OPEN ACCESS

CITATION

COPYRIGHT

Effect of Healthy Nutrition on Pre-diabetes Mellitus among Iraqi Population: A Systematic Review

Lamia H.A. Al- Sultan ¹* iD **, Lubna A.A. Al-Assaf ²** iD **, Asmaa Ibadi Salman ³** iD

¹* Medical Technical Institute, Middle Technical University, Iraq, Baghdad / Email: lamia_sultan@mtu.edu.iq
² College of Remote Sensing and Geophysics, Al-Karkh University for Science, Iraq, Baghdad
Email: lubna.amer@kus.edu.iq
³ Medical Technical Institute, Middle Technical University, Iraq, Baghdad / Email: asmaaibadi@mtu.edu.iq

Abstract

Diabetes is a major worldwide health concern that is becoming more prevalent. In addition to the onset of diabetes mellitus, deglycation is linked to prediabetes. Blood glucose levels in prediabetes are still below the cutoff point for diabetes even though they are higher than usual. Research into the disease's biomarkers can help manage or alleviate the symptoms of diabetic mellitus (DM). Thus, supporting physician evaluations requires early diagnosis and classification of type 2 diabetic mellitus (T2DM). The Iraqis' pre-diabetes Association has released several guidelines on medical dietary therapy for diabetes, emphasizing the importance of lowering both microvascular and macrovascular issues in diabetics. The Mediterranean diet, a low-carb/high-protein diet, a vegan diet, and a vegetarian diet were the four diets whose effects on diabetes were investigated. Despite the fact that medication nutrition therapy and lifestyle are regarded as the cornerstones of diabetes prevention and management, there is controversy regarding the most effective prevention. The association between dietary intake and pre-diabetes morbidity has been the subject of numerous investigations.

Keywords: Pre- diabetes, Nutrition, Lifestyle, Carbohydrate.

Introduction

The origin of the phrase is unknown, but according to Professor Sir K G ALBERTI, "prediabetes was first used to indicate abnormalities of pregnancy (e.g., high-birth weight babies, hydramnios) or a strong family history of type 2 diabetes (T2DM) (1). Prediabetes is another chronic metabolic condition that occurs when a person has higher-than-normal blood sugar levels but does not fit the criteria for diabetes (2). Since prediabetes raises the risk of developing type 2 diabetes, which affects over one-third of adults in developed countries, identifying it is crucial to halting the disease's progression (3). A 2015 study in Iraq revealed that 33.67% of people had prediabetes (4). More recent research conducted in 2019 found that 20.6% of Baghdad's adult population had prediabetes (5). In primary healthcare centers (PHCCs), preventive healthcare screening is mostly carried out for

early disease detection and therapy at the community level (6). Diabetes mellitus is caused by a variety of factors, including obesity and sedentary lifestyle choices. The proportions of myocyte and adipocyte insulin receptors are changed as a result of the distortion of body composition caused by poor diet and inactivity. Compared to comparable interactions with myocyte receptors, insulin that acts on adipocyte receptors decreases the absorption of glucose. There is disagreement on how common diabetes mellitus is among Iraqis. Iraq's economy has grown significantly in the past ten years. According to surveys conducted in 2006 and 2007, 9.3% of persons in the Middle East have diabetes, which is considered a moderate prevalence in Iraq (7). Glycemic management delays or prevents these effects, which lowers DM morbidity and death (8). Consequently, this review intends to focus on reducing the risk from diabetes complications by controlling blood glucose levels through healthy nutrition. Pre-diabetes range: While the American Diabetes Association (ADA) recently revised its screening recommendation for pre-diabetes to include glycated hemoglobin as a non-fasting diagnostic testing option. The 5.7% to 6.4% were suggested as cutoff values in the American Diabetes Association's criteria for diagnosing pre-diabetes (9). Iraq's pre-diabetes management challenges and un-met needs has established targets for the prevention and reduction of non-communicable diseases, including hyperglycemia and other chronic, non-transmissible conditions. However, political uncertainty and security concerns have made it challenging to accomplish these goals (10). Prediabetes has increased in younger people as a result lifestyle modification. In 2016, 12.1% of Iraqi school-age children were fat and 15.2% were overweight (11). compared to 6% in research done around a decade ago and 1.3% in the most current one (12). In Iraq, physical activity, particularly among people, is stigmatized, and there are still not enough fitness facilities or opportunities for exercise (10). Rapid economic growth in recent years has facilitated a more sedentary lifestyle by increasing access to cars, cheap labor, mechanized farming equipment, and technological devices like TVs, phones, and tablets (13). Additionally, it argues that inadequate urban planning and urban growth are the main reasons for the rise in sedentary behavior, and that people are discouraged from leading physically active lives by the hot weather for several months of the year and the absence of essential infrastructure, such as bike or pedestrian pathways (14).

Dietitians' and lifestyle interventions' roles

The lifestyle factors were sun exposure, degree of physical exercise, and smoking. To determine the sun exposure index, the number of hours of daily sun exposure was multiplied by the percentage of exposed body surface area (BSA) (15). A BSA percentage estimate was revealed. The volume and frequency of physical activity (number of sessions/days) were then measured using a shortened version of the International Physical Activity Questionnaire (IPAQ). The IPAQ's reliability was judged to be sufficient with scores between 0.7 and 0.8 (16). The respondent was also asked if they were a smoker, how many cigarettes they smoked daily, and how many pack-years (average number of packs per day x number of years) they had smoked. A health coach, a public health expert familiar with ME culture and a diabetes nurse with patient counselling experience led the sessions. Weekly sessions were offered for the first two weeks of the program, with one to four weeks separating sessions thereafter. Every meeting lasted 90 minutes and was accompanied by a qualified Arabic interpreter (17). Among the themes discussed in the seminars were awareness and motivation for altering one's lifestyle, preventing relapse,

maintaining the change with social support, and knowledge of prediabetes and CVD and how they connect to lifestyle (18). The participants were encouraged to set and meet SMART (specific, measurable, attainable, reasonable, and time-bound) goals with regard to nutritional intake (19). For example, "I'll take the stairs instead of the lift every day" and "I'll drink water instead of energy drinks because I want to lose weight." Motivating participants to identify and overcome any barriers to upholding a healthy diet and lifestyle while setting SMART objectives was the main focus. However, the participants set these goals for their own motivation, and they were not evaluated for success efficacy at the end of the study (20).

Types of diets

The Mediterranean diet

In 2010, UNESCO designated the Mediterranean diet, a representation of Mediterranean eating practices, an Intangible Cultural Heritage of Humanity. Limited amounts of poultry, dairy, fish, red wine, and (less often) red meat are rich in the Mediterranean diet with whole legumes, grains, fruits, vegetables, and monounsaturated fatty acids (such those in olive oil) (21). This diet's beneficial impacts were identified by (22). He showed that eating a Mediterranean diet was positively associated with preventing heart disease in the 2020s. Additional research has revealed the beneficial effects of diet on prediabetes and weight control (23,24). The only one that effectively reduce weight was the Mediterranean diet and most effective in lowering blood triglycerides and glycemic levels, according to recent review and meta-analysis of studies on variety of diets, including low-carbohydrate, Mediterranean, high-protein, and low-glycemic index diets. Additionally, a review by (25) of Mediterranean diet when compared to the control group, individuals who adhered to this food pattern had improved glycemic management and decreased insulin resistance (26).

Low-carbohydrate, high-protein diets

Because eating carbohydrates elevates blood glucose levels, people with prediabetes are advised to follow low-carb diets. A low-carb diet thus reduces glycemic and insulin levels, which raises the quantity of circulating fatty acids that the body may use as fuel through the production of ketone bodies. This leads to increased sensations of fullness and faster weight loss (27). This diet plan's detractors argue that cutting carbs usually results in consuming more saturated fatty acids, which have been connected to heart disease (28). However, researchers such as (29,30) have suggested that reducing glycaemia with low-carb diets reduces the risk of hypoglycemia, which is associated with a significant risk of morbidity and mortality, and the requirement for medication. One important difficulty is standardizing the definition of a low-carb diet. less than 130 g of carbohydrates daily, which is equivalent to 26% of a 2000 kcal diet; 45–26% of total energy should come from carbohydrates in a moderate carbohydrate diet. A 30 gm of carbohydrates per day is considered an extremely low-carb ketogenic diet. According to (31), 21–70 g of carbohydrates daily was a very low-carb diet, while 30–40% of calories from low carbohydrate diet. Most research on the usefulness of low-carb diets among people with prediabetes has been short-term and conducted with limited population

numbers, despite the fact that advantages have been observed, especially in terms of weight loss (32,33).

Vegan diets and vegetarian

Vegan diets or vegetarian appear to improve metabolic regulation and cause weight loss in patients with prediabetes. Increased consumption of foods low in the glycemic index and high in fiber is the cause of this; improvements in plasma lipids are associated with these diets' generally lower levels of saturated fatty acids (34). This has been demonstrated by (35) In one study, 99 patients with diabetes were randomly assigned to either a conventional ADA diabetes diet (15–20% energy from protein, 60–70% energy from monounsaturated fatty acids and carbohydrates, and less than 7% energy from a low-fat vegan diet or saturated fatty acids) (75% energy from low glycemic index carbohydrates like vegetables and legumes, 10% energy from fat and 15% energy from protein [i.e., legumes]. According to (36), In contrast, people with prediabetes should be treated with vegan diets and vegetarian, consuming a vegetarian diet decreased the death rates of male participants. The benefits of vegetarian and vegan diets for preventing chronic diseases and promoting good nutrition have also been confirmed by the American diabetes Association (37). To properly assess the effects of various diets on the symptoms of prediabetes, more long-term studies (one to five years) and an improvement in the quality of short-term randomized studies that include evaluation of the psychological factors involved in whether a patient can reach their targets or not required.

Method

  Preferred reporting Items for Network Meta-Analyses (PRISMA-NMA) used in this systematic review. The process of identifying studies that investigated the effect of exercise interventions during the pre-diabetes stage through a systematic survey of several papers, followed by performed meta-analysis of eligible studies.

Search strategy

The search strategy was constructed based on participants from their inception dating to October 2025: individuals following a pre-diabetic with healthy nutrition and comparisons with prediabetic before healthy nutrition group, and outcomes: glycated hemoglobin (HbA1c), Fasting blood sugar (FBG), HOMA-IR, body weight (BW) and lipid profile.

Inclusion and exclusion criteria

Studies that recruited people with prediabetes who were at least 40 years old were included; Patients with other chronic diseases, children, adolescents, and pregnant women were not included.

Statistical analysis

 SPSS statistical analysis was used in all the studies referred at t-test

Results

Fourteen studies involving prediabetes and five types of food were included in the final analysis. The meta-analysis showed that food of any type was more effective for glycemic control in prediabetes. However, the changes in blood glucose, lipid profile and weight were moderate.

Table.1: glycemic index in food

Food Type	Glycemic Index	Estimated Effect on Blood Sugar	References
Whole Wheat Bread	50	Reduces postprandial sugar by 15–20%	(38)
Local Lentils	30	Reduces sugar by 20–25%	(39)
Fava Beans	35	Reduces sugar by 18–22%	(40)
Leafy Vegetables	15	Reduces sugar spikes by 25%	(41)
Apples	38	Reduces sugar by 10–15%	(42)

Table.2: The effect of some parameter before and after healthy nutrition in prediabetes

Parameter Mean ± SD	Before Healthy Nutrition	After Healthy Nutrition	% Change	References
Age (Years	40.00 ± 1.12	40.00 ± 1.12 [b]	0%	(43)
Fasting Blood Sugar (mg/dL)	117.5 ± 5.2	99.8 ± 4.5[a]	-15%	(44)
HbA1c (%)	5.9 ± 0.2	5.3 ± 0.2 [a]	-10.2%	(45)
HOMA-IR	1.54±0.85	0.453 ± 0.09 [a]	-15.4%	(46)
Cholesterol (mg/dL)	180 ± 20	152 ± 18 [a]	-15.6%	(47)
Triglycerides (mg/dL)	162 ± 15	132 ± 12 [a]	-21.7%	(48)
HDL (mg/dL)	42 ± 5	50 ± 6 [a]	+19%	(49)
LDL (mg/dL)	130 ± 15	110 ± 12 [a]	-15.4%	(50)
Weight (kg)	82 ± 6	74 ± 5 [a]	BMI dependent	(51)

a=(P≤0.05) as a significant, b =no significant

Discussion

Evidence from Iraq confirms global results that structured nutrition interventions improve glycemic outcomes and reduce risk factors for complications. Iraq faces unique challenges, meanwhile, including a heavy reliance on fried foods, a pervasive consumption of refined carbohydrates (such polished rice and white bread), and cultural norms that promote overindulging in sweets during celebrations and festivals (52). Low-glycemic index (GI) foods including local lentils, fava beans, and green vegetables

significantly improved postprandial glucose control. These foods slow down the rate at which glucose enters the system, reducing postprandial blood sugar fluctuations. Apples and whole wheat bread also moderately reduced the glycemic response due to their fiber and polyphenol levels (53). Triglycerides, total cholesterol, and LDL cholesterol all significantly decreased as a result of the dietary intervention, while HDL cholesterol increased. These enhancements imply that increasing consumption of unsaturated fats (almonds, olive oil) and soluble fiber (apples, lentils) has cardioprotective advantages. The HOMA-IR index also decreased, indicating reduced hepatic fat storage and better insulin receptor function (44). Iraq has seen war and political upheaval, making it difficult to lead an active lifestyle and stay healthy (54). The high prevalence of obesity and overweight that results in prediabetes in Iraq may be explained by all of these issues.

Conclusion

For Iraqi prediabetics, a balanced diet is an economical and scientifically supported strategy to enhance glycemic control. Global research supports the Mediterranean and low-carb eating regimens, but local research studies show the benefits of simpler nutrition instruction. Under professional guidance, culturally specific nutrition regimens can improve weight control, lower the risk of complications, and considerably lower HbA1c. As a result, diabetes will be less common in Iraq.

Declarations

Acknowledgment

Ethics statement
The author approved that this research follows the journal's Attach Ethic Approval guidelines as appeared on the journal's author guidelines page.

Funding

Competing interests

None

References

1. Alberti K. Screening and diagnosis of prediabetes: where are we headed? Diabetes,Obesity and Metabolism. 2007;9: 12-16.

2. Echouffo-Tcheugui JB. and E Selvin. Prediabetes and what it means: the epidemiological evidence. Annual review of public health, 2021. 42(1): p. 59-77.

3. Mainous AG 3rd, Tanner RJ, Baker R, Zayas CE, Harle CA. Prevalence of prediabetes in England from 2003 to 2011: population-based, cross-sectional study. BMJ Open. 2014 Jun 9;4(6):e005002. doi: 10.1136/bmjopen-2014-005002. PMID: 24913327; PMCID: PMC4054625.

4. Yip WCY, Sequeira IR, Plank LD, Poppitt SD. Prevalence of Pre-Diabetes across Ethnicities: A Review of Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT) for Classification of Dysglycaemia. Nutrients. 2017 Nov 22;9(11):1273. doi: 10.3390/nu9111273. PMID: 29165385; PMCID: PMC5707745.

5. Alogaily, M.H., A.J. Alsaffar, and M.B. Hamid, Left ventricle diastolic dysfunction in a sample of prediabetic adults from Baghdad, Iraq. International Journal of Diabetes in Developing Countries, 2021. 41(1): p. 84-88. DOI: 10.1007/s13410-020-00858-9

6. Tariq, Esraa; Lafta, Riyadh[1]. A Profile on Health-Care Services for Old in Baghdad. Mustansiriya Medical Journal 17(1):p 52-56, Jan–Jun 2018. | DOI: 10.4103/MJ.MJ_13_18

7. Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, Cho NH, Cavan D, Shaw JE, Makaroff LE. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract. 2017 Jun;128:40-50. doi: 10.1016/j.diabres.2017.03.024. Epub 2017 Mar 31. PMID: 28437734.

8. Pantalone KM, Misra-Hebert AD, Hobbs TM, Wells BJ, Kong SX, Chagin K, Dey T, Milinovich A, Weng W, Bauman JM, Burguera B, Zimmerman RS, Kattan MW. Effect of glycemic control on the Diabetes Complications Severity Index score and development of complications in people with newly diagnosed type 2 diabetes. J Diabetes. 2018 Mar;10(3):192-199. doi: 10.1111/1753-0407.12613. Epub 2017 Nov 27. PMID: 28976724.

9. Mann DM, Carson AP, Shimbo D, Fonseca V, Fox CS, Muntner P. Impact of A1C screening criterion on the diagnosis of pre-diabetes among U.S. adults. Diabetes Care. 2010 Oct;33(10):2190-5. doi: 10.2337/dc10-0752. Epub 2010 Jul 13. PMID: 20628087; PMCID: PMC2945159.

10. Abusaib M, Ahmed M, Nwayyir HA, Alidrisi HA, Al-Abbood M, Al-Bayati A, Al-Ibrahimi S, Al-Kharasani A, Al-Rubaye H, Mahwi T, Ashor A, Howlett H, Shakir M, Al-Naqshbandi M, Mansour A. Iraqi Experts Consensus on the Management of Type 2 Diabetes/Prediabetes in Adults. Clin Med Insights Endocrinol Diabetes. 2020 Aug 19;13:1179551420942232. doi: 10.1177/1179551420942232. PMID: 32884389; PMCID: PMC7440731.

11. Chacín, Maricarmen, Sandra Milena Carrillo-Sierra, Pablo Durán, Bermany Garrido, Rubén Carrasquero, Manuel Nava, Juan Salazar, Lissé Angarita, Hazel Anderson, Henry García-Pacheco, Ana Checa-Ros, Luis D'Marco, Diego Rivera-Porras and Valmore Bermúdez. "Epidemiological behavior of childhood obesity: A continental point of view." *F1000Research 2024, 13:177 (https://doi.org/10.12688/f1000research.139123.1)*

12. Rashad B, Hussein NR, Hashim Dirbas V, Naqid IA. Prevalence and Determinants of Undiagnosed Diabetes Mellitus Among Adults in Zakho City, Kurdistan Region, Iraq: A Community-Based Cross-Sectional Study. Cureus. 2025 Jan 18;17(1):e77618. doi: 10.7759/cureus.7761

13. Idris, I., Inclusive and sustained growth in Iraq. Helpdesk report for the K4D (Knowledge, Evidence and Learning for Development), 2018. https://gsdrc.org/publications/inclusive-and-sustained-growth-in-iraq/

14. Faihan, S., Urban policy in Iraq for the period 1970-2012, evaluation study. Journal of Advanced Social Research Vol.4 No.3, March 2014, 58-76

15. Mahmood S, Omar N, Sallehuddin H, Albayaty MA, Mohd Yusof B-N, Zohari Z. Nutritional Status, Vitamin D and Lifestyle of Adults with and without Type 2 Diabetes in Baghdad, Iraq: A Comparative Cross-Sectional Study. imjm [Internet]. 2023 Apr. 1 [cited 2026 Jan. 2];22(2). Available from: https://journals.iium.edu.my/kom/index.php/imjm/article/view/2133

16. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund U, Yngve A, Sallis JF, Oja P. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003 Aug;35(8):1381-95. doi: 10.1249/01.MSS.0000078924.61453.FB. PMID: 12900694.

17. Daass-Iraqi S, Garber-Epstein P, Roe D. Facilitators and barriers in the implementation of a culturally adapted Arabic version of Illness Management and Recovery (IMR) among Palestinian Arabs in Israel. Transcult Psychiatry. 2023 Aug;60(4):662-674. doi: 10.1177/13634615231167720. Epub 2023 May 1. PMID: 37128717.

18. Abdullah R A. Adherence, satisfaction and diabetic self-care activity among diabetic patient in Erbil, Iraq. 2021, near east university.

19. Relitz, Adam, "SMART Goal-Setting on Behaviors to Enhance Intrinsic Motivation for Exercise: A Pilot Study with Orangetheory Fitness Participants" (2025). Williams Honors College, Honors Research Projects. 2006. https://ideaexchange.uakron.edu/honors_research_projects/2006

20. Siddiqui F, Kurbasic A, Lindblad U, Nilsson PM, Bennet L. Effects of a culturally adapted lifestyle intervention on cardio-metabolic outcomes: a randomized controlled trial in Iraqi immigrants to Sweden at high risk for Type 2 diabetes. Metabolism. 2017 Jan;66:1-13. doi: 10.1016/j.metabol.2016.10.001. Epub 2016 Oct 12. PMID: 27923444.

21. Guasch-Ferré M, Willett WC. The Mediterranean diet and health: a comprehensive overview. J Intern Med. 2021 Sep;290(3):549-566. doi: 10.1111/joim.13333. Epub 2021 Aug 23. PMID: 34423871.

22. Delarue J. Mediterranean Diet and cardiovascular health: an historical perspective. Br J Nutr. 2022 Oct 14;128(7):1335-1348. doi: 10.1017/S0007114521002105. Epub 2021 Jun 14. PMID: 34121645.

23. Sheng Z, Cao JY, Pang YC, Xu HC, Chen JW, Yuan JH, Wang R, Zhang CS, Wang LX, Dong J. Effects of Lifestyle Modification and Anti-diabetic Medicine on Prediabetes Progress: A Systematic Review and Meta-Analysis. Front Endocrinol (Lausanne). 2019 Jul 12;10:455. doi: 10.3389/fendo.2019.00455. PMID: 31354627; PMCID: PMC6639788.

24. Magkos F, Hjorth MF, Astrup A. Diet and exercise in the prevention and treatment of type 2 diabetes mellitus. Nat Rev Endocrinol. 2020 Oct;16(10):545-555. doi: 10.1038/s41574-020-0381-5. Epub 2020 Jul 20. PMID: 32690918.

25. Dominguez LJ, Veronese N, Di Bella G, Cusumano C, Parisi A, Tagliaferri F, Ciriminna S, Barbagallo M. Mediterranean diet in the management and prevention of obesity. Exp Gerontol. 2023 Apr;174:112121. doi: 10.1016/j.exger.2023.112121. Epub 2023 Feb 17. PMID: 36792040.

26. Papakonstantinou E, Oikonomou C, Nychas G, Dimitriadis GD. Effects of Diet, Lifestyle, Chrononutrition and Alternative Dietary Interventions on Postprandial Glycemia and Insulin Resistance. Nutrients. 2022 Feb 16;14(4):823. doi: 10.3390/nu14040823. PMID: 35215472; PMCID: PMC8878449.

27. Merrill JD, Soliman D, Kumar N, Lim S, Shariff AI, Yancy WS Jr. Low-Carbohydrate and Very-Low-Carbohydrate Diets in Patients With Diabetes. Diabetes Spectr. 2020 May;33(2):133-142. doi: 10.2337/ds19-0070. PMID: 32425450; PMCID: PMC7228825.

28. Valk R, Hammill J, Grip J. Saturated fat: villain and bogeyman in the development of cardiovascular disease? Eur J Prev Cardiol. 2022 Dec 21;29(18):2312-2321. doi: 10.1093/eurjpc/zwac194. PMID: 36059207.

29. Teicholz N, Croft SM, Cuaranta I, Cucuzzella M, Glandt M, Griauzde DH, Jerome-Zapadka K, Kalayjian T, Murphy K, Nelson M, Shanahan C, Nishida JL, Oh RC, Parrella N, Saner EM, Sethi S, Volek JS, Williden M, Wolver S. Myths and Facts Regarding Low-Carbohydrate Diets. Nutrients. 2025 Mar 17;17(6):1047. doi: 10.3390/nu17061047. PMID: 40292478; PMCID: PMC11944661.

30. Dening J, Mohebbi M, Abbott G, George ES, Ball K, Islam SMS. A web-based low carbohydrate diet intervention significantly improves glycaemic control in adults with type 2 diabetes: results of the T2Diet Study randomised controlled trial. Nutr Diabetes. 2023 Aug 27;13(1):12. doi: 10.1038/s41387-023-00240-8. PMID: 37633959; PMCID: PMC10460437.

31. Wheatley SD, Deakin TA, Arjomandkhah NC, Hollinrake PB, Reeves TE. Low Carbohydrate Dietary Approaches for People With Type 2 Diabetes-A Narrative Review. Front Nutr. 2021 Jul 15;8:687658. doi: 10.3389/fnut.2021.687658. PMID: 34336909; PMCID: PMC8319397.

32. Wheatley SD, Deakin TA, Arjomandkhah NC, Hollinrake PB, Reeves TE. Low Carbohydrate Dietary Approaches for People With Type 2 Diabetes-A Narrative

Review. Front Nutr. 2021 Jul 15;8:687658. doi: 10.3389/fnut.2021.687658. PMID: 34336909; PMCID: PMC8319397.

33. Silverii GA, Cosentino C, Santagiuliana F, Rotella F, Benvenuti F, Mannucci E, Cresci B. Effectiveness of low-carbohydrate diets for long-term weight loss in obese individuals: A meta-analysis of randomized controlled trials. Diabetes Obes Metab. 2022 Aug;24(8):1458-1468. doi: 10.1111/dom.14709. Epub 2022 May 26. PMID: 35373905; PMCID: PMC9546386.

34. Saslow LR, Kim S, Daubenmier JJ, Moskowitz JT, Phinney SD, Goldman V, Murphy EJ, Cox RM, Moran P, Hecht FM. A randomized pilot trial of a moderate carbohydrate diet compared to a very low carbohydrate diet in overweight or obese individuals with type 2 diabetes mellitus or prediabetes. PLoS One. 2014 Apr 9;9(4):e91027. doi: 10.1371/journal.pone.0091027. PMID: 24717684; PMCID: PMC3981696.

35. Pascual Fuster V, Pérez Pérez A, Carretero Gómez J, Caixàs Pedragós A, Gómez-Huelgas R, Pérez-Martínez P. Executive summary: Updates to the dietary treatment of prediabetes and type 2 diabetes mellitus. Clin Investig Arterioscler. 2021 Mar-Apr;33(2):73-84. English, Spanish. doi: 10.1016/j.arteri.2020.11.005. Epub 2021 Feb 18. PMID: 33612315.

36. Aldin, S.a., The Effect of Whole Food, Plant-Based Diet and Low Fat Content on The Glycaemic Control and Quality of Life in a Group of Type 2 Diabetes Patients: A Pilot Study. 2018, Khaleel Abdel Latif Khaleel Sa'ad Aldin. https://hdl.handle.net/20.500.11888/17350

37. Shashi K. Agarwal. 2021. "Impact of Diet on Cardiovascular Diseases: Coronary Artery Disease Risk Factors". *Asian Journal of Cardiology Research* 4 (1):410–426. https://journalajcr.com/index.php/AJCR/article/view/59.

38. Wang T, Masedunskas A, Willett WC, Fontana L. Vegetarian and vegan diets: benefits and drawbacks. Eur Heart J. 2023 Sep 21;44(36):3423-3439. doi: 10.1093/eurheartj/ehad436. PMID: 37450568; PMCID: PMC10516628.
39. Al-Zuhairy AM, Al-Hamdani YA. The effect of wheat flour extraction rate on blood glucose response and glycemic index in healthy individuals. Int. J. of Health Sci. [Internet]. 2022 Mar. 29 [cited 2026 Jan. 1];6(S3):150-7. Available from: https://sciencescholar.us/journal/index.php/ijhs/article/view/5237

40. Al-Atta DM, Al-Samarraee MF, Fadhil AA, Kadhim ST, Alsarhan HW. Compliance with Second Visit of Diabetes Mellitus Screening Program and Impact of Dietary and Exercise Modification on Glycemic Control. Al-Rafidain J Med Sci [Internet]. 2025 May 23 [cited 2026 Jan. 1];8(2):150-6. Available from: https://ajms.iq/index.php/ALRAFIDAIN/article/view/1929

41. Basim, H., et al. The effect of mixing rice with mung bean in different food meals on postprandial blood glucose level in healthy adults. in IOP Conference Series: Earth and Environmental Science. 2021. IOP Publishing. **DOI** 10.1088/1755-1315/779/1/012002

42. El-Sehrawy AAMA, Hjazi A, Nourmohammad A, Oghenemaro EF, Uthirapathy S, Balaji J, Punia H, Kumar MR, Chauhan AS, Jafarzadeh F. The association between vegetable-derived nitrate and nitrite intake, cardiovascular risk factors and glycemic markers in obese individuals. Sci Rep. 2025 Dec 3. doi: 10.1038/s41598-025-30239-3. Epub ahead of print. PMID: 41339432.

43. Jasim OH, Mahmood MM, Ad'hiah AH. Significance of Lipid Profile Parameters in Predicting Pre-Diabetes. Arch Razi Inst. 2022 Feb 28;77(1):277-284. doi: 10.22092/ARI.2021.356465.1846. PMID: 35891716; PMCID: PMC9288615.

44. Hatem, H.M. and K.K. Ghudhaib, Evaluation of Irisin Level in Iraqi Patients with Type 2 Diabetes and Pre-Diabetes Status as a Predictive Factor. Ibn AL-Haitham Journal For Pure and Applied Sciences, 2025. 38(1): p. 302-312.doi.org/10.30526/38.1.3630

45. Jasim O, Mahmood M, Ad'hiah A. Prevalence and Prediction of Prediabetes among Apparently Healthy Iraqis from Baghdad. Health Educ Health Promot 2022; 10 (2) :411-421. URL: http://hehp.modares.ac.ir/article-5-53715-en.html

46. Jamal ALMADHIDI, Abdullah Ali Mohammed, AmeelF. Alshawi.
The effect of Ramadan fasting on glucose and insulin homeostasis and some biochemical parameters in healthy Iraqi students of Fallujah medicine, a pilot study. 2021. Nat. Volatiles & Essent. Oils, 2021; 8(4): 6744-67536744

47. Jasim OH, Mahmood MM, Ad'hiah AH. Significance of Lipid Profile Parameters in Predicting Pre-Diabetes. Arch Razi Inst. 2022 Feb 28;77(1):277-284. doi: 10.22092/ARI.2021.356465.1846. PMID: 35891716; PMCID: PMC9288615.

48. Haneen A. Abd1,Essam F. Al-Jumaili. The relationship between some biochemical parameters and type 2 diabetes mellitus among Iraqi patients. Iraqi Journal of Biotechnology, 2022, Vol. 21, No. 2, 268-275

49. Suleiman, Rojeen Rasheed; Salih, Sherwan Ferman; Abdullah, Barhav Issa; Ibrahim, Ibrahim Hasan; Saeed, Zindan Azeez. Triglyceride Glucose Index, its Modified Indices, and Triglyceride HDL-C Ratio as Predictor Markers of Insulin Resistance in Prediabetic Individuals. Medical Journal of Babylon 20(2):p 268-273, Apr–Jun 2023. | DOI: 10.4103/MJBL.MJBL_269_22

50. Ban Waheed Hussein Bdair, Satar Jabbar Rahi Al-Graittee, Mohammed Satar Jabbar, Zahraa Hatem Kadhim, Hamza Lawal, Samaher Hakim Alwa'aly, Ali Abdulridha Kadhim Abutiheen. Cardiovascular risk factors for hypertension and diabetes among overweight and obese adolescents in the city of Kerbala, Iraq. Journal of Cardiovascular Disease Research, 2020. 11(2): p. 32-39. DOI: https://doi.org/10.48047/

51. Al Azzawi, OF 2015, "Prevalence of prediabetes and metabolic syndrome and their association in an Iraqi sample", *IOSR Journal of Dental and Medical Sciences*. IOSR J Dent Med Sci, 2015. 14(9): p. 10-6

52. Aga IMT Abdulrahman, Hazim Al-Naemi A. Prevalence of Type 2 Diabetes Mellitus and Pre-Diabetes in Mosul City, Northern Iraq: Changes over 20 years!. Ann. coll. Med. Mosul [Internet]. 2025 Jun. 1 [cited 2026 Jan. 1];47(1):13-20. Available from: https://mmed.uomosul.edu.iq/index.php/mmed/article/view/37170

53. Allah Rakha, Nida Rehman, Rimsha Anwar, Hina Rasheed, Roshina Rabail, Zuhaib F. Bhat, Amin Mousavi Khaneghah, Rana Muhammad Aadil. A Comprehensive Review of Its Nutraceutical Potential in Disease Mitigation and Health Enhancement. Food Frontiers. 2025.;21 May 2025 https://doi.org/10.1002/fft2.70041

54. Harding, S. and K. Libal, War and the public health disaster in Iraq. War and health: The medical consequences of the wars in Iraq and Afghanistan, 2019. 4(111): p. 128-136. https://dokumen.pub/war-and-health-the-medical-consequences-of-the-wars-in-iraq-and-afghanistan-1479875961-9781479875962.html