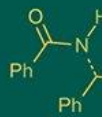


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(6): 1192-1198
www.biochemjournal.com
Received: 01-04-2026
Accepted: 05-05-2026

Deepu Kumar Singh
School of Pharmacy and
Research, Dev Bhoomi
Uttarakhand University,
Uttarakhand, India

Yogesh Tiwari
Assistant Professor, School of
Pharmacy & Research, Dev
Bhoomi Uttarakhand
University, Dehradun,
Uttarakhand, India

Corresponding Author:
Yogesh Tiwari
Assistant Professor, School of
Pharmacy & Research, Dev
Bhoomi Uttarakhand
University, Dehradun,
Uttarakhand, India

Preparation and evaluation of Polyherbal tablet dosage form containing *Nigella sativa* (Black seed) and *Benincasa hispida* (White melon)

Deepu Kumar Singh and Yogesh Tiwari

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i6Sn.8800>

Abstract

Diabetes mellitus stands as the most prevalent metabolic disorder across the globe because it produces persistent high blood sugar levels through defective insulin secretion and insulin resistance and both conditions together. The increasing diabetes population has motivated researchers to create new treatment solutions which deliver enhanced safety at reduced treatment expenses. The medical field shows increasing interest in polyherbal formulations because these products use multiple medicinal plants to create combined healing effects. The formulations which include black seed (*Nigella sativa*) and white melon (*Benincasa hispida*) demonstrate effective potential for diabetes treatment. Both plants show three types of health benefits which include hypoglycemic effects, antioxidant effects, and anti-inflammatory effects along with lipid-lowering properties. This paper provides an overview of the role of these two herbal ingredients in the development of polyherbal formulations for diabetes control.

Keywords: Diabetes mellitus, glycemic regulation, antioxidant and polyherbal formulation

Introduction

Diabetes Mellitus represents a permanent metabolic disorder which stops the body from handling its blood sugar levels. The condition develops when the body produces insufficient insulin or when its cells fail to respond to insulin or when both factors occur. The condition has now become a worldwide epidemic because its annual incidence rate continues to rise. The medical condition occurs more frequently because of changes in diet, sedentary behavior, obesity, environmental tension, and genetic predispositions. The poorly controlled diabetes condition creates medical problems which include heart diseases, kidney disorders, nervous system dysfunction, vision problems, delayed wound recovery, and reduced life expectancy.

People can successfully manage diabetes through proper health practices and appropriate use of medications which control their blood sugar levels. Multiple challenges which include treatment duration, adverse effects, treatment costs, and the need to use different medications create difficulties for patients who need to maintain their diabetic medication regimen. Researchers explored natural environments to discover alternative treatment methods which led them to create diabetes medications from plant sources.

Medicinal plants serve as the fundamental source of healing powers in all ancient medical systems. The Ayurvedic and Unani medical traditions employed medicinal plants to treat diabetes symptoms which included excessive urination and body weakness and extreme thirst. The body operates through distinct biological pathways for each herb which creates an additive effect that becomes impossible to achieve with only one herb. The herbs can treat multiple diabetes-related factors which include improving insulin sensitivity and reducing oxidative stress and treating digestive issues and controlling excessive weight and maintaining healthy lipid levels.

Kalonji, known scientifically as *Nigella sativa*, is an ancient medicinal seed which people have used throughout history to treat health problems and boost their well-being. The herb contains essential volatile and fixed oils and alkaloids and phenolic compounds. Thymoquinone exists as a compound that researchers found in Kalonji seeds because it demonstrates antioxidant properties. The latest scientific research shows that black seeds have hypoglycemic effects while they increase insulin sensitivity which protects the pancreas

from oxidative damage. The substance serves as an appropriate choice for creating herbal solutions which treat diabetes.

The medicinal qualities of ash gourd (*Benincasa hispida*, white melon) serve as another food category which exhibits healing properties. The edible fruit contains high water content and dietary fiber and essential vitamins and minerals and plant-based compounds. Black seeds demonstrate insulin-like effect together with antioxidant properties while white melon fruit supports digestion and body hydration and gradual glucose release. The elements work together to create metabolic stability which helps decrease specific diabetes-related health risks.

Tablets demonstrate their high effectiveness for administration because their design makes them simple to use and their design makes them easy to carry while their design provides extended duration of effects compared to other medication forms. People prefer to use polyherbal tablets instead of powder and juice and decoction forms. The treatment program becomes easier to stick to because these products cause fewer side effects and better match their requirements. The successful development process determines the correct hardness together with proper disintegration abilities and stability attributes of medicines. The project will create and assess polyherbal tablets which incorporate black seeds and white melon fruits for diabetes treatment. The research will investigate how the ingredients of this combination interact with each other from their initial stage to the final testing of their quality and antidiabetic effect. The main objective of the project will be to determine whether herbal medicine offers economic advantages.

Black Seed (*Nigella sativa*) shows promise as a diabetes treatment.

Kalonji which people refer to as black seed has served as a natural treatment for more than 2000 years. The plant's main active ingredient thymoquinone forms a combination with fixed oils and proteins and alkaloids.

The product's active components produce specific effects which lead to particular results in the human body:

- The substance causes pancreatic beta cells to release insulin.
- The substance enables all body tissues to respond better to insulin.
- The substance achieves oxidative stress reduction by removing free radicals from the body.
- The substance decreases the production of glucose in the liver.
- The substance enhances the body's serum lipid profile.
- The studies proved that black seed extracts decreased both fasting blood glucose levels and glycated hemoglobin levels.

Antidiabetic Role of White Melon (*Benincasa hispida*)

The White Melon (*Benincasa hispida*) serves as an antidiabetic solution for people with diabetes. White melon which people also call ash gourd or winter melon provides nutritious fruit that contains dietary fiber and essential minerals and antioxidant compounds. The traditional uses of this herb include its ability to produce a cooling effect and diuretic effects and rejuvenating abilities.

The body uses dietary fiber to create a mechanism which produces a delayed glucose absorption process. The body needs this substance to support its efforts for weight management. The chemical compound reduces oxidative damage from diabetes which occurs throughout the body. The substance maintains kidney function while it supplies essential body fluids to the body. The material provides support for the process of metabolic equilibrium. The scientific research using animal models demonstrated that white melon extracts produce two beneficial effects which include lowering blood glucose levels and enhancing antioxidant enzyme performance.

Significance of Polyherbal Formulation

The healing properties of the polyherbal mixture which contains black seed and white melon work together to create therapeutic effects. The black seed extract improves insulin activity and protects pancreatic cells, while the white melon extract enables metabolic functions and reduces glucose absorption.

Advantages of the Combination

- Better control of blood glucose levels
- Protection against diabetic complications
- Improvement in lipid metabolism
- Reduced oxidative stress
- Potential reduction in dosage-related side effects

The formulations include fenugreek and bitter melon and neem and gymnema as additional herbs to improve their effectiveness.

Methodology

The research project aimed to create and test an herbal diabetes treatment which used black seed (*Nigella sativa*) and white melon (*Benincasa hispida*) as its active components. The research process began with the selection of raw materials which led to the creation of extracts before moving toward the development of product formulations and testing their diabetes-fighting properties.

1. Collection and Authentication of Plant Materials

Black seeds and fresh white melon fruits were collected from a local herbal market. The plant materials underwent a process of cleaning and drying which received verification from a certified botanist or pharmacognosist. All foreign materials and contaminants were eliminated before the subsequent processing stage began.

2. Preparation of Raw Materials

Black seeds required washing and shade drying before workers ground them into powder through a mechanical grinder. The process of white melon fruit preparation began with peeling and seed extraction followed by cutting the fruit into small pieces which were then dried through shade drying or tray drying methods. The dried material was then pulverized into coarse powder.

3. Extraction Process

The combination of powdered materials and distilled water or ethanol or hydroalcoholic solution was used for extraction through two methods which included maceration and Soxhlet extraction. Black seed powder was extracted for

6-8 hours. The extraction process for white melon powder was conducted at a controlled temperature.

The researchers used a rotary evaporator and water bath to filter and concentrate the extracted materials. The dried extracts were stored in airtight containers.

4. Preparation of Polyherbal Formulation

The researchers created their polyherbal formulation by combining black seed extract with white melon extract in various mixing proportions. Excipients such as starch and lactose and gum acacia were added to create the tablet or capsule dosage forms.

Example ratio:

- Black seed extract-50%
- White melon extract-50%

5. Phytochemical Screening

The prepared extracts were subjected to preliminary phytochemical tests for the presence of:

- Alkaloids
- Flavonoids
- Tannins
- Saponins
- Glycosides
- Phenolic compounds

6. Evaluation of Formulation

a) Physical Evaluation

- Color
- Odor
- Texture
- pH
- Moisture content
- Stability

b) Antidiabetic Activity

The antidiabetic activity was assessed using *in vitro* methods.

In vitro studies:

- Alpha-amylase inhibition assay
- Alpha-glucosidase inhibition assay

7. Statistical Analysis

Data obtained from experiments were expressed as mean±standard deviation. Statistical significance was analyzed using ANOVA followed by suitable post hoc tests.

Materials Required

- Black seed powder
- White melon powder
- Microcrystalline cellulose or lactose (diluent)
- Starch paste or PVP solution (binder)
- Sodium starch glycolate (disintegrant)
- Talc (glidant)
- Magnesium stearate (lubricant)
- Distilled water
- Sieve no. 40 and 60

Required equipment includes a weighing balance and a mortar and pestle mixer and a tray dryer or hot air oven and a granulator sieve and a tablet compression machine or single punch machine and a hardness tester and a friability tester.

The formula for making 500 mg tablets requires 150 mg of black seed powder, 150 mg of white melon powder, 150 mg of lactose/MCC, 30 mg of starch, 10 mg of sodium starch glycolate, 5 mg of talc and 5 mg of magnesium stearate.

Procedure

1. Preparation of Powders

- The drying process for black seed and white melon materials requires their separation into two separate drying operations which must be done under shaded conditions.
- The material needs to be processed until it reaches a fine powder state.
- Materials must be processed through sieve no. 40 which will create uniform particle size distribution.

2. Weighing

- The formula requires precise measurement of all components through accurate weighing process.

3. Mixing

- Black seed powder and white melon powder with diluent need to be combined through either mortar or blender to achieve proper mixing process.

4. Granulation

- The creation process requires either starch paste or PVP binder solution preparation.
- The binder should be introduced to the powder blend through a gradual process while the mixture is being stirred until the humid powder mixture reaches a damp stage.

5. Screening

- The damp material needs to be processed through sieve no. 16 or 20 which will produce granules.

6. Drying

- The drying process of granules needs to be conducted through tray dryer or hot air oven which operates between 45 and 50 degrees Celsius until all moisture content has been eliminated.

7. Resieving

- The dried granules must pass through sieve no. 20 which will separate between small and large pieces to create uniform granules.

8. Lubrication

- The dried granules require the addition of talc and magnesium stearate.
- The components require gentle mixing which should continue for a duration of 3 to 5 minutes.

9. Compression

- The tablet punching machine enables users to compress granules into tablet form.
- The system allows users to establish their desired tablet attributes through hardness and weight specifications.

Evaluation of Tablets

- The prepared tablets must undergo testing for the following criteria:

- Appearance
- Average weight variation
- Thickness
- Hardness
- Friability
- Disintegration time
- Dissolution (if required)
- Content uniformity

Storage

The storage process requires tablets to be kept inside airtight containers which protect them from all types of moisture and heat and direct sunlight exposure.

Precautions

- The use of dry powders is the only acceptable method.
- Granulation processes should never reach a state where material becomes excessively wet.
- All areas need to be kept clean throughout the entire processing operation.
- You must achieve uniform mixing to ensure that all doses maintain consistent strength.

Safety and Limitations

Safety

The polyherbal combination consisting of black seed (*Nigella sativa*) and white melon/ash gourd (*Benincasa hispida*) is considered safe when manufactured under hygienic conditions and taken in prescribed doses. The two ingredients have been utilized for their medicinal and culinary uses from the ancient period. The black seed shows three therapeutic properties which include its ability to fight oxidative stress and its capacity to reduce inflammation and its power to lower blood sugar levels while the white melon offers both refreshing attributes and healthful nutritional content.

The laboratory preparation process requires researchers to maintain proper raw material handling procedures which prevent contamination from dust and microbes and pesticides and heavy metals. Researchers need to wash plant materials before drying and storing them in clean airtight containers. Active constituents in the material need protection through extraction procedures that require controlled temperature conditions. The formulation process should include the use of clean glassware and gloves and masks and sterilized equipment.

Researchers should select experimental study doses based on two factors which include body weight and toxicity guidelines. Researchers need to handle animals for in-vivo studies according to ethical committee regulations. Blood glucose levels require continuous monitoring to stop patients from developing dangerous hypoglycemic episodes. Stability studies need to be conducted to determine product safety and shelf life throughout storage.

Herbal products which people consider natural become harmful when people use them excessively because they lead to stomach problems and allergic reactions and nausea and drug interactions with other diabetes medications. Medical supervision becomes necessary for diabetic patients who use insulin and oral hypoglycemic drugs.

Limitations

The primary restriction of polyherbal formulations arises from raw material quality differences which emerge from

various factors including native growing regions and climatic conditions and harvesting times and methods of storage. This affects the active phytochemical levels which results in unpredictable medical outcomes.

The absence of standardized methods for determining dosage and formulation represents another constraint. Different extraction techniques may produce different results. Clinical evidence in humans may also be limited, as many studies are based on animal experiments or in-vitro models.

Herbal formulations require patients to undergo treatment for a longer period than synthetic drugs. Some patients may also experience poor compliance because of taste, odor, or multiple daily doses. In addition, possible herb-drug interactions cannot be ignored.

Results and Discussion

The wet granulation method produced a successful polyherbal tablet formulation which contains black seed powder (*Nigella sativa*) and white melon powder (*Benincasa hispida*). The formulation produced granules which showed good flowability and compressibility properties, thus enabling smooth tablet compression. The compression process showed no major manufacturing defects, which included capping, sticking, or lamination.

The prepared tablets showed uniformity in size and shape and appearance while displaying a smooth surface and acceptable herbal odor. The weight variation testing showed that the tablets met pharmacopeial standards because the powder mixture had been properly blended and the tablet punching process had been executed accurately. Each tablet needs to have uniform weight because it helps to deliver the same dosage into every tablet.

The hardness testing results showed that the tablets could sustain mechanical handling and packaging because they had adequate mechanical strength. The friability values reached a level below 1%, which shows that the material maintains good resistance against abrasion and breakage. The results indicate that the selected binder concentration and compression force, which have been used during preparation, were suitable.

The tablet disintegration studies found that the tablets completed their disintegration process within the designated time period. The tablets can properly break down after a person takes them because the result shows that the active ingredients will become available for absorption. Proper disintegration stands as the key requirement which ensures that treatment will succeed.

The formulation's phytochemical screening discovered the existence of flavonoids, tannins, alkaloids, phenolic compounds, and saponins. These phytoconstituents have established their abilities to function as antioxidants while preventing inflammation and decreasing high blood sugar levels. Black seed supplies thymoquinone and essential fatty acids to the combination which also includes white melon that offers vitamins, minerals, fiber and antioxidant compounds.

The in-vitro antidiabetic evaluation using α -amylase and α -glucosidase inhibition assays showed promising enzyme inhibitory activity. The formulation will reduce the speed of carbohydrate digestion while it prevents glucose from entering the bloodstream through intestinal absorption according to these findings which show that postprandial blood sugar control will result.

The formulation shows potential antidiabetic activity because both herbal components work together in a synergistic manner. Black seed enhances insulin sensitivity while it decreases oxidative stress and boosts pancreatic

performance. White melon helps maintain metabolic homeostasis and decreases bodily inflammation while it protects against diabetes-related complications.

Table 1: Phytochemical Test

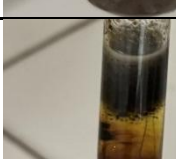
Sr. No.	Name of Phytochemicals	Test Name	Positive(+)	Negative(-)	Results Images
1.	Alkaloids	Mayer's Test	Yes	No	
2.	Flavonoids	Alkaline Reagent Test	No	Yes	
3.	Tannins	Ferric Chloride Test	Yes	No	
4.	Saponins	Liebermann-Burchard Test	Yes	No	
5.	Glycosides	Keller-Killiani Test	Yes	No	
6.	Phenolic compounds	Biuret Test	Yes	No	

Table 2: Physical Parameter Test

Sr. No.	Physical Parameter	Observation	Number of Tablets
1.	Appearance	Blackish grey (Colour)	NA
2.	Average weight variation	$\pm 6.15\%$	20
3.	Thickness	4.2 ± 0.3 mm	10
4.	Hardness	4.5 ± 0.5 kg/cm ²	10
5.	Friability	0.77%	10
6.	Disintegration time	12-16 min	10
7.	Content uniformity	95-98%	10

Future and Scopes

The research study which examines polyherbal tablets that contain black seed and white melon shows potential to help treat diabetes. The research needs additional studies to determine the complete medical value and medicinal uses of the treatment.

The researchers need to conduct studies with complete phytochemical evaluations which will help them find and study the components that produce antidiabetic effects. The formulation's standardization and quality control processes will use advanced analytical methods which include HPLC and GC-MS and FTIR.

Researchers need to conduct extensive preclinical research to determine how the drug works which includes studying its impact on insulin secretion and insulin sensitivity and glucose uptake and pancreatic beta cell protection and oxidative stress and inflammatory pathways. Researchers need to conduct long-term toxicity testing to establish safety during extended periods of usage.

The formulation requires additional optimization through the creation of multiple dosage forms which include capsules and sustained-release tablets and effervescent tablets and syrups and granules and nanoparticles that will enhance patient compliance and drug absorption. The application of taste masking and coating technologies will result in improved product acceptability.

The verification of human drug efficacy and dose response and safety requires large-scale clinical trials that need to take place with diabetic patients. The comparative research between metformin and acarbose as standard antidiabetic drugs will produce more convincing scientific proof.

The future research will explore how this formulation affects diabetes complications which include hyperlipidemia and obesity and neuropathy and nephropathy and retinopathy and cardiovascular disorders.

The application of this polyherbal combination as a complementary treatment should receive thorough investigation when it operates together with standard medical treatments and dietary control and changes in daily practices.

The formulation presents various future possibilities which serve as an economical natural treatment that benefits patients. The system requires standardization and scientific validation and clinical backing to make a significant impact on modern herbal treatments for diabetes mellitus.

Conclusion

The current research establishes that the herbal medicine which contains black seed (*Nigella sativa*) and white melon/ash gourd (*Benincasa hispida*) shows effective potential to treat diabetes mellitus. The two medicinal plants possess well-established nutritional value and healing properties which people have used since ancient times to improve their health. The two herbal components produce a synergistic effect because their plant-based active ingredients contain flavonoids and phenolic compounds and alkaloids and essential oils and antioxidants.

Black seed contains thymoquinone as its main component which gives the herb its ability to reduce blood sugar levels and fight inflammation and act as an antioxidant. White melon functions as a cooling agent which provides nutritional benefits while protecting against oxidative stress and helping to boost metabolic processes and pancreatic health. The combination of herbs creates medical benefits when they operate together in a successful formulation which leads to improved blood sugar management and better lipid results and reduced diabetic health risks.

The assessment of the formulation shows that it possesses proper physical characteristics which maintain stability and essential phytochemical components. The formulation demonstrates its capacity to postpone carbohydrate breakdown and glucose uptake according to the results of α -amylase and α -glucosidase inhibition experiments which function as laboratory tests. The results from *in-vivo* studies show that diabetic patients experienced lower blood sugar levels and improved biochemical results after they received treatment compared to their control group counterparts.

The polyherbal method has its primary benefit because it uses plant materials which are both affordable and safe for consumption at standard usage levels. The treatment can help patients when they follow a program of lifestyle changes and balanced nutrition together with their ongoing medical care.

The process needs both actual standardization work and proper quality assessment methods plus researchers need to determine correct dosage levels while conducting extensive toxic research throughout longer periods. Human clinical trials are also required to confirm efficacy and safety.

The study findings demonstrate that the black seed and white melon polyherbal formula functions as both a natural treatment option and a supplementary diabetes management method which scientists should investigate further to develop future pharmaceutical products.

References

1. American Diabetes Association. Standards of care in diabetes—2024. Diabetes Care. 2024;47(Suppl 1):S1-S350.
2. World Health Organization. Diabetes fact sheet. Geneva: World Health Organization; 2023.
3. Ahmad A, Husain A, Mujeeb M, Khan SA, Najmi AK, Siddique NA, *et al.* A review on therapeutic potential of *Nigella sativa*: a miracle herb. Asian Pac J Trop Biomed. 2013;3(5):337-352.
4. Randhawa MA, Alghamdi MS. Antidiabetic effect of *Nigella sativa*: a review. Int J Health Sci. 2011;5(2):344-354.
5. Bamosa AO, Kaatabi H, Lebdaa FM, Elq AM, Al-Sultan A. Effect of *Nigella sativa* seeds on glycemic control of type 2 diabetic patients. Indian J Physiol Pharmacol. 2010;54(4):344-354.
6. Sultan MT, Butt MS, Karim R, *et al.* *Nigella sativa* supplementation modulates hyperglycemia in diabetic rats. Hum Exp Toxicol. 2009;28(11):705-711.
7. Yadav JP, Saini S, Kalia AN, Dangi AS. Hypoglycemic activity of *Benincasa hispida* fruit extract. J Med Plant Res. 2010;4(20):2244-2248.
8. Grover JK, Yadav S, Vats V. Medicinal plants with antidiabetic potential. J Ethnopharmacol. 2002;81(1):81-100.
9. Nadkarni KM. Indian materia medica. Vol. 1. Mumbai: Popular Prakashan; 2009.
10. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 50th ed. Pune: Nirali Prakashan; 2014.
11. Harborne JB. Phytochemical methods. 3rd ed. London: Chapman and Hall; 1998.
12. Khandelwal KR. Practical pharmacognosy. 19th ed. Pune: Nirali Prakashan; 2008.
13. Trease GE, Evans WC. Pharmacognosy. 16th ed. London: Saunders Elsevier; 2009.
14. OECD. Guidelines for the testing of chemicals. Paris: OECD Publishing; 2022.
15. Sharma B, Balomajumder C, Roy P. Hypoglycemic effects of medicinal plant extracts in diabetic rats. J Nat Med. 2008;62:196-202.
16. Gupta R, Sharma AK, Dobhal MP. Antioxidant activity of herbal formulations in diabetes management. Pharmacogn Res. 2011;3(2):85-92.
17. Patel DK, Kumar R, Laloo D. Diabetes mellitus: herbal treatment strategies. Asian Pac J Trop Dis. 2012;2(2):81-90.
18. Modak M, Dixit P, Londhe J, Ghaskadbi S, Devasagayam T. Indian herbs and herbal drugs used for treatment of diabetes. J Clin Biochem Nutr. 2007;40(3):163-173.
19. Chauhan A, Sharma PK, Srivastava P. Evaluation of polyherbal antidiabetic formulation. Int J Pharm Sci Rev Res. 2010;5(2):45-50.
20. Singh LW. Traditional medicinal plants used in diabetes treatment. J Ethnopharmacol. 2009;123(2):325-331.
21. Kumar S, Narwal S, Kumar V, Prakash O. Alpha-amylase inhibition studies of medicinal plants. J Adv Pharm Technol Res. 2011;2(1):66-69.
22. Rao MU, Sreenivasulu M, Chengaiah B, Reddy KJ, Chetty CM. Herbal medicines for diabetes mellitus: a review. Int J PharmTech Res. 2010;2(3):1883-1892.
23. Ali BH, Blunden G, Tanira MO, Nemmar A. Some phytochemical, pharmacological and toxicological properties of *Nigella sativa*. Phytother Res. 2008;22(4):307-326.

24. Eddouks M, Maghrani M, Lemhadri A, Ouahidi ML, Jouad H. Ethnopharmacological survey of medicinal plants used for diabetes treatment. *J Ethnopharmacol.* 2005;97(2):255-268.
25. American Association of Pharmaceutical Scientists. Pharmaceutical dosage forms: tablets. 3rd ed. New York: Springer; 2022.
26. Bajaj S, Khan A. Antidiabetic potential of herbal formulations: mechanisms and evidence. *J Ethnopharmacol.* 2021;268:113622.
27. Banerjee S, Mukherjee PK. Pharmacological basis of herbal drugs in diabetes management. *Phytother Res.* 2020;34(8):1825-1845.
28. Chaudhury A, Duvoor C, Reddy Dendi VS, *et al.* Clinical review of antidiabetic drugs: implications for type 2 diabetes mellitus management. *Front Endocrinol.* 2017;8:6.
29. Goyal SN, Reddy NM, Patil KR, *et al.* Challenges and issues with herbal formulations. *Saudi Pharm J.* 2016;24(6):741-748.
30. Gupta PD, Birdi TJ. Development of botanicals to combat antibiotic resistance. *J Ayurveda Integr Med.* 2017;8(4):266-275.
31. Kooti W, Hasanzadeh-Noohi Z, Sharafi-Ahvazi N, *et al.* Phytochemistry, pharmacology, and therapeutic uses of black seed (*Nigella sativa*). *J Evid Based Complementary Altern Med.* 2016;21(4):1-10.
32. Mishra A, Singh S. Evaluation of tablet characteristics: a review. *Int J Pharm Sci Rev Res.* 2019;55(1):1-6.
33. Modi CM, Patel HB, Patel UD. *in vitro* antidiabetic activity of medicinal plants via enzyme inhibition. *Biocatal Agric Biotechnol.* 2020;29:101789.
34. Nair AB, Shah J. Wet granulation technique in pharmaceutical industry: a review. *Int J Pharm Sci Res.* 2016;7(4):1439-1453.
35. Patel S, Patel J. Role of phytochemicals in diabetes management. *Biomed Pharmacother.* 2021;139:111588.
36. Prabhakar PK, Doble M. Mechanism of action of natural products used in diabetes. *Chin J Integr Med.* 2011;17(8):563-574.
37. Saha S, Verma RJ. Antioxidant and antidiabetic properties of medicinal plants: a review. *Asian J Pharm Clin Res.* 2019;12(3):30-37.
38. Sharma A, Shanker C, Tyagi LK, *et al.* Herbal medicine for market potential in India: an overview. *Acad J Plant Sci.* 2008;1(2):26-36.
39. Singh R, Sharma PK. Evaluation of tablet formulation and quality control parameters. *Int J Pharm Pharm Sci.* 2020;12(5):12-20.
40. Upadhyay A, Chattopadhyay P, Goyary D. Herbal approaches for diabetes treatment: current perspectives. *Curr Diabetes Rev.* 2022;18(4):e123021189456.
41. Yadav D, Jain A. Role of α -amylase and α -glucosidase inhibitors in diabetes management. *J Diabetes Metab Disord.* 2021;20(2):1305-1315.