Effect of Beer and Barley water on some biochemical parameters of Diabetic Male Rats

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Abstract:

The present study aimed to investigate the effect of beer and barley water on body weight, blood glucose, cholesterol, triglycerides (TG), aspartate aminotransferase (AST), alanine aminotransferase (ALT), malondialdehide (MDA) and ceroluplasmine (CP) level of diabetic male rats. 2ml from beer and barley water were used and the animals were treatment for 14 days. the results showed a significant decrease in body weight, whereas it explained a significant increase blood glucose, cholesterol, TG, AST, ALT, MDA and CP of the diabetic male rats when compared with control group. the results showed a significant decrease in body weight, whereas it explained a significant increase blood glucose, cholesterol, TG, AST, ALT, MDA and CP of the diabetic male rats treated with alcohol when compared with diabetic male rats and control group. the results showed a significant increase in body weight whereas it explained a significant decrease blood glucose, cholesterol, TG, AST, ALT, MDA and CP of the diabetic male rats treated with barley water when compared with diabetic male rats and control group.

Key Words: alcohol , barley, alloxan, diabetic, male rats.

1. Introduction:

Diabetes mellitus is a metabolic disturbance of the endocrine system that precipitates disturbances in glucose, lipid and protein homoeostasis; Insulin, whose absolute or relative deficiency leads to diabetes is produced by the B cells of pancreatic islets of Langerhans. The

islets which represent the endocrine part of the pancreas it contains two main cell types, the alpha (A) cells and the beta (B) cells. A third common less type is the delta (D) cell, and a fourth, very rare cell is the C-cell. The A cells which produce glucagon make up about 20% of the islet cells and have a characteristics peripheral diffused within the islet. The B cells which product insulin are numerous forming about 70% of the islet cells and occupy the interior of the islet (Wheater *et al.*, 1987).

The natural pursuit for alcohol consumption has made it "a free for all drink" despite the obvious consequences of its acute and chronic Poisoning (Nwodo, 1999). The morbidity and mortality of the diseases associated with alcohol intake is both a social and health problem and the complication of DM may be a double tragedy for alcoholic diabetics. Fatty liver, cirrhosis and hepatitis have been associated with high intake of alcohol (Ewa and Arthur, 1996; Nwodo, 1999).

This indicates that liver damage may be as a consequence of alcohol ingestion. The presence of iron in beer has been implicated in the generation of reactive oxygen species and amplify illness diseases associated with consumption of alcoholic beverages

Barley, *Hordeum vulgare L*., Family; Germinaceae, is the most nutritious food on earth, it contains abalance of many minerals, amino acids, fibers and enzymes. It is used to support the body's own selfhealing mechanisms. The components of barley aid the body in maintaining cells in a healthy condition and work to correct abnormalities. Barley has been used as an aid in the treatment of a variety of conditions such as arthritis, gastrointestinal diseases, diabetes, skin abnormalities, weight loss, detoxifying and cancer (Khorasani *et al*., 1997).

Barley is an important variety grain and a widely used cereal, because of its dietary health advantages, ready availability and low costs. It is mostly known for its high quantity of dietary fiber such as glucan β which may reduce the risk of coronary heart disease (Lee *et al*., 2010).

Barley bran contains *β*-glucans (beta-glucans) which is polysaccharides of D-glucose monomers linked by *β*-glycosidic bonds. *β*-Glucans are a diverse group of molecules that can vary with respect to molecular mass, solubility, viscosity, and three-dimensional configuration (Bhatty, 1995). The administration of barley bran may help to reduce

appetite and weight gain and ameliorate lipid profile(Artiss *et al*., 2006; Reyna-Villasmil *et al*., 2007). The viscosity determined by water solubility and molecular weight has been shown to affect the hypocholesterolemic effect of beta-glucans (Butt *et al*., 2008). Hull-less barley brans consist of mannose, galactose, glucose, xylans, and arabinose (Gong *et al*., 2012). The hypocholesterolemic effects of dietary hull-less barley p-glucan (HBG) on cholesterol metabolism are reducing the concentration of plasma LDL cholesterol by promoting the excretion of fecal lipids and regulating the activities of HMG-CoA reductase and CYP7A1 in hypercholesterolemic hamsters (Tong *et al*., 2015).

In addition, it was postulated that the beneficial effect of barley might be explained by its high content of chromium (Mahdi and Naismith, 1991). According to Nelson *et al*. (2006) eating barley whole grains by human blood sugar can be regulated for up to 10 hours after consumption. What seen to responsible for barley's effectiveness in regulating blood glucose is Likely its soluble fiber content (Cade *et al*., 2007).

The aim of this study is to determine the influence of beer and barley water on some biochemical parameters of diabetic male rats

2. Materials and Methods:

2.1 Induction of diabetes mellitus:

The animals were fasted for 12 hr and diabetes was induced by a single intraperitoneal (IP) injection of alloxan monohydrated (BDH, England) dissolved in D.W at a dose of 125 mg/kg body weight in a volume of 0.5 ml. The diabetic state was confirmed 7 day after alloxan injection by the blood serum. Sugar value was greater than 200 mg/dl (hyperglycemia). Survived rats with a fasting blood glucose level higher than 200 ml /dl were included in the study (Alarcon *et al*., 2002).

2.2 Experimental design:

The study was carried out on twenty four mature male rats (*Rattus norvegicus*), aged as 10-12 weeks and weighing between 180 - 200 gm. The animals were housed in a well ventilated 12 hrs light and 12 hrs dark

cycles. The animals were divided into four equal groups, each group consist of (6) rats:

1- The first group(control group) was treated with (0.5ml/animal/day) from normal physiological saline (0.9% NaCl) for 14 days.

2- The second group was injected with (0.5ml/animal/day) of alloxan (125mg/kg).

3- The third group was injected with (0.5ml/animal/day) of alloxan (125mg/kg) ,after week, this group was treated with (2ml) of beer for 14 days.

4- The fourth group was injected with (0.5ml/animal/day) of alloxan (125mg/kg), after week, this group was treated with (2ml) of barley water for 14 days.

Beer and barley water were obtained from the local market in Thi-Qar province, Iraq. The animals weight was measured at the end of each week by using Animals balance, at the end of the experimental period (14 day).

2.3 Blood collection:

After 14 days of treatment, the animals were sacrificed. Blood samples were collected by cardiac puncture, 5mL of blood were drawn from each animal of experimental groups, and put in tubes without EDTA, centrifuged at 3000 rpm for 15 minutes, and then serum was separated and kept in the refrigerator at -20ºC until the time of assay.

2.4 Measurement of serum lipid profile :

The used reagents were supplied by Biolabo (France), and serum total cholesterol was measured according to Allan and Dawson (1979), and Serum TG was measured according to (Tietz *et al*., 1994).

Measuring of serum (MDA), (CP)(AST), (ALT) level

According to Muslih *et al*. (2002) the level of MDA was determined by a modified procedure described by Guidet and Shah (1989**)**. while serum Cp concentration was measured by the method of Menden *et al* (1977). and (AST), (ALT) were determined by enzymatic colorimetric methods using Atlas Medical (UK)

2.5 Statistical analysis:

Statistical analyses were done utilizing the computer data processing (SPSS, version 14). A probability value ($P<0.05$) was considered to be statistically significant. and used to calculate least significant difference (LSD) values for the comparison of means following.

3. Results:

Table 1 : Effect of Alcohol and Barley on body weight, sugar, cholesterol and triglyceride levels of Diabetic Male Rats

Animal groups	Body weight(g) Mean ± S.E	mg/dL)) Glucose(Mean ± S.E	Cholesterol Mg/dl Mean ± S.E	T.G Mg/dl Mean ± S.E
First group	74.002± 2.39 [a]	104.24±1.42 [c]	102.83± 1.42 [d]	81.79± 1.50 [c]
Second group	44.66± 3.10 [c]	228.51± 3.05 [b]	275.50± 1.13 [b]	94.06± 0.99 [b]
Third group	54.00± 1.81 [b]	242.30± 2.31 [a]	300.33± 2.33 [a]	110.43± 3.28 [a]
Fourth group	71.99± 2.23 [a]	114.82± 2.34 [c]	125.83± 1.42 [c]	87.75± 0.63 [c]
LSD	9.77	12.5	16.03	7.14

Values are means ± S.E.
Different letters refer to significant differences ($p<0.05$).
Same letters refer to No significant differences ($p<0.05$).

The results showed a significant decrease in body weight, and a significant increase blood glucose, cholesterol and TG of the diabetic male rats when compared with control group (table 1). the results showed a significant decrease in body weight, whereas it explained a significant increase blood glucose, cholesterol and TG of the diabetic male rats treated with alcohol when compared with diabetic male rats and control

group. the results showed a significant increase in body weight whereas it explained a significant decrease blood glucose, cholesterol and TG of the rats treated with barley water when compared with diabetic male rats and control group (table 1).

Table 2 : Effect of Alcohol and Barley on AST, ALT, MDA and CP levels of Diabetic Male Rats

Animal groups	AST(UL) Mean ± S.E	ALT(UL) Mean ± S.E	MDA(nmol/Ml) Mean ± S.E	(g/L) CP Mean ± S.E
First group	57.05± 1.26 c	8.98± 0.21 c	49.24± 2.03 c	4.50± 0.15 a
Second group	90.14± 2.52 a	15.25± 0.72 a	69.27± 1.40 a	5.62± 0.18 b
Third group	95.29± 1.01 a	16.70± 1.04 a	72.42± 2.33 a	5.85± 0.29 b
Fourth group	71.99± 2.23 b	11.54± 0.37 b	56.54± 0.99 b	4.96± 0.19 a
LSD	9.77	3.03	4.77	0.53

Values are means ± S.E.
Different letters refer to significant differences ($p<0.05$).
Same letters refer to No significant differences ($p<0.05$).

The results showed a significant decrease in body weight, whereas it explained a significant increase in AST, ALT, MDA and CP of the diabetic male rats when compared with control group (table 2). whereas it explained a significant increase in AST, ALT, MDA and CP of the diabetic male rats treated with alcohol when compared with diabetic male rats and control group. the results showed a significant decrease in

AST, ALT, MDA and CP of the rats treated with barley water when compared with diabetic male rats and control group. (table 2).

4. Discussion:

Table 1 showed that the normal rats had the highest weight while the diabetic rats had lower weight. Treatment with alcohol resulted to further loss in weight compared with the diabetic male rats. This suggests that the condition of diabetes can cause a decrease in weight and alcohol (beer) ingestion by diabetics compounded the problem. Earlier weight loss was reported from diabetes subjects (Ogugua, 2000).

Typically, oxidative stress can lead to weight loss that may be specific in ethanol treated rats. Alcohol in this study increased the oxidation that has lead to the loss of body weight of stressed animals. The high weight of diabetic male rats treated with barley this is because of growing research on the role of some edible plants protein in improvement of metabolic syndrome (Potter *et al.*,1998).

Table 1 showed high levels of glucose, cholesterol and TG in diabetic not treated rats which further increased in alcohol treated diabetic rats. There was height in blood glucose level of diabetic alcohol treated rats when compared with other treatments.

Barley contains many different amino acids, so the hypoglycemic effect of barley may be express by its content of amino acids and chromium. Barley had a modulating influence on the symptoms of diabetes when compared with a starch or sucrose based diet (Naismith *et al.*, 1991).

Earlier reports proposed an overall reduction of blood glucose by alcohol (Nwodo, 1999). Prolonged ingestion of alcohol could trigger off excess production of reactive oxygen species leading to increased blood glucose level. Increased MDA and CP level has been associated with increased glucose level (Reaven, 1995). Previous reports proposed an overall reduction of blood glucose by alcohol (Nwodo, 1999). Long time

ingestion of alcohol could trigger off excess production of reactive oxygen species leading to increased blood glucose level. Increased MDA and CP level has been linked with increased glucose level (Reaven, 1995).

The decrease of MDA and CP levels in rats treated with barley water might be due to its antioxidant capacity of minerals *e.g.* magnesium, selenium, copper and chromium which are abundant in barley seeds and works as cofactors for many enzymes including those with antioxidant activity (Choe *et al.,* 2010). The treatment of diabetic rats with barley and some of its components (chromium and amino acids) could repair liver damage and restoring pancreatic B-cells deformation. This was manifested by the biochemical and immunoassay results and electron microscope study where the hypoglycemic and hypolipidemic action of barley may be due to its contents generally and in specific to its content of chromium and/or amino acids (Yousef *et al.,* 2006).

Glucose autoxidation and increased oxidative stress has been Informed (Hunt and Stocker 1990). The decrease in the activities of plasma and liver AST and ALT pointer that diabetes may be caused by hepatic impairment (El-Demerdash *et al.,* 2005) and impaired synthesis of enzymes themselves from its store in liver. Thus the metabolic abnormalities caused by diabetes may result in disturbance of some metabolic enzyme synthesis. The support our conclusion that it was occur by Larcan *et al.* (1997) that liver was necrotized in diabetic patients. However, treatment of alloxan diabetic groups with barley water for 14 consecutive days could restore the activities of the above enzymes to their normal levels. A possible explanation for the differential effects of barley on the activities of these enzymes is that the treatments may inhibit the liver damage induced by alloxan.

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الخلاصــة

هدفت الدراسة الحالية إلى معرفة تأثير البيرة وماء الشعير على وزن الجسم، كلوكوز الدم، الكوليسترول، الدهون الثلاثية، وانزيمات الكبد والمالونالديهايد وسيرولوبلازمين في ذكور الجرذان المختبرية المصابة بالسكري تجريبا. اذ تم استخدام 2مل من البيرة وماء الشعير المياه وقد عوملت الحيوانات بها لمدة 14 يوما. أظهرت النتائج وجود انخفاض معنوي في وزن الجسم، بينما أظهرت زيادة معنوية في نسبة الكلوكوز في الدم، الكوليسترول، الدهون الثلاثية، وانزيمات الكبد والمالونالديهايد وسيرولوبلازمين في ذكور الجرذان المختبرية المصابة بالسكري مقارنة مع مجموعة السيطرة. بينما أظهرت النتائج وجود انخفاض معنوي في وزن الجسم، بينما أوضحت زيادة معنوية في نسبة الجلوكوز في الدم والكولسترول، الدهون الثلاثية، وانزيمات الكبد والمالونالديهايد وسيرولوبلازمين في ذكور الجرذان المختبرية المصابة بالسكري المعاملة بالكحول بالمقارنة مع ذكور الجرذان المختبرية المصابة بالسكري ومجموعة السيطرة. كما أظهرت النتائج وجود زيادة معنوية في وزن الجسم، في حين اظهرت انخفاضا معنويا في نسبة الجلوكوز في الدم والكولسترول والدهون الثلاثية، وانزيمات الكبد والمالونالديهايد وسيرولوبلازمين في ذكور الجرذان المختبرية المصابة بالسكري المعاملة بماء الشعير بالمقارنة مع ذكور الجرذان المختبرية المصابة بالسكري ومجموعة السيطرة.