge interventions, particularly well-suited for young adult populations.

The studies promoted a complex, overarching eating pattern focusing on personalized dietary prescription[27], educational sessions[24], group sessions and interventions based on motivational cards and informational materials to promote fruit and vegetable (FV) intake[24]. These interventions demonstrated cardiometabolic benefits including significant HbA1c reductions (-0.24% to -0.6%)[27,48], improvements in BMI and Mini Nutritional Assessment (MNA) scores[30] and substantial blood pressure reductions in SBP (−10.0 mmHg, 95% CI: -12.1, -7.9) and DBP (−3.8 mmHg, 95% CI: -5.0, -2.5) vs control[36].

Dietary improvements comprised increased FV consumption (+23.4 g/day total, +17.3 g/day fruit)[24,25], higher likelihood of meeting ≥5 daily FV (p = 0.008) and reduced alcohol consumption (p = 0.018)[35], enhanced overall diet quality through promotion of plant-based[30], reduced ultra processed food intake and decreased total leukocytes and lymphocyte-to-monocyte ratio (LMR)[25].

Multiple studies under specific food or nutrient substitution revealed notable dietary improvements including improvements in micronutrient status (higher circulating quercetin, vitamin C, and RBC folate)[28] and mineral balance (use of reduced-sodium, added-potassium salt substitutes)[42]. These changes were accompanied by consistent blood pressure reduction including significant short-term SBP reductions of 4.6 mmHg and DBP 1.1 mmHg[31] and 2.95 mmHg SBP vs control[39], lower HbA1c[33], higher levels of red blood cell (RBC), eicosapentaenoic acid (EPA) and docosapentaenoic acid (DPA)[47] and significant declines in serum homocysteine (Hcy) and gamma-glutamyl transferase (GGT)[28] and shifts in 24-hour urinary electrolytes, with approximately a 5.5% re-

duction in sodium excretion and a 16% increase in potassium excretion[42].

Although the effects are outcome-specific, this pattern shows a generally good, combined efficacy of dietary treatments for enhancing cardiometabolic and functional health among adults, middle-aged adults and older individuals.

Discussion

This systematic review analysed the evidence from 27 RCTs examining dietary interventions in BRICS countries between the period of 2015-2024. The studies were geographically concentrated in China (41%) with limited representation from India (26%), Brazil (19%), South Africa (11%) and Russia (4%). Methodological quality was mixed, with only 15% achieving low risk of bias, while 19% raised some concerns and 66% were rated as high risk, predominantly due to unblinded outcome assessment (70% of studies).

This review assessed the theoretical underpinnings of nudge-based interventions and synthesized evidence on their contextual suitability and impact on dietary behavior among aging populations in diverse socio-economic and cultural settings. The findings indicate that the research include traditional intensive behavioral treatments (n=23)[23-33,35-39,41,42,44-48], and there are only numerous nudge-based interventions that met the criteria(n=4)[34,40,43,49].

However, a critical finding that fundamentally constrains interpretation of our results is the substantial age heterogeneity of included study populations combined with the scarcity of nudge-based interventions. Only 7 of 27 studies (26%) exclusively recruited older adults (≥60 years), while 16 (59%) enrolled mixed-age populations and 4 (15%) targeted young/middle-aged adults (maximum age ≤60 years). Thus, this limited evidence on both older adults and younger populations constrains the ability to draw definitive conclusions about intervention effectiveness specifically for NCD prevention across adult populations.

While our primary research focus was on nudge approaches due to their theoretical benefits for scalability[51], minimal participant burden and potential suitability[10] across populations. However, nudge-based interventions comprising only (n=4)15% of the identified evidence base, represented only three BRICS nations, China (n=2), India (n=1) and South Africa (n=1), with no nudge studies identified from Brazil or Russia. This limits our ability to evaluate nudge effectiveness across different age groups and the absence reflects a substantial gap in the research base that calls for thorough examination. This finding aligns with the study of Reñosa et al.[52] highlighted that only a small proportion of behavioral intervention studies in BRICS and other low and middle income country (LMIC) settings have explicitly employed nudge-based approaches.

This study showed that most effectiveness findings are drawn from studies with mixed-age populations rather than older-adult-exclusive trials. Despite consistent benefits of dietary interventions for dietary behaviors and cardiometabolic outcomes, their applicability to older adults (≥60 years) is uncertain due to age heterogeneity in the evidence base. This means that physiological responses, baseline health status and behavioral factors, all of which vary with age, could lead to different effects across older age group.

The findings indicate the successful use of behavioral or structural interventions to improve dietary choices and mitigate risk factors for NCDs. The interventions vary from nutritional labelling to digital coaching and the significant improvement of clinical markers (blood pressure, HbA1c) and dietary behaviors (increased FV intake, reduced sodium).

The common outcome across BRICS countries shows a successful promotion of healthy eating habits and effectiveness in improving diet quality and cardiometabolic outcomes. Brazil showed strongest evidence for web-based programs (POEmaS) and traditional dietary patterns (DieTBra and Extra Virgin Olive Oil) promoting FV intake and weight reduction. This result aligns with the findings of Sartorelli DS et al.[53] points out that low-cost nutritional interventions in Brazil have been effective in changing adult lifestyles, showing a reduced intake of saturated fat and increased consumption of fruits, vegetables, fibre and olive oil.

While India emphasized consumer awareness and blood pressure reduction via warning labels and community support, which is confirmed in the studies of Bhattacharya S et al.[54] and Patil S et al.[55]. The most effective tool is the Front-of-package warning labels, which were followed by IT based interventions and dietary advice. China achieved substantial blood pressure and glycaemic control through mobile micro-interventions and labelling, were digital intervention care, family-based WeChat programs and Multiple MTL labels significantly lowered HbA1c values and food caloric intakes. South Africa demonstrated cognitive and behavioral gains through community health worker programs and Russia relied on supplementation for cardiovascular biomarker improvement.

Thus, this study shows diverse applications of dietary interventions across BRICS nations, with limited nudge-based approach. Despite few studies per country and age heterogeneity, the collective evidence demonstrates that these interventions consistently improve diet quality and cardiometabolic outcomes, suggesting their adaptability for future, targeted implementations in older adult populations.

Furthermore, majority of the included studies were lacking sufficient randomization, proper measurement, control groups or long-term follow up. The in-

ferences that can be made concerning practical efficacy are significantly constrained by this methodological flaw.

A substantial limitation is the minimal representation of nudge-based interventions, with only four studies (15%) employing such approaches. This limited evidence prevents to conduct systematic comparative effectiveness analyses or draw specific conclusions about the relative merits of these intervention types. The most significant limitation is the substantial age heterogeneity of included studies fundamentally constrains our ability to draw age-specific conclusions. This limited applicability of dietary intervention findings to adult population in BRICS countries is primarily due to a scarcity of relevant trials, especially in nudge-based studies. This constraint shows the inadequate understanding of age-specific dietary responses within these nations. Lastly, non-English articles including nudge studies were excluded due to the English language constraint.

Conclusion

In this review, the evidence from RCTs on examining dietary interventions and its effectiveness was methodically analysed. The findings demonstrate that these interventions can improve dietary behaviors and promote NCD prevention in adult populations across diverse BRICS contexts. These dietary Interventions consistently showed benefits in fruit/ vegetable intake, sodium reduction, blood pressure and HbA1c levels across countries. However, critical gaps in the study evidence limits the conclusion about intervention effectiveness for nudge-based approaches but the collective evidence demonstrates the effectiveness in dietary interventions across diverse BRICS contexts and adult age groups. Thus, future studies should harness the potential of dietary interventions for promoting NCD prevention and dietary health improvement across these diverse and rapidly evolving socioeconomic contexts.

Individual Authors' Contributions: Both the authors have contributed equally for study.

Availability of Data: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Declaration of Non-use of Generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

References

1. World Health Organization. Noncommunicable diseases- 2025 Sep 25 [cited 2026 Feb 5]. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
2. GBD 2017 Diet Collaborators. Afshin A, Sur PJ, Fay KA, et al. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet. 2019 May;393(10184):1958-1972. DOI: https://doi.org/10.1016/S0140-6736(19)30041-8. Erratum in: Lancet. 2021 Jun 26;397(10293):2466. DOI: https://doi.org/10.1016/S0140-6736(21)01342-8. PMID: 30954305 PMCID: PMC6899507
3. Govindaraju T, Sahle B, McCaffrey T, McNeil J, Owen A. Dietary Patterns and Quality of Life in Older Adults: A Systematic Review. Nutrients. 2018 Jul 26;10(8):971. DOI: https://doi.org/10.3390/nu10080971 PMid:30050006 PMCid:PMC6115962
4. Milte CM, McNaughton SA. Dietary patterns and successful ageing: a systematic review. Eur J Nutr. 2016 Mar;55(2):423-450. DOI: https://doi.org/10.1007/s00394-015-1123-7 PMid:26695408 PMCid:PMC4767865
5. Hosni H, Palma MA, Segovia MS. Behavioral and Economic Interventions: A Path to Improved Dietary Behaviors. Annu Rev Nutr. 2025 Aug;45(1):361-384. DOI: https://doi.org/10.1146/annurev-nutr-111124-101104. PMID: 40367966.
6. Muridzo Muonde, Tolulope O Olorunsogo, Jane Osareme Ogugua, Chinedu Paschal Maduka, Olufunke Omotayo. Global nutrition challenges: A public health review of dietary risks and interventions. World J Adv Res Rev. 2024 Jan 30;21(1):1467-1478. DOI: https://doi.org/10.30574/wjarr.2024.21.1.0177
7. Bucher T, Collins C, Rollo ME, McCaffrey TA, et al. Nudging consumers towards healthier choices: a systematic review of positional influences on food choice. Br J Nutr. 2016 Jun 28;115(12):2252-2263. DOI: https://doi.org/10.1017/S0007114516001653 PMid:27185414
8. Vandenbroele J, Vermeir I, Geuens M, Slabbinck H, Van Kerckhove A. Nudging to get our food choices on a sustainable track. Proc Nutr Soc. 2020 Feb;79(1):133-146. DOI: https://doi.org/10.1017/S0029665119000971 PMid:31250781
9. Blackford B. Nudging interventions on sustainable food consumption: a systematic review. The Journal of Population and Sustainability. 2021;5(2):17-62. DOI: https://doi.org/10.3197/jps.2021.5.2.17
10. Arno A, Thomas S. The efficacy of nudge theory strategies in influencing adult dietary behaviour: a systematic review and meta-analysis. BMC Public Health. 2016 Dec;16(1):676. DOI: https://doi.org/10.1186/s12889-016-3272-x PMid:27475752 PMCid:PMC4967524
11. Zaslavsky O, Su Y, Kim B, Roopsawang I, Wu KC, Renn BN. Behavior Change Factors and Retention in Dietary Interventions for Older Adults: A Scoping Review. Gerontologist. 2022 Oct 19;62(9):e534-e554. DOI: https://doi.org/10.1093/geront/gnab133 PMid:34477843 PMCid:PMC9756309
12. Sawal JN, Anjum R. BRICS the Major Emerging Economies: Prospects for a Multi-Polar World. GIRR. 2023 Jun 30;VI(II):72-82. DOI: https://doi.org/10.31703/girr.2023(VI-II).08
13. Romaniuk P, Poznańska A, Brukało K, Holecki T. Health System Outcomes in BRICS Countries and Their Association With the Economic Context. Front Public Health. 2020 Mar 31;8:80. DOI: https://doi.org/10.3389/fpubh.2020.00080 PMid:32296671 PMCid:PMC7136407
14. Suresh Lal B. The BRICS Countries: Trends of Demographic and Economic Development. IJSR. 2023 Apr 5;12(4):702-708. DOI: https://doi.org/10.21275/SR23410201331
15. Jakovljevic MB, Milovanovic O. Growing Burden of Non-

Communicable Diseases in the Emerging Health Markets: The Case of BRICS. Front Public Health. 2015 Apr 23;3:65. DOI: https://doi.org/10.3389/fpubh.2015.00065 PMID: 25954740 PMCID: PMC4407477

16. Chin MK, Anderson E, de Ridder JH, Uvinha RR, Durstine JL. BRICS to BRICSCESS-A perspective for practical action in the promotion of healthy lifestyles to improve public health in five countries. J Sport Health Sci. 2019 Nov;8(6):520-523. DOI: https://doi.org/10.1016/j.jshs.2019.07.008 PMid:31720061 PMCid:PMC6834984

17. Belardo G. Trade diversification and changing food consumption patterns since the 2000s. Available from: https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8950979&fileOId=8950985

18. Choudhury S, Bi AZ, Medina-Lara A, Morrish N, Veettil PC. The rural food environment and its association with diet, nutrition status, and health outcomes in low-income and middle-income countries (LMICs): a systematic review. BMC Public Health. 2025 Mar 13;25(1):994. DOI: https://doi.org/10.1186/s12889-025-22098-4 PMid:40082817 PMCid:PMC11907969

19. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021 Mar 29;372:n71. DOI: https://doi.org/10.1136/bmj.n71 PMid:33782057 PMCid:PMC8005924

20. Higgins J, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al. Cochrane Handbook for Systematic Reviews of Interventions. 2nd ed. Newark: John Wiley & Sons, Incorporated; 2019. p1. (Wiley Cochrane). DOI: https://doi.org/10.1002/9781119536604

21. Centre for Reviews and Dissemination. Systematic reviews; CRD's guidance for undertaking reviews in healthcare. 3 ed. York: York Publ. Services; 2009. p-281.

22. Sterne JAC, Savović J, Page MJ, Elbers RG, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019 Aug 28;l4898. DOI: https://doi.org/10.1136/bmj.l4898 PMid:31462531

23. Santos ASEAC, Rodrigues APDS, Rosa LPS, Noll M, Silveira EA. Traditional Brazilian Diet and Olive Oil Reduce Cardiometabolic Risk Factors in Severely Obese Individuals: A Randomized Trial. Nutrients. 2020 May 14;12(5):1413. DOI: https://doi.org/10.3390/nu12051413 PMid:32422956 PMCid:PMC7284483

24. Mendonça RD, Mingoti SA, Gazzinelli Bethony MF, et al. Intervention for promoting intake of fruits and vegetables in Brazilians: a randomised controlled trial. Public Health Nutr. 2022 Mar;25(3):781-793. DOI: https://doi.org/10.1017/S1368980021004341 PMid:34763746 PMCid:PMC9991710

25. Longhi R, Santos ASEAC, López-Yerena A, et al. The Effectiveness of Extra Virgin Olive Oil and the Traditional Brazilian Diet in Reducing the Inflammatory Profile of Individuals with Severe Obesity: A Randomized Clinical Trial. Nutrients. 2021 Nov 19;13(11):4139. DOI: https://doi.org/10.3390/nu13114139 PMid:34836393 PMCid:PMC8624522

26. Beleigoli A, Andrade AQ, Diniz MDF, Ribeiro AL. Personalized Web-Based Weight Loss Behavior Change Program With and Without Dietitian Online Coaching for Adults With Overweight and Obesity: Randomized Controlled Trial. J Med Internet Res. 2020 Nov 5;22(11):e17494. DOI: https://doi.org/10.2196/17494 PMid:33151151 PMCid:PMC7677024

27. Bersch-Ferreira AC, Machado RHV, Oliveira JS, et al. A Nutritional Strategy Based on Multiple Components for Glycemic Control in Type 2 Diabetes: A Multicenter Randomized Controlled Clinical Trial. Nutrients. 2024 Nov 10;16(22):3849. DOI: https://doi.org/10.3390/nu16223849 PMid:39599635 PMCid:PMC11597113

28. Isakov VA, Bogdanova AA, Bessonov VV, Sentsova TB, et al. Effects of Multivitamin, Multimineral and Phytonutrient Supplementation on Nutrient Status and Biomarkers of Heart Health Risk in a Russian Population: A Randomized, Double Blind, Placebo Controlled Study. Nutrients. 2018 Jan 25;10(2):120. DOI: https://doi.org/10.3390/nu10020120 PMid:29370120 PMCid:PMC5852696

29. Nanditha A, Thomson H, Susairaj P, et al. A pragmatic and scalable strategy using mobile technology to promote sustained lifestyle changes to prevent type 2 diabetes in India and the UK: a randomised controlled trial. Diabetologia. 2020 Mar;63(3):486-496. DOI: https://doi.org/10.1007/s00125-019-05061-y PMid:31919539 PMCid:PMC6997257

30. Vijaya S, Rodrigues A, Garg M, Vijaya S, Shetty MJ, Dhanania S. Effectiveness of dietary intervention in geriatric patients receiving new complete dentures: A randomized controlled trial. J Indian Prosthodont Soc. 2024 Oct 1;24(4):329-335. DOI: https://doi.org/10.4103/jips.jips_166_24 PMid:40227937 PMCid:PMC11614123

31. Yu J, Thout SR, Li Q, Tian M, Marklund M, Arnott C, et al. Effects of a reduced-sodium added-potassium salt substitute on blood pressure in rural Indian hypertensive patients: a randomized, double-blind, controlled trial. Am J Clin Nutr. 2021 Jul 1;114(1):185-193. DOI: https://doi.org/10.1093/ajcn/nqab054 PMid:33782684

32. Kaur J, Kaur M, Chakrapani V, Webster J, Santos JA, Kumar R. Effectiveness of information technology-enabled 'SMART Eating' health promotion intervention: A cluster randomized controlled trial. Adu-Afarwuah S, editor. PLoS ONE. 2020 Jan 10;15(1):e0225892. DOI: https://doi.org/10.1371/journal.pone.0225892 PMid:31923189 PMCid:PMC6953835

33. Malik VS, Sudha V, Wedick NM, RamyaBai M, Vijayalakshmi P, Lakshmipriya N, et al. Substituting brown rice for white rice on diabetes risk factors in India: a randomised controlled trial. Br J Nutr. 2019 Jun;121(12):1389-1397. DOI: https://doi.org/10.1017/S000711451900076X PMid:31006420 PMCid:PMC6948352

34. Singh SK, Taillie LS, Gupta A, Bercholz M, Popkin B, Murukutla N. Front-of-Package Labels on Unhealthy Packaged Foods in India: Evidence from a Randomized Field Experiment. Nutrients. 2022 Jul 29;14(15):3128. DOI: https://doi.org/10.3390/nu14153128 PMid:35956305 PMCid:PMC9370292

35. Thankappan KR, Sathish T, Tapp RJ, Shaw JE, Lotfaliany M, Wolfe R, et al. A peer-support lifestyle intervention for preventing type 2 diabetes in India: A cluster-randomized controlled trial of the Kerala Diabetes Prevention Program. PLoS Med. 2018 Jun 6;15(6):e1002575. DOI: https://doi.org/10.1371/journal.pmed.1002575 PMid:29874236 PMCid:PMC5991386

36. Wang Y, Feng L, Zeng G, Zhu H, Sun J, Gao P, et al. Effects of Cuisine-Based Chinese Heart-Healthy Diet in Lowering Blood Pressure Among Adults in China: Multicenter, Single-Blind, Randomized, Parallel Controlled Feeding Trial. Circulation. 2022 Jul 26;146(4):303-315. DOI: https://doi.org/10.1161/CIRCULATIONAHA.122.059045 PMID: 35861850 PMCID: PMC9311470.

37. Xu Z, Geng J, Zhang S, Zhang K, Yang L, Li J, Li J. A Mobile-Based Intervention for Dietary Behavior and Physical Activity Change in Individuals at High Risk for Type 2 Diabetes Mellitus: Randomized Controlled Trial. JMIR Mhealth Uhealth. 2020 Nov 3;8(11):e19869. DOI: https://doi.org/10.2196/19869 PMid:33141092 PMCid:PMC7671838

38. Zhou M, Zhang N, Zhang Y, Yan X, et al. Effect of Mobile-Based Lifestyle Intervention on Weight Loss among the Overweight and Obese Elderly Population in China: A Randomized Controlled Trial. Int J Environ Res Public Health. 2021 Aug 21;18(16):8825. DOI: https://doi.org/10.3390/ijerph18168825 PMid:34444573 PMCid:PMC8393964

39. Liu M, Xu J, Li Y, He FJ, Zhang P, Song J, et al. Long-Term Effects of a Comprehensive Intervention Strategy for Salt Reduction in China: Scale-Up of a Cluster Randomized Controlled Trial. Nutrients. 2024 Nov 27;16(23):4092. DOI: https://doi.org/10.3390/nu16234092 PMid:39683487 PMCid:PMC11643943

40. Yuan Y, Jin A, Duan P, Cao L, Wang H, et al. Experience with 2 years' intervention to progressively reduce salt supply to kitchens in elderly care facilities-challenges and further research: post hoc analysis of the DECIDE-Salt randomized clinical trial. BMC Med. 2023 Nov 3;21(1):416. DOI: https://doi.org/10.1186/s12916-023-03130-z PMid:37919742 PMCid:PMC10623877

41. Feng Y, Zhao Y, Mao L, Gu M, Yuan H, Lu J, et al. The Effectiveness of an eHealth Family-Based Intervention Program in Patients With Uncontrolled Type 2 Diabetes Mellitus (T2DM) in the Community Via WeChat: Randomized Controlled Trial. JMIR Mhealth Uhealth. 2023 Mar 20;11:e40420. DOI: https://doi.org/10.2196/40420 PMid:36939825 PMCid:PMC10131610

42. Li N, Yan LL, Niu W, Yao C, Feng X, Zhang J, et al. The Effects of a Community-Based Sodium Reduction Program in Rural China - A Cluster-Randomized Trial. PLoS One. 2016;11(12):e0166620. DOI: https://doi.org/10.1371/journal.pone.0166620 PMid:27935977 PMCid:PMC5147834

43. Lin J, Wang T, Lin W. Becoming Healthier without Paying More? Experimental Evidence from the Impact of Multiple Traffic Lights on Chinese College Students. Nutrients. 2024 Jul 3;16(13):2124. DOI: https://doi.org/10.3390/nu16132124 PMid:38999872 PMCid:PMC11243281

44. Sun T, Xu X, Ding Z, Xie H, Ma L, Zhang J, et al. Development of a Health Behavioral Digital Intervention for Patients With Hypertension Based on an Intelligent Health Promotion System and WeChat: Randomized Controlled Trial. JMIR Mhealth Uhealth. 2024 Apr 5;12:e53006. DOI: https://doi.org/10.2196/53006 PMid:38578692 PMCid:PMC11031705

45. Zhang N, Zhou M, Li M, Ma G. Effects of Smartphone-Based Remote Interventions on Dietary Intake, Physical Activity, Weight Control, and Related Health Benefits Among the Older Population With Overweight and Obesity in China: Randomized Controlled Trial. J Med Internet Res. 2023 Apr 28;25:e41926. DOI: https://doi.org/10.2196/41926 PMid:37115608 PMCid:PMC10182459

46. Zhang W, Zhu X, Que X, Zhang X. The effects of shared decision-making informed dietary intervention based on digital health technology in older adults with type 2 diabetes mellitus: A randomized controlled trial. Digit Health. 2024 Oct 13;10:20552076241272514. DOI: https://doi.org/10.1177/20552076241272514 PMid:39403713 PMCid:PMC11472356

47. Kühn L, MacIntyre UE, Kotzé C, Becker PJ, Wenhold FAM. Twelve Weeks of Additional Fish Intake Improves the Cognition of Cognitively Intact, Resource-Limited Elderly People: A Randomized Control Trial. J Nutr Health Aging. 2022;26(2):119-126. DOI: https://doi.org/10.1007/s12603-021-1723-2 PMid:35166302 PMCid:PMC12878174

48. Catley D, Puoane T, Tsolekile L, Resnicow K, Fleming KK, Hurley EA, et al. Evaluation of an adapted version of the Diabetes Prevention Program for low- and middle-income countries: A cluster randomized trial to evaluate "Lifestyle Africa" in South Africa. PLoS Med. 2022 Apr;19(4):e1003964. DOI: https://doi.org/10.1371/journal.pmed.1003964 PMid:35427357 PMCid:PMC9053793

49. Gopalan A, Paramanund J, Shaw PA, Patel D, et al. Randomised controlled trial of alternative messages to increase enrolment in a healthy food programme among individuals with diabetes. BMJ Open. 2016 Nov 30;6(11):e012009. DOI: https://doi.org/10.1136/bmjopen-2016-012009 PMid:27903559 PMCid:PMC5168560

50. Campbell M, McKenzie JE, Sowden A, Katikireddi SV, Brennan SE, Ellis S, et al. Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. BMJ. 2020 Jan 16;l6890. DOI: https://doi.org/10.1136/bmj.l6890 PMid:31948937 PMCid:PMC7190266

51. Lakerveld J, Mackenbach JD, de Boer F, Brandhorst B, et al. Improving cardiometabolic health through nudging dietary behaviours and physical activity in low SES adults: design of the Supreme Nudge project. BMC Public Health. 2018 Jul 20;18(1):899. DOI: https://doi.org/10.1186/s12889-018-5839-1 PMID: 30029600 PMCID: PMC6054749.

52. Reñosa MDC, Landicho J, Wachinger J, Dalglish SL, et al. Nudging toward vaccination: a systematic review. BMJ Glob Health. 2021 Sep;6(9):e006237. DOI: https://doi.org/10.1136/bmjgh-2021-006237 PMid:34593513 PMCid:PMC8487203

53. Sartorelli DS, Sciarra EC, Franco LJ, Cardoso MA. Beneficial effects of short-term nutritional counselling at the primary health-care level among Brazilian adults. Public Health Nutr. 2005 Oct;8(7):820-825. DOI: https://doi.org/10.1079/PHN2005737 PMid:16277797

54. Bhattacharya S, Bera OP, Shah V. Consumers' Perception About Front of Package Food Labels (FOPL) in India: A Survey of 14 States. Front Public Health. 2022 Jul 15;10:936802. DOI: https://doi.org/10.3389/fpubh.2022.936802 PMid:35910921 PMCid:PMC9336528

55. Patil S, Kalashetti S, Kokane H, Somalaram V, Kaur A, Gupta V. Prospective evaluation of digital therapeutic intervention on blood pressure control in Indian patients with uncontrolled primary hypertension. European Heart Journal. 2023 Jan 25;44(Supplement_1):ehac779.128. DOI: https://doi.org/10.1093/eurheartj/ehac779.128