



Effectiveness of printed nutrition education media on dietary knowledge, dietary adherence, and glycemic control among patients with type 2 diabetes mellitus: A narrative literature review

Efektivitas media edukasi gizi cetak terhadap pengetahuan diet, kepatuhan diet, dan kontrol glikemik pada pasien diabetes mellitus tipe 2: Narrative literature review

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Abstract

Type 2 diabetes mellitus is a chronic metabolic disorder with increasing prevalence, necessitating appropriate dietary management to prevent complications. Evidence indicates that most patients exhibit low dietary adherence, which directly affects glycemic control, and limited dietary knowledge remains a primary barrier. Print-based nutrition education, including leaflets, booklets, and pocket guides, is widely employed because of its practicality, affordability, and capacity for repeated consultation. This narrative literature review examines the effectiveness of print-based nutrition education in enhancing dietary knowledge, adherence, and glycemic outcomes in patients with type 2 diabetes. Literature searches were conducted in Google Scholar, Taylor & Francis, and Dimensions using relevant keywords, and selections were made following the PRISMA framework. Of the 510 identified articles, three met the inclusion criteria. The findings consistently demonstrate that print-based nutrition education improves dietary knowledge among patients. Pocket guides were generally more effective than leaflets, offering convenient and repeatable use. Improvements in dietary adherence and blood glucose levels were more pronounced when printed materials were supplemented with repeated counseling and dietary monitoring. In conclusion, print-based nutrition education effectively enhances dietary knowledge and is a viable tool for diabetes care.

Keywords: Dietary adherence, diabetes nutrition education, printed educational media, type 2 diabetes mellitus

Abstrak

Diabetes melitus tipe 2 adalah penyakit metabolik kronis dengan prevalensi yang terus meningkat, sehingga memerlukan pengelolaan diet yang tepat untuk mencegah komplikasi. Bukti menunjukkan bahwa sebagian besar pasien memiliki kepatuhan diet rendah, yang secara langsung memengaruhi kontrol glikemik, sementara pengetahuan diet yang terbatas tetap menjadi hambatan utama. Edukasi gizi berbasis media cetak, seperti leaflet, booklet, dan buku saku, banyak digunakan karena praktis, ekonomis, dan dapat dibaca ulang. Kajian literatur naratif ini menganalisis efektivitas edukasi gizi berbasis media cetak dalam meningkatkan pengetahuan diet, kepatuhan diet, dan hasil glikemik pada pasien diabetes tipe 2. Pencarian literatur dilakukan di Google Scholar, Taylor & Francis, dan Dimensions dengan kata kunci terkait, serta seleksi mengikuti kerangka PRISMA. Dari 510 artikel yang teridentifikasi, tiga artikel memenuhi kriteria inklusi. Hasil kajian menunjukkan bahwa edukasi gizi berbasis media cetak secara konsisten meningkatkan pengetahuan diet pasien. Buku saku umumnya lebih efektif dibanding

leaflet karena praktis dan dapat dibaca berulang. Perbaikan kepatuhan diet dan kadar glukosa darah lebih optimal bila media cetak dikombinasikan dengan konseling berulang dan pemantauan diet. Kesimpulannya, edukasi gizi berbasis media cetak efektif meningkatkan pengetahuan diet dan tetap layak digunakan dalam pelayanan diabetes.

Kata Kunci: Diabetes melitus tipe 2, edukasi gizi diabetes, kepatuhan diet, media edukasi cetak

Introduction

Diabetes mellitus (DM) is a non-communicable disease with a steadily increasing global prevalence, characterized by chronic disturbances in glucose metabolism, leading to sustained hyperglycemia (World Health Organization [WHO], 2024). The International Diabetes Federation projects that over 700 million individuals worldwide will be affected by diabetes by 2045 (Scobie & Hopkins, 2023), with type 2 diabetes mellitus (T2DM) representing the majority of the cases. T2DM is closely associated with dietary patterns, lifestyle behaviors, and genetic predisposition (American Diabetes Association Professional Practice Committee, 2024). The high prevalence of T2DM is a major public health concern because of its association with chronic complications, including cardiovascular disease, neuropathy, nephropathy, and retinopathy, which contribute to increased morbidity and mortality and substantial economic burdens on healthcare systems (Bommer et al., 2020; Chawla et al., 2016).

In Indonesia, the increasing prevalence of diabetes poses a significant challenge. Data from the Basic Health Research survey indicate an upward trend in diabetes prevalence among individuals aged ≥ 15 years in recent years (Riset Kesehatan Dasar, 2018). This trend is closely linked to shifts in dietary habits, low physical activity levels, and increasing rates of obesity (Garduno-Diaz et al., 2024). Poorly managed diabetes can lead to severe complications, including coronary heart disease, stroke, renal impairment, and vision disorders, substantially reducing the quality of life (Chawla et al., 2016). Consequently, effective diabetes management requires a comprehensive approach that integrates pharmacological therapy with sustained health behavior modification.

Dietary management is a cornerstone of T2DM care, aiming to maintain blood glucose levels within target ranges and prevent long-term complications (Howells et al., 2025).

Effective dietary therapy involves not only restricting specific foods but also optimizing food quantity, composition, and timing (Muchiri et al., 2021). Balanced dietary patterns have been shown to enhance insulin sensitivity and support glycemic control (Safwendra et al., 2025), making dietary management a critical component of non-pharmacological therapy for patients with diabetes (Muchiri et al., 2016).

However, many patients struggle to adhere to the recommended dietary regimens. Limited knowledge of appropriate and restricted foods is often the primary barrier to dietary compliance (Nikbina et al., 2020). Sociocultural factors, habitual eating behaviors, and individual perceptions of disease further influence dietary practices (Goorabi et al., 2017). Nonadherence impedes glycemic control and increases the risk of complications (Barsasella & Afifah, 2025), underscoring the need for interventions that enhance patient knowledge and promote behavioral changes.

Nutrition education is a key strategy for addressing these challenges. This involves providing information aimed at improving dietary knowledge and encouraging healthier food choices (Amoore et al., 2023). In patients with diabetes, nutrition education facilitates the understanding of diet management, food selection, portion control, and carbohydrate intake regulation (Thuita et al., 2020). Print-based media, such as leaflets, pamphlets, and booklets, are widely utilized for this purpose because of their accessibility, ease of use, and capacity for repeated consultation (Abdalla, 2022; Hidayah & Sopiandi, 2018).

Evidence indicates that nutrition education interventions can improve dietary knowledge and eating behaviors in patients with diabetes (Amoore et al., 2023; Chavez, 2025; Thuita et al., 2020) and enhance dietary adherence and glycemic control (Abdalla, 2022; Akbar & Kurnaini, 2025; Hidayah & Sopiandi, 2018). However, the effectiveness of print media remains inconsistent. Some studies have

reported significant gains in knowledge, while others have shown limited impact on adherence and glycemic outcomes (Hidayah & Sopiandi, 2018; Nikbina et al., 2020). Key uncertainties include whether print materials alone suffice as an intervention or whether they require integration with repeated counseling. Most prior research has focused on single outcomes or specific populations, limiting our comprehensive understanding.

This narrative literature review addresses these gaps by synthesizing evidence on the effectiveness of print-based nutrition education in simultaneously improving dietary knowledge, dietary adherence, and glycemic control among patients with T2DM. Additionally, it examines the factors influencing the success of print media interventions. The findings aim to provide an evidence-based foundation for developing more effective nutrition education strategies to support diabetes management in the future.

Methods

Study Design

This study employed a narrative literature review methodology that incorporated descriptive analysis and narrative synthesis. Unlike systematic reviews, which require a registered protocol and formal risk-of-bias assessment, narrative reviews allow for a more flexible and interpretive synthesis of relevant studies (Snyder, 2019).

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework was applied solely to enhance the transparency and reproducibility of the literature search process without implying that this study constitutes a systematic review. Literature review, as a research method, involves identifying, evaluating, and synthesizing previously published studies to obtain a comprehensive understanding of a research topic (Snyder, 2019).

The primary objective of this study was to assess the effectiveness of print-based nutrition education in improving dietary knowledge among patients with type 2 diabetes mellitus (T2DM). Articles included in the review were retrieved from multiple scientific databases and screened according to predefined inclusion and exclusion criteria (Snyder, 2019).

Literature Search Strategy

A systematic search was conducted across three scientific databases: Google Scholar, Taylor & Francis, and DIMENSIONS. These databases were selected for their coverage of peer-reviewed literature relevant to public health, nutrition, and chronic disease management (Bramer et al., 2018).

The search strategy included four keyword categories: population ("type 2 diabetes mellitus," "T2DM"), intervention ("nutrition education," "dietary education"), educational media ("leaflet," "pamphlet," "printed educational material"), and outcomes ("dietary compliance," "dietary knowledge," "HbA1C"). Boolean operators AND and OR were applied to combine keywords and optimize the retrieval of studies aligned with the research objectives.

Inclusion and Exclusion Criteria

Studies were included if they: (1) involved patients with T2DM; (2) implemented any form of nutrition or dietary education intervention; (3) utilized print-based educational media as part of the intervention or evaluated its effectiveness on dietary knowledge, dietary adherence, or clinical parameters in T2DM patients; (4) reported outcomes related to dietary knowledge, adherence, or clinical indicators such as HbA1C; (5) were available in full text; (6) were published between 2015 and 2025; and (7) employed experimental, quasi-experimental, or intervention study designs.

Studies were excluded if they did not focus on T2DM patients, did not involve nutrition education, were review articles, editorials, or opinion pieces, or lacked full-text availability.

Study Selection Process

Article selection followed the PRISMA guidelines (Page et al., 2021). The initial search yielded 510 articles that were screened. Title screening excluded 478 irrelevant studies, leaving 32 articles for full-text screening. Abstract screening identified 21 potentially relevant studies.

Full-text assessment excluded 18 articles that did not meet the inclusion criteria. Consequently, three studies were included in the detailed analysis.

Data Extraction and Analysis

For each included study, key information was extracted, including authorship, year of publication, study title, design, sample size, type

of print-based educational media, study variables and outcomes (Page et al., 2021).

Descriptive analysis was used to summarize the study characteristics, including design, sample size, and type of educational media. Narrative synthesis involved comparing

and interpreting findings across studies to identify patterns related to the effectiveness of print-based nutrition education in enhancing dietary knowledge among T2DM patients (Campbell et al., 2020). The results are presented in both tabular and narrative formats.

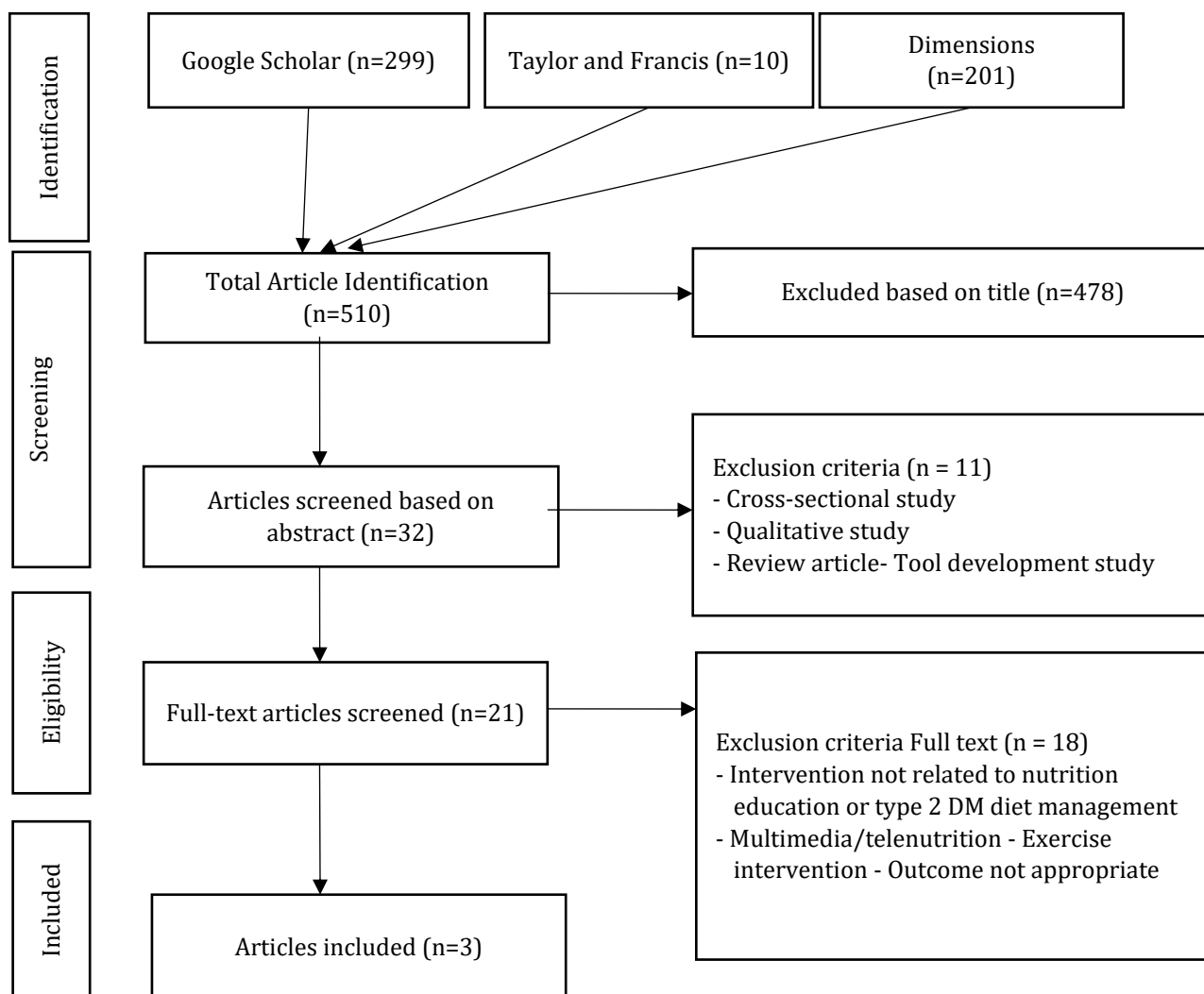


Figure 1. PRISMA flow diagram

Result and Discussion

The selected studies included in this review are summarized in Table 1, providing a comprehensive overview of their key characteristics, including the study title, year, authors, location, methodology or study design, type of print-based educational media, sample size, and main findings based on measured variables. Collectively, these studies offer insights into the effectiveness of print-based nutrition education for patients with type 2 diabetes mellitus (T2DM), highlighting

variations in intervention intensity, media format, and outcome measures. By presenting this information in a structured table, this review facilitates a clear comparison of the different approaches, enabling the identification of patterns and trends in knowledge enhancement, dietary adherence, and glycemic control.

This synthesis also provides a foundation for understanding the contextual factors and mechanisms that influence the success of print-based educational interventions, setting the stage for a detailed

discussion of their implications for clinical practice and diabetes management in the future.

Table 1. Selected studies

Authors (Year). Title	Location	Methodology / Study Design	Print Media Type	Sample Size	Findings by Measured Parameters/ Variables
Hidayah & Sopiandi (2018). Effectiveness of Pocket Book and Leaflet Educational Media on Knowledge and Dietary Compliance of Outpatients with Type 2 Diabetes Mellitus at a Community Health Center	Pontianak, Indonesia	Quasi-experimental, pretest-posttest with two groups	Pocket book and leaflet	50	The variables measured were dietary knowledge and compliance. A significant improvement in knowledge was observed after education ($p = 0.000$), but no significant change in dietary compliance ($p = 0.641$). Pocket books tended to produce greater knowledge gains than did leaflets.
Barsasella, Afifah, Kaswari, & Sunindya (2025). The Effect of Nutritional Counselling on Knowledge Level, Dietary Compliance, and Fasting Blood Glucose Levels in Outpatients with T2DM	Blitar, Indonesia	Quasi-experimental, control group pre-test and post-test	Leaflet	30	The measured variables included knowledge, dietary compliance, and fasting blood levels. The intervention group receiving three counseling sessions, leaflets, and dietary monitoring showed improved knowledge, enhanced dietary adherence, and a reduced proportion of poor fasting glucose levels. The outcomes exceeded those of the control group, which received a single counseling session.
Akbar & Kurnaini (2025). Effectiveness of Nutrition Education Program on Glycemic Control in Patients with Type 2 Diabetes Mellitus	Indonesia	Quasi-experimental, pre-test and post-test control group	Leaflet and nutrition booklet	60	measured variables included fasting blood glucose levels, knowledge, and dietary compliance. A four-week intensive nutrition education program significantly reduced fasting glucose levels in the intervention group compared to the control group ($p < 0.05$) and improved knowledge and dietary adherence.

All three studies consistently demonstrated that print-based nutrition education enhances dietary knowledge in patients with T2DM. Two studies, Akbar & Kurnaini (2025) and Barsasella & Afifah (2025), showed more pronounced effects on dietary compliance and glycemic control, particularly when print media was combined with repeated counseling or intensive education programs. Conversely, Hidayah & Sopiandi (2018) indicated that print media alone had a

stronger impact on cognitive outcomes than on behavioral dietary change.

Print-Based Nutrition Education and Knowledge Enhancement

The synthesis of the three studies indicates that print-based nutrition education is associated with improved dietary knowledge among T2DM patients. These findings align with modern diabetes management frameworks that emphasize education and self-management

support as central components, given that knowledge improvement is a prerequisite for understanding the relationships among diet, blood glucose, medications, and complication prevention (Evert et al., 2019; Powers et al., 2020). Structured education can enhance patients' decision-making regarding daily dietary management, particularly when the materials are practical, simple, and easily comprehensible (Garduno-Diaz et al., 2024; Muchiri et al., 2016).

Hidayah and Sopiandi (2018) reported that both pocket books and leaflets improved knowledge, with pocket books producing greater gains. The study highlighted that pocket books are portable, concise, and allow patients to revisit the material multiple times. This repeatable access supports reinforcement, which is critical in T2DM management, as dietary education involves restructuring established eating habits rather than merely providing new information to patients. Consequently, the success of pocket books in improving knowledge derives not only from content quality but also from the media format that facilitates repeated engagement.

Akbar and Kurnaini (2025) reinforced this finding, demonstrating that a four-week intensive nutrition education program using leaflets and booklets increased patient knowledge and subsequently improved dietary compliance. This pattern suggests that the effectiveness of print media is amplified when integrated into active educational processes and complemented with additional print resources, functioning as memory aids, visual supports, and tools to make abstract concepts more tangible (Akbar & Kurnaini, 2025). Similarly, Barsasella et al. (2025) found that the intervention group receiving three counseling sessions, leaflets, and dietary monitoring achieved greater knowledge improvement than the control group receiving a single counseling session, indicating that print media can bridge educational sessions and extend message exposure beyond face-to-face interactions.

Overall, knowledge outcomes consistently showed improvement across studies, consistent with systematic review evidence demonstrating that structured diabetes self-management education enhances both knowledge and glycemic control (Moshoeshoe et al., 2025).

Thus, print media can serve as a practical instrument to strengthen dietary literacy among T2DM patients, particularly in primary care and outpatient settings, where counseling time may be limited.

Print-Based Nutrition Education and Glycemic Control

The impact of print-based nutrition education on glycemic control was most evident in studies that combined print media with intensive education. Akbar & Kurnaini (2025) reported that a four-week program improved knowledge and dietary adherence while significantly reducing fasting blood glucose levels in the intervention group. These outcomes suggest that print media contributes to clinical improvements when integrated into programs that support the translation of dietary knowledge into actual behavior. Clinically, fasting glucose reduction results from improved food quality, portion control, and meal regularity, rather than mere exposure to educational materials.

Barsasella et al. (2025) reported similar patterns: repeated counseling supplemented with leaflets and dietary monitoring improved fasting glucose more effectively than single-session interventions. Bivariate analysis indicated a significant association between dietary adherence and fasting glucose levels post-counseling, supporting the mechanism that improved glycemic indices stem from enhanced knowledge and behavioral regulation.

Although Hidayah & Sopiandi (2018) did not assess biochemical outcomes, their results underscore the sequential nature of cognitive and behavioral changes. Knowledge improvement may precede behavioral adjustments, implying that clinical outcomes require longer interventions, intensive reinforcement, and time for patients to modify their eating habits. These observations align with the principles of medical nutrition therapy, positioning structured nutrition education alongside pharmacological therapy and self-management support as a key strategy for glycemic control (Evert et al., 2019). Evidence from Yudismara and Rahma (2025) and Garduno-Diaz et al. (2024) further confirms that patient-centered, structured nutrition education can improve dietary management and glycemic outcomes in T2DM patients. Collectively, these findings indicate that print media can contribute to glycemic control when embedded in

structured, repeated, and behavior-oriented interventions. Although clinical outcomes are slower to change than knowledge, they are attainable through sustained improvements in understanding and adherence.

Print-Based Nutrition Education and Dietary Compliance

In contrast to knowledge, dietary compliance outcomes showed greater variability. Hidayah & Sopiandi (2018) observed that knowledge gains did not translate into significant dietary adherence, likely due to entrenched habits, fatigue from dietary restrictions, and beliefs that medication could compensate for dietary lapses. This illustrates that behavioral change is more complex than cognitive improvement: patients may know what to eat but may lack motivation, readiness, or support for consistent application (Hidayah & Sopiandi, 2018).

In contrast, Barsasella & Afifah (2025) demonstrated that dietary compliance improved when print media was integrated with intensive interventions. Participants receiving three counseling sessions, leaflets, and dietary monitoring showed greater adherence than those receiving a single counseling session. Employing the 3 J principle (quantity, type, and schedule), adherence measurement was comprehensive, indicating that print media are more effective when reinforcing repeated counseling messages. When written guidance is coupled with feedback on dietary practices, the likelihood of behavioral change increases (Barsasella & Afifah, 2025).

Akbar & Kurnaini (2025) provided further evidence: a four-week intensive program significantly enhanced dietary adherence alongside knowledge and fasting glucose improvements. These findings suggest that adherence changes are more probable when patients receive actionable learning, opportunities for discussion, menu planning simulations, and incremental reinforcement, positioning print media as an integrated component of a behavioral change package rather than a standalone informational tool. These results are consistent with those of Powers et al. (2020), who emphasized that effective diabetes education supports goal setting, problem solving, and sustained self-management.

The supporting literature reinforces this interpretation. Yudismara & Rahma (2025)

found that structured nutrition education improved specific dietary behaviors, such as reduced starchy food and energy intake, in resource-limited T2DM settings. Nikbina et al. (2020) reported that combined group and individual counseling, supplemented with booklets and telephone follow-up, improved the metabolic parameters. These studies suggest that dietary compliance requires a combination of information, motivation, reinforcement, and regular follow-up. Therefore, variations in outcomes across the three selected studies reflect the complexity of behavioral change rather than the shortcomings of print media (Muchiri et al., 2021; Nikbina et al., 2020).

Overall, print media has the potential to support dietary adherence, with effectiveness contingent on intervention intensity, counseling frequency, and monitoring. Consequently, leaflets, booklets, or pocket books should be deployed as reinforcement tools within ongoing education rather than as stand-alone interventions (Hidayah & Sopiandi, 2018; Powers et al., 2020).

Factors Influencing the Success of Print Media Interventions

The analysis of the three studies identified several key factors affecting the success of print-based interventions. First, media characteristics, pocket books provide greater knowledge gains than leaflets (Hidayah & Sopiandi, 2018), indicating that size, completeness of information, portability, and rereadability are critical. Materials that are too brief may lack depth, whereas overly dense media may reduce readability. Effective print media require clear, concise content that is easily accessible to patients.

Second, intervention intensity and frequency. Akbar & Kurnaini (2025) and Barsasella & Afifah (2025) reported superior outcomes compared to Hidayah & Sopiandi (2018), which was attributable to the higher intervention intensity. Print media were combined with repeated counseling, discussions, and monitoring, consistent with evidence that structured, continuous diabetes education is more effective than single-contact interventions (Powers et al., 2020).

Third, patient characteristics and social context. Knowledge alone is insufficient if patients face barriers such as entrenched eating habits, limited resources, low self-efficacy, or a lack of family support. Limited resources and

poor access to healthy foods can hinder behavioral changes (Muchiri et al., 2021), emphasizing the need for patient-centered education tailored to individual needs, preferences, and literacy levels (Garduno-Diaz et al., 2024; Muchiri et al., 2021).

Fourth, integration with other educational approaches. Akbar & Kurnaini (2025), Barsasella & Afifah (2025), and Nikbina et al. (2020) demonstrated that print media is more effective when combined with interactive lectures, individual counseling, group discussions, booklets, reminders, or telephone/chat follow-ups. Multimodal reinforcement allows patients to process, discuss, and apply the information. Hence, successful print-based interventions rely on the synergy between written material, interpersonal communication, and follow-up support.

Collectively, these factors indicate that print media is not a standalone intervention but is part of a broader nutrition education ecosystem. Its utility depends on the material design quality, frequency of educational contact, patient characteristics, and implementation context.

Implications for Nutrition Education

This review has practical implications for healthcare professionals. Print media, such as leaflets, booklets, and pocket books, remain relevant, particularly in contexts with limited counseling time.

However, their effectiveness depends on integration within interactive and participatory education sessions. The content should be tailored to the patient's reality, using local food examples, simple language, and actionable explanations. Evaluation should extend beyond knowledge gains to include dietary adherence and clinical indicators, such as blood glucose. In summary, print media has tangible potential, but its optimal impact is achieved when embedded within structured and sustained educational programs.

Conclusion

Print-based nutrition education plays a significant role in enhancing dietary knowledge among patients with type 2 diabetes mellitus. Materials such as leaflets, booklets, and pocket guides can effectively support patients'

understanding of dietary management principles, with knowledge improvement being the most consistently observed outcome across the studies reviewed.

However, the effects on dietary adherence and glycemic control were more variable, typically achieving meaningful behavioral and clinical improvements when print media were integrated into comprehensive interventions, including repeated counseling and active dietary monitoring. Consequently, print media remains relevant as an educational strategy, particularly in resource-limited settings, but its effectiveness is maximized when embedded within structured, contextualized, and continuous education programs.

Nutrition professionals should use leaflets or pocket guides in conjunction with interactive counseling sessions featuring locally relevant menu examples and patient-friendly language. Healthcare facilities should incorporate ongoing monitoring of dietary adherence and glycemic outcome. Future research employing randomized controlled trials with larger sample sizes and broader database coverage is warranted to strengthen the evidence of the effectiveness of print media in T2DM management.

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