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ANTIDIABETIC AND ANTIHYPERLIPIDAEMIC ACTIVITY OF SPROUTS OF *TRITICUM AESTIVUM* EXTRACT

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ABSTRACT

Objective: The main objective of this research work is to investigate the antidiabetic and hyperlipidemic activity of sprout extract of *triticum aestivum* through streptozotacin and NA model and triton model in albino rats. **Materials and methods:** Blood glucose, serum total cholesterol, serum triglyceride and body weight proportion were assessed in streptozotacin and triton induced diabetic rats at a regular interval of time. The statistical analysis was done on streptozotacin induced diabetic for 28 days. **Result:** It is observed that there is significant decrease in blood glucose, serum total cholesterol and serum triglyceride after administration of sprout extract of *triticum aestivum* of dose 200mg/kg, 400mg/kg and 800mg/kg to diabetic and lipidemic rats. Blood glucose level and serum cholesterol and serum triglyceride decreased non significantly at 60 mins and 120 mins. **Conclusion:** From this findings it is concluded that sprout extract of *triticum aestivum* has potent antidiabetic and antihyperlipidemic activity.

KEYWORDS: Diabetes mellitus, *triticum aestivum*, Streptozotocin, Hyperlipidaemic, oxidative stress.

INTRODUCTION

The diet plays an important role in well-being of our health system.[4,10,11] It also giving a great contribution to prevent many diseases. Now a days, it is clear that fruits and vegetables consumption contribute to interuption of many degenerative diseases.[7,8,14] Among the phytonutrients, some specific phytochemicals like isothiocyanates, isoflavones, saponins, inositol, dithiolthiones allium compounds, hexa phosphate, folic acid flavonoids phytoesterols, vitamin C and E, beta-carotene, lycopene, lutein and dietary fibres.[7] which have protective effects.

The processing of seeds Sprouting is one of the natural method to enhance the nutritive value[2,3,5] and health qualities,[2,15] of foods. This process of sprouting is simple and inexpensive to carry out and different seeds can be sprouted for human consumption. All legumes (bean, pea, lentil, soyabean), grains (wheat,barley, oats) and seeds of vegetables (alfalfa, reddish).[10] Oxidative stress is responsible in the course of diabetes associated complication. It is found that occurance of continuous production of reactive oxygen species(ROS) in hyperglycemic condition. There is an evidence which showed diabetes induced changes in the activity of antioxidant enzymes in different tissues. Antooxidants play a vital role in scavenging free radicals and provide the protection to the human body from oxidative stress.[12,13,14] According WHO for the treatments for diabetes, the evaluation of traditional plant are more effective as they are non toxic and having less or no side effects.[15] These are considered to be a good candidates for oral therapy. It is reported that chemical constituents from the plants like glycosides, alkaloids, terpenoids, flavonoids, carotenoids are having antidiabetic effect.[16]

Hyperglycemia and hyperlipidemia have become a threat to mankind which progress with age. Diabetes is a disease which is caused due to metabolic disorder of carbohydrate, lipid and lipoprotein. 4% population of world are suffering from diabetes mellitus, it may increased to 5.4 % of precautions will not be taken in 2025.[17] If there is sugar level and cholesterol remain high for longer period in blood, it leads to cardiovascular diseases. So researchers try a lot to reduce blood sugar level and lowers the lipid in blood. They try to discover new drug molecules from plant source as it has less side effect and cost is less. In Indian climate varieties of medicinal plants grow throughout the year. Out of many medicinal plants, *triticum aestivum* which grow in the climate of India and have medicinal value of antidiabetic and antihyperlpidemic activities. Sprout extract of

triticum aestivum has both antidiabetic and antihyperlipidemic activities. It is found through animal test. Wheat sprouts have anti-obesity effect. Twenty compounds (1-20) where determined for first time from *triticum aestivum* and its sprouts. Generally wheat bran contains high level of starch (6% to 30%), protein (14% to 26%), liquid (3% to 4%), phenolic acid (0.4% to 0.8%) and other minor constituents. An extended lasting of nutrients and their possible health related effect have been described by broans and others (2012) and it includes essential amino acids such as lysine and tryptophan and vitamins suggest ferulic acid and alkyl resorcinols and minerals such as Phosphorus and iron. The intake of 14 gram of fibre per thousand kcal can decrease the risk of cardiovascular diseases and type 2 diabetes. Epidemiological studies clearly demonstrated the health benefits of consuming white grain foods which reduce risk of gastro-intestinal cancer Type 2 diabetes, cardiovascular diseases and obesity**.** Symptoms of rheumatoid arthritis in patients reduced by *triticum aestivum.*[18] It is also found that severity of rectal bleeding can be reduced by *triticum aestivum* in patient with ulcerative colitis.[19] *Triticum aestivum* was found to reduce the frequency of blood transfusion in patient with thalassemia major.[20]

MATERIALS AND METHODS

Preparation of sprout extract

By using domestic grinder, the Frozen samples were palverised. The sprouts of wheat (40g) were immediately homogenised with 100 ml of tetrahydrofuran (THF) stabilized with butylated hydroxy toluene (0.1 g kg-1BHT) for 3 minutes at 8000. In a buchner funnel, the resulting suspension was filtered under vacuum, washed with THF until the filtrate was colourless. Then concentrated in a rotary evaporator and dried at 35°C. The extract was partitioned between diethyl ether (3 x 30 ml) add salt water and transferred to a separating funnel. Water is used to wash the organic layer until the diethyl ether extract was Colourless. The diethyl ether phases were combined, dry over anhydrous sodium sulphate, filtered under vacuum and evaporated at to dryness. The dry residue was dissolved in 1.5 ml of dichromate for HPLC analysis. All steps were performed under diminished light.

Animals: Male albino rats with body weight of 225-250 gm was used in this experiment. Before the study, all the animals were housed in the polypropylene cage for the period of seven days for proper acclimatization. The experiment was carried out after getting CPCSEA, IAEC approval (IAECR Regd No.:2024/PO/Re/S/18/CPCSEA).

Acute toxicity studies: Oral acute toxicity of ethanol extract of *Triticum aestivum* sprout was performed by using albino rats weighing about 175-200 g with different dose level as per OECD guideline 425.

Chemical requirements: The chemicals used during the experiments are purely analytical grade with high strength such as Sodium Chloride, Triton WR1339, streptozotocin, nicotinamide from Himedia Lab, Mumbai whereas Atorvastatin from Ranbaxy Lab. Besides the biochemical kits such as glucose, cholesterol, and triglyceride kit were purchased from Crest bio system.

Experimental design

Oral Glucose Tolerance Test (OGTT)

For Oral Glucose Tolerance Test, healthy rats are preferred who are not given food overnight. Rats were divided into five groups (n=6). Group I supplied with normal saline. Group II received reference drug gliclazide at the dose of 25 mg per kg. Group III, IV and V received sprout extract of *Triticum aestivum* at the dose of 200, 400, 800 mg/kg p.o respectively. After the administration of glucose, the blood samples were collected from sublingual vein at 30, 60 and 120 mins. Glucometer and strip was used for measuring both fasting and postprandial glucose level.

Experimental methods to assess the antidiabetic activity of sprout extract of *Triticum aestivum*

Diabetes was induced in 12 hr fasted rats by a single intraperitoneal dose of nicotinamide (NA) of 120 mg/kg followed by fresh prepared streptozotocin (STZ) at the dose of 60 mg per kg in citrate buffer. Next day of induction, blood sugar levels were measured, rats having plasma glucose level more than 200 mg/dl were selected for the experiment. In five groups, rats were divided (n=6).

Group I: Negative control received normal saline without induction of NA and STZ (non-diabetic).

Group II: Positive control received normal saline with NA and STZ (diabetic). **Group III:** Treated group received with sprout extract of *Triticum aestivum* 200 mg/kg once a day with NA and STZ.

Group IV: Treated group received with sprout extract of Triticum aestivum 400 mg/kg once a day with NA and STZ.

Group V: Standard control received with gliclazide 25 mg/kg body weight once a day with NA and STZ. During the experimental period, fasting blood was collected form each group for estimation of plasma glucose level.

Induction of hyperlipidemia using triton WR-1339

For inducing hyperlipidemia, all animals were divided into five group (n=6). The rats of groups II, III, and IV were induced with single intraperitoneal dose (200 mg per kg) of triton WR-1339. Group I was treated as negative control in which only administered with distilled water, whereas group II was treated with (Triton WR-1339, 200mg/kg) and called as triton control group. Group III was treated with standard atorvastatin 7.2

mg/kg. Group IV and V were treated with sprout extract of *Triticum aestivum* at the dose of 400mg/kg and 800mg/kg respectively after induction of triton WR-1339. During the administration of sprout extract of *Triticum aestivum* and atorvastatin, blood sample was collected from each animal in the interval of 0, 18,24,40,48 hours dose treatment for estimation of cholesterol and triglycerides using separated serum.

Statistical analysis

The obtained data from the studies is subjected to one way analysis of variance (ANOVA), to calculate the significant difference. The inter group significance was analyzed by using Dennett test, and p values <0.05 were considered to be significant. Mean+SEM is used to expressed all the values.

RESULTS

Oral glucose tolerance test

After administration sprout extract of *Triticum aestivum* at the dose of 200 mg/kg, 400 mg/kg and 800mg/kg body weight orally in the OGTT experiment, results shows that there was no significant difference among different groups at 0 min and 30 minutes but significant difference occurred in blood glucose level at 60 and 120 minutes shown in table 1 & figure 1 when compare with standard group. Therefore it is concluded that group of glyclazide (50mg/dl) and *triticum aestivum* extract (200mg/kg and 400 mg/kg and 800mg/kg b.w) showed the peak values of blood sugar significantly decreased from 87.5 ± 6.51 to 73.16 ± 4 in case of gliclazide between 60 min to 120 min,again from 120 ± 4.81mg/dl to 114.83 ± 4.2mg/dl in case of *triticum aestivum* extract OD also from 109 ± 2.5 mg/dl to 81.6 ± 4.2 mg/dl in case of *triticum aestivum* BD and 109.66 ± 2.8mg/dl to 81 ± 4.8mg/kg in case of *triticum aestivum* QD extract on the 28th day,respectively indicates statistically significant (P<0.01) anti-diabetic activity when compared diabetic control.So it is concluded that *triticum aestivum* ethanolic extract (OD&BD) able to reduce the blood sugar levels in diabetic rats non significantly but values did not return to those of normal control .

Table 1: Effect of *Triticum aestivum* sprout extract on oral glucose tolerance test in antidiabetic model (STZ & NA Model).

	Non diabetic control	Diabetic control	Standard	*Triticum aestivum* (200mg/kg b.w)	*Triticum Aestivum* Extract (400mg/kg b.w)	*Triticum Aestivum* Extract (800mg/kg b.w)
0 mins	73.83±7.10	73.5±7.21	71.21±3.81	77.8±3.11	73.1±3.2	72.2±3.7
30 mins	75.66±6.15	136.5±6.01	85.9±5.11	128±7.06	115±4.2	115.8±4.8
60 mins	75.4±4.43	130.3±6.5	87.5±6.51	120±4.81	109±2.5	109.66±2.8
120 mins	75.38±3.62	127.9±4.21	73.16±4.00	114.83±4.2	81.6±4.2	81±4.8

Values are expressed as mean ± SEM, n=6, P*≤0.05,vehicle control vs diabetic control, **P≤0.05 Diabetic control vs treated group

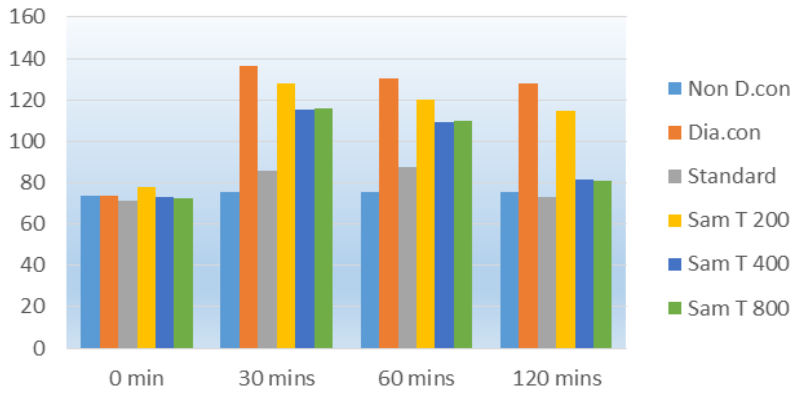

Fig. 1: Effect of *triticum aestivum* sprout extract on oral glucose tolerance test in STZ &NA model.

Blood glucose level in antidiabetic model

After administration of STZ, the blood glucose level were measured, it was found to in the in the range of 240-293 mg/dl in each rat, this range is considered as severe diabetes. When standard drug and test substance were administered, then their blood glucose level decreased significantly. From the result it was found that blood sugar level in standard group decrease from 194 ± 10.81 to 143 ± 3.41 mg/dl whereas in case of OD dose of sprout extract of Triticum aestivum the blood sugar level decreases from 241.5 ± 7.5 mg/dl to 207.83 ± 1.7 mg/dl. When the frequency of dosage increases then the rate of blood sugar decreases i.e., 227.5 ± 7.4 mg/dl to 201.5 ± 4.31 mg/dl in BD dose and 225.5 ± 8.7 mg/dl to 203.4 ± 5.6 mg/dl in QD dosage on 28th day respectively in significant manner shown in Table 2 and figure 2. From the statistical analysis it was found that sprout extract of Triticum aestivum has antidiabetic effect (P<0.01) when it is compared with diabetic control. It is found that in the 28th day, there was a significant decrease of blood glucose level in STZ diabetic animals.

Table 2: Effect of *Triticum aestivum* sprout extract on blood sugar level in antidiabetic model.

	Non diabetic control	Diabetic control	Gliclazide	*triticum aestivum* (200mg/kg b.w)	*triticumaestivum* Extract (400mg/kg b.w)	*triticum aestivum* Extract (800mg/kg b.w.)
Week 0	87.56±6.5	254±4.25	194±10.85	241.5±7	227.8±7.4	225.5±8.7
Week 2	93.5±5.21	276.5±2.71	163±2.31	214.3±2.13	216.66±6.5	218±8.3
Week 4	95.61±8.41	295.8±6.91	143±3.41	207.63±1.7	201.5±4.31	203.4±5.6

P*≤0.05, vehicle control vs diabetic control,
P*≤0.05, diabetic control vs treated groups

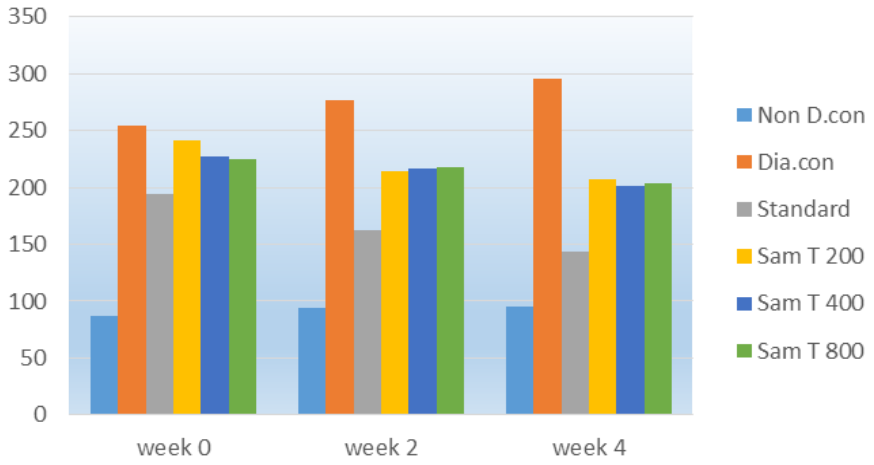

Fig. 2: Effect of *Triticum aestivum* sprout extract on blood sugar level in antidiabetic model.

Effect of sprout extract of Triticum aestivum in hyperlipidemia rat induced by using triton WR-1339

From the experiment it was found that, the mean body weight of group I and group II were not changed significantly, similarly in the treated group there was no significant changes in body weight shown in table 3 and figure 3.

Table 3: Effect of sprout extract of Triticum aestivum on body weight in triton-induced hyperlipidaemic rats.

Groups for treatment	Body weight(g)		
	Day 0	Day 1	Day 2
I. Vehicle control (demineralisd water)10ml/kg	242.17±4.81	262.33±4.71	261.34±5.5
II. Triton Control (200mg/kg I.p)	241.5±2.15	255.4±2.85	261.15±3.71
III. ATROVASTIN 7.2mg/kg	244.5±3.13	254.8±3.57	259.57±4.52
IV. Extract of *triticum aestivum* sprout (800mg/kg)	241.83±3.95	253.5±4.54	258.83±4.41

Values are expressed as mean ± SEM, N=6, except for groups 2 and 5 where N=5 here extract T is *triticum aestivum*

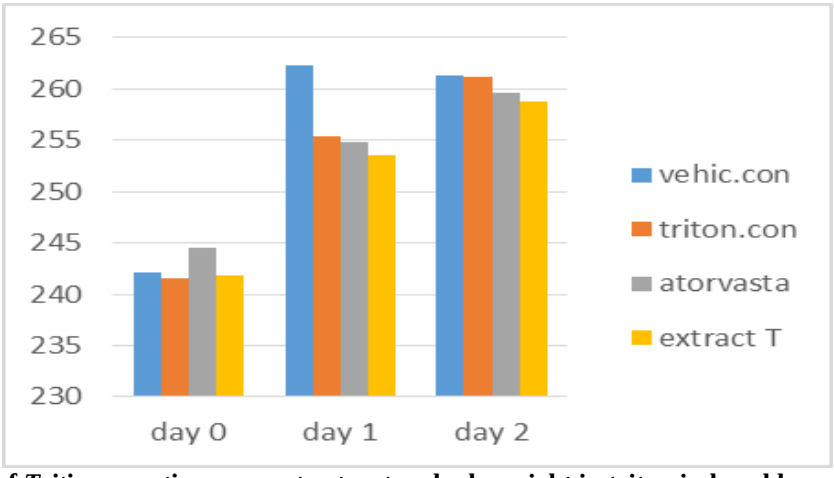

Fig. 3: Effect of *Triticum aestivum* sprout extract on body weight in triton induced hyperlipidemic rat.

When we analyzed the serum cholesterol in five group, results reveals sprout extract of Triticum aestivum shows very less significant decrease in serum cholesterol when compared with positive control in 18 and 24 hrs. shown in table 4 and figure 4. When we analyzed in day 0, there was no change in serum total cholesterol level, but after induction of triton, there was a significant increase of serum total cholesterol in hour18 and hour 24. When we compare data with standard group, there is significant decrease in serum total cholesterol level was found after administration when compared with Triton control group.

Table 4: Effect of sprout extract of Triticum aestivum on serum total cholesterol in triton-induced hyperlipidaemic rats.

Serum total cholestrol					
Treatment group	**Hour 0**	**Hour 18**	**Hour 24**	**Hour 40**	**Hour 48**
I. Vehicle control (demineralised water, 10ml/kg)	61.5±3.21	36.8±5.81	38.51±2.64	47.50±3.26	45.89±1.61
II. Triton control (200mg/kg)	65.55±5.71	247.85±29.81	213.62±28.71	58.12±3.94	53.83±3.42
III. Atorvastatin 7.2mg/kg	63.51±5.48	123.71±17.71	111.95±19.83	58.55±6.41	58.75±5.21
IV. Extract T 800mg/kg	62.9±2.51	187.8±12.51	142.65±14.81	57.82±3.69	52.98±4.31

Values are expressed as mean + SEM, except for group 2 where n=5, here extract T means *triticum aestivum*
P*<0.05,vehicle control vs Triton control
P** <0.05,triton control vs treated groups

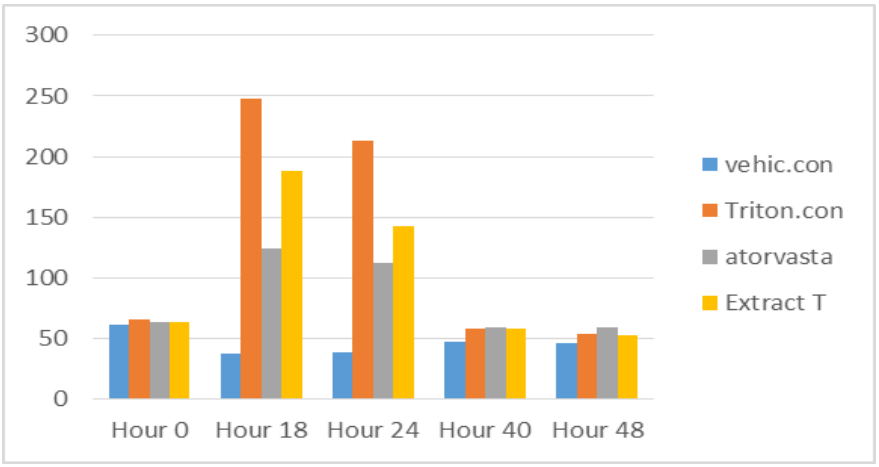

Fig. 4: Effect of *Triticum aestivum* sprout extract in serum total cholesterol in triton induced hyperlipidemic rats.

Similarly, when we examined the mean serum triglyceride level in each group, it was found that there was no significant changes occurring among all groups at 0 hr. At 18 and 24 hr, it was found that both sprout extract of Triticum aestivum and atorvastatin showed very less significant decrease in serum triglycerides level when compared with positive control group II shown in table 5 and figure 5.

Table 5: Effect of *Triticum aestivum* sprout extract on serum triglyceride in triton induced hyperlipidemic rats.

Serum triglyceride(mg/dl)					
Treatment group	**Hour 0**	**Hour 18**	**Hour 24**	**Hour 40**	**Hour 48**
I. Vehicle control (demeralized water,10ml/kg)	51.24±4.65	57.71±11.26	87.56±17.6	89.35±16.13	81.71±7.45
II. Triton control (200mg/kg)	60.51±3.1	1131.35±46.8	648.71±73.3	87.89±5.21	61.91±4.51
III. Atorovastatin (7.2mg/kg)	41.78±4.75	663.73±140.31	354.74±109.71	74.16±3.12	65.5±5.31
IV. Extract of Triticum aestivum (800mg/kg)	73.55±10.53	904.81±43.65	501.34±72.82	91.58±19.74	75.01±12.50

Values are expressed as mean ± SEM, n=6 except Gr-2 where n=5
Here extract T is *triticum aestivum*

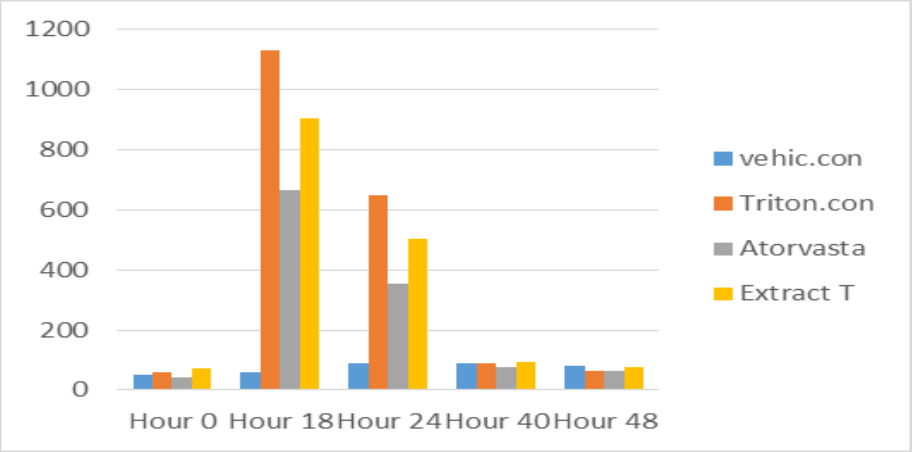

Fig. 5: Effect of *Triticum aestivum* sprout extract on serum triglyceride in triton induced hyperlipidemic rats.

DISCUSSION

Form the literature review we found that, diabetic mellitus[23] was induced by NA and STZ, leads to severe diabetic like conditions in which various organs get affected a lot because of action of STZ on beta cell of pancreas. The free radical generation characteristics STZ, able to cause abnormalities in beta cell and produces diabetic mellitus, further increase blood sugar. Many author proposes the mechanism of blood sugar induction, STZ stimulated beta cell death is due to alkylation of DNA by intercalating with six position of guanine nucleoside of DNA. It was also suggested that this molecule contributes to STZ induced DNA damage which causes DNA fragmentation. In addition, the STZ induced DNA damage decreases the cellular NAD+ and also decreases the content of ATP and inhibits synthesis and secretion of insulin [24]. In this experiment our study, after using sprout extract of Triticum aestivum for a certain period of time the blood sugar abnormalities were significantly restored by decreasing the blood sugar level.[21]

In the OGTT.[22] or glucose loaded hyperglycemic model, sprout extract of Triticum aestivum shows significant antihyperglycemic activity at the dose of 400 mg/kg and 800 mg/kg body weight respectively, indicates the test substances might have enhance the peripheral utilization of glucose. However, our experimental finding supported that dosage of sprout extract of Triticum aestivum in OD, BD and QD enhances the glucose utilization at 60 and 120 minutes.

When diabetic rats were treated with both sprout extract of Triticum aestivum and glyclazide, we found that there is significant decrease in plasma glucose level, indicates sprout extract of Triticum aestivum has antidiabetic activity due to revering action of oxidative stress or increase of plasma insulin level.

In hyperlipidaemic model the sprout extract of Triticum aestivum showed very less significant reduction of cholesterol and triglyceride in plasma when compared with positive control, indicates that our test substance having some ability of interference of cholesterol synthesis process could support to reduce plasma hyperlipid level.

From the reported phytochemical analysis it was found that *triticum aestivum* sprout extract consists of major constituent's alkaloids like premnine, flavoids luteonin sterol and triterpene. These alkaloids rich with antioxidant properties which could reverse the STZ induced oxidative stress in diabetic rats. Form the above discussion it may be conclude that sprout extract of Triticum aestivum has significant effectiveness against metabolic disorders like diabetes hence further exploration of isolates and molecular mechanism study are required to get the exact usefulness in the management of diabetes mellitus.

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