Nutrient Profiling of Bark of Banyan Tree (*Ficus benghalensis* L.): Impact of Supplementation in Type 2 Diabetic Subjects

EXECUTIVE SUMMARY

By

ANUPRIYA MAMGAIN

M.Sc. (Community Science) in Food Science and Nutrition

Department of Foods and Nutrition
Faculty of Family and Community Sciences,
The Maharaja Sayajirao University of Baroda
Vadodara- 390002
Gujarat, India

January, 2026

INDEX

S. No.	Contents	Page No.
1.	Table of Contents	1
2.	List of Tables	2 - 5
3.	List of Figures	6 - 8
4.	Introduction	9 - 10
5.	Rationale of the Study	10
6.	Objectives of the Study	10
7.	Methodology	10 - 14
8.	Key Findings	15 - 20
9.	Conclusion	20 - 21
10.	Recommendations	21 - 22
11.	Bibliography	22 - 63

TABLE OF CONTENT

S. No.	Content	Page No.
1.	**Abstract**	i - iii
2.	**Chapter 1- Introduction**	1 - 11
3.	**Chapter 2- Review of Literature**	12 - 61
4.	**Chapter 3- Methodology**	62 - 106
5.	**Chapter 4- Results and Discussion**	107 - 221
6.	**Chapter 5- Summary and Conclusion**	222 - 232
7.	**References**	233 - 274
8.	**Annexures**	iv - lvi

LIST OF TABLES

S. No.	Table No.	Table Title	Page No.
1.	2.1	Diagnostic Criteria for Diabetes Mellitus According to IDF 20205	17
2.	2.2	Prevalence of Adults Having High or Very High Random Blood Glucose Levels Based on NFHS-5 Report	17
3.	2.3	Prevalence of CAM Use among Adult Diabetic Patients across Different Countries	31-35
4.	2.4	Taxonomy of *Ficus benghalensis* L.	38
5.	2.5	Vernacular Names of *Ficus benghalensis* L.	39
6.	2.6	Phytochemical Constituents Present in Different Parts of *Ficus benghalensis* L.	42-44
7.	2.7	Antidiabetic Potential of Different Parts of *Ficus benghalensis* L.	48-54
8.	3.1	FSSAI Cut-off Values for Heavy Metals	67
9.	3.2	Methods of Qualitative Screening of Phytochemicals	74-76
10.	3.3	Estimated Average Requirements (EAR) of the Nutrients (ICMR-NIN)	92
11.	3.4	Upper Limits of Fats and Sugar Intake based on EAR 2024 (ICMR-NIN) and WHO 2015	92
12.	3.5	Asia-Pacific Classification of BMI	94
13.	3.6	Waist Circumference Cut-off Values Given by IDF for South Asian Population	94
14.	3.7	Blood Pressure Cut-off Values for Adults Recommended by the Eighth Joint National Committee (JNC 8) Panel Members	97
15.	3.8	Categorization of Physical Activity Level Based on MET Minutes a Week	97
16.	3.9	Methods for Estimation of Biochemical Parameters	99-103
17.	3.10	Cut-off Values of Biochemical Parameters Used in the Study	103
18.	4.1.1	The concentration of Heavy Metals in *Ficus benghalensis* L. Bark Powder	109
19.	4.1.2	Nutrient Composition of *Ficus benghalensis* L. Bark Powder	109

20.	4.1.3	Phytochemical Screening of Hydroalcoholic Extract of *Ficus benghalensis* L. Bark	113
21.	4.1.4	Antioxidant Analysis of *Ficus benghalensis* L. bark	119
22.	4.2.1	Overview of the Medical History of the Subjects (n, %)	127
23.	4.2.2	Gender-wise Prevalence of Self-reported Comorbid Conditions Among the Subjects (n, %)	127
24.	4.2.3	Family Medical History of the Subjects (n, %)	129
25.	4.2.4	Association Between Supplements Usage and Characteristics of the Subjects (Chi-Square and Mann-Whitney Test) (n, %)	133-134
26.	4.2.5	List of Polyherbal Formulations Used by the Subjects (n, %)	137
27.	4.2.6	List of "Other" Supplements with Low Consumption Rates Among the Subjects (n, %)	138-139
28.	4.2.7	Beliefs and Reasons for Usage of Supplements Among the Subjects	144
29.	4.2.8	Sources of Information for Dietary Supplement Use Among the Subjects	148
30.	4.2.9	Reasons for Discontinuation of Supplement Use	148
31.	4.3.1	Socio-Demographic Profile of the Subjects (n, %)	155-157
32.	4.3.2	Overview of the Medical History of the Subjects	160
33.	4.3.3	Gender-wise Prevalence of Self- Reported Comorbid Conditions (n, %)	160
34.	4.3.4	Family Medical History among the Subjects (n, %)	162
35.	4.3.5	Dietary Practices of the Subjects (n, %)	164-165
36.	4.3.6	Mean Percentage Distribution of Food Frequency Intake in the Experimental and Placebo Groups	167
37.	4.3.7	History of Substance Use (n, %)	170
38.	4.3.8	Baseline Comparison of Macronutrient Intake between Experimental and Placebo Groups (Mean ± SD)	170
39.	4.3.9	Pre- and Post-Intervention Nutrient Intake: Experimental vs. Placebo Group (Mean ± SD)	171
40.	4.3.10	Percentage of Estimated Average Requirement (EAR) Met for Nutrient Intake Pre- and Post-Intervention	173

41.	4.3.11	Percentage of Recommended Upper Limit Met for Nutrient Intake Pre- and Post- Intervention	174
42.	4.3.12	Baseline Comparison of MET mins per week and Physical activity levels of Subjects between Experimental and Placebo Groups	176
43.	4.3.13	Percentage Distribution of Subjects by Physical Activity Level Pre and Post Intervention in Experimental and Placebo Groups (n, %)	176
44.	4.3.14	Pre- and Post-Intervention MET mins and Sitting hours of the Subjects: Experimental vs. Placebo Group (Mean ± SD)	176
45.	4.3.15	Baseline Comparison of BMI Classification between Experimental and Placebo Groups (n, %)	177
46.	4.3.16	Group-wise Anthropometric Profile of Subjects at Pre- and Post-Intervention (n, %)	177
47.	4.3.17	Comparison of Anthropometric Data at Three Time Points During Intervention: Experimental vs. Placebo Group (ANOVA)	178
48.	4.3.18	Gender-wise Comparison of Baseline Data (Mean ± SD)	181
49.	4.3.19	Baseline Comparison of the Variables Among the Subjects Having Less Than or Greater than 7% HbA1c	183
50.	4.3.20	Compliance Percentage of the Supplementation in Experimental and Placebo Group (%)	197
51.	4.3.21	Baseline Comparison of Blood Pressure between Experimental and Placebo Groups (Mean ± SD)	197
52.	4.3.22	Comparison of Blood Pressure at Three Time Points During Intervention: Experimental vs. Placebo Group (ANOVA)	197
53.	4.3.23	Impact of Supplementation on Blood Pressure of the Subjects Based on Initial Levels of Systolic Blood Pressure (Mean ± SD)	199
54.	4.3.24	Impact of Supplementation on Blood Pressure of the Subjects Based on Initial Levels of Diastolic Blood Pressure (Mean ± SD)	199
55.	4.3.25	Random Blood Sugar Levels of the Subjects Across the Intervention Period in Experimental and Placebo Group (Mean ± SD)	202

56.	4.3.26	Baseline Comparison of Glycaemic and Lipemic Parameters Between Experimental and Placebo Groups (Mean ± SD)	202
57.	4.3.27	Impact of Supplementation on Glycaemic Parameters of the Subjects: Experimental vs. Placebo Group (Mean ± SD)	202
58.	4.3.28	Impact of Supplementation on Glycemic Parameters Based on Initial Levels of Fasting Blood Sugar (FBS) (Mean ± SD)	205
59.	4.3.29	Impact of Supplementation on Glycemic Parameters Based on Initial Levels of Post Prandial Blood Sugar (PP2BS) (Mean ± SD)	205
60.	4.3.30	Impact of Supplementation on Lipemic Parameters and Inflammatory Markers of the Subjects: Experimental vs. Placebo Group (Mean ± SD)	208
61.	4.3.31	Impact of Supplementation on Lipid Parameters Based on Initial Levels of Total Cholesterol (TC) (Mean ± SD)	210
62.	4.3.32	Impact of Supplementation on Lipid Parameters Based on Initial Levels of Triglycerides (TG) (Mean ± SD)	211
63.	4.3.33	Impact of Supplementation on Lipid Parameters Based on Initial Levels of Low Density Lipoprotein Cholesterol (LDL) (Mean ± SD)	214
64.	4.3.34	Effect of Supplementation on Hepatic and Renal Function Parameters: Experimental vs. Placebo Group (Mean ± SD)	218

LIST OF FIGURES

S. No.	Figure No.	Figure Caption	Page No.
1.	2.1.	Pathophysiology of Hyperglycaemia in Type 2 Diabetes Mellitus	20
2.	2.2	Probable Mechanism of Antidiabetic Activity of *Ficus benghalensis* L. Bark	60
3.	3.1	Overview of Study Design for Phase 1	65
4.	3.2	Overview of Study Design for Phase 2	80
5.	3.3.	Overview of Study Design for Phase 3	84
6.	3.4	Sample Size per Group for Comparing Two means	85
7.	3.5	Composition of the Tablets	89
8.	3.6	Tablets and its Packaging	89
9.	3.7	Details of Biochemical Parameters Assessed in Phase 3	98
10.	3.8	Data Monitoring Timeline During Intervention	105
11.	4.1.1	Standard Graph of Rutin for Flavonoid Estimation	117
12.	4.1.2	Standard Graph of Catechin for Tannin Estimation	117
13.	4.2.1	Sex of the Subjects	124
14.	4.2.2	Religion of the Subjects	124
15.	4.2.3	Marital Status of the Subjects	124
16.	4.2.4	Occupation of the Subjects	124
17.	4.2.5	Education of the Subjects	124
18.	4.2.6	Family Type of the Subjects	125
19.	2.4.7	Socio-Economic Status	125
20.	4.2.8	Monthly Family Income (in INR)	125
21.	4.2.9	Education of the Family Head	125
22.	4.2.10	Occupation of the Family Head	125
23.	4.2.11	Prevalence of the Dietary Supplements Consumption	131
24.	4.2.12	Number of Supplements Used	131

25.	4.2.13	Percentage Distribution of Dietary Supplements Consumed by the Subjects	136
26.	4.2.14	Health Reasons for Consuming Supplements	144
27.	4.2.15	Doctor's Consent Regarding Dietary Supplement Usage	151
28.	4.2.16	Monthly Expenditure of the Subjects on Dietary Supplements	151
29.	4.3.1	Correlation and Univariate Linear Regression Analysis of Hba1c with other Parameters	185
30.	4.3.2	Correlation and Univariate Linear Regression Analysis of Fasting Blood Sugar (FBS) with other Parameters	187
31.	4.3.3	Correlation and Univariate Linear Regression Analysis of Postprandial Blood Sugar (PP2BS) with other Parameters	188
32.	4.3.4	Correlation and Univariate Linear Regression Analysis of Total Cholesterol (TC) with other Parameters	189
33.	4.3.5	Correlation and Univariate Linear Regression Analysis of Triglycerides (TG) with other Parameters	190
34.	4.3.6	Correlation and Univariate Linear Regression Analysis of High Density Lipoprotein Cholesterol (HDL) with other Parameters	191
35.	4.3.7	Correlation and Univariate Linear Regression Analysis of Low Density Lipoprotein Cholesterol (LDL) with other Parameters	191
36.	4.3.8	Correlation and Univariate Linear Regression Analysis of Apolipoprotein A1 (Apo A1) with Serum Creatinine	191
37.	4.3.9	Correlation and Univariate Linear Regression Analysis of Apolipoprotein B (Apo B) with other Parameters	192
38.	4.3.10	Percent Change in Systolic and Diastolic Blood Pressure Post-Intervention in Subjects with Elevated Systolic Blood Pressure (SBP ≥ 140 mmHg)	200
39.	4.3.11	Percent Change in Systolic and Diastolic Blood Pressure Post-Intervention in Subjects with Elevated Diastolic Blood Pressure (DBP ≥ 90 mmHg)	200

40.	4.3.12	Changes in Blood Sugar Levels of the Subjects at Three Time Points During Intervention: Experimental vs Placebo Group	203
41.	4.3.13	Percent Change in Glycaemic Parameters of Subjects in Experimental and Placebo Group Post-Intervention	203
42.	4.3.14	Percent Change in Glycaemic Parameters Post-Intervention in Subjects with Elevated Fasting Blood Sugar (FBS ≥ 145 mg/dL)	206
43.	4.3.15	Percent Change in Glycaemic Parameters Post-Intervention in Subjects with Elevated Post Prandial Blood Sugar (PP2BS > 160 mg/dL)	206
44.	4.3.16	Percent Change in Lipid Parameters and Inflammatory Marker of Subjects Post-Intervention	209
45.	4.3.17	Percent Change in Lipid Parameters Post-Intervention in Subjects with Total Cholesterol (TC) ≥ 170 mg/dL	212
46.	4.3.18	Percent Change in Lipid Parameters Post-Intervention in Subjects with Elevated Triglycerides (TG ≥ 150 mg/dL)	212
47.	4.3.19	Percent Change in Lipid Parameters Post-Intervention in Subjects with Elevated Low Density Lipoprotein Cholesterol (LDL ≥ 100 mg/dL)	215
48.	4.3.20	Percent Change in Hepatic and Renal Function Parameters of Subjects Post-Intervention	219

INTRODUCTION

According to the World Health Organization, non-communicable diseases (NCDs) were responsible for at least 43 million deaths in 2021, making up 75% of non-pandemic-related fatalities globally, highlighting a major public health challenge. Diabetes mellitus is one of the major NCDs and has emerged as a significant global public health concern as well as a leading cause of mortality, with its prevalence increasing at an alarming rate.

Diabetes mellitus is a chronic metabolic disorder characterized by persistently elevated blood glucose levels due to inadequate insulin production, impaired insulin function, or both. According to the International Diabetes Federation (2025), an estimated 589 million people worldwide were living with diabetes in 2024, and this number was projected to increase by 45% by 2050. India bears a significant share of this burden, ranking second among the countries with the highest number of adults (aged 20 to 79 years) with diabetes. In 2024, 89.8 million people in India were living with diabetes, and this figure is expected to rise by approximately 74% by 2050 International Diabetes Federation (2025).

Effective diabetes management requires a comprehensive approach that includes hypoglycaemic drugs, insulin therapy, dietary adjustments, regular exercise, and behavioural modifications. In addition to dietary modifications, Complementary and Alternative Medicine (CAM) is increasingly recognized for its role in diabetes management. Dietary supplements are an essential component of CAM, commonly used to support overall well-being and sustain optimal health. A systematic review and meta-analysis by Alzahrani et al., 2021 examined the global prevalence of CAM use among adults with diabetes, revealing a wide variation in usage, ranging from 8% to 89%, with a pooled prevalence of 51%. Among the various CAM therapies, herbal and nutritional supplements were the most commonly used. The demand for dietary supplements has expanded beyond vitamins and minerals to include botanicals and herbs, as consumers seek natural alternatives for disease prevention and wellness.

Among the numerous botanicals studied for their anti-diabetic potential, *Ficus benghalensis* L. is one such plant that has attracted scientific interest. It is commonly known as “banyan tree” and native to India, Pakistan, and Sri Lanka. This large evergreen tree, belonging to the Moraceae family, is characterized by its aerial roots that descend from the branches and develop into pillar-like trunks. *Ficus benghalensis* L. has long been an integral part of traditional medicine across the Indian subcontinent, valued for its therapeutic properties.

Various parts of the tree, including its bark, roots, leaves, and latex, have been traditionally utilized in the treatment of diverse ailments, reflecting its longstanding role in folk medicine.

In addition to its traditional use, scientific studies have demonstrated the therapeutic potential of *Ficus benghalensis* L. bark in the management of diabetes and its related metabolic disturbances. Experimental studies using animal models have also shown that the bark possesses hypoglycemic and hypocholesterolemic effects (Amali et al., 2025; Gayathri & Kannabiran, 2008; Khanal & Patil, 2021; Saifi et al., 2024; Shukla et al., 2004). However, its clinical relevance remains underexplored, indicating the need for further investigation to determine its potential role in diabetes management.

RATIONALE OF THE STUDY

Plant-based therapies have long been employed in traditional medicine for the management of diabetes mellitus, with *Ficus benghalensis* L. being a botanical of substantial potential, as demonstrated in in vitro and in vivo studies. However, there is a dearth of studies assessing the nutrient composition of *Ficus benghalensis* L. bark, and no clinical evidence is currently available to establish its effectiveness in human subjects. Therefore, the present study was undertaken with the broad objective of evaluating the impact of *Ficus benghalensis* L. bark supplementation in individuals with type 2 diabetes mellitus.

OBJECTIVES OF THE STUDY

1) To analyze the nutrient composition, phytochemical and antioxidant profile of bark of *Ficus benghalensis* L.
2) To study the consumption of dietary supplements among diabetes subjects for the management of diabetes mellitus.
3) To study the impact of bark of *Ficus benghalensis* L. supplementation on glycaemic, lipemic, liver and kidney function in stable type 2 diabetes mellitus subjects.

METHODOLOGY

Before initiating the study, ethical approval was obtained from the Institutional Ethical Committee of the Maharaja Sayajirao University of Baroda, Vadodara, India (IECHR/FCSc/PhD/2021/121), ensuring adherence to ethical guidelines and participant safety. The study was conducted in three phases:

Phase 1: Nutrient composition, phytochemical and antioxidant profile of bark of *Ficus benghalensis* L.

Phase 2: Cross-Sectional Study of Dietary Supplement Consumption Among Diabetic Subjects

Phase 3: Impact of *Ficus benghalensis* L. Bark Supplementation on Subjects with Type 2 Diabetes Mellitus

Phase 1: Nutrient Composition, Phytochemical and Antioxidant Profile of Bark of *Ficus benghalensis* L.

Phase 1 employed a laboratory-based experimental design to analyze the nutrient composition, phytochemical profile, and antioxidant profile of *Ficus benghalensis* L. bark. The bark powder was procured and authenticated to verify its botanical origin. After authentication, the sample underwent heavy metal testing to ensure compliance with safety standards. Following analysis was done using standard methods:

- **Heavy metal testing**: lead, mercury and arsenic.
- **Proximate Composition**: moisture, ash, fibre, protein, fat, carbohydrate and energy
- **Micronutrients**: iron, calcium, phosphorus, sodium, potassium, magnesium and vitamin C
- **Phytochemical analysis**: qualitative analysis of phytochemicals and quantitative estimation of total phenol, flavonoid, and tannin.
- **Antioxidant assays**: FRAP and DPPH assay

Phase 2: Cross-Sectional Study of Dietary Supplement Consumption Among Diabetic Subjects

In Phase 2, a cross-sectional study design was used to determine the prevalence and use of dietary supplements among diabetic patients in Vadodara, Gujarat, India. Four healthcare clinics providing medical care to diabetic patients were purposively selected based on patient load and willingness to participate. From these clinics, 400 diabetic subjects were recruited and interviewed. Data were collected using a pretested questionnaire designed to gather detailed information on supplement usage, the beliefs influencing its use, and physicians' opinions, offering a comprehensive understanding of the patterns and factors associated with their consumption.

Sample Size Calculation

The sample size was calculated by using the formula (Shete et al., 2020):

$$n = \frac{(Z_{(1-\alpha/2)})^2 \times (\mathrm{p}) \times (\mathrm{q})}{(d)^2}$$

Where:

- Z(1-α/2) represents the standard normal critical value corresponding to the selected confidence level (1.96 for a 95% confidence interval).
- p denotes the estimated proportion of the population, which was taken as 52% based on a previous study on supplement use among diabetic patients (Li et al., 2020).
- q = 1− p
- d denotes the margin of error (precision) = 5%

Using this formula, the calculated sample size was 383.54, which was rounded up to 400 for practical feasibility. Therefore, the final sample size for Phase 2 was set at 400.

Sample Selection Criteria

Inclusion Criteria:

Individuals were eligible to participate if they:

- Had a diagnosis of diabetes mellitus.
- Were above 18 years of age.
- Resided in Vadodara city during the study.

Exclusion Criteria:

- Participants were excluded if they were pregnant at the time of enrolment.

Phase 3: Impact of *Ficus benghalensis* L. Bark Supplementation on Subjects with Type 2 Diabetes Mellitus

In the third phase, a randomized, triple-blind, placebo-controlled trial was conducted to assess the effects of *Ficus benghalensis* L. bark supplementation in individuals with Type 2 Diabetes Mellitus. A total of 80 participants diagnosed with Type 2 Diabetes Mellitus were recruited from four preselected clinics and randomly allocated into two groups of 40 each. To maintain the triple-blind nature of the study, similar tablets, with and without the active

ingredient, were prepared for both groups. These tablets were coded as Code A and Code B to ensure blinding.

Subjects in Group A received standard diabetes care along with Code A supplementation, while those in Group B received standard diabetes care along with Code B supplementation. The intervention was administered for a duration of 90 days. The coding details were securely sealed in an envelope and remained undisclosed throughout the study. These details were revealed to the researcher only after the study was completed, that is, upon the completion of data analysis.

Sample Size Calculation

The sample size was determined using the sample size table for comparing means between two groups from the book Designing Clinical Research (Hulley et al., 2007). The table was based on the general formula as follows:

$$N= [(1/q_1+ 1/q_2) S^2 (z_{\alpha}+ z_{\beta})^2]/ E^2$$

Where,

- Confidence level 95%
- Power = 80%
- SD= 45 mg/ dl
- Expecting reduction 30 mg/dl ~ 1 % HbA1C
- Effect size (E/S) = 0.66= 0.7
- n = 34
- With attrition of 10% sample size, n= 38 ~ 40 (in each group)

Sample Selection Criteria

Inclusion Criteria:

- Adults with a confirmed diagnosis of type 2 diabetes mellitus.
- Stable diabetic subjects

Exclusion Criteria:

- History of medical condition like cancer, thyroid disorders, asthma, or stroke.

- Currently taking any dietary supplements or functional foods.
- Alcoholic, smokers and/or tobacco chewers.
- Individuals undergoing insulin therapy.

Supplementation Details

- **Dose:** 3 gram per day
- **Form:** tablets
- **1 table**t: contains 500 mg of active ingredient
- **Frequency:** six tablets per day (3 tablets after lunch and 3 after dinner)
- **Time period:** 90 days

Note: Dose was based on the recommendations of the Department of AYUSH, Ministry of Health and Family Welfare, Government of India and the Food Safety and Standards authority of India, Ministry of Health and Family Welfare, Government of India (2016).

Data Collection

- Data pertaining to socio-economic status, educational status, medical history of the subjects as well as the family history regarding any disease condition, dietary habits and addiction pattern was collected.
- Data with respect to diet pattern (3 day -24-hour dietary recall), FFQ, anthropometric measurements (BMI, WC, HC, WSR, WHR), biophysical measurements, physical activity (IPAQ) and biochemical parameters was collected using standard techniques.
- The Impact of bark of *Ficus bengalensis* L. supplementation was studied on the following biochemical parameters:
    - **Glycemic Parameters**: FBS, PP2BS and HbA1c
    - **Lipemic Parameters**: TC, TG, HDL, LDL, VLDL and Apolipoproteins
    - **Inflammatory marker**: hs- CRP
    - **Liver and kidney function test**: Microalbumin, Urinary Creatine, SGPT and SGOT

Note: The blood sample collection for analysis was done by trained technicians.

KEY FINDINGS

Phase 1: Nutrient Composition, Phytochemical and Antioxidant Profile of Bark of *Ficus benghalensis* L.

To comprehensively evaluate the bark's therapeutic potential and ensure its safety for human consumption, analyses of its nutrient composition, phytochemical constituents, antioxidant activity, and heavy metals concentration were conducted. The key findings from these assessments are summarised below.

Heavy Metals Testing

Ficus benghalensis L. bark powder was screened for heavy metals to ensure the safety of the product. The levels of heavy metals such as lead, mercury, and arsenic were reported to be less than 0.1 mg/Kg of the sample which is within the permissible limits.

Estimation of Nutrient Composition

- The analysis revealed that the bark is rich in carbohydrates (77.86%), energy (360 Kcal), crude fiber (21.86%), and ash (6.29%), with lower levels of moisture (7.58%), protein (5.14%), and fat content (3.13%).
- the bark was found to be rich in minerals, with the highest concentration of potassium (1417 mg/100 gm), followed by phosphorus (1370 mg/100 gm), calcium (472 mg/100 gm), iron (147 mg/100 gm), and magnesium (96.7 mg/100 gm). Sodium (12.6 mg/100 gm) and vitamin C (7.56 mg/100 gm) are present in comparatively lower concentrations.

Phytochemical Analysis

- Qualitative analysis confirmed the presence of tannins, phenols, saponins, glycosides, flavonoids, terpenoids, carbohydrates, and amino acids in the sample.
- The Concentration of total phenols, flavonoid and tannins in the bark were found to be 244.736 mg per 100gram, 332 mg of rutin equivalent per gram and 70.3 µg catechin equivalents per gram, respectively.

Antioxidant Analysis

- The DPPH assay, using ascorbic acid as the standard, showed 75.37% scavenging activity for the bark.

- In addition, the FRAP assay revealed an antioxidant capacity of 0.461 µM ferric equivalents per gram of the bark, demonstrating its ability to reduce ferric ions (Fe^{3+}) to ferrous ions (Fe^{2+}).

Phase 2: Cross-sectional Study on Dietary Supplement Consumption among Individuals with Diabetes Mellitus

As supplement consumption is often influenced by personal perceptions, cultural beliefs, and traditional practices, region-specific data is essential to understand local usage patterns, underlying motivations, and the types of supplements consumed, which may vary across populations. Therefore, this section summarises the results of the cross-sectional study conducted in Vadodara, Gujarat, to determine the prevalence and determinants of dietary supplement use among individuals with diabetes mellitus.

- Data was collected from 400 adult diabetic subjects. The mean age was 60.59 ± 11.44 years, with 55.25% male and 44.75% female participants, and most (90.25%) identified as Hindu. Among the participants, 32.25% were graduates, 87.25% were married, and 60.50% lived in nuclear families. Homemakers were the largest occupational group (38.50%), followed by retirees (29%) and those employed (19.50%).
- According to the Modified Kuppuswamy Socioeconomic Scale (Saleem and Jan, 2021), 50% of participants belonged to the upper middle class, followed by 21.71% in the upper lower class.
- It was found that the average duration of diabetes among subjects was 11.03 ± 9.24 years (mean ± SD) and average age at diabetes onset was 49.56 ± 11.27 years (mean ± SD). Most subjects (73.25%) had at least one comorbidity along with diabetes mellitus. Hypertension was the most prevalent comorbidity, affecting 59.75% of the subjects, followed by hyperlipidemia (30.25%), thyroid disorders (13.50%), and coronary heart disease (11.75%).
- The data reveals that 62% of participants had used dietary supplements at least once since their diabetes diagnosis, but only 36.75% were actively using them at the time of the study, indicating a 40.72% had discontinued use.
- The association between various respondent characteristics and dietary supplement consumption was analyzed using the Chi-square test and the Mann-Whitney test. Results revealed that supplement usage was significantly higher among respondents aged 60-79 years (52.02%, p=0.02), those with a family history of diabetes (66.53%, p=0.0056), and those with a family history of chronic diseases (79.84%, p=0.0027). Additionally, the

average duration of diabetes was significantly longer among participants who had used dietary supplements (11.76 ± 9.20 years) compared to non-users ($p = 0.0074$).

- The most commonly used supplement was fenugreek seeds (*Trigonella foenum-graecum*), reported by 41.13% of participants. Other frequently used supplements included commercial polyherbal formulations (≈20%), Ayurvedic powders of unspecified composition (17.34%), self-prepared herbal mixes (14.11%), and giloy (*Tinospora cordifolia*, 12.10%). Additional supplements reported were juice mixes, Indian blackberry seeds (*Syzygium cumini*), bitter gourd (*Momordica charantia*), neem (*Azadirachta indica*), Paneer doda (*Withania coagulans*), turmeric (*Curcuma longa*), amla juice (*Phyllanthus emblica*), and various Ayurvedic and homeopathic preparations.
- Apart from diabetes and its complications, participants also reported using these supplements for general health, immunity, body pain, bowel health, hypertension, renal health, dyslipidemia, weight loss, flatulence, COVID-19, and other conditions.
- The consumption of dietary supplements by participants was driven by various beliefs and motives. The three most common reasons were influence from others (43.95%), the belief that Ayurveda and natural products have fewer or no side effects (19.35%), and the goal of reducing or discontinuing allopathic medications (13.31%).
- The findings indicated that most participants (68.55%) were influenced by family and friends, followed by mass media (17.34%), while only 14.92% relied on prescriptions from Ayurvedic, homeopathic, or naturopathic practitioners. Social media (11.69%) and internet searches (7.66%) also contributed to participants' awareness of supplements.
- The survey findings indicate that 40.72% of respondents eventually discontinued supplement use due to various reasons. The most common reasons for discontinuation were inconvenience or forgetfulness, perceived ineffectiveness, side effects, effective control of symptoms or health indicators, inaccessibility, and unpleasant taste.
- The findings indicate that nearly two-thirds of participants did not disclose their dietary supplement use to their doctors.

Phase 3: Impact of *Ficus benghalensis* L. Bark Supplementation on Subjects with Type 2 Diabetes Mellitus

This phase provides the first clinical evidence evaluating the antidiabetic efficacy of *Ficus benghalensis* L. bark in humans. A randomized, triple-blind, placebo-controlled trial was conducted, in which adult Type 2 diabetic participants received 3 g of bark powder in tablet form daily for 90 days. The key findings of the trial are presented below.

- The mean age of subjects in the experimental group was 50.95 ± 6.89 years, while that of the placebo group was 56.23 ± 7.91 years. The experimental group consisted of 23 males and 17 females, whereas the placebo group included 19 males and 21 females.
- Across both groups, the majority of subjects were Hindu, had graduate-level education, were married, and worked in services or business; most were also classified as upper middle class according to the Modified Kuppuswamy Socioeconomic Scale (Radhakrishnan and Nagaraja, 2023).
- The study subjects had an average diabetes duration of 7.22 ± 5.81 years, with the mean age at onset reported as 46.37 ± 7.36 years, suggesting that the majority developed the condition during mid-adulthood.
- Self-reported comorbidities were prevalent among the subjects, with 50% of the experimental group and 67.5% of the placebo group reporting at least one additional condition. Hypertension was the most frequently reported, followed by hyperlipidemia.
- A predominantly vegetarian diet was observed across both groups. All participants reported daily milk consumption, mostly full cream- 68.42% in the experimental group and 56.76% in the placebo group. Average daily sugar/jaggery intake was 7.7 ± 7.81 g and 5.74 ± 6.61 g, respectively, and preference for artificial sweeteners was low in both groups.
- Regarding edible oil consumption, most participants reported using the same type of oil year-round, with cottonseed and groundnut oils being the most commonly used.
- The mean percentage distribution of food frequency indicated that cereals and legumes/pulses were the most frequently consumed food groups across both groups. Millet consumption was comparatively low, with only 12.41% of the experimental group and 8.11% of the placebo group reporting intake at least once per week. The most commonly consumed millets were sorghum (jowar), pearl millet (bajra), and kodo millet (kodri).
- A seasonal consumption pattern was observed for vegetables and fruits. Roots and tubers were consumed weekly by 49-62% of participants, while nearly 22% reported weekly intake of nuts and oilseeds. Daily consumption of ghee or butter ranged from 39-65%, and sugar or jaggery from 37-46%. Ready-to-eat foods were consumed weekly by 19-24% of participants.
- The percentage of the Estimated Average Requirement (EAR) or Upper Limit (UL) met by subjects at pre- and post-intervention was determined according to the ICMR-NIN 2024 RDA and EAR guidelines. In both groups, protein intake was close to the EAR, indicating adequacy, while energy intake was only 55-67% of the EAR, suggesting a potential energy

deficit. Visible fat intake exceeded recommendations, and most minerals were consumed below recommended levels, although iron intake was relatively adequate, particularly in males. Vitamin C intake exceeded the EAR in both groups, whereas vitamin A was markedly inadequate in the experimental group (≤50% of the EAR) but substantially higher in the placebo group, exceeding 75% in males and 100% in females.

- In the experimental group, no significant changes in nutrient intake were observed post-intervention ($p > 0.05$), whereas the placebo group exhibited a significant increase in total saturated fatty acids and added sugars ($p < 0.05$).
- Based on the IPAQ, the majority of subjects in both groups reported engaging in moderate-intensity physical activity. Physical activity remained unchanged during the intervention, with no significant differences observed in MET minutes and sitting hours post-intervention.
- Most subjects in both groups were classified as obese grade I (BMI 25–29.9) and exhibited a high prevalence of central obesity. Over 85% of males and females exceeded waist circumference thresholds (≥90 cm for males, ≥80 cm for females), and waist-to-hip ratios surpassed 0.90 in males and 0.85 in females in all experimental subjects, and in nearly 90% of the placebo group. Statistical analysis using ANOVA showed no significant changes in any anthropometric indices within either group across measurements recorded on days 0, 45, and 90.
- The baseline analysis revealed that subjects with elevated HbA1c levels had significantly higher diastolic blood pressure, TC, LDL-C, TC/HDL ratio, and Apo B, along with a lower Apo A1/B ratio compared to those with lower HbA1c levels.
- Correlation and regression analyses demonstrated interrelationships between glycemic status, lipid parameters, renal function, abdominal obesity, and micronutrient intake in type 2 diabetic subjects. Elevated fasting glucose levels were associated with adverse lipid profiles and an increased atherogenic risk.
- Higher central adiposity was associated with elevated triglyceride levels and reduced HDL-C.
- Age at diabetes diagnosis was significantly negatively correlated with HbA1c and PP2BS, indicating that earlier onset is associated with poorer glycemic control.
- Higher serum creatinine levels were associated with lower HDL-C and apo A1, and higher TG, suggesting that impaired renal function contributes to a more atherogenic lipid profile.

- Higher intake of dietary fiber, magnesium, copper, and zinc was associated with improved lipid profiles- lower TC, LDL-C, and apo B- suggesting a protective role of these nutrients against dyslipidemia in diabetes mellitus.
- Overall, supplementation did not result in significant changes in blood pressure across groups. However, in participants with elevated SBP (≥140 mmHg), a significant reduction of 8.11% in SBP was observed, while those with elevated DBP (≥90 mmHg) showed significant reductions of 6.29% in SBP and 8.29% in DBP.
- Although not statistically significant, the experimental group showed greater reductions in FBS (7.8%), PP2BS (4.02%), and HbA1c (2.79%) compared to the control group. Additionally, the experimental group exhibited a modest but consistent decline in FBS and PP2BS, whereas the placebo group showed variable changes during supplementation.
- Subgroup analysis revealed that participants in the experimental group with elevated baseline FBS (≥145 mg/dL) showed a significant 9.24% reduction in HbA1c, accompanied by notable, though non-significant, reductions in FBS (16.36%) and PP2BS (14.63%).
- Overall, supplementation had no significant effect on lipid and inflammatory markers, except for a 7.62% increase in apo A1 in the experimental group. Although not significant, hs-CRP decreased by 17.93% in the experimental group, compared to an 18.04% increase in the placebo group.
- Subgroup analysis revealed that in the experimental group participants with elevated baseline TC (≥170 mg/dL) or LDL-C (≥100 mg/dL) showed significant reductions in TC (4–5.3%) and LDL-C (5.55-7.24%), along with increases in apo A1 (10–12.93%) and the apo A1/B ratio (12.9-16.13%). Those with elevated triglycerides (≥150 mg/dL) demonstrated significant increases in HDL-C (10.32%) and apo A1 (10.06%).
- No significant adverse effects on liver or renal markers were observed post-supplementation. The experimental group showed non-significant reductions in SGOT (21.28%), SGPT (24.91%), and the urinary albumin-to-creatinine ratio (20.81%), indicating a potential trend toward improved liver and kidney function.

CONCLUSION

The study demonstrated that the bark possesses a high content of fiber, phosphorus, and potassium, while exhibiting comparatively low sodium levels. Its bioactive compounds, including flavonoids, tannins, and phenols, confer notable antioxidant and therapeutic properties, as confirmed by strong DPPH radical scavenging activity. Moreover, the cross-

sectional phase provided a comprehensive analysis of dietary supplement usage among diabetic subjects, exploring key influencing factors. Although supplement use was highly prevalent, disclosure to healthcare providers remained notably low. This gap in communication between patients and physicians raises concerns about unmonitored supplement use. The study identified a wide range of herbs and botanicals commonly used by the subjects, including fenugreek seeds, giloy, Indian blackberry seeds, paneer doda, polyherbal formulations, Ayurvedic powders, herbal mixes, and others.

Furthermore, the clinical trial showed that supplementation with *Ficus benghalensis* L. bark at 3 g/day for 90 days resulted in a modest but consistent reduction in glycaemic parameters compared to the placebo group. Notably, the supplementation yielded more pronounced and statistically significant improvements in subjects with uncontrolled glycemia, dyslipidemia and elevated blood pressure, indicating that bark supplementation was beneficial for individuals with higher baseline metabolic risk. Additionally, the supplementation showed no signs of toxicity or adverse effects, while also improving hepatic and renal function parameters, indicating its safety and potential therapeutic benefits.

The study demonstrates that *Ficus benghalensis* L. bark supplementation is safe for human use, with no observed adverse effects on hepatic or renal function, and suggests its potential role as an adjunct in diabetes management. These results help bridge preclinical findings with clinical application and support its consideration as an evidence-based complementary approach in diabetes care.

RECOMMENDATIONS

- The dietary supplements reported by study participants highlight new research opportunities, underscoring the need for well-designed clinical investigations to rigorously evaluate their efficacy, safety, and therapeutic potential in diabetes management.
- The implementation of educational programmes through digital and social media platforms is recommended to improve patient awareness of evidence-based supplement use and to promote appropriate disclosure and monitoring.
- Comprehensive and well-structured intervention studies are needed to elucidate the causal impact of magnesium, copper, and zinc-rich foods on lipid profiles and cardiovascular health in individuals with diabetes.

- To strengthen the clinical evidence, prospective long-term studies are essential to determine the sustained impact of *Ficus benghalensis* L. bark on glycaemic control and other relevant biochemical parameters in patients with diabetes.
- Future studies should focus on dose optimization and the evaluation of various *Ficus benghalensis* L. bark formulations, such as decoctions, standardized extracts, and isolated bioactive compounds, to identify the optimal formulation and dosage for safe and effective diabetes management.
- Future studies may investigate the synergistic effects of combining the bark with other antidiabetic herbs or supplements to enhance therapeutic efficacy.
- *Ficus benghalensis* L. bark has potential for development into therapeutic products, including herbal teas, functional beverages, health bars, and other nutraceutical formulations, which may serve as complementary interventions for diabetes management.
- Future research may consider conducting clinical studies to investigate the therapeutic potential of *Ficus benghalensis* L. bark beyond diabetes, assessing its efficacy in the management of other metabolic, cardiovascular or inflammatory disorders.

BIBLIOGRAPHY

Abbaspour, N., Hurrell, R., & Kelishadi, R. (2014). Review on iron and its importance for human health. *Journal of Research in Medical Sciences*, *19*(2), 164-174.

Abdul Khaliq, H. (2017). A review of pharmacognostic, physicochemical, phytochemical and pharmacological studies on *Ficus bengalensis* L. *Journal of Scientific and Innovative Research, 6*(4), 151-163.

Abdullah, R., Allah, A., Mubarak, A., Abdullah, R., Alzhrani, S., Alsufyani, M., Alharthi, Salman J. A., & Althomali, O. H. (2020). Prevalence and predictors of using complementary and alternative medicine among diabetic patients in Taif city, Saudi Arabia. *Journal of Family Medicine and Primary Care, 9*(4), 2092-2098. https://doi.org/10.4103/jfmpc.jfmpc_1222_19

Abell, L. L., Levy, B. B., Brodie, B. B., Kendall, F. E., Kaplan, A., Jacques, S., & Reinhold, J. (1958). Cholesterol in serum**.** In D. Seligson (Ed.), *Standard methods of clinical chemistry* (Vol. 2, pp. 26–33). Academic Press.

Abhishek, M., Varghese, A., Krishnakumar, K., & Thankachan, I. (2020). A review on influence of complementary and alternative medicine in type 2 diabetic patients. *American Journal of PharmTech Research, 10*(1), 128-136. http://www.ajptr.com/

Afzal, T., Ali, Q., & Malik, A. (2020). Phenolic compounds proliferation by HPLC to determine antibacterial activities in *Ficus benghalensis* plant extract. *International Journal of Botany Studies, 5*(2), 140-144. https://www.botanyjournals.com

Ahmed, F. (2021). *Ficus benghalensis* bark extract shows blood pressure lowering effect in normotensive and angiotensin II-induced hypertensive rats. *Pharmacophore, 12*(5), 7-10. https://doi.org/10.51847/obczpvxvjp

Ahmed, F., Chavan, S., Satish, A., & Kumar, R. P. (2011). Inhibitory activities of *Ficus benghalensis* bark against carbohydrate hydrolyzing enzymes: An in vitro study. *Pharmacognosy Journal, 3*(20), 33-37. https://doi.org/10.5530/PJ.2011.20.7

Ahmed, W., Dixit, P., & Halli, S. (2024). Additive interaction of family medical history of cardiovascular diseases with hypertension and diabetes on the diagnosis of cardiovascular diseases among older adults in India. *Frontiers in Cardiovascular Medicine, 11*, 1386378. https://doi.org/10.3389/fcvm.2024.1386378

Ajayakumar, A., Himani, & Sandeep, T. S. (2024). A comprehensive literary review of Vata and *Ficus benghalensis* Linn. *International Journal of AYUSH, 13*(3), 39-60.

Akimbekov, N. S., Coban, S. O., Atfi, A., & Razzaque, M. S. (2024). The role of magnesium in pancreatic beta-cell function and homeostasis. *Frontiers in Nutrition, 11*, 1458700. https://doi.org/10.3389/fnut.2024.1458700

Al Alawi, A. M., Majoni, S. W., & Falhammar, H. (2018). Magnesium and human health: Perspectives and research directions. *International Journal of Endocrinology, 2018*, Article 9041694. https://doi.org/10.1155/2018/9041694

Al-Geffari, M., Ahmad, N. A., Al-Sharqawi, A. H., Youssef, A. M., Alnaqeb, D., & Al-Rubeaan, K. (2013). Risk factors for thyroid dysfunction among type 2 diabetic patients in a highly diabetes mellitus prevalent society. *International Journal of Endocrinology, 2013*. https://doi.org/10.1155/2013/417920

Aljulifi, M. Z., Alfhaid, F., Alshahrani, A., Albatil, K. A., Aljthalin, R. A., Alloboon, F., Aljagwani, A. S., & Alenzi, D. A. (2022). The prevalence and pattern of using complementary and alternative medicine in Saudi patients with diabetes: A cross-sectional study. *Cureus, 14*(10), 1-11. https://doi.org/10.7759/cureus.30700

Al-Kindi, R. M., Al-Mushrafi, M., Al-Rabaani, M., & Al-Zakwani, I. (2011). Complementary and alternative medicine use among adults with diabetes in the Muscat region, Oman. *Clinical & Basic Research, 11*(1), 62-68.

Allain, C. C., Poon, L. S., Chan, C. S. G., Richmond, W., & Fu, P. C. (1974). Enzymatic determination of total serum cholesterol. *Clinical Chemistry, 20*(4), 470-475. https://doi.org/10.1093/clinchem/20.4.470

Al-Luwaym, A. H., Al-Quwaidhi, A. J., & Al-Ghadeeb, R. B. (2024). Prevalence and factors associated with using complementary medicine among adults with type 2 diabetes in primary healthcare centers of Al-Ahsa, Eastern Saudi Arabia. *Cureus, 16*(8), 1-12. https://doi.org/10.7759/cureus.67953

Al-ma'aitah, O. H., Demant, D., Jakimowicz, S., & Perry, L. (2022). Glycaemic control and its associated factors in patients with type 2 diabetes in the Middle East and North Africa: An updated systematic review and meta-analysis. *Journal of Advanced Nursing, 78*(8), 2257-2276. https://doi.org/10.1111/jan.15255

Almogbel, E. S., AlHotan, F. M., AlMohaimeed, Y. A., Aldhuwayhi, M. I., AlQahtani, S. W., Alghofaili, S. M., Bedaiwi, B. F., & AlHajjaj, A. H. (2022). Habits, traditions, and beliefs associated with the use of complementary and alternative medicine among diabetic patients in the Al-Qassim region, Saudi Arabia. *Cureus, 14*(12), 1-16. https://doi.org/10.7759/cureus.33157

Alwafi, H., Alsharif, A. A., Wei, L., Langan, D., Naser, A. Y., Mongkhon, P., Bell, J. S., Ilomäki, J., Al Metwazi, M. S., Man, K. K. C., Fang, G., & Wong, I. C. K. (2020). Incidence and prevalence of hypoglycaemia in type 1 and type 2 diabetes individuals: A systematic review and meta-analysis. *Diabetes Research and Clinical Practice, 170*, 1-15. https://doi.org/10.1016/j.diabres.2020.108522

Alzahrani, A. S., Price, M. J., Greenfield, S. M., & Paudyal, V. (2021). Global prevalence and types of complementary and alternative medicines use amongst adults with diabetes: Systematic review and meta-analysis. *European Journal of Clinical Pharmacology, 77*, 1259-1274. https://doi.org/10.1007/s00228-021-03097-x

Amali, O. O. E., Amande, N. M., Obinna, B. I., & Oladele, T. E. (2025). Phytochemical analysis and the effect of *Ficus benghalensis* Linn. leaf and bark ethanolic extracts on the lipid profile of female Wistar rats. *FULafia Journal of Health Sciences, 1*(2), 67–72. http://fjohs.org/index.php/fujohs/article/view/35

American Diabetes Association Professional Practice Committee for Diabetes. (2026). 2. Diagnosis and classification of diabetes: Standards of care in diabetes- 2026. *Diabetes Care, 49*(Supplement 1), S27–S49. https://doi.org/10.2337/dc26-S002

American Diabetes Association Professional Practice Committee. (2025). 6. Glycemic goals and hypoglycemia: Standards of care in diabetes- 2025. *Diabetes Care, 48*(Supplement 1), S128-S145. https://doi.org/10.2337/dc25-S006

American Diabetes Association. (2009). Diagnosis and classification of diabetes mellitus. *Diabetes Care, 32*(Supplement 1), S62-S67. https://doi.org/10.2337/dc09-S062

American Diabetes Association. (2014). Diagnosis and classification of diabetes mellitus. *Diabetes Care, 37*(Supplement 1), S81-S90. https://doi.org/10.2337/dc14-S081

American Diabetes Association. (2025). Severe hypoglycemia (severe low blood glucose). https://diabetes.org/living-with-diabetes/hypoglycemia-low-blood-glucose/severe

Anjana, R. M., Unnikrishnan, R., Deepa, M., Pradeepa, R., Tandon, N., Das, A. K., Joshi, S., Bajaj, S., Jabbar, P. K., Das, H. K., Kumar, A., Dhandhania, V. K., Bhansali, A., Rao, P. V., Desai, A., Kalra, S., Gupta, A., Lakshmy, R., Madhu, S. V., … Ghosh, S. (2023). Metabolic non-communicable disease health report of India: The ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17). *The Lancet Diabetes & Endocrinology, 11*(7), 474-489. https://doi.org/10.1016/S2213-8587(23)00119-5

Anupama, N., Fernandes, J., & Govinda, K. A. (2022). Antiulcer activity and isolation of chemical constituents from ethanolic stem bark extract of *Ficus benghalensis*. *Journal of Pharmaceutical Research International, 34*(29A), 16-24. https://doi.org/10.9734/JPRI/2022/V34I29A36043

Armstrong, V., & Seidel, D. (1985). Evaluation of a commercial kit for the determination of LDL cholesterol in serum based on precipitation of LDL with dextran sulfate. *Ärztliches Labor, 31*, 325-330.

Ashwell, M., & Hsieh, S. D. (2005). Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. *International Journal of Food Sciences and Nutrition, 56*(5), 303-307. https://doi.org/10.1080/09637480500195066

Ávila, M., Mora Sánchez, M. G., Bernal Amador, A. S., & Paniagua, R. (2025). The metabolism of creatinine and its usefulness to evaluate kidney function and body composition in clinical practice. *Biomolecules, 15*(1), Article 41. https://doi.org/10.3390/biom15010041

Azagew, A. W., Abate, H. K., Mekonnen, C. K., Mekonnen, H. S., Tezera, Z. B., & Jember, G. (2024). Diabetic dyslipidemia and its predictors among people with diabetes in Ethiopia: A systematic review and meta-analysis. *Systematic Reviews, 13*(1), 1-13. https://doi.org/10.1186/s13643-024-02593-2

Bachorik, P. S. (2000). Measurement of low-density lipoprotein cholesterol. In N. Rifai, G. R. Warnick, & M. H. Dominiczak (Eds.), *Handbook of lipoprotein testing* (pp. 245-263). AACC Press.

Baharom, N., Shamsul, A. S., & Rotina, A. (2016). Prevalence of complementary and alternative medicine use among patients with type II diabetes in Negeri Sembilan, Malaysia. *Medicine & Health, 11*(2), 257-266. https://doi.org/10.17576/MH.2016.1102.14

Baheti, J. R., & Goyal, R. K. (2011). Evaluation of hepatoprotective activity of *Ficus benghalensis*. *International Journal of Research in Pharmaceutical Sciences, 2*(4), 522-525. https://www.researchgate.net/publication/228838955

Banaszak, M., Górna, I., & Przysławski, J. (2021). Zinc and the innovative zinc-α2-glycoprotein adipokine play an important role in lipid metabolism: A critical review. *Nutrients, 13*(6), 2023. https://doi.org/10.3390/nu13062023

Banaszak, M., Górna, I., Woźniak, D., Przysławski, J., & Drzymała-Czyż, S. (2024). The impact of curcumin, resveratrol, and cinnamon on modulating oxidative stress and antioxidant activity in type 2 diabetes: Moving beyond an anti-hyperglycaemic evaluation. *Antioxidants, 13*(5), Article 510. https://doi.org/10.3390/antiox13050510

Banday, M. Z., Sameer, A. S., & Nissar, S. (2020). Pathophysiology of diabetes: An overview. *Avicenna Journal of Medicine, 10*(4), 174-188. https://doi.org/10.4103/AJM.AJM_53_20

Banu, H., Jyothi, A., & Sc, M. (2016). Hypoglycemic and hypocholesterolemic effect of *Eugenia jambolana* (kala jamun) spicy mix on type II diabetic subjects. *Imperial Journal of Interdisciplinary Research, 2*(4). https://doi.org/10.13140/RG.2.2.30250.90566

Barrett, T. J., Distel, E., Murphy, A. J., Hu, J., Garshick, M. S., Ogando, Y., Liu, J., Vaisar, T., Heinecke, J. W., Berger, J. S., Goldberg, I. J., & Fisher, E. A. (2019). Apo AI (apolipoprotein AI) promotes atherosclerosis regression in diabetic mice by suppressing myelopoiesis and plaque inflammation. *Circulation, 140*(14), 1170-1184. https://doi.org/10.1161/CIRCULATIONAHA.119.039476

Becker, V. W., Rapp, W., Schwick, H. G., & Störiko, K. (1968). Methoden zur quantitativen Bestimmung von Plasmaproteinen durch Immunpräzipitation [Methods for the quantitative determination of plasma proteins by immunoprecipitation]. *Zeitschrift für Klinische Chemie und Klinische Biochemie, 6*(3), 113-122.

Benzie, I. F. F., & Strain, J. J. (1999). Ferric reducing/antioxidant power assay: Direct measure of total antioxidant activity of biological fluids and modified version for simultaneous

measurement of total antioxidant power and ascorbic acid concentration. *Methods in Enzymology, 299*, 15-27.

Bhalerao, M. S., Bolshete, P. M., Swar, B. D., Bangera, T. A., Kolhe, V. R., Tambe, M. J., Wade, M. P., Bowate, S. D., Sonje, U. B., Gogtay, N. J., & Thatte, U. M. (2013). Use of and satisfaction with complementary and alternative medicine in four chronic diseases: A cross-sectional study from India. *The National Medical Journal of India*. https://www.researchgate.net/publication/257460601

Bhange, A. J., Walke, R. D., Shinde, Y. B., & Galande, D. A. (2022). Pharmacognostic and phytochemical evaluation of aerial roots of *Ficus benghalensis* Linn. *Journal of Pharmacognosy and Phytochemistry, 11*(5), 128-132. https://www.phytojournal.com/archives/2022.v11.i5.14487

Bhaskara Rao, K. V., Ojha, V., Preeti, Kumar, G., & Karthik, L. (2014). Phytochemical composition and antioxidant activity of *Ficus benghalensis* (Moraceae) leaf extract. *Journal of Biologically Active Products from Nature, 4*(3), 236-248. https://doi.org/10.1080/22311866.2014.936902

Bhosle, S. V., Ghule, V. P., Aundhe, D. J., & Jagtap, S. D. (2009). Ethnomedical knowledge of plants used by the tribal people of Purandhar in Maharashtra, India. *Ethnobotanical Leaflets, 13*, 1353-1361.

Bhowmik, P., Shohan, F. S., Baroi, J. A., Pranto, T. I., Ullah, M. R., Rupak, M. A. H. B., Zaman, T. S., Rasna, I. J., & Tashin, R. (2024). Evaluation of the effects of ethanolic extract of *Ficus benghalensis* on the lipid profile and kidney function in a rat model. *International Research Journal of Gastroenterology and Hepatology, 7*(1), 22-28. https://doi.org/10.1016/J.JEP.2017.12.045

Bianchi, L. (2024). The efficacy of bitter gourd (*Momordica charantia* L.) in reducing oxidative stress in diabetic patients. *The Pharma Innovation Journal, 13*(7), 7-9. https://doi.org/10.33545/26631067.2022.v4.i1a.86

Birdee, G. S., & Yeh, G. (2010). Complementary and alternative medicine therapies for diabetes: A clinical review. *Clinical Diabetes, 28*(4), 147-155. https://doi.org/10.2337/diaclin.28.4.147

Bo, M. S., Cheah, W. L., Lwin, S., Moe Nwe, T., Win, T. T., & Aung, M. (2018). Understanding the relationship between atherogenic index of plasma and cardiovascular disease risk factors among staff of an university in Malaysia. *Journal of Nutrition and Metabolism, 2018*, 1-6. https://doi.org/10.1155/2018/7027624

Brown, R. B. (2020). Diabetes, diabetic complications, and phosphate toxicity: A scoping review. *Current Diabetes Reviews, 16*(7), 674-689.

Bureau of Indian Standards. (1967). *IS 3579-1966: Methods of test for oilseeds*. BIS.

Bureau of Indian Standards. (1969). *IS 5305-1969: Method for volumetric determination of phosphorus*. BIS.

Bureau of Indian Standards. (1992). *IS 3025-43: Methods of sampling and test (physical and chemical) for water and wastewater- Phenols*. BIS.

Bureau of Indian Standards. (2007). *IS 1656-2007: Milk-cereal based complementary foods*. BIS.

Burtis, C. A., Ashwood, E. R., Bruns, D. E., & Tietz, N. W. (2013). *Tietz textbook of clinical chemistry and molecular diagnostics* (5th ed.). Elsevier Health Sciences.

Carrillo-Larco, R. M., Guzman-Vilca, W. C., Xu, X., & Bernabe-Ortiz, A. (2024). Mean age and body mass index at type 2 diabetes diagnosis: Pooled analysis of 56 health surveys across income groups and world regions. *Diabetic Medicine, 41*(2), e15174. https://doi.org/10.1111/dme.15174

Carroll, M. D., Fryar, C. D., & Nguyen, D. T. (2017). *Total and high-density lipoprotein cholesterol in adults: United States, 2015-2016* (NCHS Data Brief No. 290). National Center for Health Statistics. https://www.cdc.gov/nchs/data/databriefs/db290.pdf

Ceja-Galicia, Z. A., Aranda-Rivera, A. K., Amador-Martínez, I., Aparicio-Trejo, O. E., Tapia, E., Trujillo, J., Ramírez, V., & Pedraza-Chaverri, J. (2023). The development of dyslipidemia in chronic kidney disease and associated cardiovascular damage, and the protective effects of curcuminoids. *Foods, 12*(5), Article 921. https://doi.org/10.3390/foods12050921

Centers for Disease Control and Prevention (United States). (2024). *Type 2 diabetes*. https://www.cdc.gov/diabetes/about/about-type-2-diabetes.html

Ch, H., Rani, S. Y., & Tssk, P. (2020). Estimation of nutritive composition of seven small millets. *Journal of Pharmacognosy and Phytochemistry, 9*(3), 1871-1874.

Chacko, M., Sarma, P. S., Harikrishnan, S., Zachariah, G., & Jeemon, P. (2020). Family history of cardiovascular disease and risk of premature coronary heart disease: A matched case-control study. *Wellcome Open Research, 5*, Article 70. https://doi.org/10.12688/wellcomeopenres.15829.2

Chag, J. P., & Venugopal, S. (2015). *Nutrient profile of insulin plant (Costus igneus) and efficacy of insulin plant supplementation on the lipemic status of type 2 diabetes mellitus*

subjects: A randomized double-blind placebo-controlled trial [Master's thesis]. Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda.

Chang, H. Y. A., Wallis, M., & Tiralongo, E. (2011). Use of complementary and alternative medicine among people with type 2 diabetes in Taiwan: A cross-sectional survey. *Evidence-Based Complementary and Alternative Medicine, 2011*, 1-8. https://doi.org/10.1155/2011/983792

Chattopadhyay, K., Wang, H., Kaur, J., Nalbant, G., Almaqhawi, A., Kundakci, B., Panniyammakal, J., Heinrich, M., Lewis, S. A., Greenfield, S. M., Tandon, N., Biswas, T. K., Kinra, S., & Leonardi-Bee, J. (2022). Effectiveness and safety of Ayurvedic medicines in type 2 diabetes mellitus management: A systematic review and meta-analysis. *Frontiers in Pharmacology, 13*, Article 821810. https://doi.org/10.3389/fphar.2022.821810

Chaudhari, R. N., Mulani, Y. M., More, P. V., Nikumbh, A. N., & Ahemad, A. I. A. T. (2022). Pharmacognostic, phytochemical, and pharmacological potential of banyan tree (*Ficus benghalensis* L.). *International Journal of Pharmacy and Pharmaceutical Research, 25*(1), 230-251.

Chaudhary, P., Janmeda, P., Docea, A. O., Yeskaliyeva, B., Abdull Razis, A. F., Modu, B., Calina, D., & Sharifi-Rad, J. (2023). Oxidative stress, free radicals and antioxidants: Potential crosstalk in the pathophysiology of human diseases. *Frontiers in Chemistry, 11*, Article 1158198. https://doi.org/10.3389/fchem.2023.1158198

Chaudhary, S., Alok, S., Jain, S. K., Chanchal, K., & Dongray, A. (2015). Phytopharmacology and pharmacognostic properties of *Ficus benghalensis*: A review. *International Journal of Pharmacognosy, 2*(12), 560-569. https://doi.org/10.13040/IJPSR.0975-8232.IJP.2(12).560-69

Chauhan, A., Semwal, D., Mishra, S., & Semwal, R. (2015). Ayurvedic research and methodology: Present status and future strategies. *AYU: An International Quarterly Journal of Research in Ayurveda, 36*(4), 364-369. https://doi.org/10.4103/0974-8520.190699

Cheung, J. T. K., Lau, E., Tsui, C. C. T., Siu, E. L. N., Tse, N. K. W., Hui, N. Y. L., Ma, R. C. W., Kong, A. P. S., Fu, A., Lau, V., Jia, W., Sheu, W. H. H., Sobrepena, L., Yoon, K. H., Tan, A. T. B., Chia, Y. C., Sosale, A., Saboo, B. D., Kesavadev, J., … Chan, J. C. N. (2022). Combined associations of family history and self-management with age at diagnosis and cardiometabolic risk in 86,931 patients with type 2 diabetes: Joint Asia

Diabetes Evaluation (JADE) register from 11 countries. *BMC Medicine, 20*(1), Article 236. https://doi.org/10.1186/s12916-022-02424-y

Chikaraddy, A., & Maniyar, Y. (2017). Evaluation and comparison of hypoglycemic activity of bark and leaf of *Ficus benghalensis* Linn. in alloxan-induced diabetes in albino rats. *Indian Journal of Pharmacy and Pharmacology, 4*(3), 138-142. https://doi.org/10.18231/2393-9087.2017.0031

Ching, S. M., Zakaria, Z. A., Paimin, F., & Jalalian, M. (2013). Complementary alternative medicine use among patients with type 2 diabetes mellitus in the primary care setting: A cross-sectional study in Malaysia. *BMC Complementary and Alternative Medicine, 13*, 1-7. https://doi.org/10.1186/1472-6882-13-148

Chowdhary, N., Kaur, M., Singh, A., & Kumar, B. (2014). Wound healing activity of aqueous extracts of *Ficus religiosa* and *Ficus benghalensis* leaves in rats. *Indian Journal of Research in Pharmacy and Biotechnology, 2*(2), 1071-1081.

Ciorba, A. L., Saber, S., Abdelhamid, A. M., Keshk, N., Elnaghy, F., Elmorsy, E. A., Abu-Khudir, R., Hamad, R. S., Abdel-Reheim, M. A., Farrag, A. A., El-Kott, A. F., Negm, S., Morsy, K., AlShehri, M. A., Gaafar, A., & Cavalu, S. (2025). Diabetic retinopathy in focus: Update on treatment advances, pharmaceutical approaches, and new technologies. *European Journal of Pharmaceutical Sciences, 214*, 1-23. https://doi.org/10.1016/j.ejps.2025.107307

Cormick, G., & Belizán, J. M. (2019). Calcium intake and health. *Nutrients, 11*(7), Article 1606. https://doi.org/10.3390/nu11071606

Croci, D., Nespolo, A., Bosoni, M. A., & Tarenghi, G. (1989). A simple immunoturbidimetric method for IgG and albumin quantitation in cerebrospinal fluid and serum. *Journal of Clinical Chemistry and Clinical Biochemistry, 27*, 863-868.

Cyuńczyk, M., Zujko, M. E., Jamiołkowski, J., Zujko, K., Łapińska, M., Zalewska, M., Kondraciuk, M., Witkowska, A. M., & Kamiński, K. A. (2022). Dietary total antioxidant capacity is inversely associated with prediabetes and insulin resistance in the Bialystok PLUS population. *Antioxidants, 11*(2), Article 283. https://doi.org/10.3390/antiox11020283

D'Elia, L., Masulli, M., Cappuccio, F. P., Zarrella, A. F., Strazzullo, P., & Galletti, F. (2022). Dietary potassium intake and risk of diabetes: A systematic review and meta-analysis of prospective studies. *Nutrients, 14*(22), Article 4785. https://doi.org/10.3390/nu14224785

Danell, J. A. B., Wode, K., Jong, M., Kristoffersen, A. E., van der Werf, E., & Nordberg, J. H. (2025). Use of complementary and alternative medicine (CAM) in Sweden: A cross-

sectional survey. *Scandinavian Journal of Primary Health Care, 43*(3), 529-537. https://doi.org/10.1080/02813432.2025.2466180

Daniel, R. S., Devi, K. S., Augusti, K. T., & Nair, C. R. S. (2003). Mechanism of action of antiatherogenic and related effects of *Ficus benghalensis* Linn. flavonoids in experimental animals. *Indian Journal of Experimental Biology, 41*, 296-303.

Das, B. K., Al-Amin, M. M., Russel, S. M., Kabir, S., Bhattacherjee, R., & Hannan, J. M. A. (2014). Phytochemical screening and evaluation of analgesic activity of *Oroxylum indicum*. *Indian Journal of Pharmaceutical Sciences, 76*(6), 571-576. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4293694/

Davis, C. C., & Choisy, P. (2024). Medicinal plants meet modern biodiversity science. *Current Biology, 34*(4), 158-173. https://doi.org/10.1016/j.cub.2023.12.038

Davis, T. M. E., & Davis, W. (2020). Incidence and associates of diabetic ketoacidosis in a community-based cohort: The Fremantle Diabetes Study Phase II. *BMJ Open Diabetes Research & Care, 8*(1), 1-7. https://doi.org/10.1136/bmjdrc-2019-000983

de Brito Alves, J. L., Brasil, J. M. A., Maia, L. A., Lima, M. da C., Sampaio, K. B., & de Souza, E. L. (2023). Phenolic compounds in hypertension: Targeting gut-brain interactions and endothelial dysfunction. *Journal of Functional Foods, 104*, Article 105531. https://doi.org/10.1016/j.jff.2023.105531

Debbarma, S. S., Dasgupta, A., Ghosh, A., Choudhury, K., Kole, P., Paul, S., Kalai, B., & Saikumar, V. (2024). Study of pattern of lipid profile among type II diabetic patients of two major tribal populations of Tripura. *Journal of Family Medicine and Primary Care, 13*(12), 5476-5483. https://doi.org/10.4103/jfmpc.jfmpc_1625_23

Deepa, V., & Nalina, K. B. (2018). Consumer buying behaviour towards Ayurvedic products in Mysore District, Karnataka. *Journal of Emerging Technologies and Innovative Research, 5*, 666-667.

Department of AYUSH, Ministry of Health and Family Welfare, Government of India. (n.d.). *The Ayurvedic pharmacopoeia of India* (Vol. 1).

Dhara, J., & Dhruv, S. (2012). *Studies on product development and sensory evaluation of kodari (Paspalum scrobiculatum Linn.) incorporated recipes: Impact of kodari supplementation in the management of hyperglycemia in type 2 diabetic subjects* [Master's thesis]. Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda.

Ding, J., Liu, Q., Liu, Z., Guo, H., Liang, J., & Zhang, Y. (2022). Associations of dietary iron, copper, and selenium levels with metabolic syndrome: A meta-analysis of observational

studies. *Frontiers in Nutrition, 8*, Article 810494. https://doi.org/10.3389/fnut.2021.810494

Djaoudene, O., Romano, A., Bradai, Y. D., Zebiri, F., Ouchene, A., Yousfi, Y., Amrane-Abider, M., Sahraoui-Remini, Y., & Madani, K. (2023). A global overview of dietary supplements: Regulation, market trends, usage during the COVID-19 pandemic, and health effects. *Nutrients, 15*(15), Article 3320. https://doi.org/10.3390/nu15153320

Duan, C., Lv, M., Shou, X., Chen, Z., Luan, Y., & Hu, Y. (2024). Associations between nine dietary mineral intakes and all-cause mortality in individuals with atherosclerotic cardiovascular disease. *Frontiers in Nutrition, 11*, Article 1447167. https://doi.org/10.3389/fnut.2024.1447167

Dur-e-Sameen, Khan, U. A. J., Shahzad, M., Amin, S., & Qaisar, A. (2022). Use of complementary and alternative medicine in type 2 diabetics. *Khyber Journal of Medical Sciences, 15*(1), 57-63.

Eda, S., Kaufmann, J., Roos, W., & Pohl, S. (1998). Development of a new microparticle-enhanced turbidimetric assay for C-reactive protein with superior features in analytical sensitivity and dynamic range. *Journal of Clinical Laboratory Analysis, 12*(3), 137-144. https://onlinelibrary.wiley.com/doi/abs/10.1002/(SICI)1098

Ediriweera, E. R. H. S. S., & Ratnasooriya, W. D. (2009). A review on herbs used in the treatment of diabetes mellitus by Sri Lankan Ayurvedic and traditional physicians. *AYU, 30*(4), 373-391. https://www.researchgate.net/publication/285706172

Edwin, E., Sheeja, E., Chaturvedi, M., Sharma, S., & Gupta, V. B. (2008). A comparative study on antihyperglycemic activity of *Ficus benghalensis* Linn. aerial roots and bark. *Pharmacognosy Magazine, 4*(13), 95-97.

Egede, L. E., Ye, X., Zheng, D., & Silverstein, M. D. (2002). The prevalence and pattern of complementary and alternative medicine use in individuals with diabetes. *Diabetes Care, 25*(2), 324-329. https://doi.org/10.2337/diacare.25.2.324

Ejeta, A., Abdosh, T., Hawulte, B., Lamessa, A., Fite, M. B., & Fekadu, G. (2021). Diabetes concordant comorbidities and associated factors among adult diabetic out-patients at Hiwot Fana Specialized University Hospital, Harar, eastern Ethiopia: A cross-sectional study. *Diabetes, Metabolic Syndrome and Obesity, 14*, 2281-2289. https://doi.org/10.2147/DMSO.S308553

El Oirdi, M. (2024). Harnessing the power of polyphenols: A new frontier in disease prevention and therapy. *Pharmaceuticals, 17*(6), Article 692. https://doi.org/10.3390/ph17060692

El-Mohandes, N., Yee, G., Bhutta, B. S., & Huecker, M. R. (2023). Pediatric diabetic ketoacidosis. In *Quick hits for pediatric emergency medicine*. StatPearls Publishing. https://doi.org/10.1007/978-3-031-32650-9_21

Emdin, C. A., Khera, A. V., Natarajan, P., Klarin, D., Zekavat, S. M., Hsiao, A. J., & Kathiresan, S. (2017). Genetic association of waist-to-hip ratio with cardiometabolic traits, type 2 diabetes, and coronary heart disease. *JAMA, 317*(6), 626-634. https://doi.org/10.1001/jama.2016.21042

Evans, W. C. (1997). *Trease and Evans pharmacognosy* (14th ed.). Harcourt Brace & Company Asia Pvt. Ltd.

Fan, Z., Wang, C., Yang, T., Li, X., Guo, X., & Li, D. (2022). Flavonoid subclasses and coronary heart disease risk: A meta-analysis of prospective cohort studies. *British Journal of Nutrition, 128*(3), 498-508. https://doi.org/10.1017/S0007114521003391

Feingold, K. R. (2023). Dyslipidemia in patients with diabetes. In *Endotext*. MDText.com, Inc. https://www.ncbi.nlm.nih.gov/books/NBK305900/

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2011). *Food safety and standards (contaminants, toxins and residues) regulations*.

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2011). *Food safety and standards (food product standards and food additives) regulations*.

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2016). *Food safety and standards (health supplements, nutraceuticals, food for special dietary use, food for special medical purpose, functional food and novel food) regulations*.

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2016a). *Manual of methods of analysis of foods: Fruit and vegetable products*.

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2016b). *Manual of methods of analysis of foods: Metals*.

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2023). *Manual of methods of analysis of foods: Cereal and cereal products* (2nd ed.).

Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India. (2022). *Food safety and standards (health supplements,*

nutraceuticals, food for special dietary use, food for special medical purpose, and prebiotic and probiotic food) regulations, 2022.

Frenkel, M., Morse, M. B., & Narayanan, S. (2023). Addressing patient requests to add dietary supplements to their cancer care: A suggested approach. *Nutrients, 15*(24), Article 5029. https://doi.org/10.3390/nu15245029

Friedewald, W. F., Levy, R. I., & Fredrickson, D. S. (1972). Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clinical Chemistry, 18*(6), 499-502.

Fu, Y., Yang, J., Chen, J., & Li, Y. (2024). The role and molecular mechanisms of copper in regulating animal lipid metabolism. *Journal of Animal and Feed Sciences, 33*(4), 401-415. https://doi.org/10.22358/JAFS/188788/2024

Gabler, M., Geier, S., Mayerhoff, L., & Rathmann, W. (2021). Cardiovascular disease prevalence in type 2 diabetes: An analysis of a large German statutory health insurance database. *BMC Public Health, 21*(1), 1-9. https://doi.org/10.1186/s12889-021-10381-z

Garg, V. K., & Paliwal, S. K. (2011). Wound-healing activity of ethanolic and aqueous extracts of *Ficus benghalensis*. *Journal of Advanced Pharmaceutical Technology & Research, 2*(2), 110-114. https://doi.org/10.4103/2231-4040.82957

Garrow, D., & Egede, L. E. (2006). Association between complementary and alternative medicine use, preventive care practices, and use of conventional medical services among adults with diabetes. *Diabetes Care, 29*(1), 15-19. https://doi.org/10.2337/diacare.29.01.06.dc05-1675

Gayake, D. N., Awasarkar, U. D., & Sharma, P. P. (2013). Indigenous traditional medicinal plant resources from Ahmednagar District, Maharashtra, India. *Asian Journal of Biomedical & Pharmaceutical Sciences, 3*(22), 1-5. http://www.jbiopharm.com

Gayathri, M., & Kannabiran, K. (2008). Antidiabetic and ameliorative potential of *Ficus bengalensis* bark extract in streptozotocin-induced diabetic rats. *Indian Journal of Clinical Biochemistry, 23*(4), 394-400. https://doi.org/10.1007/s12291-008-0087-2

Gayathri, M., & Kannabiran, K. (2009). Effects of oral administration of an aqueous extract of *Ficus bengalensis* stem bark on some hematological and biochemical parameters in rats with streptozotocin-induced diabetes. *Turkish Journal of Biology, 33*(1), 9-13. https://doi.org/10.3906/biy-0805-12

Gentile, D., Fornai, M., Pellegrini, C., Colucci, R., Blandizzi, C., & Antonioli, L. (2018). Dietary flavonoids as a potential intervention to improve redox balance in obesity and

related co-morbidities: A review. *Nutrition Research Reviews, 31*(2), 239-247. https://doi.org/10.1017/S0954422418000082

Gerbaut, L. (1987). Immunoturbidimetry of albumin in serum, cerebrospinal fluid, and urine with a unique calibration curve. *Clinical Chemistry, 33*(7), 1260-1261.

Gewali, M. B. (2008). *Aspects of traditional medicine in Nepal* (S. Awale, Ed.). Institute of Natural Medicine, University of Toyama.

Ghorat, F., Mosavat, S. H., Hadigheh, S., Kouhpayeh, S. A., Naghizadeh, M. M., Rashidi, A. A., & Hashempur, M. H. (2024). Prevalence of complementary and alternative medicine use and its associated factors among Iranian diabetic patients: A cross-sectional study. *Current Therapeutic Research, 100*, 1-9. https://doi.org/10.1016/j.curtheres.2024.100746

Gibson, S., & Ashwell, M. (2020). A simple cut-off for waist-to-height ratio (0.5) can act as an indicator for cardiometabolic risk: Recent data from adults in the Health Survey for England. *British Journal of Nutrition, 123*(6), 681-690. https://doi.org/10.1017/S0007114519003301

Gnanasegaran, S., Gopal, S., Adhimoolam, M., Raj, G. M., Velayudhan, S., & Yuvaraj, M. (2024). Evaluation of microalbuminuria in type 2 diabetes mellitus under oral hypoglycemic agents: Association with age, sex, BMI, and renal clearance. *Journal of Family Medicine and Primary Care, 13*(3), 938-943. https://doi.org/10.4103/jfmpc.jfmpc_1286_23

Gong, L., Wang, C., Ning, G., Wang, W., Chen, G., Wan, Q., Qin, G., Yan, L., Wang, G., Qin, Y., Luo, Z., Tang, X., Huo, Y., Hu, R., Ye, Z., Shi, L., Gao, Z., Su, Q., Mu, Y., & Chen, L. (2021). High concentrations of triglycerides are associated with diabetic kidney disease in new-onset type 2 diabetes in China: Findings from the China Cardiometabolic Disease and Cancer Cohort (4C) study. *Diabetes, Obesity & Metabolism, 23*(11), 2551-2560. https://doi.org/10.1111/dom.14502

Gopalan, A., Mishra, P., Alexeeff, S. E., Blatchins, M. A., Kim, E., Man, A., Karter, A. J., & Grant, R. W. (2020). Initial glycemic control and care among younger adults diagnosed with type 2 diabetes. *Diabetes Care, 43*(5), 975-981. https://doi.org/10.2337/dc19-1380

Goswami, S., Pal, N., Singh, A., Singh, P., Pandey, A., & Singh, R. P. (2020). HPTLC fingerprinting of quercetin from *Ficus benghalensis*. *Journal of Critical Reviews, 7*(7), 524-528. https://doi.org/10.31838/jcr.07.07.92

Govindan, V., & Shoba, F. G. (2015). Qualitative and quantitative determination of secondary metabolites and antioxidant potential of *Ficus benghalensis* Linn seed. *International Journal of Pharmacy and Pharmaceutical Sciences, 7*(7), 118-124.

Grosso, G., Godos, J., Currenti, W., Micek, A., Falzone, L., Libra, M., Giampieri, F., Forbes-Hernández, T. Y., Quiles, J. L., Battino, M., La Vignera, S., & Galvano, F. (2022). The effect of dietary polyphenols on vascular health and hypertension: Current evidence and mechanisms of action. *Nutrients, 14*(3), Article 545. https://doi.org/10.3390/nu14030545

Gupta, R., Johri, S., & Saxena, A. M. (2013). Antidiabetic effect of ethanol extract of stem bark of *Ficus benghalensis* Linn. In *Medicinal plants: Phytochemistry, pharmacology and therapeutics* (Vol. 3, pp. 323-333). Daya Publishing House.

Guzman, J. R., Paterniti, D. A., Liu, Y., & Tarn, D. M. (2019). Factors related to disclosure and nondisclosure of dietary supplements in primary care, integrative medicine, and naturopathic medicine. *Journal of Family Medicine and Disease Prevention, 5*(4), Article 109. https://doi.org/10.23937/2469-5793/1510109

Haber, S. L., & Keonavong, J. (2013). Fenugreek use in patients with diabetes mellitus. *American Journal of Health-System Pharmacy, 70*(14), 1196-1203. https://doi.org/10.2146/ajhp120523

Habli, M. M. (2024). Comprehensive insights into diabetic nephropathy: Pathophysiology, clinical features, and emerging treatments. *Journal of the Egyptian Society of Nephrology and Transplantation, 24*(4), 163-168. https://doi.org/10.4103/jesnt.jesnt_16_24

Harborne, J. B. (1993). *Phytochemistry* (pp. 89–113). Academic Press.

Harikumar, R., & Sreena, T. V. (2025). Prevalence of non-communicable diseases and their lifestyle risk factors among the elderly in India: An analysis of WHO SAGE data. *International Journal of Community Medicine and Public Health, 12*(5), 2108-2112. https://doi.org/10.18203/2394-6040.ijcmph20251033

Hassan, H. A., Attia, E. Z., Desoukey, S. Y., Mohamed, K. M., & Kamel, M. S. (2019). Quantitative analysis of total phenolic and total flavonoid constituents of some *Ficus* species. *Journal of Advanced Biomedical and Pharmaceutical Sciences, 2*(1), 38-40.

Heo, J. H., Go, T., & Kang, D. R. (2025). The relationship between low-density lipoprotein cholesterol levels and cardiovascular risk in Koreans with and without diabetes. *Journal of Lipid and Atherosclerosis, 14*(3), 1-10. https://doi.org/10.12997/jla.2025.14.e23

Hoelzel, W., Weykamp, C., Jeppsson, J. O., Miedema, K., Barr, J. R., Goodall, I., Hoshino, T., John, W. G., Kobold, U., Little, R., Mosca, A., Mauri, P., Paroni, R., Susanto, F., Takei, I., Thienpont, L., Umemoto, M., & Wiedmeyer, H. M. (2004). IFCC reference system

for measurement of hemoglobin A1c in human blood and the national standardization schemes in the United States, Japan, and Sweden: A method-comparison study. *Clinical Chemistry, 50*(1), 166-174. https://doi.org/10.1373/clinchem.2003.024802

Hölzen, L., Schultes, B., Meyhöfer, S. M., & Meyhöfer, S. (2024). Hypoglycemia unawareness: A review on pathophysiology and clinical implications. *Biomedicines, 12*(2), Article 391. https://doi.org/10.3390/biomedicines12020391

Hoque, M. B., Tanjila, M. J., Hosen, M. I., Hannan, M. A., Haque, P., Rahman, M. M., & Hasan, T. (2025). A comprehensive review of the health effects, origins, uses, and safety of tannins. *Plant Soil*, 507, 221-240. https://doi.org/10.1007/s11104-024-06768-7

Huang, Y., Zhang, X., Li, B., Zhu, X., Li, C., Zhou, C., Gu, C., Wang, Y., Ma, M., Fan, Y., Xu, X., Chen, H., & Zheng, Z. (2023). Association of BMI and waist circumference with diabetic microvascular complications: A prospective cohort study from the UK Biobank and Mendelian randomization analysis. *Diabetes Research and Clinical Practice, 205*, Article 110975. https://doi.org/10.1016/j.diabres.2023.110975

Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D. G., & Newman, T. B. (2007). *Designing clinical research* (3rd ed.). Lippincott Williams & Wilkins, a Wolters Kluwer.

Igwe, K. K., Nwankwo, P. O., Otuokere, I. E., Ijioma, S. N., & Amaku, F. J. (2015). GC-MS analysis of phytocomponents in the methanolic extract of *Moringa oleifera* leaves. *Journal of Research in Pharmaceutical Science, 2*(11), 1-6. http://www.questjournals.org

Ilhan, M., Demir, B., Yüksel, S., Çataklı, S. A., Yıldız, R. S., Karaman, O., & Taşan, E. (2016). The use of complementary medicine in patients with diabetes. *Northern Clinics of Istanbul, 3*(1), 34-38. https://doi.org/10.14744/nci.2016.63825

Imran, M., Sharma, J. N., Kamal, M., & Asif, M. (2021). Standardization and wound-healing activity of petroleum, ethanolic, and aqueous extracts of *Ficus benghalensis* leaves. *Pharmaceutical Chemistry Journal, 54*(10), 1057-1062. https://doi.org/10.1007/s11094-021-02319-x

Indian Council of Medical Research - National Institute of Nutrition Expert Group. (2024). *Revised short summary report of nutrient requirements for Indians: Recommended dietary allowances (RDA) and estimated average requirements (EAR)*. ICMR–NIN.

Indian Standards Institution. (1971). *IS 5838–1970: Methods for estimation of vitamin C in foodstuffs*. BIS.

Indian Standards Institution. (1974). *IS 7219–1973: Method for determination of protein in foods and feeds*. BIS.

Institute for Health Metrics and Evaluation. (2025). *Global burden of disease 2023: Findings from the GBD 2023 study*. IHME.

Institute for Health Metrics and Evaluation. (2024). *Global burden of disease 2021: Findings from the GBD 2021 study*. IHME.

International Diabetes Federation. (2006). *The IDF consensus worldwide definition of the metabolic syndrome*. IDF.

International Diabetes Federation. (2023). *IDF atlas reports: Diabetes and kidney disease*. https://www.diabetesatlas.org

International Diabetes Federation. (2025a). *Diabetes and nerve health*. https://idf.org/about-diabetes/diabetes-complications/nerve-health/

International Diabetes Federation. (2025b). *Diabetes and the eyes*. https://idf.org/about-diabetes/diabetes-complications/eyes/

International Diabetes Federation. (2025c). *Diabetes and the heart*. https://idf.org/about-diabetes/diabetes-complications/cardiovascular-disease/

International Diabetes Federation. (2025d). *Diabetes complications*. https://idf.org/about-diabetes/diabetes-complications/

International Diabetes Federation. (2025e). *IDF diabetes atlas* (11th ed.). IDF.

International Diabetes Federation. (2025f). *IDF global clinical practice recommendations for managing type 2 diabetes*. https://idf.org/t2d-cpr-2025

International Institute for Population Sciences (IIPS) & ICF. (2021a). *National Family Health Survey (NFHS-5), India, 2019-21: District fact sheet Vadodara, Gujarat*. IIPS.

International Institute for Population Sciences (IIPS) & ICF. (2021b). *National Family Health Survey (NFHS-5), 2019-21: India* (Vol. I). http://www.rchiips.org/nfhs

IPAQ- International Physical Activity Questionnaire. (2002). *International Physical Activity Questionnaire: Short last 7 days self-administered format*. https://sites.google.com/view/ipaq/download

Islas, J. F., Acosta, E., G-Buentello, Z., Delgado-Gallegos, J. L., Moreno-Treviño, M. G., Escalante, B., & Moreno-Cuevas, J. E. (2020). An overview of neem (*Azadirachta indica*) and its potential impact on health. *Journal of Functional Foods, 74*, Article 104171. https://doi.org/10.1016/j.jff.2020.104171

Ismail, L., Materwala, H., & Al Kaabi, J. (2021). Association of risk factors with type 2 diabetes: A systematic review. *Computational and Structural Biotechnology Journal, 19*, 1759-1785. https://doi.org/10.1016/j.csbj.2021.03.003

Jabeen, A., Khan, M. A., Ahmad, M., Zafar, M., & Ahmad, F. (2009). Indigenous uses of economically important flora of Margallah Hills National Park, Islamabad, Pakistan. *African Journal of Biotechnology, 8*(5), 763-784. http://www.academicjournals.org/AJB

Jagetia, G. C. (2018). A review on the role of jamun (*Syzygium cumini* Skeels) in the treatment of diabetes. *International Journal of Complementary & Alternative Medicine, 11*(2). https://doi.org/10.15406/ijcam.2018.11.00374

Jahagirdar, M. A. Q. F., Hugar, S., Patil, V. P., Khot, A., & Nanjappaiah, H. M. (2020). Screening of antistress activity of *Ficus benghalensis* fruit extract. *Research Journal of Pharmacy and Technology, 13*(1), 191-196. https://doi.org/10.5958/0974-360X.2020.00039.6

Jaiswal, Y. S., & Williams, L. L. (2017). A glimpse of Ayurveda- The forgotten history and principles of Indian traditional medicine. *Journal of Traditional and Complementary Medicine, 7*(1), 50-53. https://doi.org/10.1016/j.jtcme.2016.02.002

James, P. A., Oparil, S., Carter, B. L., Cushman, W. C., Dennison-Himmelfarb, C., Handler, J., Lackland, D. T., LeFevre, M. L., MacKenzie, T. D., Ogedegbe, O., Smith, S. C., Svetkey, L. P., Taler, S. J., Townsend, R. R., Wright, J. T., Narva, A. S., & Ortiz, E. (2014). 2014 Evidence-based guideline for the management of high blood pressure in adults: Report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA, 311*(5), 507-520. https://doi.org/10.1001/jama.2013.284427

Jaya, M. K. A., Rahmawati, F., Yasin, N. M., & Ikawati, Z. (2025). Risk factors contributing to hypoglycemia among diabetes mellitus patients: A systematic review and meta-analysis. *Journal of Public Health and Development, 23*(2), 339-362. https://doi.org/10.55131/JPHD/2025/230223

Jayakumari, C., Jabbar, P. K., Soumya, S., Jayakumar, R. V., Das, D. V., Girivishnu, G., Gopi, A., Gomez, R., Sreenath, R., & Nair, A. (2020). Lipid profile in Indian patients with type 2 diabetes: The scope for atherosclerotic cardiovascular disease risk reduction. *Diabetes Spectrum, 33*(4), 299-306. https://doi.org/10.2337/DS19-0046

Jităreanu, A., Trifan, A., Vieriu, M., Caba, I. C., Mârțu, I., & Agoroaei, L. (2022). Current trends in toxicity assessment of herbal medicines: A narrative review. *Processes, 11*(1), Article 83.

Joeliantina, A., Soedirham, O., Agil, M., Qomaruddin, M. B., & Kusnanto, K. (2019). A literature review of complementary and alternative medicine used among diabetes mellitus patients. *International Journal of Public Health Science, 8*(2), 277-286. https://doi.org/10.11591/ijphs.v8i2.16537

Joint FAO/WHO Expert Committee on Food Additives. (1984). *Evaluation of certain food additives and contaminants: Twenty-eighth report of the Joint FAO/WHO Expert Committee on Food Additives*. World Health Organization.

Joseph, B., & Raj, S. J. (2011). An overview of *Ficus bengalensis* Linn. *International Journal of Pharmaceutical Sciences Review and Research, 6*(1), 21-24.

Kajal, Manjula, S., Mohandas, R. K., Shobha, K., Rucha, D., Kumar, S. P., & Vasanthalaxmi, K. R. (2024). Protective effect of *Ficus benghalensis* on cyclophosphamide-induced neurotoxicity and hepatotoxicity in rats. *African Journal of Biomedical Research, 27*(3), 1761-1768. https://doi.org/10.53555/AJBR.V27I3.4527

Kasireddy, G. R., Kumar, K. B. S., Nadithe, L. R., & Chinnam, P. (2021). Experimental evaluation of hypoglycemic effect of bark extract of *Ficus benghalensis* in streptozotocin-induced diabetic rats. *National Journal of Physiology, Pharmacy and Pharmacology, 11*(3), 320-325. https://doi.org/10.5455/njppp.2021.11.12359202023012021

Katayama, Y., Soya, H., Fujinaka, M., Mori, H., Tomita, A., & Kayahara, N. (2009). Evaluation of new homogeneous assay kit to determine HDL-C with high reactivity with cholesterol in various types of HDL. In *Proceedings of the AACC Meeting 2009* (Poster Abstract B-103).

Ke, C., Stukel, T. A., Shah, B. R., Lau, E., Ma, R. C., So, W. Y., Kong, A. P., Chow, E., Chan, J. C. N., & Luk, A. (2020). Age at diagnosis, glycemic trajectories, and responses to oral glucose-lowering drugs in type 2 diabetes in Hong Kong: A population-based observational study. *PLOS Medicine, 17*(9), e1003316. https://doi.org/10.1371/journal.pmed.1003316

Kesavadev, J., Saboo, B., Shankar, A., Krishnan, G., Jothydev, S., Chandran, V., Basanth, A., Raj, S., Manojan, K. K., & Aravind, S. R. (2023). Prevalence of complementary and alternate medicine use among people with diabetes in Kerala, India. *International Journal of Diabetes and Technology, 2*(3), 85-89. https://doi.org/10.4103/ijdt.ijdt_36_23

Khalaf, A. J., & Whitford, D. L. (2010). The use of complementary and alternative medicine by patients with diabetes mellitus in Bahrain: A cross-sectional study. *BMC Complementary and Alternative Medicine, 10*, 1-5.

Khalil, S. A., Azar, S., Hafidh, K., Ayad, G., & Safwat, M. (2024). Prevalence and co-prevalence of comorbidities among patients with type 2 diabetes mellitus in the MENA region: A systematic review. *Current Diabetes Reviews, 20*(7). https://doi.org/10.2174/1573399820666230731105704

Khan, S. U., Khan, R. U., Mehmood, S., Ullah, I., Ullah, Z., & Zahoor, M. (2013). Study of prominent indigenous medicinal plants of village Ahmad Abad, District Karak, KPK, Pakistan. *Journal of Medicinal Plants Studies, 1*(4), 121-127.

Khanal, P., & Patil, B. (2019). Gene set enrichment analysis of alpha-glucosidase inhibitors from *Ficus benghalensis*. *Asian Pacific Journal of Tropical Biomedicine, 9*(6), 263-270. https://doi.org/10.4103/2221-1691.260399

Khanal, P., & Patil, B. M. (2020). In vitro and in silico antioxidant, cytotoxicity, and biological activities of *Ficus benghalensis* and *Duranta repens*. *Chinese Herbal Medicines, 12*(4), 406-413. https://doi.org/10.1016/j.chmed.2020.02.004

Khanal, P., & Patil, B. M. (2021). Consolidation of network and experimental pharmacology to divulge the antidiabetic action of *Ficus benghalensis* L. bark. *3 Biotech, 11*, Article 238. https://doi.org/10.1007/s13205-021-02788-7

Khanal, P., & Patil, B. M. (2022). Reversal of insulin resistance by *Ficus benghalensis* bark in fructose-induced insulin-resistant rats. *Journal of Ethnopharmacology, 284*, 1-14. https://doi.org/10.1016/j.jep.2021.114761

Khare, C. P. (2016). *Ficus bengalensis* Linn. stem bark (Nyagrodha). In *Ayurvedic pharmacopoeial plant drugs: Expanded therapeutics* (pp. 261-262). CRC Press.

Khatiwada, S., Kc, R., Sah, S. K., Khan, S. A., Chaudhari, R. K., Baral, N., & Lamsal, M. (2015). Thyroid dysfunction and associated risk factors among Nepalese diabetes mellitus patients. *International Journal of Endocrinology, 2015*, Article 570198. https://doi.org/10.1155/2015/570198

Kifle, Z. D. (2021). Prevalence and correlates of complementary and alternative medicine use among diabetic patients in a resource-limited setting. *Metabolism Open, 10*, Article 100095. https://doi.org/10.1016/j.metop.2021.100095

Kim, J., Noh, W., Kim, A., Choi, Y., & Kim, Y. S. (2023). The effect of fenugreek in type 2 diabetes and prediabetes: A systematic review and meta-analysis of randomized controlled trials. *International Journal of Molecular Sciences, 24*(18), Article 13999. https://doi.org/10.3390/ijms241813999

Kim, M. K., Lee, K. N., Han, K., & Lee, S. H. (2024). Diabetes duration, cholesterol levels, and risk of cardiovascular diseases in individuals with type 2 diabetes. *The Journal of Clinical Endocrinology & Metabolism, 109*(12), 2317-2323. https://doi.org/10.1210/clinem/dgae092

Klec, C., Ziomek, G., Pichler, M., Malli, R., & Graier, W. F. (2019). Calcium signaling in β-cell physiology and pathology: A revisit. *International Journal of Molecular Sciences, 20*(24), Article 6110. https://doi.org/10.3390/ijms20246110

Kokate, A. (1999). Phytochemical methods. *Phytotherapy* (2nd ed., Vol. 78, pp. 126-129).

Kokate, C. K., Khandelwal, K. R., Pawar, A. P., & Gohale, S. B. (1995). *Practical pharmacognosy* (3rd ed., pp. 137-139). Nirali Prakashan.

Kukreti, N., Prakash, H., Verma, A., & Kumar, P. (2023). Preliminary phytochemical screening of aqueous extract of *Ficus bengalensis* leaf bud. *AYUSHDHARA, 10*(2), 77-81. https://doi.org/10.47070/ayushdhara.v10i2.1176

Kumar, D., Bajaj, S., & Mehrotra, R. (2006). Knowledge, attitude and practice of complementary and alternative medicines for diabetes. *Public Health, 120*(8), 705-711. https://doi.org/10.1016/j.puhe.2006.04.010

Kumar, R., & Bhagat, N. (2012). Ethnomedicinal plants of district Kathua (J&K). *International Journal of Medicinal and Aromatic Plants, 2*(4), 603-611.

Kumar, Y. A., Gautam, G. B., & Mishra, P. K. (2019). Protective role of *Carica papaya* and *Ficus bengalensis* latex against CCl_4-induced liver toxicity in experimental rats. *Journal of Drug Delivery and Therapeutics, 9*(3), 465-469. https://doi.org/10.22270/jddt.v9i3.2936

Kumari, M., & Jain, S. (2012). Tannin: An antinutrient with positive effect to manage diabetes. *Research Journal of Recent Sciences, 1(12), 70-73*.

Kunwar, R. M., & Bussmann, R. W. (2006). *Ficus* (fig) species in Nepal: A review of diversity and indigenous uses. *Lyonia: A Journal of Ecology and Application, 11*(1), 85-97.

Kyrou, I., Tsigos, C., Mavrogianni, C., Cardon, G., Van Stappen, V., Latomme, J., Kivelä, J., Wikström, K., Tsochev, K., Nanasi, A., Semanova, C., Mateo-Gallego, R., Lamiquiz-Moneo, I., Dafoulas, G., Timpel, P., Schwarz, P. E. H., Iotova, V., Tankova, T., Makrilakis, K., & Manios, Y. (2020). Sociodemographic and lifestyle-related risk factors for identifying vulnerable groups for type 2 diabetes: A narrative review with emphasis on data from Europe. *BMC Endocrine Disorders, 20*(1), Article 134. https://doi.org/10.1186/s12902-019-0463-3

Laware, R. B., Pulate, S. P., Dighe, S. B., & Bhawar, S. B. (2019). Formulation development and evaluation of leaf extract of *Ficus benghalensis* for antidiabetic activity. *Journal of Drug Delivery and Therapeutics, 9*(3-S), 611-614. https://doi.org/10.22270/jddt.v9i3-s.2919

Leal, S., Sousa, A. C., Valdiviesso, R., Pádua, I., Gonçalves, V. M. F., & Ribeiro, C. (2025). Exploring factors associated with health status and dietary supplement use among Portuguese adults: A cross-sectional online survey. *Healthcare, 13*(7), Article 769. https://doi.org/10.3390/healthcare13070769

Lee, Y., Lim, N. K., & Park, H. Y. (2025). Associations of four obesity indices with diabetes mellitus in Korean middle-aged and older adults using the Korean Genome and Epidemiology Study (KoGES). *BMC Public Health, 25*, Article 21567. https://doi.org/10.1186/s12889-025-21567-0

Leese, G. P., Gill, G. V., & Houghton, G. M. (1997). Prevalence of complementary medicine usage within a diabetes clinic. *Practical Diabetes International, 14*(7), 207-215.

Li, A., Liu, Y., Liu, Q., Peng, Y., Liang, Q., Tao, Y., Cui, C., Ren, Q., Zhou, Y., Long, J., Fan, G., Lu, Q., & Liu, Z. (2024). Waist-to-height ratio and body roundness index: Superior predictors of insulin resistance in Chinese adults considering gender and age. *Frontiers in Nutrition, 11*, Article 1480707. https://doi.org/10.3389/fnut.2024.1480707

Li, J., Li, X., Gathirua-Mwangi, W., & Song, Y. (2020). Prevalence and trends in dietary supplement use among US adults with diabetes: The National Health and Nutrition Examination Surveys, 1999-2014. *BMJ Open Diabetes Research & Care, 8*(1), e000925. https://doi.org/10.1136/bmjdrc-2019-000925

Li, J., Pandian, V., Davidson, P. M., Song, Y., Chen, N., & Fong, D. Y. T. (2025). Burden and attributable risk factors of non-communicable diseases and subtypes in 204 countries and territories, 1990–2021: A systematic analysis for the Global Burden of Disease Study 2021. *International Journal of Surgery, 111*(3), 2385-2397. https://doi.org/10.1097/js9.0000000000002260

Lian, H., Wu, H., Ning, J., Lin, D., Huang, C., Li, F., Liang, Y., Qi, Y., Ren, M., Yan, L., You, L., & Xu, M. (2021). The risk threshold for hemoglobin A1c associated with albuminuria: A population-based study in China. *Frontiers in Endocrinology, 12*, Article 673976. https://doi.org/10.3389/fendo.2021.673976

Liu, F., Sirisena, S., & Ng, K. (2021). Efficacy of flavonoids on biomarkers of type 2 diabetes mellitus: A systematic review and meta-analysis of randomized controlled trials. *Critical Reviews in Food Science and Nutrition, 63*(21), 4916-4941. https://doi.org/10.1080/10408398.2021.2009761

Liu, W. Y., Chen, W. Y., Zhang, J. H., Targher, G., Byrne, C. D., Misra, A., Lonardo, A., Zheng, M. H., & Sun, D. Q. (2025). The global burden of diabetes-related chronic kidney

disease from 1990 to 2021, with projections to 2036. *Metabolism Target Organ Damage, 5*, 1-14. https://doi.org/10.20517/mtod.2025.42

Logesh, R., Vivekanandarajah Sathasivampillai, S., Varatharasan, S., Rajan, S., Das, N., Pandey, J., & Prasad Devkota, H. (2023). *Ficus benghalensis* L. (Moraceae): A review on ethnomedicinal uses, phytochemistry and pharmacological activities. *Current Research in Biotechnology, 6*, 1-9. https://doi.org/10.1016/j.crbiot.2023.100134

Longvah, T., Ananthan, R., Bhaskarachary, K., & Venkaiah, K. (2017). *Indian food composition tables*. National Institute of Nutrition, Indian Council of Medical Research, Ministry of Health & Family Welfare, Government of India.

Lotankar, A. R., Sharma, J. B., & Momin, A. J. (2016). Anti-stress activity of flavonoids rutin and quercetin isolated from the leaves of *Ficus benghalensis*. *International Journal of Pharmacy and Pharmaceutical Research, 5*(4), 5-19.

Lu, X., Xie, Q., Pan, X., Zhang, R., Zhang, X., Peng, G., Zhang, Y., Shen, S., & Tong, N. (2024). Type 2 diabetes mellitus in adults: Pathogenesis, prevention and therapy. *Signal Transduction and Targeted Therapy, 9*(1), Article 195. https://doi.org/10.1038/s41392-024-01951-9

Luo, L., Wang, B., Jiang, J., Fitzgerald, M., Huang, Q., Yu, Z., & Chen, S. (2021). Heavy metal contaminations in herbal medicines: Determination, comprehensive risk assessments, and solutions. *Frontiers in Pharmacology, 11*, Article 595335.

Ma, J., Guo, Y., Jiang, C., & Fu, X. (2025). Editorial: Novel insights into the pathophysiology of diabetes-related complications: Implications for improved therapeutic strategies, volume II. *Frontiers in Endocrinology, 16*, Article 1570628. https://doi.org/10.3389/fendo.2025.1570628

Majeed, M., Narayanan, N. K., Mundkur, L., Prakasan, P., & Nagabhushanam, K. (2023). Super fruit amla (*Emblica officinalis* Gaertn.) in diabetes management and ensuing complications: A concise review. *Nutraceuticals, 3*(3), 329-352. https://doi.org/10.3390/nutraceuticals3030026

Makkar, H. P. S., Blümmel, M., Borowy, N. K., & Becker, K. (1993). Gravimetric determination of tannins and their correlations with chemical and protein precipitation methods. *Journal of the Science of Food and Agriculture, 61*(2), 161-165. https://doi.org/10.1002/jsfa.2740610205

Manikandaselvi, S., Subalakshmi, R., Thinagarbabu, R., & Ravikumar, R. (2012). Evaluation of antidiabetic potential of ethanolic extract of leaves of *Ficus benghalensis* Linn. *International Journal of Pharma and Bio Sciences, 3*(2), 108-114.

Manocha, N., Chandra, S. K., Sharma, V., Sangameswaran, B., & Saluja, M. (2011). Anti-rheumatic and antioxidant activity of extract of stem bark of *Ficus bengalensis*. *Research Journal of Chemical Sciences, 1*(2).

Mathew, B. C., Yoseph, B. A., Dessale, T., Daniel, R. S., Alemayehu, A., Campbell, I. W., & Augusti, K. T. (2012). Hypolipidaemic effect of leucodelphinidin derivative from *Ficus bengalensis* Linn. on cholesterol-fed rats. *Research Journal of Chemical Sciences, 2*(2), 54-60.

Mazumder, K., Khanra, R., Biswas, K., Bala, N. N., & Maji, H. S. (2022). Exploration of anti-inflammatory activity of extract and isolated compounds obtained from the aerial root of *Ficus benghalensis* Linn. *Research Journal of Pharmacy and Technology, 15*(10), 4584-4588. https://doi.org/10.52711/0974-360x.2022.00769

Mbizo, J., Okafor, A., Sutton, M. A., Leyva, B., Stone, L. M., & Olaku, O. (2018). Complementary and alternative medicine use among persons with multiple chronic conditions: Results from the 2012 National Health Interview Survey. *BMC Complementary and Alternative Medicine, 18*(1), 1-12. https://doi.org/10.1186/s12906-018-2342-2

McRae, M. P. (2017). Dietary fiber is beneficial for the prevention of cardiovascular disease: An umbrella review of meta-analyses. *Journal of Chiropractic Medicine, 16*(4), 289-299. https://doi.org/10.1016/j.jcm.2017.05.005

Mehdi, E. K., & Farhood, H. F. (2019). Knowledge, attitudes, and practice of complementary and alternative medicine among diabetic patients. *Medical Journal of Babylon, 16*(1), 13-19. https://doi.org/10.4103/mjbl.mjbl_83_18

Mekuria, A. B., Belachew, S. A., Tegegn, H. G., Ali, D. S., Netere, A. K., Lemlemu, E., & Erku, D. A. (2018). Prevalence and correlates of herbal medicine use among type 2 diabetic patients in a teaching hospital in Ethiopia: A cross-sectional study. *BMC Complementary and Alternative Medicine, 18*(1), Article 85. https://doi.org/10.1186/s12906-018-2147-3

Miida, T., Nishimura, K., Okamura, T., Hirayama, S., Ohmura, H., Yoshida, H., Miyashita, Y., Ai, M., Tanaka, A., Sumino, H., Murakami, M., Inoue, I., Kayamori, Y., Nakamura, M., Nobori, T., Miyazawa, Y., Teramoto, T., & Yokoyama, S. (2014). Validation of homogeneous assays for HDL-cholesterol using fresh samples from healthy and diseased subjects. *Atherosclerosis, 233*(1), 253-259.

Mikulski, M. A., Wichman, M. D., Simmons, D. L., Pham, A. N., Clottey, V., & Fuortes, L. J. (2017). Toxic metals in ayurvedic preparations from a public health lead poisoning

cluster investigation. *International Journal of Occupational and Environmental Health, 23*(3), 187-192. https://doi.org/10.1080/10773525.2018.1447880

Miller, W. G. (2009). Estimating glomerular filtration rate. *Clinical Chemistry and Laboratory Medicine, 47*(9), 1017-1019. https://doi.org/10.1515/cclm.2009.264

Mirmiran, P., Hosseini-Esfahani, F., Esfandiar, Z., Hosseinpour-Niazi, S., & Azizi, F. (2022). Associations between dietary antioxidant intakes and cardiovascular disease. *Scientific Reports, 12*(1), Article 5632. https://doi.org/10.1038/s41598-022-05632-x

Mishra, S., Srivastava, A., Srivastava, S., & Prasad, R. K. (2025). A comprehensive review of *Ficus benghalensis*: Phytochemical constituents and pharmacological activity. *Journal of Emerging Technologies and Innovative Research, 12*(6), 750-779.

Mitra, A. (2007). Anti-diabetic uses of some common herbs in tribal belts of Midnapur (West) District of Bengal. *Studies on Ethno-Medicine, 1*(1), 37-45.

Mittal, R., Prasad, K., Lemos, J. R. N., Arevalo, G., & Hirani, K. (2025). Unveiling gestational diabetes: An overview of pathophysiology and management. *International Journal of Molecular Sciences, 26*(5), Article 2320. https://doi.org/10.3390/ijms26052320

Młynarska, E., Czarnik, W., Dzieża, N., Jędraszak, W., Majchrowicz, G., Prusinowski, F., Stabrawa, M., Rysz, J., & Franczyk, B. (2025). Type 2 diabetes mellitus: New pathogenetic mechanisms, treatment and the most important complications. *International Journal of Molecular Sciences, 26*(3), 1-24. https://doi.org/10.3390/ijms26031094

Modzelewski, R., Stefanowicz-Rutkowska, M. M., Matuszewski, W., & Bandurska-Stankiewicz, E. M. (2022). Gestational diabetes mellitus- Recent literature review. *Journal of Clinical Medicine, 11*(19), 1-14. https://doi.org/10.3390/jcm11195736

Mohamed, H., Abdin, J., Lenjawi, B., Hamadani, Z., & Schlögl, J. (2016). Use of complementary and alternative medicine among patients with type 2 diabetes mellitus in a newly developing country: A cross-sectional study in Qatar. *International Journal of Clinical Research & Trials, 1*, Article 106. https://doi.org/10.15344/2456-8007/2016/106

Mohan, V. R., Nishanthini, A., & Devi, G. S. (2015). Evaluation of antioxidant properties of *Ficus bengalensis* bark. *International Journal of Pharmacognosy and Phytochemical Research, 7*(4), 758-763.

Moonesinghe, R., Beckles, G. L. A., Liu, T., & Khoury, M. J. (2018). The contribution of family history to the burden of diagnosed diabetes, undiagnosed diabetes, and prediabetes in the United States: Analysis of the National Health and Nutrition Examination Survey, 2009-2014. *Genetics in Medicine, 20*, 1159-1166. https://doi.org/10.1038/gim.2017.238

Mori, Y., Daikuhara, H., Oshima, T., Suzuki, H., Okada, S., & Miyatake, N. (2023). Use of complementary and alternative medicine and its relationship with health-related quality of life in patients with type 2 diabetes mellitus. *Epidemiologia, 4*(1), 53-59. https://doi.org/10.3390/epidemiologia4010005

Munthali, L. M., Thombozi, E., & Mbakaya, B. C. (2023). Use of complementary and alternative medicine among persons with diabetes at Mzuzu Central Hospital in Malawi: A cross-sectional study. *Advances in Integrative Medicine, 10*(3), 101-106. https://doi.org/10.1016/j.aimed.2023.07.002

Murugan, V. (2021). Consumer buying behavior towards ayurvedic products in Tiruvarur District, Tamil Nadu. *International Journal of Innovative Research in Technology, 8*, 831-835.

Murugesu, S., Selamat, J., & Perumal, V. (2021). Phytochemistry, pharmacological properties, and recent applications of *Ficus benghalensis* and *Ficus religiosa*. *Plants, 10*(12), 1-29. https://doi.org/10.3390/plants10122749

Nagalakshmi, G. C. D., Rao, S. S., & Fareeda, G. (2010). Hypoglycemic effect of aqueous fruit extract of *Ficus bengalensis* in normal and streptozotocin-induced diabetic rats. *The Bioscan, 5*(2), 197-200.

Naik, A. K., & Dash, J. R. (2025). Hypoglycemic and hypolipidemic effect of *Ficus benghalensis* Linn. bark laticiferous sap in alloxan-induced diabetes mellitus in rats. *International Journal of Advanced Biochemistry Research, 9*(8), 363-368. https://doi.org/10.33545/26174693.2025.v9.i8e.5183

Naito, H. K. (1988). Reliability of lipid, lipoprotein, and apolipoprotein measurements. *Clinical Chemistry, 34*(8B), B84-B94.

Naja, F., Mousa, D., Alameddine, M., Shoaib, H., Itani, L., & Mourad, Y. (2014). Prevalence and correlates of complementary and alternative medicine use among diabetic patients in Beirut, Lebanon: A cross-sectional study. *BMC Complementary and Alternative Medicine, 14*, 1-11. https://doi.org/10.1186/1472-6882-14-185

Naquvi, K. J., Ali, M., & Ahamad, J. (2015). Two new phytosterols from the stem bark of *Ficus bengalensis* L. *Journal of Saudi Chemical Society, 19*(6), 650-654. https://doi.org/10.1016/j.jscs.2012.06.006

Narayanan, N., & Patil, U. (2019). *Vata (Ficus benghalensis): A detailed review from classical texts*. *International Journal of Ayurveda and Pharma Research, 7*(11), 64-69.

Nartea, R., Mitoiu, B. I., & Ghiorghiu, I. (2023). The link between magnesium supplements and statin medication in dyslipidemic patients. *Current Issues in Molecular Biology, 45*(4), 3146-3167. https://doi.org/10.3390/cimb45040205

National Agricultural Library, U.S. Department of Agriculture. (n.d.). *Phytonutrients*. Retrieved February 19, 2025, from https://www.nal.usda.gov/human-nutrition-and-food-safety/food-composition/phytonutrients

National Cancer Institute. (2024, October 31). *Complementary and alternative medicine*. https://www.cancer.gov/about-cancer/treatment/cam

National Center for Complementary and Integrative Health (United States). (2021, April). *Complementary, alternative, or integrative health: What's in a name?* https://www.nccih.nih.gov/health/complementary-alternative-or-integrative-health-whats-in-a-name

National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. (2002). *Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III): Executive summary*. National Institutes of Health.

National Institute for Health and Care Excellence. (2025, January 14). *Overweight and obesity management (NICE guideline NG246)*. https://www.nice.org.uk/guidance/ng246

National Institutes of Health, Office of Dietary Supplements (United States). (1994, October 25). *Dietary Supplement Health and Education Act of 1994 (Public Law 103-417): 103rd Congress*. https://ods.od.nih.gov/About/DSHEA_Wording.aspx

National Medicinal Plants Board, Ministry of AYUSH, Government of India. (2025, March 25). *Indian medicinal plants: Fact sheet*. https://nmpb.nic.in/content/medicinal-plants-fact-sheet

Navale, S., Jeyabalan, G., Singh, Y., & Shirsath, M. (2019). Pharmacognostic and phytochemical investigation of *Ficus bengalensis* Linn. bark. *International Journal of ChemTech Research, 12*(1), 129-137. https://doi.org/10.20902/ijctr.2019.120115

Nazari, M., Ashtary-Larky, D., Nikbaf-Shandiz, M., Goudarzi, K., Bagheri, R., Dolatshahi, S., Omran, H. S., Amirani, N., Ghanavati, M., & Asbaghi, O. (2023). Zinc supplementation and cardiovascular disease risk factors: A GRADE-assessed systematic review and dose-response meta-analysis. *Journal of Trace Elements in Medicine and Biology, 79*, Article 127244. https://doi.org/10.1016/j.jtemb.2023.127244

Ndagijimana, E., Nshimiyimana, A., Habyarimana, T., Izere, C., & Niyonzima, F. N. (2024). Association of blood glucose and lipid profile concentrations in diabetic patients attending Gisenyi District Hospital in Rwanda: A cross-sectional study. *East Africa Science, 6*(1), 62-69. https://doi.org/10.24248/easci.v6i1.96

Negussie, Y. M., Getahun, M. S., & Bekele, N. T. (2023). Factors associated with diabetes-concordant comorbidities among adult diabetic patients in central Ethiopia: A cross-sectional study. *Frontiers in Clinical Diabetes and Healthcare, 4*, Article 1307463. https://doi.org/10.3389/fcdhc.2023.1307463

Nie, T., & Cooper, G. J. S. (2021). Mechanisms underlying the antidiabetic activities of polyphenolic compounds: A review. *Frontiers in Pharmacology, 12*, Article 798329. https://doi.org/10.3389/fphar.2021.798329

Nikhal, S. B., & Dambe, P. A. (2010). Hydroalcoholic extraction of *Mangifera indica* (leaves) by Soxhlet extraction. *International Journal of Pharmaceutical Sciences and Research, 1*(7).

Noor, N. A. M., Muhammad, A., & Isa, F. M. (2019). Consumption of dietary supplement products among Malaysian consumers: The roles of attitude, social influence and perceived behavioural control. *The Journal of Social Sciences Research, 5*(12), 1768-1776. https://doi.org/10.32861/jssr.512.1768.1776

Ogbera, A. O., Dada, O., Adeleye, F., & Jewo, P. I. (2010). Complementary and alternative medicine use in diabetes mellitus. *West African Journal of Medicine, 29*(3), 158-162.

Ogunlowo, O. P., Arimah, B. D., & Adebayo, M. A. (2013). Phytochemical analysis and comparison of in vitro antimicrobial activities of the leaf, stem bark and root bark of *Ficus benghalensis*. *IOSR Journal of Pharmacy, 3*(4), 33-38.

Orngugaoje, B. O., Tor-Agbideh, S., Ocheifa, M. N., De-kaa, N. L. P., Tor-Anyiin, I., Daniel, D. A., Ben-Ameh, M, Irowa, O., Nwaeze, C., Swende, L. T., Akwaras, N. A., Tyovenda, K., Ayatse, O. D., Itodo, E. P., Obekpa, J. E., & Nwagbo, A. N. (2025). The burden of complementary and alternative medicine use among diabetics attending a tertiary hospital in North Central Nigeria. *South Asian Research Journal of Applied Medical Sciences, 7*(4), 221-230. https://doi.org/10.36346/sarjams.2025.v07i04.017

Pan American Health Organization. (2023). *The NCD roadmap 2023-2030 for the global action plan on the prevention and control of noncommunicable diseases 2013-2030*.

Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: An overview. *Journal of Nutritional Science, 5*, e47. https://doi.org/10.1017/jns.2016.41

Papitha, R., Ravi, L., Kaviyarasi, R., & Bhuvaneswari, M. (2017). Phytochemical investigation, gas chromatography-mass spectrometry, and Fourier transform infrared analysis in adventitious roots of *Ficus benghalensis* L. *International Journal of Green Pharmacy, 11*(2), Article 127. https://doi.org/10.22377/ijgp.v11i02.925

Parmar, D. N., & Patel, N. K. (2013). Sacred and medicinal plant diversity of Vandiol Sacred Grove of Sabarkantha District (N.G.). *Life Sciences Leaflets, 39*, 34-49.

Patel, M. A., Patel, P. K., & Patel, M. B. (2010). Aqueous extract of *Ficus bengalensis* Linn. bark for inflammatory bowel disease. *Journal of Young Pharmacists, 2*(2), 130-136. https://doi.org/10.4103/0975-1483.63149

Patel, M. H., Malek, S., Patel, V., Desai, B., Jha, S., & Patel, D. (2023). Chemical composition and tannin content in leaves of *Ficus* spp. as top feed for ruminants from the Dang Forest of South Gujarat Province, India. *International Journal of Veterinary Sciences and Animal Husbandry, 8*(3), 225-228. https://doi.org/10.22271/veterinary.2023.v8.i3d.548

Patel, R., Shukla, P. K., & Singh, M. P. (2017). Pharmacognostical and phytochemical evaluation and *in silico* lead finding of *Ficus bengalensis* Linn. with hepatoprotective potentials. *International Journal of Phytopharmacy, 7*(5), 57-63. https://doi.org/10.7439/ijpp

Patel, V. P., & Dhruv, S. (2016). *Elephant apple powder supplementation in the management of type 2 diabetes mellitus: A triple-blind randomized controlled trial* [Master's thesis]. Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda.

Pathomwichaiwat, T., Jinatongthai, P., Prommasut, N., Ampornwong, K., Rattanavipanon, W., Nathisuwan, S., & Thakkinstian, A. (2023). Effects of turmeric (*Curcuma longa*) supplementation on glucose metabolism in diabetes mellitus and metabolic syndrome: An umbrella review and updated meta-analysis. *PLOS ONE, 18*(7), e0288997. https://doi.org/10.1371/journal.pone.0288997

Patil, V. V., & Patil, V. R. (2010). A comparative evaluation of anti-inflammatory activity of the bark of *Ficus bengalensis* in plants of different age. *Journal of Basic and Clinical Pharmacy, 1*(2), 107–113.

Paul, H. (2022). Pathophysiology of diabetes mellitus and its complications. *Diabetes Case Reports, 7*(3), 1-2.

Paul, S., Debnath, S., Singh, A. K., Mishra, S., Rajotiya, S., Singh, M., Parashar, R., Pal, P., & Kumar, S. (2024). Epidemiologic pattern and factors associated with adverse outcomes of diabetic ketoacidosis in medical intensive care units of a tertiary care centre in India.

Endocrine and Metabolic Science, 16, Article 100204. https://doi.org/10.1016/j.endmts.2024.100204

Pedgaonkar, A., Adithya, G. M., Reddy, P. S., Thanuja, K., Divyashree, L., Vasudha, B., & Narender, B. (2019). Assessment of antioxidant activity of *Ficus benghalensis* leaves: An *in vitro* study. *Journal of Drug Delivery and Therapeutics, 9*(2), 20-24. https://doi.org/10.22270/jddt.v9i2.2366

Pengpid, S., & Peltzer, K. (2021). Utilization of complementary and traditional medicine practitioners among middle-aged and older adults in India: Results of a national survey in 2017-2018. *BMC Complementary Medicine and Therapies, 21*, Article 285. https://doi.org/10.1186/s12906-021-03432-w

Pereira, M. L. L., da Costa, M. D. R., de Almeida Viana, G., Magalhães, E. P., Duque, B. R., da Silva, M. E., Teixeira, I. M. M., de Sousa Alves, R., de Menezes, R. R. P. P. B., Martins, A. M. C., de Queiroz, M. G. R., & Sampaio, T. L. (2024). Correlation of apolipoprotein A1 with renal function in diabetic patients. *Brazilian Archives of Biology and Technology, 67*, e24230487. https://doi.org/10.1590/1678-4324-2024230487

Pisani, T., Gebski, C. P., Leary, E. T., Warnick, G. R., & Ollington, J. F. (1995). Accurate direct determination of low-density lipoprotein cholesterol using an immunoseparation reagent and enzymatic cholesterol assay. *Archives of Pathology & Laboratory Medicine, 119*(12), 1127-1135.

Pöge, U., Gerhardt, T., Palmedo, H., Klehr, H. U., Sauerbruch, T., & Woitas, R. P. (2005). MDRD equations for estimation of glomerular filtration rate in renal transplant recipients. *American Journal of Transplantation, 5*(6), 1306-1311. https://doi.org/10.1111/j.1600-6143.2005.00861.x

Prakash, K., Chandran, D. S., Khadgawat, R., Jaryal, A. K., & Deepak, K. K. (2016). Waist circumference rather than body mass index is a better indicator of insulin resistance in type 2 diabetes mellitus in a North Indian population. *Indian Journal of Physiology and Pharmacology, 60*(1), 52-56.

Prapula Thejashwini, P., Madhusudhan, M. C., Sushma, T., Gulnaz, A. R., Gowda, A. C. H., Roopa, G., Pushpalatha, H. G., & Geetha, N. (2024). Evaluation of phytochemical composition and *in vitro* assessment of antioxidant and antimicrobial activities of various medicinal plant extracts. *Journal of Pharmacognosy and Phytochemistry, 13*(3), 37-45. https://doi.org/10.22271/phyto.2024.v13.i3a.14942

Prasad, D., Kabir, Z., Suganthy, J., Dash, A., & Das, B. (2013). Appropriate anthropometric indices to identify cardiometabolic risk in South Asians. *WHO South-East Asia Journal of Public Health, 2*(3-4), 142-148. https://doi.org/10.4103/2224-3151.206760

Prem, J. J. D., Kannappan, A., & Jaffer, A. (2025). Prevalence of complementary and alternative medicine use in patients with type 2 diabetes in Tamil Nadu. *Global Journal of Public Health Medicine, 7*(1), 276-288.

Price, C. P., Trull, A. K., Berry, D., & Gorman, E. G. (1987). Development and validation of a particle-enhanced turbidimetric immunoassay for C-reactive protein. *Journal of Immunological Methods, 99*(2), 205-211. https://doi.org/10.1016/0022-1759(87)90129-3

Priya, S. K., Thamizhiniyan, V., & Subramanian, S. (2013). Antidiabetic potential of *Ficus bengalensis* fruit extract studied in alloxan-induced experimental diabetes in rats. *Research Journal of Pharmacology and Pharmacodynamics, 5*(2), 110-118.

Radhakrishnan, M., & Nagaraja, S. B. (2023). Modified Kuppuswamy socioeconomic scale 2023: Stratification and updates. *International Journal of Community Medicine and Public Health, 10*(11), 4415-4418. https://doi.org/10.18203/2394-6040.ijcmph20233487

Radwan, H., Hasan, H., Hamadeh, R., Hashim, M., Abdulwahid, Z., Gerashi, M. H., Al Hilali, M., & Naja, F. (2020). Complementary and alternative medicine use among patients with type 2 diabetes living in the United Arab Emirates. *BMC Complementary Medicine and Therapies, 20*(1), Article 260. https://doi.org/10.1186/s12906-020-03011-5

Rageeb, M. D., Usman, M. D., & Bhat, N. G. (2023). Evaluation of antidiabetic activity of *Withania coagulans* L. Dunal. *International Journal of Pharmaceutical Sciences and Research, 14*(2), 981-987. https://doi.org/10.13040/ijpsr.0975-8232.14(2).981-87

Raheel, R., Saddiqe, Z., Iram, M., & Afzal, S. (2017). *In vitro* antimitotic, antiproliferative, and antioxidant activity of stem bark extracts of *Ficus benghalensis* L. *South African Journal of Botany, 111*, 248-257. https://doi.org/10.1016/j.sajb.2017.03.037

Rahman, A. H. M. M., & Khanom, A. (2013). A taxonomic and ethnomedicinal study of species from Moraceae (mulberry) family in Bangladesh flora. *Research in Plant Sciences, 1*(3), 53-57. https://doi.org/10.12691/plant-1-3-1

Rains, J. L., & Jain, S. K. (2011). Oxidative stress, insulin signaling, and diabetes. *Free Radical Biology and Medicine, 50*(5), 567-575. https://doi.org/10.1016/j.freeradbiomed.2010.12.006

Ranasinghe, P., Wathurapatha, W. S., Ishara, M. H., Jayawardana, R., Galappatthy, P., Katulanda, P., & Constantine, G. R. (2015). Effects of zinc supplementation on serum

lipids: A systematic review and meta-analysis. *Nutrition & Metabolism, 12*, Article 23. https://doi.org/10.1186/s12986-015-0023-4

Rani, K. (2017). Role of antioxidants in prevention of diseases. *Journal of Applied Biotechnology & Bioengineering, 4*(1). https://doi.org/10.15406/jabb.2017.04.00091

Rauf, A., Almasoud, N., Ibrahim, M., Alomar, T. S., Khalil, A. A., Khursheed, T., Khan, M. U., Jan, M. S., Bhardwaj, K., Iriti, M., & Sharma, R. (2024). Anti-diabetic, anti-cholinesterase, and anti-inflammatory potential of plant-derived extracts and column semi-purified fractions of *Ficus benghalensis*. *Frontiers in Bioscience - Landmark, 29*(5), Article 183. https://doi.org/10.31083/j.fbl2905183

Rawat, D. S., & Kharwal, A. D. (2021). Quantitative ethnobotany of different *Ficus* species in Shivalik Hills, Himachal Pradesh (India). *International Journal of Botany Studies, 6*(6), 1214-1216.

Rehman, W., Aziz, F., & Abubakar, U. (2025). Use of complementary and alternative medicine among type 2 diabetes mellitus patients in South Asia: A systematic literature review. *Tropical Journal of Natural Product Research, 9*(7), 3150-3161.

Richter, E., Geetha, T., Burnett, D., Broderick, T. L., & Babu, J. R. (2023). The effects of *Momordica charantia* on type 2 diabetes mellitus and Alzheimer's disease. *International Journal of Molecular Sciences, 24*(5), Article 4643. https://doi.org/10.3390/ijms24054643

Rifai, N., & King, M. E. (1986). Immunoturbidimetric assays of apolipoproteins A, AI, AII, and B in serum. *Clinical Chemistry, 32*(6), 957-961. https://doi.org/10.1093/clinchem/32.6.957

Robinson, G. A., Peng, J., Peckham, H., Radziszewska, A., Butler, G., Pineda-Torra, I., Jury, E. C., & Ciurtin, C. (2021). Sex hormones drive changes in lipoprotein metabolism. *IScience, 24*(11), Article 103257. https://doi.org/10.1016/j.isci.2021.103257

Roeschlau, P., Bernt, E., & Gruber, W. (1974). Enzymatic determination of total cholesterol in serum. *Zeitschrift für Klinische Chemie und Klinische Biochemie, 12*(5), 226-230.

Sabi, E. M., Mujamammi, A. H., Althafar, Z. M., Al-Shouli, S. T., Dahman, L. S. B., & Sumaily, K. M. (2022). Protective effects of *Ficus benghalensis* in streptozotocin-induced diabetic zebrafish (*Danio rerio*) model. *Indian Journal of Pharmaceutical Education and Research, 56*(3), 822-829. https://doi.org/10.5530/ijper.56.3.134

Sabi, E. M., Mujamammi, A. H., Sumaily, K. M., Dahman, L. S. B., & Althafar, Z. M. (2022). Anti-inflammatory and anti-hyperuricemic effect of *Ficus benghalensis* bark extract in

RAW 264.7 cell line. *Indian Journal of Pharmaceutical Education and Research, 56*(2), 520-528. https://doi.org/10.5530/ijper.56.2.74

Saggar, S., Mir, P. A., Kumar, N., Chawla, A., Uppal, J., Shilpa, & Kaur, A. (2022). Traditional and herbal medicines: Opportunities and challenges. *Pharmacognosy Research, 14*(2), 107-114. https://doi.org/10.5530/pres.14.2.15

Sahakyan, G., Vejux, A., & Sahakyan, N. (2022). The role of oxidative stress-mediated inflammation in the development of T2DM-induced diabetic nephropathy: Possible preventive action of tannins and other oligomeric polyphenols. *Molecules, 27*(24), Article 9035. https://doi.org/10.3390/molecules27249035

Sahu, A. K., Dinesh, D., Verma, V. K., Prajapati, V., Bhatia, J., & Arya, D. S. (2024). Therapeutic potential of *Ficus benghalensis* in thromboembolic disorders. *Journal of Ayurveda and Integrative Medicine, 15*(4), Article 100929. https://doi.org/10.1016/j.jaim.2024.100929

Saifi, A., Gupta, M. K., Mohan, R., Singh, B., Alam, S., & Patel, N. M. (2024). Comparative study of antidiabetic activity of stem bark of *Ficus benghalensis* Linn. collected from different geographical regions on alloxan-induced diabetic rats. *Journal of Pharmaceutical Analysis, 14*(1), 60-67.

Saifi, A., Namdeo, K. P., Chauhan, R., & Dwivedi, J. (2014). Standardization and evaluation for antidiabetic activity of *Ficus benghalensis* Linn. stem bark. *Indo American Journal of Pharmaceutical Research, 4*(4), 1960-1967.

Saleem, S. M., & Jan, S. S. (2021). Modified Kuppuswamy socioeconomic scale updated for the year 2021. *Indian Journal of Forensic and Community Medicine, 8*(1), 1-3. https://doi.org/10.18231/j.ijfcm.2021.001

Santos, L. R. dos, Melo, S. R. de S., Severo, J. S., Morais, J. B. S., Beserra, J. B., Fontenelle, L. C., Oliveira, A. R. S. de, Cruz, K. J. C., Sousa, M. de P., Oliveira, F. E. de, Sousa, G. S. de, Henriques, G. S., & Marreiro, D. do N. (2021). Magnesium parameters and their association with lipid metabolism markers in obese women. *Revista Chilena de Nutrición, 48*(1), 80-88. https://doi.org/10.4067/S0717-75182021000100080

Saraswathi, S., Senthamarai, R., & Sundari, S. K. K. (2013). Antidiabetic activity of leaf extract of *Ficus benghalensis* Linn. on alloxan-induced diabetic rats. *International Journal of Pharmacology & Biological Sciences, 7*(3), 47-51.

Sasmita, P. C., Yonata, A., & Larasati, T. (2022). Role of dietary potassium in prevention of insulin resistance. *Medical Profession Journal of Lampung, 11*(4), 357-361. https://doi.org/10.53089/medula.v11i4.299

Satish, A., Punith Kumar, R., Rakshith, D., Satish, S., & Ahmed, F. (2013). Antimutagenic and antioxidant activity of *Ficus benghalensis* stem bark and *Moringa oleifera* root extract. *International Journal of Chemical and Analytical Science, 4*(2), 45-48.

Seo, H., Park, S. J., & Song, M. (2025). Diabetic retinopathy: Mechanisms, current therapies, and emerging strategies. *Cells, 14*(5), Article 376. https://doi.org/10.3390/cells14050376

Shafras, M., Sabaragamuwa, R., & Suwair, M. (2024). Role of dietary antioxidants in diabetes: An overview. *Food Chemistry Advances, 4*, Article 100666. https://doi.org/10.1016/j.focha.2024.100666

Shah, A., Marwat, S. K., Gohar, F., Khan, A., Bhatti, K. H., Amin, M., Din, N. U., Ahmad, M., & Zafar, M. (2013). Ethnobotanical study of medicinal plants of semi-tribal area of Makerwal and Gulla Khel (lying between Khyber Pakhtunkhwa and Punjab Provinces), Pakistan. *American Journal of Plant Sciences, 4*(1), 98-116. https://doi.org/10.4236/ajps.2013.41015

Sharma, M., Gaidhane, A., & Choudhari, S. G. (2024). A comprehensive review on trends and patterns of non-communicable disease risk factors in India. *Cureus, 16*(3), Article e57027. https://doi.org/10.7759/cureus.57027

Sharma, R., Amin, H., & Prajapati, P. K. (2015). Antidiabetic claims of *Tinospora cordifolia* (Willd.) Miers: Critical appraisal and role in therapy. *Asian Pacific Journal of Tropical Biomedicine, 5*(1), 68-78.

Sharma, S., Chaturvedi, M., Edwin, E., Shukla, S., & Sagrawat, H. (2007). Evaluation of the phytochemicals and antidiabetic activity of *Ficus bengalensis*. *International Journal of Diabetes in Developing Countries, 27*(2), 56-59. https://doi.org/10.4103/0973-3930.37036

Shete, A., Shete, A. A., Dube, S. P., & Dubewar, A. P. (2020). Sample size calculation in biostatistics with special reference to unknown population. *International Journal for Innovative Research in Multidisciplinary Field, 6*(7), 236-238.

Shim, K. H., Sharma, N., & An, S. S. A. (2022). Mechanistic insights into the neuroprotective potential of sacred *Ficus* trees. *Nutrients, 14*(22), Article 4731. https://doi.org/10.3390/nu14224731

Shrilatha, K., Moorthy, J., Harini, R. R., Kaaviya, A. A., Sabarathinam, S., & Kumar, S. M. (2019). Prevalence and pattern of use of complementary and alternative medicine in diabetes patients in a South Indian tertiary care teaching hospital. *Drug Invention Today, 11*(2), 274-279.

Shukla, R., Anand, K., Prabhu, K. M., & Murthy, P. S. (1994). Hypoglycaemic effect of the water extract of *Ficus bengalensis* in alloxan-recovered, mildly diabetic and severely diabetic rabbits. *International Journal of Diabetes in Developing Countries, 14*, 78-81.

Shukla, R., Anand, K., Prabhu, K. M., & Murthy, P. S. (1995). Hypolipidemic effect of water extract of *Ficus bengalensis* in alloxan-induced diabetes mellitus in rabbits. *Indian Journal of Clinical Biochemistry, 10*(2), 119-121. https://doi.org/10.1007/bf02871016

Shukla, R., Gupta, S., Gambhir, J. K., Prabhu, K. M., & Murthy, P. S. (2004). Antioxidant effect of aqueous extract of the bark of *Ficus bengalensis* in hypercholesterolaemic rabbits. *Journal of Ethnopharmacology, 92*(1), 47-51. https://doi.org/10.1016/j.jep.2004.01.020

Shuvo, S. D., Hossen, M. T., Riazuddin, M., Hossain, M. S., Mazumdar, S., Parvin, R., & Elahi, M. T. (2023). Prevalence of comorbidities and associated factors among type 2 diabetes patients: A hospital-based study in Jashore District, Bangladesh. *BMJ Open, 13*(9), e076261. https://doi.org/10.1136/bmjopen-2023-076261

Siam, N. H., Snigdha, N. N., Tabasumma, N., & Parvin, I. (2024). Diabetes mellitus and cardiovascular disease: Exploring epidemiology, pathophysiology, and treatment strategies. *Reviews in Cardiovascular Medicine, 25*(12), Article 436. https://doi.org/10.31083/j.rcm2512436

Sidana, S., Singh, V. B., Meena, B. L., Beniwal, S., Singh, K., Kumar, D., & Singla, R. (2017). Effect of *Syzygium cumini* (jamun) seed powder on glycemic control: A double-blind randomized controlled trial. *Journal of Medical Society, 31*(3), 185-189. https://doi.org/10.4103/jms.jms_62_16

Siedel, J., Hagele, E. O., Ziegenhorn, J., & Wahlefeld, A. W. (1983). Reagent for the enzymatic determination of serum total cholesterol with improved lipolytic efficiency. *Clinical Chemistry, 29*(6), 1075-1080. https://doi.org/10.1093/clinchem/29.6.1075

Siedel, J., Schiefer, S., Rosseneu, M., Bergeaud, R., De Keersgieter, W., Pautz, B., Vinaimont, N., & Ziegenhorn, J. (1988). Immunoturbidimetric method for routine determinations of apolipoproteins A-I, A-II, and B in normo- and hyperlipemic sera compared with immunonephelometry. *Clinical Chemistry, 34*(9), 1821-1825. https://doi.org/10.1093/clinchem/34.9.1816

Singh, A. B., Yadav, D. K., Maurya, R., & Srivastava, A. K. (2009). Antihyperglycaemic activity of α-amyrin acetate in rats and db/db mice. *Natural Product Research, 23*(9), 876-882. https://doi.org/10.1080/14786410802420416

Singh, A., & Sharma, V. K. (2024). Phytochemical screening and pharmacological activities of *Ficus benghalensis* Linn. bark. *International Journal of Pharmaceutical Sciences, 2*(7), 809-811. https://doi.org/10.5281/zenodo.12736831

Singh, A., Singh, M. K., & Singh, R. (2013). Traditional medicinal flora of the district Buxar (Bihar, India). *Journal of Pharmacognosy and Phytochemistry, 2*(2), 41-49.

Singh, M., Mukhtar, H. M., & Vashishth, D. (2012). Standardization of stem bark of *Ficus bengalensis*. *International Journal of Research in Pharmacy and Chemistry, 2*(3), 790-793.

Singh, P., Dhankhar, J., Kapoor, R. K., Kumar, D., Bhatia, S., Al-Harrasi, A., & Sharma, A. (2023). *Ficus benghalensis*: A comprehensive review on pharmacological research, nanotechnological applications, and patents. *Journal of Applied Pharmaceutical Science, 13*(10), 59-82. https://doi.org/10.7324/japs.2023.134426

Singh, R. K., Mehta, S., Jaiswal, D., Rai, P. K., & Watal, G. (2009). Antidiabetic effect of *Ficus bengalensis* aerial roots in experimental animals. *Journal of Ethnopharmacology, 123*(1), 110-114. https://doi.org/10.1016/j.jep.2009.02.017

Singh, S. P., & Verma, N. K. (2019). Evaluation of the antioxidant activity of *Ficus benghalensis* bark extracts. *International Journal of Pharmacy and Biological Sciences, 9*(2), 62-69. https://doi.org/10.21276/ijpbs.2019.9.2.62

Sinha, S. K., & Nicholas, S. B. (2023). Pathomechanisms of diabetic kidney disease. *Journal of Clinical Medicine, 12*(23), Article 7349. https://doi.org/10.3390/jcm12237349

Sinoriya, P., Kaushik, R., Sinoria, A., & Gaur, P. K. (2024). Comprehensive review on *Withania coagulans* Dunal: Unveiling pharmacognosy, phytochemistry, and pharmacological potentials. *Pharmacognosy Reviews, 18*(35), 47-59. https://doi.org/10.5530/phrev.2024.18.5

Solaiman, A. S., Alsaleem, M. A., & Alsaleem, S. A. (2020). Prevalence and patterns of complementary and alternative medicine practices among type 2 diabetics. *World Family Medicine Journal / Middle East Journal of Family Medicine, 18*(2), 12-19. https://doi.org/10.5742/mewfm.2020.93755

Song, Q., Song, L., Liu, H., Tan, H., Yang, B., Fan, C., & Liu, L. (2024). Association of magnesium intake with predicted atherosclerotic lesions and cardiovascular risk in young adults based on PDAY score: A cross-sectional study. *BMC Public Health, 24*, Article 20785. https://doi.org/10.1186/s12889-024-20785-2

Soto-Vega, E., Pérez-Zepeda, M. F., Lome-Gutiérrez, E., Cabrera-Martínez, C. M., Gómez-Gómez, S., Duno-Caldera, S., & Soto Vega, E. (2023). Internet health information on

patients' decision-making: Implications, opportunities and challenges. *Medical Research Archives, 11*(7). https://doi.org/10.18103/mra

Sreeramulu, N., Suthari, S., Ragan, A., & Raju, V. S. (2013). Ethnobotanical medicine for common human ailments in Nalgonda and Warangal districts of Telangana, India. *Annals of Plant Sciences, 2*(7), 220-229.

Stalin, C., Gunasekaran, V., & Jayabalan, G. (2016). Evaluation of neuroprotective effect of *Ficus benghalensis* against alloxan-induced diabetic neuropathy in rats. *International Journal of Pharmacology, Phytochemistry and Ethnomedicine, 4*, 52-60. https://doi.org/10.18052/www.scipress.com/ijppe.4.52

Sultana, S., Ali, M., & Mir, S. R. (2018). Chemical constituents from the aerial roots of *Ficus benghalensis* L., leaves of *Nyctanthes arbor-tristis* L., and roots of *Verbesina encelioides* (Cav.) Benth. & Hook. f. *UK Journal of Pharmaceutical and Biosciences, 6*(6), 16-26. https://doi.org/10.20510/ukjpb/6/i6/179229

Sun, J., Wang, Y., Zhang, X., Zhu, S., & He, H. (2020). Prevalence of peripheral neuropathy in patients with diabetes: A systematic review and meta-analysis. *Primary Care Diabetes, 14*(5), 435-444. https://doi.org/10.1016/j.pcd.2019.12.005

Tabassum, R., Ruotsalainen, S., Ottensmann, L., Gerl, M. J., Klose, C., Tukiainen, T., Pirinen, M., Simons, K., Widén, E., & Ripatti, S. (2022). Lipidome- and genome-wide study to understand sex differences in circulatory lipids. *Journal of the American Heart Association, 11*(19), e027103. https://doi.org/10.1161/jaha.122.027103

Tadhani, M. B., Patel, V. H., & Subhash, R. (2007). *In vitro* antioxidant activities of *Stevia rebaudiana* leaves and callus. *Journal of Food Composition and Analysis, 20*(3-4), 323-329. https://doi.org/10.1016/j.jfca.2006.08.004

Tahir, M. M., Rasul, A., Riaz, A., Batool, R., Nageen, B., Adnan, M., Sarfraz, I., Sadiqa, A., & Selamoglu, Z. (2023). *Ficus benghalensis*: A plant with potential pharmacological properties from tradition to pharmacy. *Tropical Journal of Pharmaceutical Research, 22*(11), 2407-2413. https://doi.org/10.4314/tjpr.v22i11.22

Taur, D. J., Patil, R. Y., & Nirmal, S. A. (2009). Pharmacognostic and preliminary phytochemical investigation on *Ficus benghalensis* L. bark. *Pharmacologyonline, 3*, 19-23.

Teo, Z. L., Tham, Y. C., Yu, M., Chee, M. L., Rim, T. H., Cheung, N., Bikbov, M. M., Wang, Y. X., Tang, Y., Lu, Y., Wong, I. Y., Ting, D. S. W., Tan, G. S. W., Jonas, J. B., Sabanayagam, C., Wong, T. Y., & Cheng, C. Y. (2021). Global prevalence of diabetic retinopathy and projection of burden through 2045: A systematic review and meta-

analysis. *Ophthalmology, 128*(11), 1580-1591. https://doi.org/10.1016/j.ophtha.2021.04.027

Thamburaj, S., Rajagopal, V., Palanivel, R., & Pugazhendhi, S. (2022). Effect of different drying treatments on total polyphenolics content and *in vitro* biological properties of *Ficus benghalensis* fruit: A comparative study. *Biocatalysis and Agricultural Biotechnology, 39*, Article 102249. https://doi.org/10.1016/j.bcab.2021.102249

Tharini, P., Sivaraj, C., Arumugam, P., & Manimaran, A. (2018). Antioxidant activities and GC–MS analysis of fruits of *Ficus benghalensis* L. *Journal of Pharmacognosy and Phytochemistry, 7*(4), 518-523.

Trease, G. E., & Evans, W. C. (2002). *Pharmacognosy* (15th ed.). Harcourt Publishers Limited.

Tripathi, I. P., Pandey, P., Chaudhary, P., Mishra, M. K., & Pathak, V. (2019). Quantitative screening of phytochemicals of different parts of *Ficus benghalensis* Linn. *International Journal of Advanced Scientific Research and Management, 5*, 160-166.

Tsokkou, S., Tzintros, S. T., Konstantinidis, I., Keramas, A., Georgaki, M. N., Stamoula, E., & Matsas, A. (2025). Assessment of environmental risk factors for gestational diabetes mellitus: A ten-year systematic review and meta-analysis. *Journal of Clinical Medicine, 14*(5), Article 1646. https://doi.org/10.3390/jcm14051646

Tu, Q. M., Jin, H. M., & Yang, X. H. (2025). Lipid abnormality in diabetic kidney disease and potential treatment advancements. *Frontiers in Endocrinology, 16*, Article 1503711. https://doi.org/10.3389/fendo.2025.1503711

United Nations Department of Economic and Social Affairs. (2025). *The sustainable development goals report 2025*. United Nations.

United Nations Department of Economic and Social Affairs. (n.d.). *Sustainable Development Goal 3: Ensure healthy lives and promote well-being for all at all ages*. Retrieved December 22, 2025, from https://sdgs.un.org/goals/goal3

Unnikrishnan, N., Mathappan, R., Somanath, M., & Sheela, D. (2012). Preliminary phytochemical analysis of bark of *Ficus bengalensis* Linn. and antibacterial activity of its bark oil. *Research Journal of Pharmaceutical, Biological and Chemical Sciences, 3*(2), 388-392.

Varanasi, S., & Narayana, A. (2007). Medico-historical review of Nyagrōdha (*Ficus bengalensis* Linn.). *Journal of Indian Medical Heritage, 37*(2), 167-178.

Ved, D. K., Sureshchandra, S. T., Barve, V., Srinivas, V., Sangeetha, S., Ravikumar, K., Kartikeyan, R., Kulkarni, V., Kumar, A. S., Venugopal, S. N., Somashekhar, B. S., Sumanth, M. V., Begum, N., Rani, S., Surekha, K. V., & Desale, N. (2016). *Plant details*

for Ficus bengalensis L. FRLHT's ENVIS Centre on Medicinal Plants. https://envis.frlht.org/plantdetails/969/3beb23fa20c693ad795c5475572a4d65

Verma, V. K., Sehgal, N., & Prakash, O. (2015). Characterization and screening of bioactive compounds in the extract prepared from aerial roots of *Ficus benghalensis*. *International Journal of Pharmaceutical Sciences and Research, 6*(12), 5056-5069. https://doi.org/10.13040/ijpsr.0975-8232.6(12).5056-69

Vidya, K. R., & Lohit, K. (2019). Complementary and alternative medicine use by diabetic patients in rural Bengaluru. *International Journal of Community Medicine and Public Health, 6*(11), 4863-4866. https://doi.org/10.18203/2394-6040.ijcmph20195069

Villa-Caballero, L., Morello, C. M., Chynoweth, M. E., Prieto-Rosinol, A., Polonsky, W. H., Palinkas, L. A., & Edelman, S. V. (2010). Ethnic differences in complementary and alternative medicine use among patients with diabetes. *Complementary Therapies in Medicine, 18*(6), 241-248. https://doi.org/10.1016/j.ctim.2010.09.007

Vishnu, N., Mini, G. K., & Thankappan, K. R. (2017). Complementary and alternative medicine use by diabetes patients in Kerala, India. *Global Health, Epidemiology and Genomics, 2*, Article e6. https://doi.org/10.1017/gheg.2017.6

Waddell, I. S., & Orfila, C. (2023). Dietary fiber in the prevention of obesity and obesity-related chronic diseases: From epidemiological evidence to potential molecular mechanisms. *Critical Reviews in Food Science and Nutrition, 63*(27), 8752-8767. https://doi.org/10.1080/10408398.2022.2061909

Walia, P., Kumari, R., & Singh, M. (2023). Prevalence, pattern, and predictors of ever use of complementary and alternative medicine in diabetes and hypertension: A cross-sectional study. *Indian Journal of Community Medicine, 48*(4), 627-632. https://doi.org/10.4103/ijcm.ijcm_657_22

Walldius, G., de Faire, U., Alfredsson, L., Leander, K., Westerholm, P., Malmström, H., Ivert, T., & Hammar, N. (2021). Long-term risk of a major cardiovascular event by apoB, apoA-1, and the apoB/apoA-1 ratio- Experience from the Swedish AMORIS cohort: A cohort study. *PLOS Medicine, 18*(12), e1003853. https://doi.org/10.1371/journal.pmed.1003853

Wan, S., Luo, J., Zhu, Y., An, P., Luo, Y., & Xing, Q. (2024). The effect of antioxidant polyphenol supplementation on cardiometabolic risk factors: A systematic review and meta-analysis. *Nutrients, 16*(23), Article 4206. https://doi.org/10.3390/nu16234206

Wang, L., Yan, N., Zhang, M., Pan, R., Dang, Y., & Niu, Y. (2022). The association between blood glucose levels and lipids or lipid ratios in type 2 diabetes patients: A cross-sectional

study. *Frontiers in Endocrinology, 13*, Article 969080. https://doi.org/10.3389/fendo.2022.969080

Weaver, C. M. (2013). Potassium and health. *Advances in Nutrition, 4*(3), 368S-377S. https://doi.org/10.3945/an.112.003533

Wiebe, D. A., & Bernert, J. T. (1984). Influence of incomplete cholesteryl ester hydrolysis on enzymic measurements of cholesterol. *Clinical Chemistry, 30*(3), 352-356. https://doi.org/10.1093/clinchem/30.3.352

Willcox, M. L., Elugbaju, C., Al-Anbaki, M., Lown, M., & Graz, B. (2021). Effectiveness of medicinal plants for glycaemic control in type 2 diabetes: An overview of meta-analyses of clinical trials. *Frontiers in Pharmacology, 12*, 1-13. https://doi.org/10.3389/fphar.2021.777561

Wong, S. K. (2022). A review of current evidence on the relationship between phosphate metabolism and metabolic syndrome. *Nutrients, 14*(21), Article 4525. https://doi.org/10.3390/nu14214525

World Flora Online. (2025). *Ficus benghalensis* L. Published on the Internet. https://www.worldfloraonline.org/taxon/wfo-0000687501

World Health Organization Regional Office for the Western Pacific. (2000). *The Asia-Pacific perspective: Redefining obesity and its treatment*. https://iris.who.int/handle/10665/206936

World Health Organization. (2006). *Guidelines for the prevention, management and care of diabetes mellitus* (O. M. N. Khatib, Ed.). EMRO Technical Publications Series No. 32.

World Health Organization. (2008). *Waist circumference and waist-hip ratio: Report of a WHO expert consultation*. https://www.who.int/publications/i/item/9789241501491

World Health Organization. (2015). *Guideline: Sugars intake for adults and children*. https://www.who.int/publications/i/item/9789241549028

World Health Organization. (2019). *WHO global report on traditional and complementary medicine 2019*. https://www.who.int/publications/i/item/978924151536

World Health Organization. (2022). *Noncommunicable diseases progress monitor 2022*. https://www.who.int/publications/i/item/9789240047761

World Health Organization. (2024a). *Diabetes*. https://www.who.int/news-room/fact-sheets/detail/diabetes

World Health Organization. (2024b, December 23). *Noncommunicable diseases*. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

World Health Organization. (2025a). *Global health estimates: Leading causes of death-Cause-specific mortality, 2000-2021*. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death

World Health Organization. (2025b). *Global traditional medicine strategy 2025-2034*. https://www.who.int/publications/i/item/9789240113176

Xu, J., Xue, Y., Chen, Q., Han, X., Cai, M., Tian, J., Jin, S., & Lu, H. (2022). Identifying distinct risk thresholds of glycated hemoglobin and systolic blood pressure for rapid albuminuria progression in type 2 diabetes from NHANES (1999-2018). *Frontiers in Medicine, 9*, Article 928825. https://doi.org/10.3389/fmed.2022.928825

Xu, Y. C., Zheng, H., Hogstrand, C., Tan, X. Y., Zhao, T., Song, Y. F., Wei, X. L., Wu, L. X., & Luo, Z. (2023). Novel mechanism for zinc inducing hepatic lipolysis via the HDAC3-mediated deacetylation of β-catenin at lysine 311. *The Journal of Nutritional Biochemistry, 121*, Article 109429. https://doi.org/10.1016/j.jnutbio.2023.109429

Yadav, P., Dubey, V., Diwakar, A., & Tiwari, M. (2021). Anti-ulcer activity of *Ficus benghalensis* Linn. stem bark ethanolic extract in rats. *International Journal of Science and Research, 10*(11), 626-629. https://doi.org/10.21275/SR211110213359

Yanai, H., Hirowatari, Y., & Yoshida, H. (2019). Diabetic dyslipidemia: Evaluation and mechanism. *Global Health & Medicine, 1*(1), 30-35. https://doi.org/10.35772/ghm.2019.01007

Yang, C., Liu, Z., Zhang, L., & Gao, J. (2024). The association between blood glucose levels and lipids in the general adult population: Results from NHANES (2005–2016). *Journal of Health, Population and Nutrition, 43*(1), Article 12. https://doi.org/10.1186/s41043-024-00660-x

Yang, Y., Zhao, B., Wang, Y., Lan, H., Liu, X., Hu, Y., & Cao, P. (2025). Diabetic neuropathy: Cutting-edge research and future directions. *Signal Transduction and Targeted Therapy, 10*(1), Article 36. https://doi.org/10.1038/s41392-025-02175-1

Yeh, G. Y., Eisenberg, D. M., Kaptchuk, T. J., & Phillips, R. S. (2003). Systematic review of herbs and dietary supplements for glycemic control in diabetes. *Diabetes Care, 26*(4), 1277-1294. https://doi.org/10.2337/diacare.26.4.1277

Yeh, G. Y., Eisenberg, D. M., Davis, R. B., & Phillips, R. S. (2002). Use of complementary and alternative medicine among persons with diabetes mellitus: Results of a national survey. *American Journal of Public Health, 92*(10), 1648-1652. https://doi.org/10.2105/AJPH.92.10.1648

Yim, J., Son, N. H., Kyong, T., Park, Y., & Kim, J. H. (2023). Muscle mass has a greater impact on serum creatinine levels in older males than in females. *Heliyon, 9*(11), e21866. https://doi.org/10.1016/j.heliyon.2023.e21866

Zhang, Z., Chen, H., Chen, L., Liang, W., Hu, T., Sun, N., Zhao, Y., & Wei, X. (2025). Association of total cholesterol to high-density lipoprotein cholesterol ratio with diabetes risk: A retrospective study of Chinese individuals. *Scientific Reports, 15*(1), Article 87277. https://doi.org/10.1038/s41598-025-87277-0

Zhao, Q., Yi, X., & Wang, Z. (2021). Meta-analysis of the relationship between abdominal obesity and diabetic kidney disease in type 2 diabetic patients. *Obesity Facts, 14*(4), 338-345. https://doi.org/10.1159/000516391

Zhishen, J., Mengcheng, T., & Jianming, W. (1999). The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. *Food Chemistry, 64*(4), 555-559. https://doi.org/10.1016/S0308-8146(98)00102-2

Zhou, D., Liu, X., Lo, K., Huang, Y., & Feng, Y. (2022). The effect of total cholesterol/high-density lipoprotein cholesterol ratio on mortality risk in the general population. *Frontiers in Endocrinology, 13*, Article 1012383. https://doi.org/10.3389/fendo.2022.1012383