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COMPARISON OF ANTI-DIABETIC POTENTIAL OF POLYHERBAL FORMULATIONS DIAB-SALACIA CAPSULE, DIA-FREE CAPSULE, AND BGR-34 TABLET

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ABSTRACT

The aim of the current study is to compare the anti-diabetic and antioxidant properties of many polyherbal formulations, including BGR-34 Tablet (BGR-34), Diab-Salacia Capsule (DSC), Dia-Free Capsule (DFC) against diabetic wistar rats that were given STZ. It is found that BGR-34 contain 34 SPMs from 06 plants, DSC contains 14 SPMs from 02 plants while DFC contains 42 SPMs from 06 herbal plants. All polyherbal formulations confirmed phenolic compounds, terpenoids, steroids, reducing sugars, glycosides, phytosterols. With increasing concentrations, the BGR-34, DFC and DSC all exhibited higher free radical-scavenging activity. BGR-34 exhibited the highest capacity for NO scavenging. The reducing power of BGR-34, DSC and DFC increased with increasing dosage. BGR-34, DFC and DSC have produced significant anti-diabetic effect in all treatment groups. BGR-34, DFC and DSC had alleviated glucose level. BGR-34, DFC and DSC had induced maximum reduction was observed after 21 days. Furthermore, BGR-34, DFC and DSC had a significant therapeutic benefit on the HDL level in the animals that were treated. BGR-34 and DFC had a therapeutically beneficial VLDL-lowering effect on cholesterol levels. BGR-34 and DFC had a therapeutically beneficial VLDL-lowering effect on cholesterol levels. Finally, BGR-34, DFC, and DSC induced antioxidant activity through significant superoxide radical scavenging activity, inhibition of lipid oxidation, by protecting

glutathione in liver. Through the inhibition of cell membrane oxidation, all polyherbal formulations generated strong antioxidant activity in a dose-dependent manner. BGR-34, DFC, and DSC produced antioxidant activity dose dependently by preventing membrane oxidation.

KEYWORDS: Antioxidant, Anti-diabetic glutathione, hypolipidemic, lipid oxidation, radical-scavenging, superoxide.

Diabetes Mellitus: General Introduction

Seki *et al.*, 2004, *Diabetes mellitus* (DM) result from a defect in insulin secretion (pancreas not producing enough insulin), insulin action (cells not responding properly to the insulin produced), or both. Joseph *et al.*, 2011, DM is a metabolic disorder caused by a defect in either the action or secretion of insulin, or both. Retinopathy, neuropathy, nephropathy, and cardiovascular diseases (CVD), which can harm organs and tissues, are examples of macro and microvascular difficulties that are mostly brought on by DM. Senthilkumar and Subramanian (2007), illustrated that oxidative stress / oxidative damage is a pathogenic factor in development of diabetic complications. DM chronic complications include hyperglycemia, hyperlipidemia, oxidative stress, retinopathy, nephropathy, neuropathy, peripheral atherosclerotic vascular diseases and atherosclerotic coronary artery disease (Wang *et al.*, 2013). Hegde and Jaisal (2014), DM has been characterized as genetically based predisposition and dietary indiscretion. It's predicted that by 2040, there would be 642 million diabetic population.

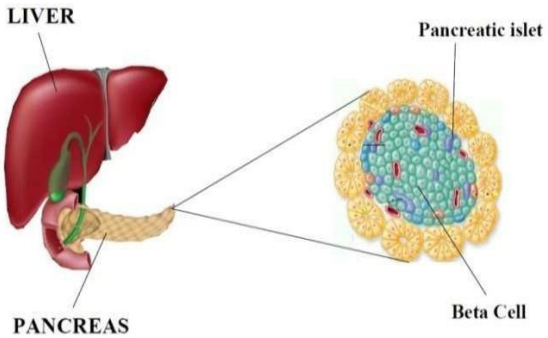

Fig. 1: Islets beta cells of pancreas secrete and discharge insulin.

WHO (2016), International Diabetes Federation (IDF) has reported prevalence of diabetes in 2017 with 146 million people and in 2045 it will be 156 million. Besides, urban prevalence of diabetes in 2017 is 279 million people and in 2045 it will be 473 million. Type- 1 DM is an

autoimmune disorder (absoluteinsulin deficiency; pancreas produce no insulin). Type-1 DM is further sub-classified as:

- Type 1A Diabetes: It is caused by the autoimmune destruction of beta cells which leads to insulin deficiency.
- Type 1B Diabetes: It is characterized by insulin deficiency which leads to development of ketosis.

Al Homsi and Lukic (1992) have summarised that T1-DM is related with annihilation of insulin conveying pancreatic β-cells and also clarified that T1DM as an immune system malady:

(i) Occurrence of immuno-able and adornment cells in pancreatic islets.
(ii) Sickness with the class II (invulnerable reaction).
(iii) Islet cell explicit auto antibodies
(iv) Modification of T cell mediated immuneregulation.
(v) Commitment of monokines and TH1 cells conveying interleukins in sickness.
(vi) Retort to immunotherapy.

NIDDM has a more unmistakable inherited bond than T2-DM, the pathogenesis of NIDDM is depicted by weakened insulin emanation and insulin obstruction. Lee *et al*., 2015, one of the most prevalent long-term effects of DM is DR, which is a leading cause of vision impairment in people in developed nations. Long-term DM can lead to a kind of retinal microangiopathy called DR. DR is commonly observed in patients with DM as a result of the disease's progression. This condition may be brought on by the start and dysregulation of several pathways, including the PKC, AGE/RAGE, polyol and hexosamine pathways, all of which have detrimental effects on eye health and vision. Patients with both type 1 and type 2 diabetes are affected by this illness (those with type 1 diabetes develop proliferative retinopathy).

Vishal *et al*., 2005, oxidative stress is defined as a disturbance in the equilibrium between free radical (FR), Reactive Oxygen Species (ROS), and endogenous anti-oxidant defense mechanism (Chandra *et al*., 2000). Ueda *et al*., 2010, summarised that the biological functions of ROS and their potential roles in inflammations, degeneration of cells, tissues and organs, in cancer development and even in disease progression (Amaral *et al*., 2013).

Schwager *et al*., 2008, found that Oxidative stress is involved in various physiological and

pathological processes including DNA damage, proliferation, cell adhesion, and survival / pathological state including carcinogenesis (Valco *et al*., 2006). Sdayria *et al*., 2018, established that all these collectively leads to carcinogenesis (complex interaction between ROS generation, ROS signalling, ROS –induced damage and carcinogenesis) (Vilar *et al*., 2016; Inoue *et al*., 2003).

Kusuhara *et al*., 2018, the most frequent side effects of DM in people is DR, which can cause partial or whole blindness. Due to the rising number of people with DM. According to predictions from the International Diabetes Federation (IDF), there could be 700 million cases of diabetes worldwide by 2045. This could result in a significant number of individuals suffering from extremely serious illnesses related to the visual system. Based on statistical data, 2.6 million people worldwide experienced visual dysfunction due to diabetes in 2017, which represents 2.6% of all occurrences of vision loss worldwide.

Type-1 DM requires insulin administration at all times, according to Felig *et al*., 1995 research. Rosac *et al*., 2002, state that the patient is treated with the following hypoglycaemic drugs like biguanide (metformin), glucosidase inhibitors (acarbose), sulphonylurea (glibenclamide), and dipeptidyl peptidase 4 inhibitors (sitagliptin).

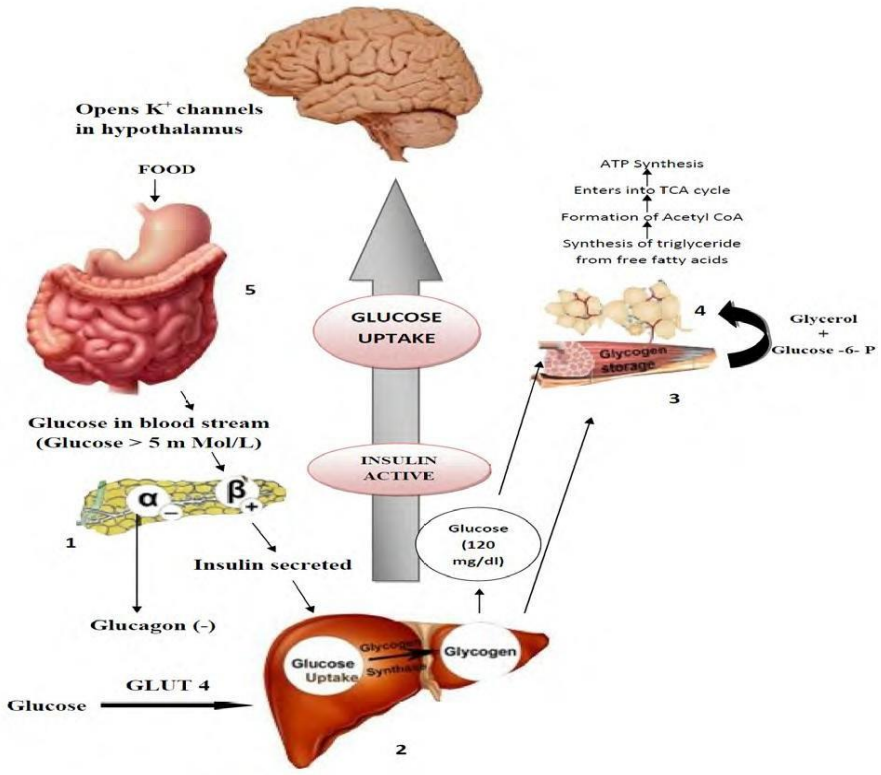

Fig. 2: Different physiological target of synthetic drugs.

Some 1000 plants may be able to prevent diabetes in ethnopharmacology, according to Rao *et al*., 2010. There are several medicinal plants that have been demonstrated to have hypoglycemic activity by established pathways. Complementary and Alternative Medicines (CAM) have been used for the management of diabetes and their use has rapidly increased (up to 72.8%) during last decades. 5,000 year old Ayurvedic system of medicine recommends a combination of lifestyle management and treatment with specific herbs and minerals to cure diabetes.

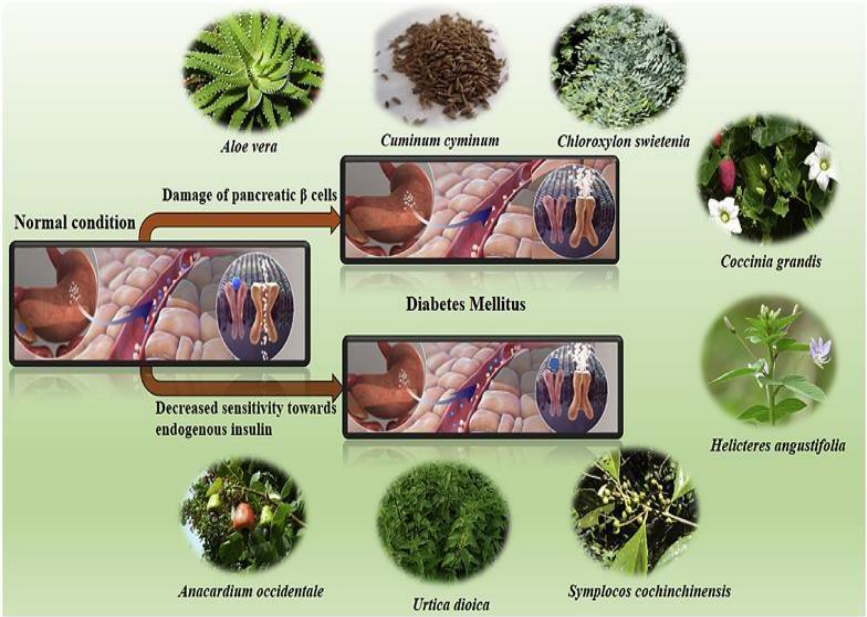

Fig. 3: Herbals drugs which improve insulin secretion.

MATERIALS AND METHODS

BGR-34 (an acronym for B: Blood G: Glucose R: Regulator) Blood Glucose Regulator-34) is an Ayurvedic-derived product that is sold in India as an over-thecounter pill for the management of type 2 diabetes. It works as a blood glucose metabolizer to protect vital organs from oxidative damage. The ingredients mentioned on its pack show that it consists of daruharidra, vijaysar, giloy, gudmar, methika and majeeth, which it says would improve the function of the pancreas and reduces the level of glycosylated hemoglobin. BGR-34, is a polyherbal Ayurvedic Blood Glucose Regulator prepared from six medicinal plants. BGR 34 possesses antidiabetic, antihyperglycemic, antioxidant, cardio protective, and adaptogenic properties "Diab-Salacia Capsules" are an Ayurvedic herbal supplement manufactured by companies like Planet Ayurveda, formulated to help manage blood sugar levels. The primary ingredients are standardized extracts of *Salacia chinensis* (Saptarangi) and Fenugreek (*Trigonella foenum-graecum*). These capsules help in the secretion of insulin as it acts on the

liver and pancreas. It helps to prevent sugar level fluctuations and support overall health in diabetic-related weakness, balance blood sugar while enhancing insulin efficiency, control blood sugar levels, and support healthy insulin production.

Salacia species have been studied for their potential to reduce blood sugar and glycated hemoglobin (HbA1c) levels. Chemicals in the root and stem are thought to modulate targets that improve type 2 diabetes and obesity-associated hyperglycemia. Fenugreek is also a common herb used in traditional medicine for diabetes management.

Kapiva Dia Free Capsules manage blood sugar levels by blending six potent herbs: Karela, Gudmar, Vijaysaar, Jamun, Methi, and Tutah. It support insulin production, improve insulin effectiveness, and help convert sugar to energy.

Only 15% of higher plants are thought to have had their potential natural chemicals studied. It has been discovered that plants contain chemicals with antidiabetic properties, such as phenolics, alkaloids glycosides, flavonoids, and terpenoids. Numerous therapeutic herbs have been shown in studies to have anti-diabetic properties. There are numerous commercially marketed herbal, phyto, and Ayurvedic medicines for type-2 diabetes. Aim / Objectives of the study were:

- Comparison of BGR-34, Diab-Salacia Capsules, and Dia Free Capsules on various parameters like composition, Active anti-diabetic phyto-constituents, Pharmacological / Uses, Mechanism of action Dose, Side effects and Clinical efficacy.
- Antioxidant potential of BGR-34, DSC and DFC.
- Anti-diabetic study of BGR-34, DSC and DFC. in STZ induced diabetic Wistar Rats.
- To compare the profiles for biochemical parameters like liver function tests (LFTs), Cholesterol, triglyceride in animals treated with BGR-34, DSC and DFC.

MATERIALS AND METHODS

Pharmacognostical and Pharmacological Comparison of BGR-34, DSC and DFC

Composition of Diab-Salacia Capsule (DSC)

Table 1: Diab-Salacia Capsule Composition.

S.No.	Botanical Name	Quantity (mg)
Each 500 mg Capsule contains:		
1.	Saptarangi Roots (*Salacia chinensis std. ext.)*	250
2.	Fenugreek Seeds (*Trigonella foenum-graecum* Std. Ext.)	250
Total		500

Composition of Dia-Free Capsule (DFC; Kapiva)

Table 2: Dia-Free Capsule (DFC; Kapiva) Composition.

S.No.	Botanical Name	Hindi / Part Used	Quantity (mg)
Each 500 mg Capsule contains			
1.	*Trigonella foenum-graecum*	Methi Seeds	204.75
2.	*Gymnema sylvestre*	Gudmar Leaves	222.75
3.	*Syzygium cumini*	Jamun Seeds	4.50
4.	*Morus alba*	Tutah Fruits	15.0
5.	*Pterocarpus Marsupium*	Vijaysaar heart wood	4.50
6.	*Momordica charantia*	Karela fruit	13.50
Preservative : Potassium sorbate			
Excipients			QS

Composition of BGR-34 Tablet

Table 3: BGR-34 Tablet (BGR-34; AIMIL Pharmaceuticals) Composition.

S.No.	Botanical Name	A. Aq. Extract Quantity (mg)	B. Powder Quantity (mg)
Each 620 mg Tablet contains the following:			
1.	*Berberis aristata* (Daruharidra; Bark)	1150	75
2.	*Pterocarpus marsupium* (Vijaysar; Heartwood)	400	25
3.	*Gymnema sylvestre* (Gurmar; leaves)	400	25
4.	*Rubia cordifolia* (Majeeth; Root)	375	25
5.	*Trigonella foenum-graecum* (Methi Seeds)	350	25
6.	*Tinospora cordifolia* (Giloy)	350	25
Shilajeet Sudh / *Purified Black Bitumen* RTS-I			10
Excipients			QS
Other Ingredients : Sodium Methylparaben, Sodium propylparaben			

Table 4: Pharmacognostical and Pharmacological Comparison of Polyherbal Formulation Diab-Salacia Capsule, Dia-Free Capsule and BGR-34 Tablet.

Diab-Salacia Capsule	Dia-Free Capsule	BGR-34 Tablet
Constituents		
14 SPMs from 02 natural herbs	42 SPMs from 06 natural herbs	34 SPMs from 06 natural herbs / minerals
Main Constituents Plants and Minerals		
Salacia chinensis Trigonella foenum-graecum	*Trigonella foenum-graecum Gymnema sylvestre Syzygium cumini Morus alba Pterocarpus Marsupium Momordica charantia*	*Berberis aristata* DC *Rubia cordifolia Trigonella foenum-graecum Pterocarpus marsupium Tinospora cordifolia Gymnema sylvestre* Shilajeet Sudh (RTS-I)
Pharmacological / Medicinal Uses		
Revitalizes body; tone up pancreas; optimize	lower blood sugar; increase body's	Lowers blood sugar levels; reducing

carbohydrate metabolism;	resistance;	inflammation;
Dose		
1 (500 mg) capsule before meal;	1 (500 mg) Capsule before meal;	1 (620 mg) tablet before meal;
Toxicity Profile		
Safe dose: 2000 mg/kg bw (Toxicity absent)	Safe dose: 2000 mg/kg bw (Toxicity absent)	Safe dose: 3000 mg (Toxicity absent)
Side Effects		
Stomach gas, belching, abdominal pain, nausea, and diarrhoea;	Dangerously low blood sugar levels (hypoglycemia); Free from side effects(safe)	No side effects (safe)

Detection of PPMs / SPMs

Polyherbal formulations DSC, DFC, and BGR-34 were used for qualitative analysis for the detection of various categories of PPMs / SPMs by using standard procedures described by Kokate (2005) as follows:

***In-vitro* Antioxidant effects**

In-vitro antioxidant activity of Diab-Salacia Capsule (DSC), Dia-Free Capsule (DFC), and BGR-34 Tablet (BGR-34) by DPPH (Blois, 1958), NO (Larson, 1994) radical scavenging method, FRAP assay (Benzie and Strain, 1996) and Reducing Power Assay (Jayaprakasha *et al*., 2001) were performed.

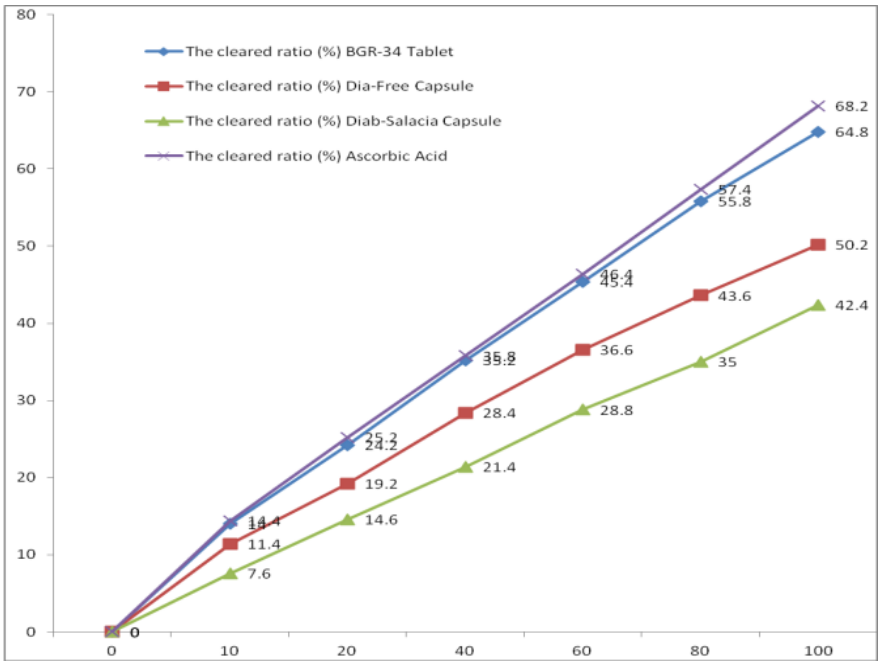

Fig. 4: DPPH regression curve.

Table 5: BGR-34 induced scavenging effects.

Concentration (µg/ml)	% Inhibition	IC50 µg/ml	R2
20	10.74±0.36		
40	21.40±1.11		
60	32.54±1.66	62.40	0.9924
80	40.22±1.73		
100	51.42±1.65		
Curcumin (Standard)	34.24±1.26	17.72	0.9921

Comparative Anti-diabetic study

Animal Study (Form B Proposal no. IEC/IAEC/2026/01) approval was granted by IAEC meeting (20-02-2026) of IEC College of Engineering & Technology in accordance with IAEC / CPCSEA rules. Male albino rats weighing 200 gm were purchased from CLAR at JNU in Delhi. The animals were housed in animal houses with a 12-hour day-night cycle, temperature of 25°±2°C, and humidity of 55±5% after being acclimated.

All rats were divided into various groups as follows:

Group I (Normal): Citrate buffer.

Group II (Toxic Control; STZ + vehicle group): Streptozotocin (50 mg/kg i.p./day) for 07 days

Groups III-V (STZ + Polyherbal Formulation): Induced DM with STZ and received BGR-34 Tablet (620 mg/kg p.o./day; Group III), Dia Free Capsules (500 mg/kg b.wt. p.o./day; Group IV), and Diab-Salacia Capsules (500 mg/kg b.wt. p.o./day; Group V).

Groups VI (STZ + Glipizide): DM induced with Streptozotocin (50mg/kg i.p./day) for 07 days followed by 21 days treatment with Glipizide (5mg/kg b.wt. p.o./day)

Action of Polyherbal Formulations BGR-34, DFC and DSC on Blood Glucose Level

DSC, DFC, and BGR-34 were administered to the animals, whereas distilled water was given to the control group. After the fasting period, which was measured as zero time (0 h), blood was drawn from the retro-orbital plexus while the animals were under anaesthesia. The Accuchek Glucometer or the GOD/POD method was used to measure and track the blood glucose levels at 1, 2, and 3 hours after therapy.

Action of Polyherbal Formulations BGR-34, DFC and DSC on OGTT

Normal rats had been fasted overnight were subjected to an oral glucose tolerance test. Six animals in six groups of healthy rats were used. Animals were given polyherbal formulation BGR-34, DFC and DSC; distilled water was given to the control group. After 60 minutes of

medication, animals were given glucose (2 g/kg b.w.) orally. Blood glucose levels and glucose loading (at 0, 30, 60, 90, and 120 minutes) were estimated.

Comparison of Anti-diabetic effect of BGR-34, DFC and DSC

By administering 50 mg/kg intraperitoneally in 0.1M citrate buffer (pH = 4.5), Himedia Laboratories Pvt. Ltd., Mumbai, produced diabetes. Each animal's fasting blood glucose levels were examined seven days after receiving an injection of STZ. Animals with blood sugar levels above 200 mg/dl during fasting were employed. After being randomly divided into six groups of six animals each, all animals were allowed unrestricted access to pellet food. The way that the animals were treated followed established protocols. Following 21 days of oral treatment with BGR-34 (Group III), DFC (Group IV), DSC (Group V) and Glipizide (Group VI) blood glucose levels were determined.

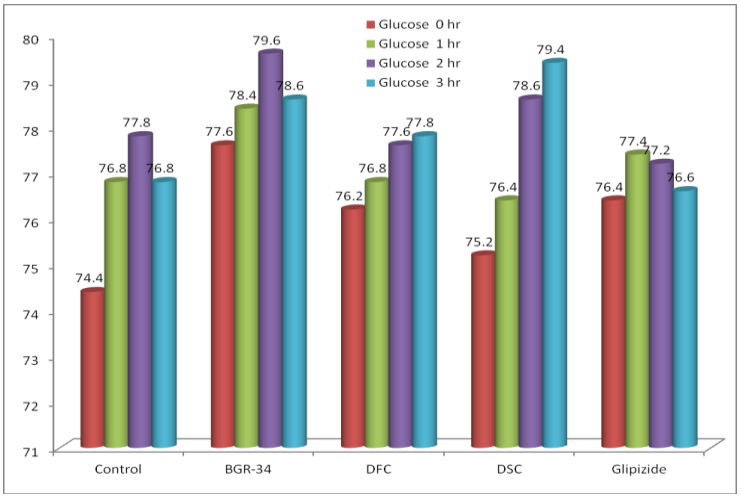

Figure 5: BGR-34, DFC, and DSC action on blood glucose.

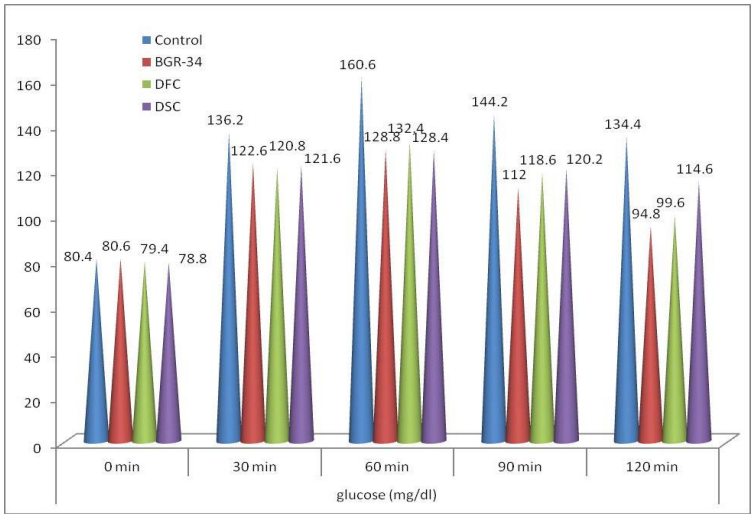

Fig. 6: Effect of BGR-34, DSC and DFC on glucose tolerance.

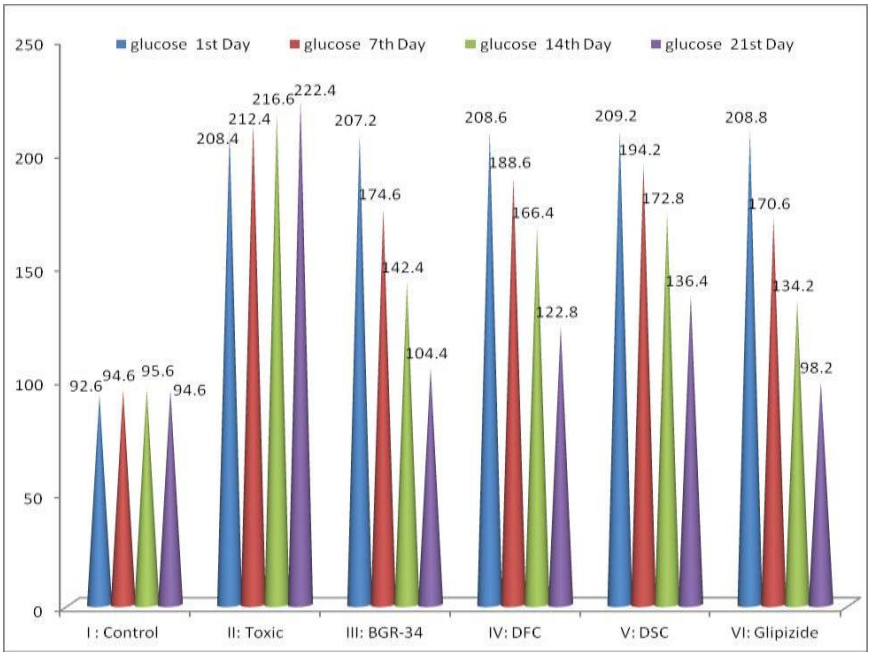

Fig. 7: BGR-34, DSC and DFC effect on blood sugar.

4.5. Effect of BGR-34, DFC and DSCon Lipid Profile in diabetic rats

Cholesterol estimated with Agappe Liqui CHECK kit.

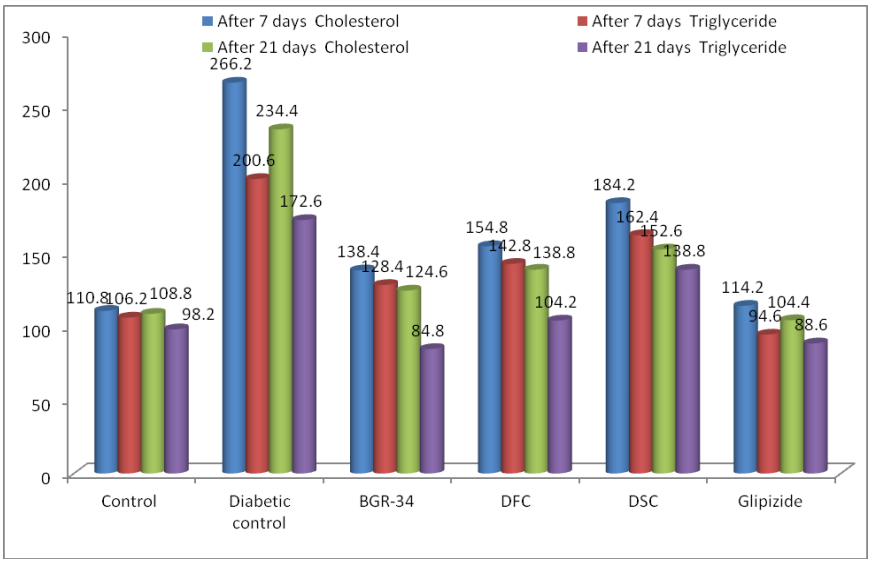

Fig. 8: Effect of formulations on cholesterol and triglycerides.

High Density Lipoprotein Cholesterol: Serum HDL levels estimated (Crest Bio systems).

Low Density Lipoprotein (LDL): Friedwald *et al.*, 1972 method was used : LDL cholesterol = TC – (VLDL + HDL cholesterol)

VLDL: Friedewald *et al.*, 1972 illustrated VLDL visualized by formula : VLDL cholesterol = TG/5

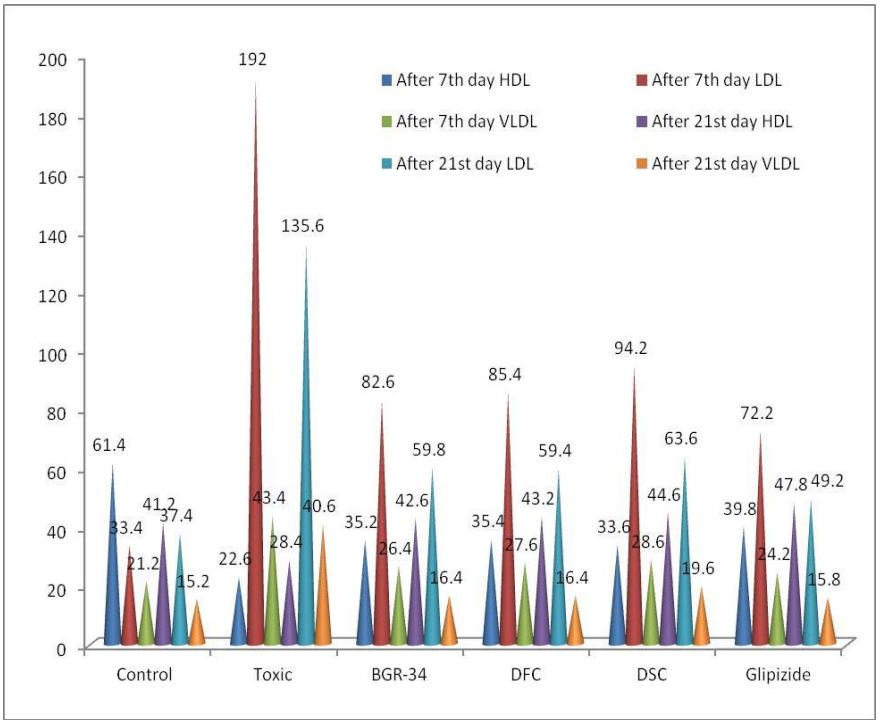

Fig. 9: Effect of formulations on lipoproteins in diabetic rats.

Effect of BGR-34, DFC and DSC on Enzyme Assays

(i) SOD analysis by Habbu *et al*., 2008;

(ii) Peroxidase estmation by Nicholas, 1962;

(iii)Catalase analysis by Aebi (1984);

Liver Tissue Preparation for Enzyme Assays

Removed, cleansed, and homogenised hepatic tissues using a cold 1.15% KCl and 10 mM phosphate buffer containing EDTA (pH 7.4) Centrifuged for 10 minutes at 10,000 rpm, supernatant centrifuged for 60 minutes at 3,000 rpm. - calculated SOD, CAT, and peroxidase in cytosolic extract.

SOD activity (Beauchamp and Fridovich 1971; Chidambara *et al*. 2002)

Using a kit from Sun Pharma, India, the SOD (units/milligram) was calculated based on the reduction of nitrobluetetrazolium to water-insoluble blue formazan. They followed standard operating procedures (Habbu *et al*., 2008).

Catalase activity: Catalase activity was determined by SOP of Aebi (1984).

Peroxidase activity: Assayed by the SOP method of Nicholas (1962).

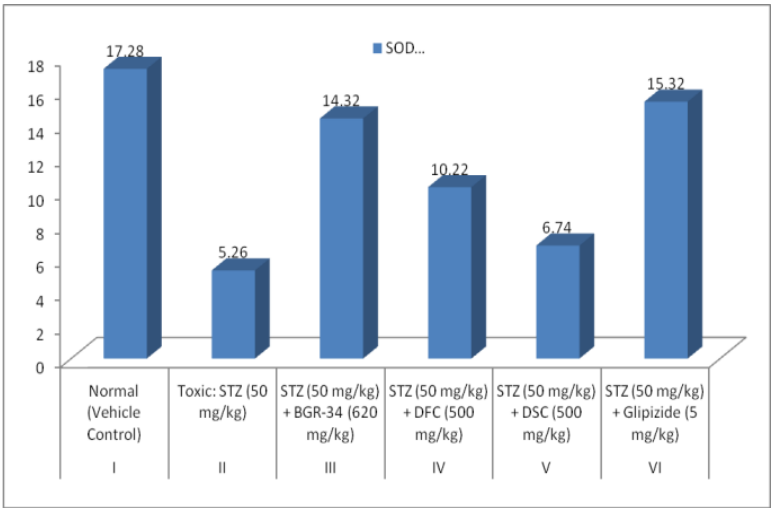

Fig. 10: BGR-34, DFC, DSC and Glipizide effect on SOD.

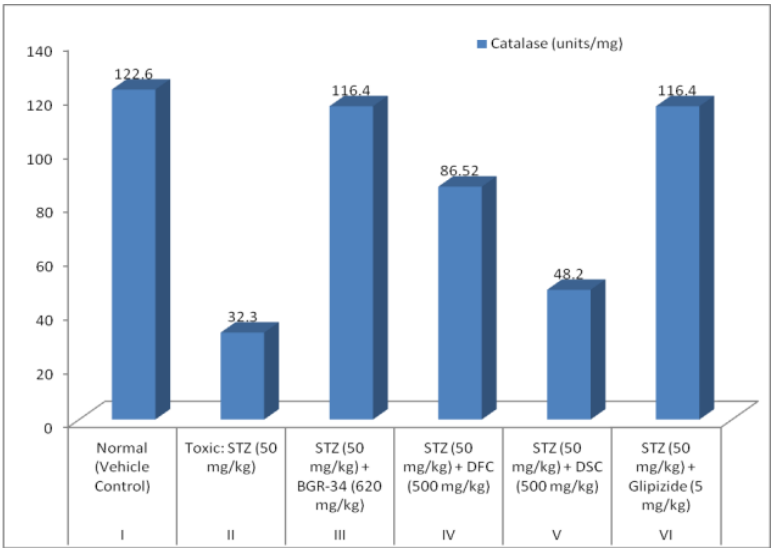

Fig. 11: BGR-34, DFC, DSC and Glipizide effect on Catalase.

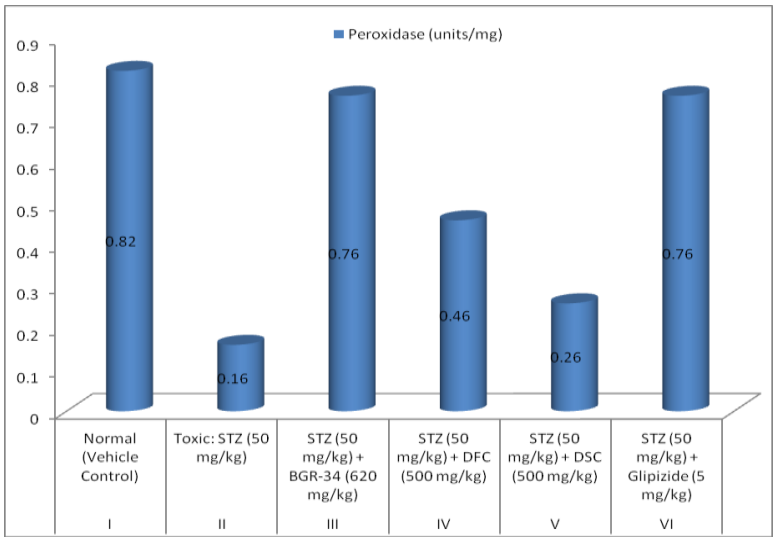

Fig. 12: BGR-34, DFC, DSC and Glipizide Effects on Peroxidase.

RESULTS AND DISCUSSION

The research work was started with procurement / purchase of polyherbal formulations BGR-34, DFC and DSC from reliable / genuine commercial sources and it marked the beginning of the dissertation research project, and their literature was examined and contrasted. It was found that polyherbal formulation DSC contains 14 SPMs / phytoconstituents which are derived from 02 medicinal herbs whereas polyherbal DFC formulation is found to contain 42 SPMs from 06 herbal medicinal plants. Besides, it is found that polyherbal formulation BGR-34 contain 34 SPMs from 06 medicinal herbs / medicinal plants. Subsequently, the qualitative chemical test analysis (phytochemical screening) of polyherbal formulations BGR-34, DFC and DSC confirmed the presence of alkaloids, flavanoids, Phenolic compounds, terpenoids, reducing sugars, glycosides, steroids, phytosterols, amino acids, proteins and carbohydrate etc. as SPMs and PPMs.

Additionally, the polyherbal formulations BGR-34, DFC, and DSC were tested for their *in-vitro* antioxidant activities using the DPPH and NO radical scavenging method. Antioxidant activities of the Diab-Salacia Capsule (DSC), Dia-Free Capsule (DFC), and BGR-34 Tablet (BGR-34) was directly proportional to their concentrations of total phenolic content (TPC) and total flavonoid content (TFC) ($p < 0.05$). It was observed that polyherbal formulation BGR-34 Tablet contains 1026.24±5.12 mg GAE/100 gDW as TPC, Dia-Free Capsule (DFC) contains 878.62±5.68 (mg GAE/100 gDW) and Diab-Salacia Capsule (DSC) contains 618.42±4.16 (mg GAE/100 gDW). As concentrations increased, so were the free radical-scavenging abilities of the BGR-34, DFC, and DSC (regression equations significant at $p < 0.05$). BGR-34 exhibited the strongest NO scavenging activity. With an increase in dosage, antioxidant activity was demonstrated by the BGR-34, DSC and DFC reducing power assays. Antioxidant activity by reducing power assay of BGR-34, DSC, DFC were directly proportional (increased activity::increased dose).

The reducing power of BGR-34, DSC and DFC increased with increasing dosage (possess free radical scavengers/anti-oxidants activity). The antioxidant activity of BGR-34, DSC, and DFC by FRAP assay was found to be 1022.24±4.84 µmol FeSO4/g DW, 868.14±4.82 µmol FeSO4/g DW and 7.16±4.36 µmol FeSO4/g DW respectively. Further, rats with STZ-induced diabetes were used for the comparative anti-diabetic investigation of BGR-34, DFC and DSC. Comparative anti-diabetic study of BGR-34, DFC and DSC was performed in STZ induced diabetes albino rats. Form B Proposal no. IEC/IAEC/2026/01 was approved by

IAEC meeting held on 20-02-2026 at IEC College of Engineering & Technology in accordance with IAEC / CPCSEA rules. Animals were procure from CLAR, JNU (Delhi). The animals were acclimatised in animal houses with a 12-hour day-night cycle, temperature of 25°±2°C, and humidity of 55±5% after being acclimated.

Group I (Normal) animals were Citrate buffer and water *ad libitum*. Group II (Toxic Control ; STZ + vehicle group) animals were streptozotocin (50 mg/kg i.p./day) for 07 days and left untreated. Further, Groups III-V (STZ+polyherbal Formulation) animals were induced DM with STZ and received BGR-34 Tablet (620 mg/kg p.o./day; Group III), Dia Free Capsules (500 mg/kg b.wt. p.o./day; Group IV), and Diab-Salacia Capsules (500 mg/kg b.wt. p.o./day; Group V). Subsequently, Groups VI (STZ+Glipizide) animals were induced DM with streptozotocin (50mg/kg i.p./day) for 07 days followed by 21 days treatment with Glipizide (5mg/kg b.wt. p.o./day)

After two hours of therapy, BGR-34, DFC and DSC significantly reduced glucose levels. After three hours, sugar levels returned to normal in every treatment group. The glucose level was reduced in BGR-34, DFC and DSC ($P < 0.001$). BGR-34, DFC and DSC have produced significant anti-diabetic effect in all treatment groups. Polyherbal formulations DFC, BGR-34, and DSC had alleviated glucose level ($P < 0.001$)

BGR-34 Tablet and DFC produced better action than DSC and toxic control group. BGR-34, DFC and DSC had induced maximum reduction was observed after 21 days. Blood glucose levels in animals treated with BGR-34 were dramatically reduced, going from 207.2 mg/dl on the first day to 174.6 mg/dl on the seventh, 142.4 mg/dl on the fourteenth, and 104.4 mg/dl on the twenty-first day.

Lastly, to ascertain how BGR-34, DFC and DSC affect the lipid profile in rats with diabetes. It was revealed that the impact of BGR-34, DFC and DSC on the levels of cholesterol and triglycerides in rats with STZ-induced diabetes. Effect of BGR-34, DFC and DSC on lipid profile in diabetic rats was evaluated. The effects of BGR-34, DSC and DFC on the levels of cholesterol and triglycerides in STZ-induced diabetic rats were observed in BGR-34, DFC and DSC had a significant therapeutic benefit on the HDL level in the animals that were treated. BGR-34 Tablet, DFC and standard had a positive (LDL-reducing) impact on the LDL levels of the treatment groups. Serum cholesterol and triglycerides were reduced with BGR-34 therapy. BGR-34 Tablet and DFC capsules had a therapeutically beneficial VLDL-

lowering effect on cholesterol levels.

Glipizide, the usual reference medication, 5 mg/kg reduced triglycerides [94.6±1.28 (7 days); 88.6 ± 1.16 (21 days)], and cholesterol [114.2±1.66 (7 days); 104.4±1.48 (21 days). Significantly less hypolipidemic and hypocholesterolemic action was produced by BGR-34 and DFC than by the standard medication ($P < 0.0001$). Triglycerides [128.4±1.26 (7 days); 84.8±2.42 (21 days)] and cholesterol [138.4±2.6 (7 days); 124.6±1.34 (21 days)] were reduced with BGR-34 treatment. Triglycerides [142.8±2.16 (7 days); 104.2 ± 2.28 (21 days)] and cholesterol [154.8±2.8 (7 days); 138.8±1.26 (21 days)] were reduced with DFC treatment. The HDL levels in the groups under diabetic management and toxic control were 22.6±0.6 (7 days) and 28.4±1.44 (21 days). In comparison to the normal control group, diabetic rats exhibited a substantial decrease in HDL ($P < 0.0001$). BGR-34, DFC and DSC had a therapeutic benefit on the HDL level in the animals that were treated. LDL (bad cholesterol) levels were found to be 33.4±0.42 (7 days) and 37.4±.62 (after 21 days) in healthy animals (normal group). The LDL levels in the toxic control group were 192±2.32 (21 days) and 135.6±1.8 (7 days).

Animals in the STZ hazardous group showed a considerable rise in LDL ($P < 0.0001$). LDL levels of 82.6±.68 (7 days) and 59.8±1.6 (21 days) were reduced by BGR-34, and LDL levels of 85.4±.86 (7 days) and 59.4±1.4 (21 days) were created by DFC treatment. LDL levels of 94.2±.34 (7 days) and 63.6±1.72 (21 days) were reduced with DSC. Serum LDL levels in the glipizide-treated group were 72.2±.72 (7 days) and 49.2±1.22 (21 days). BGR-34, DFC and standard had a positive (LDL-reducing) impact on the LDL levels of the treatment groups.

VLDL levels were reduced with BGR-34 to 26.4±.12 (7 days) and 16.4± 0.8 (21 days). Serum VLDL levels in the glipizide -treated group were 24.2±.32 (7 days) and 15.8±0.8 (21 days). BGR-34 and DFC had a therapeutically beneficial VLDL-lowering effect on cholesterol levels. Finally, in determination of Effect of BGR-34, DFC and DSC on enzyme assays in liver tissues in diabetic rats. Polyphenol, tannins, and flavonoids in BGR-34, DFC, and DSC induced antioxidant activity through significant superoxide radical scavenging activity, inhibition of lipid oxidation, by protecting glutathione in liver. These polyherbal formulations produced antioxidant activity dose dependently by preventing membrane oxidation. The antioxidant activity of BGR-34, DFC, and DSC was significant (mean±S.D.), and the ANOVA techniques were used to complete the analysis of variance. Through the inhibition of cell membrane oxidation, all polyherbal formulations generated strong

antioxidant activity in a dose-dependent manner.

CONCLUSIONS

With increasing concentrations, the BGR-34, DFC and DSC all exhibited higher free radical-scavenging activity. BGR-34 exhibited the highest capacity for NO scavenging. The reducing power of BGR-34, DSC and DFC increased with increasing dosage (possess free radical scavengers/anti-oxidants activity). BGR-34, DFC and DSC have produced significant anti-diabetic effect in all treatment groups. BGR-34, DFC and DSC had a significant therapeutic benefit on the HDL level in the animals that were treated. BGR-34 and DFC had a therapeutically beneficial VLDL-lowering effect on cholesterol levels. Finally, BGR-34, DFC, and DSC induced antioxidant activity through significant superoxide radical scavenging activity, inhibition of lipid oxidation, by protecting glutathione in liver. Through the inhibition of cell membrane oxidation, all polyherbal formulations generated strong antioxidant activity in a dose-dependent manner. BGR-34, DFC, and DSC produced antioxidant activity dose dependently by preventing membrane oxidation.

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