In vitro antidiabetic evaluation of nanoparticles encompass dual bioflavonoid

Satheesh Kumar D1,2, Shailendra Kumar1, Ravichandran S2
1 Bundelkhand University, Jhansi-28412, Uttar Pradesh, India.
2 PSV College of Pharmaceutical Science and Research, Krishnagiri-635108, Tamil Nadu, India.

ABSTRACT

The flavonoids which are widely spread in plants. It can be categorized as flavonols, flavonols, flavanones, flavones, anthocyanidin and isoflavones. Apigenin and Hesperidin account these three flavonoids used a significant proportion of flavonol intake in the diet as a functional food. Among all other flavonoids, Apigenin has many health cares and disease-prevention benefits. Polymer-based formulations, such as nanoemulsions and solid lipid nanoparticles, have been developed to increase the therapeutic efficacy of flavonoids. New drug delivery systems such as Dual Loaded Flavono Nanoparticulate System (DLFNPs) have not yet been studied with Apigenin and Hesperidin. In the present study, dual loaded flavonol nanoparticulate systems have been developed for oral delivery of Apigenin to enhance its antioxidant and antidiabetic activities. The fabrication of Dual Loaded Flavono Nanoparticles by Nano precipitation technique. Prepared Dual Loaded Flavono polymeric nanoparticles were subjected to characterization and various pharmacological activities. In vitro results revealed that the Alfa amylase percentage of inhibition 33.5% for Nanoparticles Encompass Dual Bioflavonoid by the indication pet ether extracts have lesser activity. This work will be useful for diabetic research workers to be found in the new chemical entity for the treatment of DM and its associated diseases.

INTRODUCTION

Diabetes mellitus is aroused as a result of metabolic disarray consequently affects the carbohydrate, lipid and protein fate in the physiological system. [1] It is also by and mostly responsible for the impaired insulin secretion and resistance to the pancreatic cell receptors. As a result, diabetes-prone to cause various complications at a cellular level to encompass micro and macrovascular damages. [2] Basically, diabetes is classified in the following manner.

- Type-I: Insulin-Dependent Diabetes mellitus
- Type-II: NonInsulin Dependent Diabetes mellitus
- Principally condition of increased glucose in the blood leads to the development of long-term side effects in the ocular, hepatic, nephron, cells of Cardium, including blood vessels. The state of diabetes gives rise to a modification of collagen present in visceral parts5. Malevolent effect of hyperglycemic impediment paves the way for permanent damage on organ function and thereby causing end-organ damage. [3]

- Flavonols
  - e.g., Kaempferol, rutin, quercetin, myricitrin etc.,
- Flavonones
  - e.g., Hesperidin, Apigenin, naringenin, eriodictyol
etc.,

- Flavones
e.g., Apigenin, baicalein, tangerine etc.,
- Flavanolols
e.g., Silymarin, silibinin, taxifolin etc.,
- Flavan-3-ols
e.g., Catechin and its analogues
- Isoflavones
e.g., Genistein, daidzin etc.,

The classification indicates the various categories of bioflavonoids based on their position. Bioflavonoids comprise different beneficial activities viz cardio-tonic, anti-diabetic, antioxidant, anti-fungal, antimicrobial activity and so on. These flavonoid groups find it to be utilized in different disease and ailments, and its potential application can be catered fully if it can be given acceptably. [4] The effects of flavonoids is of primary concern viz-a-viz anti-diabetic and antioxidant activity since most of the flavonoids play the role as a free radical scavenger and which is necessary for managing complications emerging in hyperglycemic conditions. [5] A treatment pattern which is pointing to cease the open fundamental uprooting mechanism and complexity in association with hyperglycemia is a beneficial domain for the researchers to explore into. With the hand full of bioflavonoid option and concerning the above statement, the opportunity for utilizing it as an alternative approach is sturdy.

There are some species of herbs known to encompass purposeful bioflavonoids viz Acacia Arabica, Aegle marmelos, Phyllanthus amarus, Momordica charantia, Allium cepa, Azadirachta indica etc., Almost all the plants which do possess a considerable to trace of flavonoid components, nevertheless only a few species of the plants do get the flavonoids in a significant amount which benefited in several ways. [6–8] The plant, as mentioned above, species contain flavonoids of different moieties, and they exhibit the general pharmacological action toward the biological system since it includes a specific functional group which does the activity. It is quite safe with utmost deprive of side effects.

In type 1 diabetes, there is insufficient insulin production to suffice the need for glucose metabolism. Usually, this type of diabetes starts at the age of twenties; the treatment protocol involves insulin supplement to have control of blood sugar. On the other hand, type 2 diabetes is the most prevalent diabetes contributing 95% of the population. This type of diabetes is characterized by the deprived generation of insulin or developing resistance to the insulin of pancreas. Usually, this type of diabetes prevails at 40 years of age. There are diverse ranges of methods by which nanoparticles are generated, and these methods are discussed below. Majorly factors governing for selecting the methods for a particular material are a type of drug delivery, drug solubility profile, decomposition trait of the candidate and so on. [9] Different ways are available for the formulation of nanoformulations, nonetheless to be précised for the formulation of nanosuspension is widely observed. The different parameters ranging from the availability of instruments to operational expertise in using the technique by the operating personnel also a vital and significant fact. Selection of an appropriate method for the manufacturing of nanoparticles is essential as it reduces the inevitable time-wasting and the resource materials. One of the easiest ways to choose the criteria choosing of variables then the priority weight are allotted according to the saaty scale, which has been explained in the Analytical Hierarchy Process. By the way, appropriate methods to be utilized for the fabrication of nanoparticles to selected purposes were identified with ease. Especially biodegradable material utilized method of manufacturing the nanosuspension they are discussed below in Figure 1.

Figure 1: Manufacturing the Nano suspension

The method involves the utilization of dialysis membrane acting between two phases viz organic as well as the aqueous phase. Diffusion is the principle implied in this method leads to the preparation of nanosuspension. The technique includes the biodegradable agent and candidate in water phase augmented with specific opposite ions leading to the formation of a gel. The obtained mass is then processed instrumentally using ultrasonication to get the particles of desired size and shape. It is a common method known for its full acceptance for the preparation of various nanoformulations.
method deals with the diffusion of organic solvent pertaining to the mass into the water phase leads lessening of interfacial tension with mild mechanical spin. Nanosuspension will be formed as a product of the above notion [10].

The drug-polymer-solvent mixture is pre-filtered in micron filter. The atomized spray of the mix made exposed to gas with a simultaneous vivacious spray nozzle. The emerging dried particles can be collected at the discharge. This method utilizes the application drugs by desolvating agent input, preferably protein solution at temperature. The content is allowed for cross-association with proteinaceous material for a specific period. The mixture of candidate and polymer is treated with a solution containing metals of salts like sodium chloride, calcium chloride etc. and saturation of the aqueous phase does not get soluble with organic solvent leads to a mixture. If procedure, as mentioned above, is continued with plenty of water leads to the diffusion of the organic phase. In this deception, candidate and polymer are solubilized in supercritical fluid and influx into the container through the nozzle. It is a very versatile technique out of all the method of producing nanoparticles. Then the system is heated to forty degrees Celcius then the content is oozed out a way to obtain nanosized particles. Currently used method for the nanoformulation preparation, the candidate is mixed with a polymer and solubilized with immiscible solvent. The above mixture is added with surfactants with shearing, excess solvent is evaporated at specific temperature and pressure. The scientific back information predicates the very minimal or lesser toxicity of flavonoids, besides some food and home remedies it is consumed often. Animal studies are shown that less than 10 gm. The medicinally rated flavonoids are various abundant species of plants having lesser side effect, prolonged t-half, and increased intestinal uptake accepts the utilization of these flavonoids and its forms in chronic treatments, preferably hyperglycemia [11].

**MATERIALS & METHODS**

**In vitro α- Amylase Inhibition activity**

Five hundred microlitre of samples in a test tube and additional to Five hundred microlitre of 0.20 mM buffer of the phosphate-containing α-amylase solution and incubate at 25°C for 10 minutes. Five hundred microlitre of one percentage starch solution in 0.02 M sodium phosphate buffer additional each tube. Reaction combination was incubated at 25°C for 10 minutes and mix with 3, 5 dinitro salicylic acid colour reagent which incubates boiling water bath for five minutes and cools to room temperature then make up 10 ml refine water which absorbance estimated at 540 nm. [12–14]

Proportion inhibition in each examine was intended formulae

\[
\text{Inhibition (\%)} = \frac{(\text{Control} - \text{Test})}{\text{Control}} \times 100
\]

**RESULTS AND DISCUSSION**

**In vitro antidiabetic study**

In vitro results revealed that the Alfa amylose percentage of inhibition 33.5% for to Nanoparticles Encompass Dual Bioflavonoid sample- A Flower by the indication pet ether extract have lesser activity when compared to Nanoparticles Encompass Dual Bioflavonoid sample-B (40.2%), Nanoparticles Encompass Dual Bioflavonoid sample-C (43.6%) leaves and Acarbose (45%) [15, 16]. In our comparative results stated that the Nanoparticles Encompass Dual Bioflavonoid sample-have more alfa amylose inhibition property when compared to other samples. Still, Acarbose has constantly higher activity when compared to different samples [17, 18]. Based on the above results, various Nanoparticles Encompass Dual Bioflavonoid sample working mechanism expressed given below:

The squalor of starch and complex glucose to single glucose by Alfa-amylase and Alfa-glucosidase enzymes if suppressed by block glucose absorption. Ultimately, the eminent postprandial blood sugar controlled [19, 20]. Numerous drugs were used to control DM and induction of stress; many are established to adverse drug reactions [21–23]. Based on the higher alfa amylose activities of Nanoparticles Encompass Dual Bioflavonoid sample-A have been used for in-vivo studies [24–27] (Tables 1, 2, 3 and 4 Figures 2, 3 and 4).

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<th>Concenetrated(µg/ml)</th>
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Table 1: α- Amylase Inhibition of Nanoparticles Encompass Dual Bioflavonoid sample-A
Table 2: α-Amylase Inhibition of Nanoparticles Encompass Dual Bioflavonoid sample-B

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Table 3: α-Amylase Inhibition of Nanoparticles Encompass Dual Bioflavonoid sample-C

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Table 4: α-Amylase

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CONCLUSION

The results of the present study provide scientific evidence for antidiabetic activity of flowers by the evaluation of various in vitro and in vivo models and hence supports the therapeutic usage of flowers in traditional medicines for treating DM and its associated complications. This work will be useful for diabetic research workers to be found the new chemical entity for the treatment of DM and its associated diseases.
CONFLICT OF INTEREST

Authors declared no conflict of interest.

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REFERENCES


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