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Research Article

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Effect of brewer's yeast on glucose homeostasis and lipid profile in streptozotocin induced diabetic rats

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ABSTRACT

Brewer's yeast may have beneficial effects on insulin receptors in diabetic rats because of its glucose tolerance factor. This study was conducted to investigate the effects of Brewer's yeast on glycemia and lipid profile in Streptozotocin (STZ) induced diabetic rats. Twenty four Wistar albino rats of either sex weighing 170 - 220 g bw were divided into four groups, (i) Control (ii) Control treated with Brewer's yeast iii) STZ (60 mg/kg body wt) induced diabetic rats iv) STZ induced diabetic rats treated with Brewer's yeast. Effect of a four-week oral administration of Brewer's yeast (160 mg/kg/day) on the glucose homeostasis (RBS & HbA1c) & lipid profile was assessed in Control & STZ -induced diabetic rats. Body weight, food consumption, blood glucose, lipid profile were measured. Administration of STZ produced a significant increase in blood glucose and HbA1c levels ($p<0.05$) as compared to control group. Treatment with Brewer's yeast significantly reduced blood glucose and HbA1c levels ($p<0.05$) in STZ induced diabetic rats. Significant decrease in blood glucose levels were also observed in control rats treated with Brewer's yeast. Alterations in lipid profile produced in STZ group of rats were reversed with Brewer's yeast. Based on this study, it can be concluded that Brewer's yeast supplementation has a modest beneficial effect on glycemia and lipid profile in STZ induced type 2 diabetic rats. Further studies are required to confirm the more beneficial effects of Brewer's yeast in diabetes mellitus.

Keywords: Brewer's yeast, Streptozotocin, Blood glucose, HbA1c, Lipid profile, Albino rats.

INTRODUCTION

DM is one of the most common metabolic disorders and non infectious diseases in the world[1]. In diabetic individuals, long-standing hyperglycaemia leads to nephropathy, neuropathy, and CV diseases[2]. WHO reports state that >246 million people are affected by NIDDM[3] and this could go up to 438 million by 2030[4].In Iran, one out of five persons is diabetics and 10%-15% of these patients die every year[5,6].

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Diabetes mellitus(DM) once considered as a disease of least significance to World Health Organization (WHO), has now become one of the major threats to human health in 21st century[8].In last few years developing countries such as India have the maximum increase in number of patients with DM. In India current prevalence of type 2 Diabetes is 2.4% in the rural population and 11.4% in urban population. The International Diabetes Federation declared India as Diabetic Capital of the World[9]. Currently insulin and oral anti-diabetic drugs are the mainstay of the treatment but they have their own limitation. The goal of treatment of DM is to allow the patients to lead normal life while achieving normal metabolicstate to slow down or prevent long term complications of DM.In order to achieve these goals there has been continuous search for new effective, safer and cheaper drugs.

Impaired glucose tolerance resulting from chromium deficiency is reversed by chromium supplement especially rapidly by food with high organic content. Trivalent Chromium is a dinicotinato, glutathione like complex is considered an essential element for insulin action and glucose utilization. This biologically active molecule is known as glucose tolerance factor (GTF)[10].

Though GTF is present in variety of foods such as liver, meat, cheese and whole grain, the richest known source is Brewer's yeast. GTF present in brewer's yeast is rapidly absorbed and biologically active and enhances peripheral action of insulin thus improving glycemic control. Improved glycemic control in diabetic individuals improve lipid metabolism thereby reducing risk factors for coronary heart disease. Therefore the present study is undertaken to evaluate the effect of brewer's yeast containing GTF on glycemia and lipid profile in Streptozotocin induced diabetic rats.

EXPERIMENTAL SECTION

Wistar rats weighing 170-220gm of either sex bred from a stock were obtained from the Central Animal House, BLDEU's Sri BM Patil Medical College Hospital &Research Center, Bijapur, India and were used in the study.

Animals were housed in quarantine room individually in polypropylene cages for one week of acclimation before starting the experiment. The study was approved by Institutional Animal Ethical Committee (IAEC).

Grouping of Animals

Animals were randomly divided in to 4 groups

Group 1: Control-Will receive gum acacia by gavage orally for four weeks.

Group 2: Control treated with Brewer's yeast-Will receive Brewer's yeast 160mg/kg/day[11] by gavage for four weeks.

Group 3: STZ induced diabetic rats –Will receive gum acacia by gavage for four weeks started three weeks after administration of streptozotocin (STZ) 60 mg/kg body wt[12].

Group 4: STZ induced diabetic rats treated with Brewer's yeast-Will receive Brewer's yeast by gavage for four weeks started three weeks after administration of STZ.

Effect of a four-week oral administration of Brewer's yeast (160 mg/kg/day) on the glucose homeostasis & lipid profile was assessed in Control & STZ -induced diabetic rats. All animals will have access to food and water *ad libitum*. No animals were sacrificed at the end of study.

Parameters evaluated

Body weight (Weekly from base line- till 28th day), Food consumption (weekly from base line- till 28th day), Baseline and at the end of study(28th day), Blood glucose (GOD-POD method), HbA1c levels and Lipid profile[On 7, 14 and 21st days RBS was done using glucometer].

STATISTICAL ANALYSIS

All the values were expressed as the mean ±SEM and analysed by one way analysis of variance (ANOVA) followed by Games-Howell post hoc comparisons tests to study the differences between groups. The level of statistical significance was set at $p<0.05$.

RESULTS

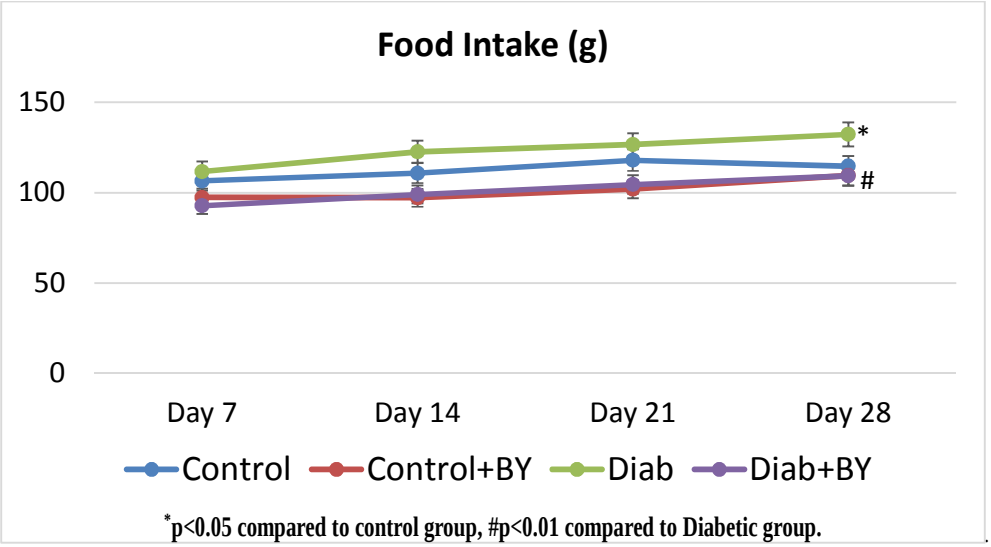
Table 1: Body weight gain in 28 days

	Body Weight				
	Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
Control	216±8.2	233±8.7	233±9.2	240±9.1	242±8.2
Control + BY	195±13.5	202±13.1	209±12.8	214±12.4	219±12.4
Diab	186±9.8	191±6.4	199±6.2	199±8.0*	187±9.8*
Diab + BY	192±9.4	201±9.4	208±9.2	210±9.5	216±7.9

*Figures are in (Mean±SEM). *p<0.05 compared to control group.*

Animals in all groups gained body weight throughout study period, however there was significant reduction in the body weight in diabetic group ($p<0.05$) as compared to control group on 21st and the 28th day (Table 1).

FOOD INTAKE



Bars indicate SEM
Fig 1: Food intake over 28 days in various groups

Food intake: There was significant increase in the food intake in diabetic group as compared to control group on 28th day (Figure 1). Concurrent administration of Brewer's yeast in diabetic rats significantly prevented the increase in food intake on 28th day compared to untreated diabetic group ($p<0.05$).

BLOOD GLUCOSE

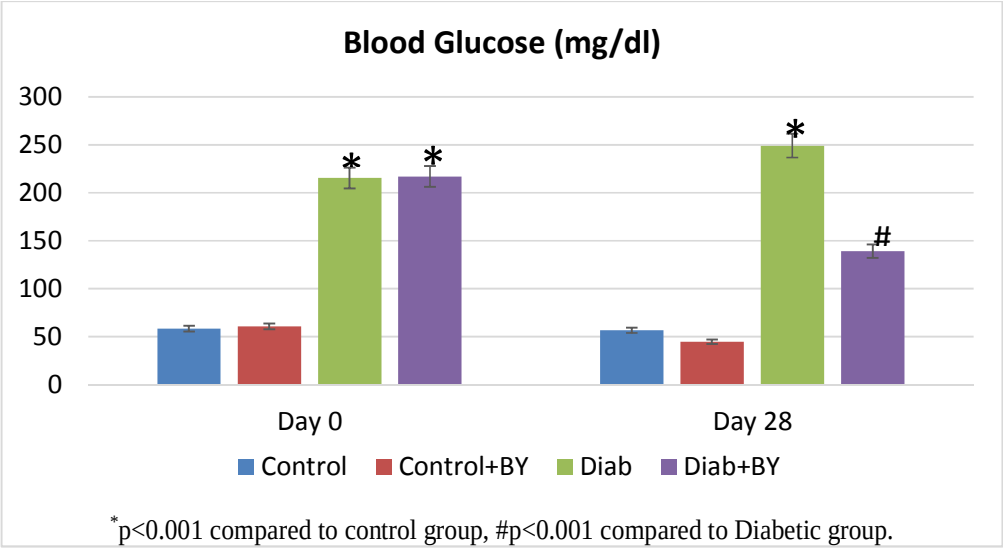


Fig 2: Blood Glucose levels over 28 days in various groups

Blood Glucose: Significant increase in blood glucose levels in both the Diabetic groups on day 0 compared to control group ($p<0.001$) was observed (Figure 2). Treatment with Brewer's Yeast has reduced blood glucose levels significantly on day 28 ($p<0.001$).

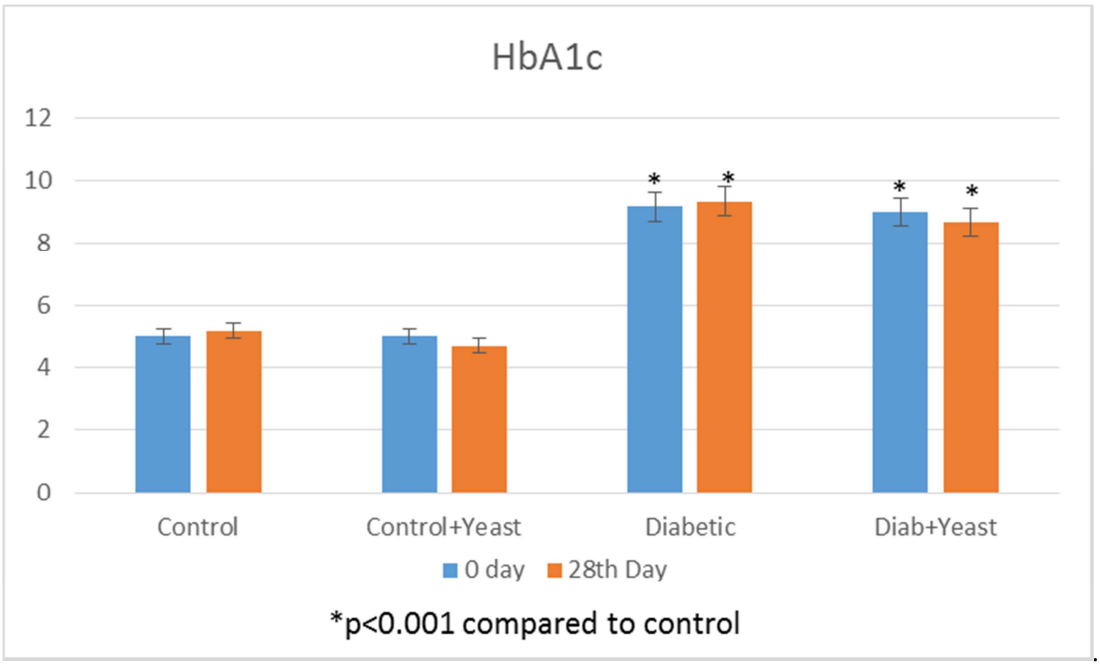
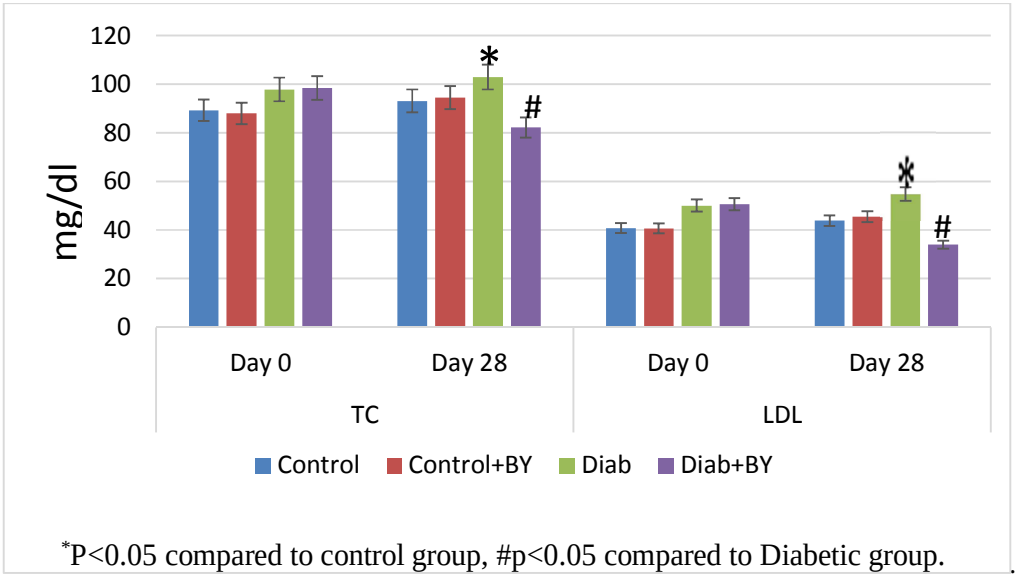


Fig 3: HbA1c levels in different groups

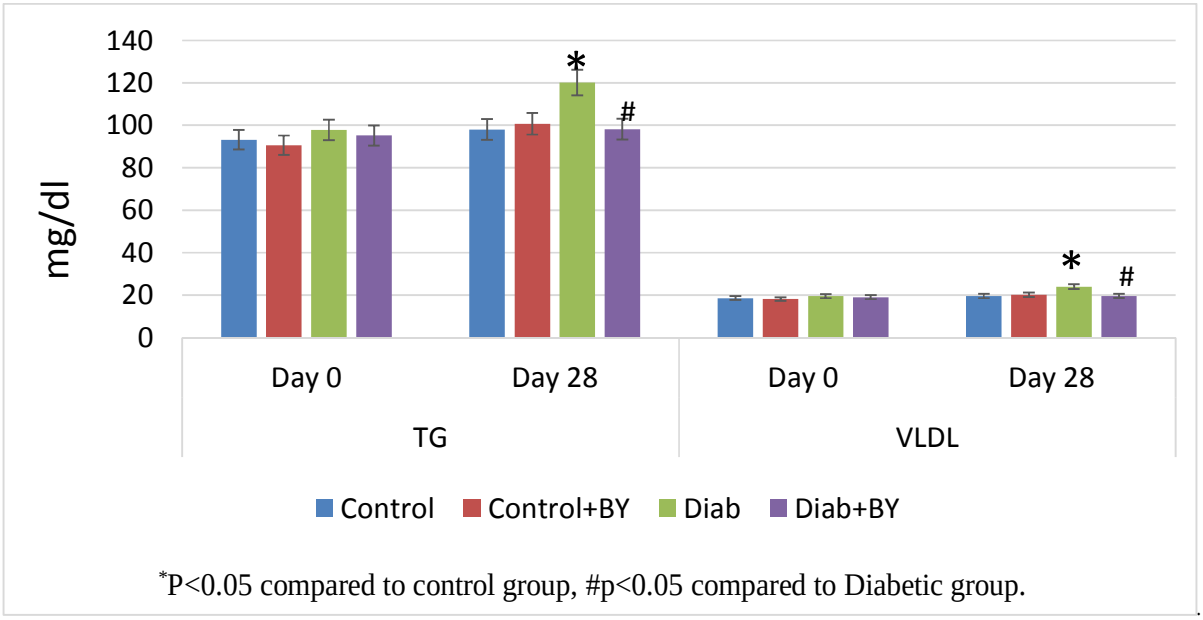
HbA1c levels: HbA1c levels were increased significantly in both treated and untreated diabetic rats compared to normal control rats. This increase was reduced by 28 days yeast treatment, but significant difference was not achieved (Figure 3).

LIPID PROFILE



Bars indicate SEM

Figure 4. Serum lipid levels in different groups



Bars indicate SEM

Fig 5: Serum lipid levels in different groups

Lipid Profile: There was significant increase in Serum Total Cholesterol, LDL, TG & VLDL in Diabetic group compared to control group ($p<0.05$) on 28th day. This increase was prevented significantly in Brewer's yeast treated diabetic group ($p<0.05$) on 28th day (Figure 4 and Figure 5).

Table 2: HDL levels in various groups

HDL (mg/dl)		
	Day 0	Day 28
Control	30±1.3	30±1.4
Control + BY	29±1.2	29±0.6
Diab	28±0.9	24±1.2*
Diab + BY	29±0.9	29±0.9#

Figures are in (Mean±SEM).

** p<0.05 compared to control group, # p<0.05 Compared to Diabetic group.*

On other hand, HDL levels were decreased significantly in diabetic rats ($p<0.05$) on day 28, while Brewer's yeast treatment ameliorated this effect significantly ($p<0.05$) (Table 2).

DISCUSSION

Our study results show improved glycemic control in diabetic rats and lipid metabolism thereby reducing risk factors for coronary heart disease.Chromium which is present in Brewer's yeast appears to be involved in the regulation of insulin action and it's effects on carbohydrate, protein and lipid metabolism by enhancing insulin sensitivity.

Studies have shown that individuals with type 2 diabetes have low chromium as compared to normal subjects and chromium supplements enhance the metabolic actions of insulin improving glycemic control[13]. Insulin resistance with or without the presence of metabolic syndrome significantly increases cardiovascular risk. By enhancing the insulin sensitivity chromium as chromium picolinate lowers the risk of cardiovascular adverse events.

Study carried out by Chen WY et al. (2009) suggested that chromium supplementation can provide a beneficial effect in diabetic subjects by enhancing insulin signaling in skeletal muscle[14]. Study carried out by Racek J et al. (2006) suggest that supplementation with Cr-enriched yeast in well controlled type 2 diabetes mellitus is safe and can result in improvements in blood glucose variables and oxidative stress[15]. Lia MH et al. (2006) studied chromium yeast supplementation for its ability to improve carbohydrate and lipid metabolism in streptozotocin induced diabetic rats. The result of their study suggested that chromium yeast supplementation decreased the fasting blood glucose and LDL-cholesterol levels in STZ-induced diabetic rats.

This study increases the possibility of using chromium yeast supplementation to improve carbohydrate and lipid metabolism in patients with type 2 diabetes mellitus[16].

CONCLUSION

The results of this study suggest that Brewer's yeast decreased the blood glucose and LDL-cholesterol levels in STZ-induced diabetic rats. This raises the possibility that Brewer's yeast supplementation can be considered to improve carbohydrate and lipid metabolism amongst human patients featuring type 2 diabetes mellitus. Further studies are required to confirm the more beneficial effects of Brewer's yeast in diabetes mellitus.

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