Asian Journal of Chemistry Vol. 22, No. 3 (2010), 2375-2378

Effect of Streptozotocin on Biochemical Parameters in Rats

CENNET RAGBETLI* and EBUBEKIR CEYLAN†
Department of Pharmacology-Toxicology, Iki Nisan, Konuklar Sit., Van-65100, Turkey
E-mail: cennetr@hotmail.com

This study was carried out to investigate whether streptozotocin induced diabetic rats could effect some of serum biochemical parameters. Twenty Sprague-Dawley albino rats were divided into two experimental: Control (50 mg/kg SF) and streptozocin (60 mg/kg), Control rats were given only physiological saline (50 mg/kg). Serum glucose, AST, ALT and cholesterol levels of rats were determined after treatment of 1, 3 and 6 h, while the level of glucose, aspartate amino transferase (AST) and alanine amino transferase (ALT) were increased and cholesterol level was decreased. It is concluded from the experimental study that streptozocin (60 mg/kg) may increase of serum glucose, AST, ALT levels and cause diabet in rats.

Key Words: Streptozotocin, Serum, Rats.

INTRODUCTION

Streptozotocin (STZ) induces diabetes in laboratory animals through the damage and death of the endocrine pancreatic islet B cells thus causing diabetes in experimental animals[1]. There is an evidence that the generation of hydrogen peroxide, superoxide anion radicals, and hydroxyl radicals play a critical role in the cytotoxicity of streptozotocin[2]. Diabetes mellitus is an endocrinological metabolic disorder. The International Diabetes Federation (IDF) estimates that more than 246 million people worldwide have diabetes and this number is expected to rise to 380 million within 20 years. The mechanism by which diabetes leads to a lot of complications is complex and not yet fully understood, but involves the direct toxic effects of high glucose levels, abnormal lipid levels and both functional and structural abnormalities of small blood vessels[3]. Diabetes mellitus is a common disease with substantial associated morbidity and mortality. However, morbidity associated with STZ and its ability to induce diabetes vary with different dosages among different animal species, including nonhuman primates. Because diabetes is defined by blood glucose levels and pressure, much of the attention in diabetes care focuses on the management of hyperglycemia. It has been found that a lot of drug and nutritions decrease serum glucose in experimental animals and may potentially be therapeutic for diabetes mellitus[4-6].

†Department of Internal Medicine, Veterinary Faculty, Yuzuncu Yil University, Van, Turkey.

The present experiment was designed to investigate the biochemical disturbances (glucose, ALT, AST and cholesterol) that occur in rats after the evolution of streptozotocin (60 mg/kg) induced diabetes in different times.

EXPERIMENTAL

Biochemical procedures: At the end of the experimental period (1, 3 and 5 h), blood samples were taken to determine of serum concentrations of glucose, ALT, AST and cholesterol in treatment group of animals (n = 6). Blood samples of control group animals were taken to determine of serum concentrations of glucose, ALT, AST and cholesterol only before the treatment (0 h). Seum glucose, AST, ALT and cholesterol levels were measured using an autoanalyser (BNN/HITACHI-911) and the corresponding kit (DPC, Diagnostic products corporation, USA).

Animals: Twenty male Sprague-Dawly rats weighing 225-250 g were haused in temperature controlled room 20-22 °C with a 12 h light/dark cycle. All animals prepared according to criteria outlined in the Guide for the Care and Use of Laboratory Animals prepared by the National Academy of Sciences and published by National Institues of Health. All procedures were performed sterilized conditions.

Rat treatment: Control rats (n = 10) were given only physiological saline (50 mg/kg), single dose streptozotocin induced diabetic rats were exposed[7] to 60 mg/kg (n = 10) doses of STZ distilled water by intraperitoneal administering immediately[8]. Serum samples were obtained from fresh rat blood. The fasting blood glucose, AST, ALT and cholesterol levels were measured after 5 h in all of the groups. The blood samples centrifuged at 2000 rpm for 10 min, plasma and buffy coat were removed. Then, samples were obtained.

Statistical analysis: The data were expressed as mean ± standard deviation (SD) and analyse during analysis of variance ANOVA. Tukey's test was used to test for differences among means for which ANOVA indicated a significant ($p < 0.05$).

Parameters of control and treatment groups are shown in Table-1. Serum paramaters increased or decreased significantly ($p < 0.05$) in streptozotocin rats.

RESULTS AND DISCUSSION

The effects of streptozotocin (STZ) on levels of glucose, AST, ALT and cholesterol in rat serum samples were investigated *in vivo*. After the treatment of STZ (1, 3 and 6 h) of rats produced change in the levels of serum glucose, AST, ALT, cholesterol. The levels of glucose, AST and ALT increased significantly, while levels of cholesterol decreased significantly in different doses STZ intraperitonealy administering. Streptozotocin was well tolerated, and no side effects were observed.

Diabetes mellitus comprises a heterogeneous group of hyperglycemic disorders characterized by loss of glucose homeostasis and disturbances of carbohydrate and lipid metabolism[9]. Patients with diabetes are at increased risk of atherosclerosis and its clinical sequelae: coronary, renal, peripheral vascular and cerebrovascular diseases. Concurrently, the most common cause of death in persons with diabetes is myocardial

infarction. The pathogenesis, progression and epidemiology of atherosclerotic disease are distinct in patients with diabetes[10]. Because of alot of therapeutic agents were used for solving this problem. Stptozotocin is a frequently used drug that exerts a diabetogenic effect through a specific damage of the pancreatic β-cells, mimicking type 1 DM. Blood glucose need to be individually tailored as part of a comprehensive cardiovascular risk management strategy[11]. Effects of biochemical on hypoglycemic effects of Traditional Indian anti-diabetic plants in streptozotocin induced diabetic rats have been done[12] *in vivo*. Biochemical study on the effects of *Nigella sativa* in streptozotocin-induced diabetic rats have been investigated[13]. Previous studies reported that STZ was also efficacious after intraperitoneal administration of a similar or higher dose, but single dose below 40 mg/kg bw may be ineffective[14]. Other additional studies conclude that low-dose of STZ at 55 mg/kg successfully induces diabetes in cynomolgus monkeys with minimal liver and kidney toxicity[15]. To find an optimal dose of STZ that would cause diabetes with minimal toxicity, we compared of streptozotocin groups which administered single dose 60 mg/kg (n = 6) to induce diabetes. It is also found that the levels serum glucose, AST and ALT levels in 1, 3 and 6 h increased due to increasing dose of streptozotocin (60 mg/kg) and induced diabetes. The present study was similar with previous studies[16]. These manifestations are a consequence of a metabolic alteration, with an increase of glyconeogenesis and of cetogenesis and/or of hepatic lesions that occur in diabetic animals[17]. It is found that the levels of cholesterol decreased all of the streptozotocin groups compared to the control group (Table-1). A recent work reported that reversibility of diabetic state acute and chronic streptozotocin injection, as demonstrated by reduction of glucose, AST and ALT levels with some of the foods[16,18]. However, more studies are needed to verify and clarify the relationship between different doses streptozotocin induced diabet and biochemical parameters.

TABLE-1
LEVELS OF BLOOD GLUCOSE CONTROL (50 mg/kg PHYSIOLOGICAL SALINE) AND AFTER THE SINGLE ADMINISTRATION OF STREPTOZOTOCIN 60 mg/kg DOSES FOR THE 1, 3 AND 5 h

Parameters	C = 50 mg/kg (n = 6)	1 h (n = 6)	3 h (n = 6)	5 h (n = 6)
Glucose(mg/dL)	97 ± 5	175 ± 9^{c}	244 ± 5^{b}	264 ± 9^{a}
AST (U/dL)	23 ± 7	41 ± 3^{b}	33 ± 3^{b}	109 ± 2^{a}
ALT (U/dL)	24 ± 5	196 ± 6^{a}	74 ± 4^{b}	186 ± 4^{a}
Cholesterol (mg/dL)	141 ± 8	41 ± 5^{c}	64 ± 5^{a}	49 ± 7^{b}

Control (C); Alanine amino transferase (ALT); Aspartate aminotransferase (AST); streptozotosin (STZ); a, b, c; $p < 0.05$.

REFERENCES

1. M.J. Golalipour and S. Ghafari, *Int. J. Zool. Res.*, **3**, 186 (2007).
2. S. Matsumoto, I. Koshiishi, T. Inoguchi, H. Nawata and H. Utsumi, *Free Radical Res.*, **37**, 767 (2003).
3. H. King, R. Aubert and W. Herman, *Diabetes Care*, **21**, 1414 (1998).

4. J. Hasegawa, A. Mori, R. Yamamoto, T. Kinugawa, T. Morisawa and Y. Kishimoto, *Cardiovasc. Drugs Ther.*, **13**, 325 (1999).
5. S.A. Ziai, B. Larijani, S. Akhoondzadeh, H. Fakhrzadeh, A. Dastpak, A. Rezai, F. Bandarian, H.N. Badi and T. Emami, *J. Ethnopharmacol.*, **14**, 202 (2005).
6. M. Safdar and K.A. Habibullah, *Pak. J. Nutr.*, **5**, 573 (2006).
7. O.P. Ganda, A.A. Rossi and A.A. Like, *Diab.*, **25**, 603 (1976).
8. A. Noorafshan, B. Esmail-Zadeh, S. Bahmanpour and A. Poost-Pasand, *Indian J. Gastroenterol.*, **24**, 104 (2005).
9. D. Lu, T. Ventura-Holman, J. Li, R.W. McMurray, J.S. Subauste and J.F. Maher, *Molec. Cell Bio.*, **25**, 6570 (2004).
10. R.W. Nesto and M.K. Rutter, *Acta Diabetologica*, **39**, 22 (2002).
11. J. Lowe, *Aust Prescr.*, **25**, 8 (2002).
12. J.K. Grover, V. Vats, S.S. Rahi and R. Dawar, *J. Ethnopharmacol.*, **76**, 233 (2001).
13. M. Kanter, O. Coskun, A. Korkmaz and S. Oter, *Anat. Rec.*, **279**, 685 (2004).
14. K. Katsumata, K. Katsumata and Y. Katsumata, *Horm. Metab. Res.*, **24**, 508 (1992).
15. M. Koulmanda, A. Qipo, S. Chebrolu, J. O'Neil, H. Auchincloss and R.N. Smith, *Am. Soc. Transplant Surgeons*, **3**, 267 (2003).
16. A. Imaeda, T. Kaneko, T. Aoki, Y. Konda and H. Nagase, *Food Chem. Tox.*, **40**, 979 (2002).
17. D.M. Mori, A.M. Baviera, L.T. De Oliveria Ramalho, R.C. Vendramini, I.L. Brunetti and M.T. Pepato, *Biotech. Appl. Biochem., San Diego*, **38**, 183 (2003).
18. N. Singh, V. Kamath and P.S. Rajini, *Clin. Chim. Acta*, **353**, 165 (2005).

(*Received*: 31 July 2009; *Accepted*: 3 December 2009) AJC-8132