RESEARCH ARTICLE

Anti-Hyperglycemic Activity of Silver Nanoparticles in Diabetes Induced Rats

Ravi Babu Birudu*[1], Manoharan Sathish Kumar[2], Kishore Babu Bonige[3]

Birudu RB, Kumar MS, Bonige K. Anti-Hyperglycemic Activity of Silver Nanoparticles in Diabetes Induced Rats. J Nanosci Nanomed. 2020;4(3):4-6.

ABSTRACT

Silver nanoparticles have many biological approaches. In our present study silver nanoparticles were used to treat the dextrose induced diabetic rats. Silver nanoparticles treated diabetic rats shoed good results. In this present study we got good results for glucose, SGPT and SGOT biochemical parameters. Diabetic rats treated with silver nanoparticles decreased the glucose levels. The SGOT and SGPT levels were decreased when treated with silver nanoparticles. The administration of silver nanoparticles was done with intra peritoneal injection to the rats. The diabetic rats treated with silver nanoparticles showed very low effect on lipid profile. Significant results obtained for LDL cholesterols. Silver nanoparticles decreased the LDL Cholesterol. Our present study showed the significant results for dextrose induced diabetic rats treated with silver nanoparticles.

Key Words: *Diabetes; Glucose; Lipid profile; SGOT; SGPT; Silver nanoparticles*

INTRODUCTION

The diabetes is a metabolic disorder. Diabetes results due to hyperglycemia, which continues growing to be major worldwide epidemic. it is estimated that in the 2025 the prevalence can be of 380 million [1]. Type 2 diabetes mellitus is the most common form of diabetes, with more 90% of diabetes cases, its varying prevalence among different racial and ethnic groups. The diabetes has been described as a new epidemic in the paediatric population in America because the overall 33% increase in the incidence and prevalence of diabetes observed during the last decade [2]. Similarly, Europe the incidence of diabetes in childhood has been rising by 3.9% each year during recent years [3]. In the case of Mexico, the proportion of adults diagnosed with diabetes in 2012 was 9.2%, while in 2000 and 2006 was 4.6% and 7.3% respectively. The increases in incidence and prevalence of diabetes in children and adults justify the study of new techniques and therapeutic procedures that can help to mitigate the effects of this serious disease.

The nanotechnology is commonly defined as the manipulation of mater about the nanometers order (1-100 nm) to create materials with novel properties and functions with a possible wide range to applications [4,5]. The nanomedicine is the application of the nanotechnology to medicine. Because of the similarity in the domain of size of nanotechnology with the biological structures and certain functional properties it is expected to make significant advances in the areas of gene therapy, imaging and novel drug discovery and drug delivery in the treatment of diseases like diabetes and cancer [6,7]. The cancer is a studied disease in nanomedicine, with nanostructures development with powerful therapeutic functions. Liposomes, polymer micelles and dendrimers are nanostructures responsible to carry drugs and small interfering RNA into target cells resulting in a powerful therapeutic modality [8-11].

MATERIAL AND METHODS

Silver nanoparticles solution was purchased from Nano Green Technology LTD, India. The size of silver nanoparticles was 50ug.

Normal healthy male Wistar albino rats, [9-12] weeks old with an average weight of 200-250gm were procured from the Mahaveer Enterprises, Bagh Amberpet, and Hyderabad. They were housed in polypropylene cages and fed with a standard chow diet and water ad libitum. The animals were acclimatized to the conditions by maintaining them at a temperature 25±2°C and relative humidity 55±10 at 12 hour each at dark and light cycle for about 7 days prior to dosing and during the commencement of experiment. All experimental procedures involving animals were conducted in accordance with the guidelines of Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA)011/NCP/IAEC/2015).

Induction of experimental diabetes: Dextrose was used to induce diabetes mellitus in normoglycemic male albino wistar rats. A freshly prepared solution of dextrose was given as feed orally at 6.6 grams/rat/5ml. After 15 days, rats with moderate diabetes having glycosuria and hyperglycemia were selected for the experiment.

Total 18 rats were used in the experiment. The animals were randomly divided into 3 groups of 6 rats in each group. The nanoparticle solution was administered by intra-peritonial injection to the rats at the dose of 2ml/200gms/bw.

Group I: Normal rats

Group II: Diet induced diabetes diseased rats

Group III: Diet induced diabetic rats treated with silver nanoparticles (2ml/200gms/ bw)

Estimation of glucose: The collected serum samples of different study group were subjected to the serum glucose level estimation by enzymatic GOD-POD method as per Braham and Trinder.

Estimation of total cholesterol: Total cholesterol in the plasma, erythrocytes and tissues was estimated by the enzymic method described by Allain et al. (1974).

Estimation of triacylglycerides: Triacylglycerol in the plasma and tissues were estimated using the diagnostic kit based on the enzymic method described by McGowan et al. (1983).

Estimation of HDL-cholesterol: HDL-cholesterol was estimated using the diagnostic kit based on the enzymic method described by Izzo et al. (1981).

*[1]*Department of Biotechnology, Acharya Nagarjuna University, Guntur, A.P, India;*

[2]*Department of Pharmacology, Bapatla College of Pharmacy, Bapatla, A.P, India;*

[3]*Department of Engineering Chemistry, Andhra University, Visakhapatnam, A.P. India.*

Correspondence: Ravi Babu Birudu, Department of Biotechnology, Acharya Nagarjuna University, Guntur, A.P, India. Telephone: 9908089507; e-mail: ravibabubiotech@gmail.com

Received: October 13, 2020, Accepted: November 05, 2020, Published: November 12, 2020

Estimation of LDL & VLDL Cholesterol: LDL and VLDL Cholesterol were estimated by the standard formula as follows and were expressed as mg/dl.

Calculation

VLDL = Triglycerides /5

LDL cholesterol = Total cholesterol – (HDL cholesterol + VLDL cholesterol)

Remaining biochemical parameters are estimated in the diagnostic center.

Statistical analysis

Results were expressed as mean±SD for six rats in each experimental group. Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) 9.05 software. The data were analyzed using one-way analysis of variance (ANOVA) and group means were co-pared with Dunnets Test P-values < 0.05 were considered as significant.

RESULTS AND DISCUSSION

In the present study we evaluated the possible therapeutic effect of silver nanoparticles on dextrose induced diabetic rats. There are various kinds of nanoparticles that are evaluated for their use as drug delivery systems [12]. The nanoparticles have a great role in medical and biological applications [13]. Our results showed a great reduction in blood glucose level in diabetic groups treated with SNPs (Table 1). This showed a great antidiabetic activity of those nanoparticles. There were significant changes in the serum, SGOT and SGPT levels in the rats when treated with silver nanoparticles. Table showed the normal rats have blood glucose levels of 134.50mg/dl. The diabetic rats have glucose levels of 428.67mg/dl. Silver nanoparticles in diabetic rats decreased the blood glucose levels of 193.33mg/dl. Here Silver nanoparticles worked effectively and reduce the blood glucose levels in diabetic rats. The SGOT and SGPT levels are also decreased when treated with silver nanoparticles. The SGOT levels in normal rat was 19.96U/L while in diabetic rats it was 69.46U/L. The diabetic rats treated with silver nanoparticles can reduced the SGOT levels up to 41.89U/L. The SGPT levels in normal rats was 45.80U/L. In diabetic rats the SGPT mean was 78.25U/L. There was large variance between normal rats and diabetic rats SGPT mean values. The diabetic rats treated with silver nanoparticles have SGPT mean was 46.43U/L. This SGPT mean value was very close to the normal rats. It showed that the silver nanoparticles were more effective in decreasing the SGPT in diabetic rats. Similarly, the silver nanoparticles reduced the total proteins from 9.75g/dl to 7.70g/dl. This was close to the normal rats' total proteins mean 5.95g/dl. Serum albumin, serum creatinine and alkaline phosphatase results were very close to the normal

TABLE 1

Changes in biochemical parameters in dextrose induced diabetic rats treated with silver nanoparticles.

Biochemical parameter	Normal rats	Dextrose induced Diabetic rats	Diabetic rats treated with silver (50 ug)-2ml/200gms body weight
Glucose	134.50±5.75	428.67±25.97*	193.33±15.42*
SGOT	19.96±2.33	69.46±8.99*	41.89±1.23*
SGPT	45.80±2.31	78.25±2.22*	46.43±2.44
Total Proteins	5.95±0.19	9.75±0.27*	7.70±0.24*
Serum albumin	4.55±0.24	5.37±0.16*	4.20±0.17
Serum creatinine	0.58±0.23	1.17±0.21*	0.95±0.14*
Alkaline phasphatases	113.19±4.91	261.05±1.98*	253.63±2.21*
Total cholesterol	97.12±2.15	157.52±2.35*	107.88±1.93*
Triglycerides	132.85±1.82	169.13±2.75*	165.88±1.86*
HDL	40.37±2.39	35.60±2.50*	56.02±1.78*
LDL	30.18±.46	63.09±3.40*	18.69±3.06*
VLDL	26.57±.36	33.82±.55*	33.18±.37*
Sodium	144.98±1.41	166.05±3.00*	143.48±1.99
Potassium	5.55±0.29	6.33±0.31*	6.05±0.38
Chloride	105.40±4.55	145.30±4.03*	142.08±3.11*

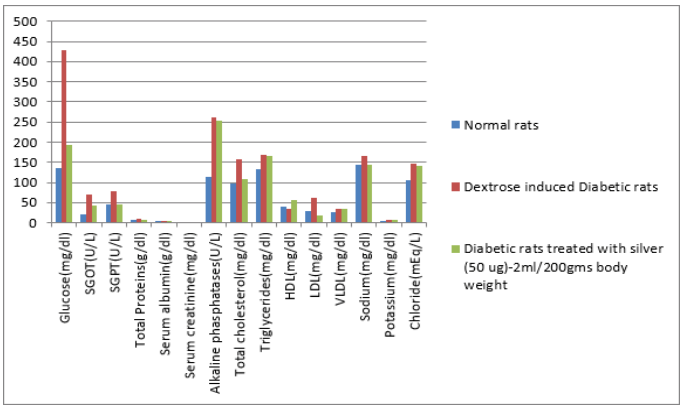

Figure 1) *Biochemical changes in Diabetic rats treated with silver nanoparticles.*

rats when treated with silver nanoparticles. The cholesterol levels were decreased with silver nanoparticles in diabetic rats. The HDL cholesterol was decreased in diabetic rats treated with silver nanoparticles. This was not good indication. VLDL, Triglycerides decreased very low when compared to other biochemical parameters. LDL decreased at high rate when treated with silver nanoparticles. There were slight changes in sodium, potassium and chloride levels in diabetic rats treated with silver nanoparticles.

CONCLUSION

Based on present study we concluded that silver nanoparticles have efficiency in decreasing the glucose levels. Study showed that Silver nanoaparticles have anti hyperglycaemic activity, but silver nanoparticles showed effect on lipid profile of diabetic rats. Silver nanoparticles also showed effect on decreased liver enzymes SGOT and SGPT. Overall study showed there was a significant place for silver nanoparticles in the treatment of diabetes in dextrose induced rats.

ACKNOWLEDGEMENT

I am very thankful to Nimra college of pharmacy for providing the laboratory facilities. I am very thankful to Dr.Janardhan and Dr.M.Jagadish Naik for their valuable guidance for my research work.

CONFLICT OF INTEREST

None

REFERENCES

1. Golbidi S, Badran M, Ayas N et al. Cardiovascular Consequences of Sleep Apnean. Lung. 2012;190:113–32.
2. Krantz J, Kaufman FR, Li CR et al. Gender disparity in atherosclerosis risk factors in adolescents with T1DM. Diabetes. 2002;51(2):170.
3. Virgen-Ortiza A, Mirand SL, Soto-Covarrubiasb MA et al. Biocompatible Silver Nanoparticles Synthesized Using Rumex Hymenosepalus Extract Decreases Fasting Glucose Levels In Diabetic Rats. Dig J Nanomater Biostructures. 2015;10(3):927 – 33.
4. National Science and Technology Council. National nanotechnology iniciative strategic plan. Executive office of president of the United States. 2007.
5. Logothetidis S. Nanotechnology in Medicine: The Medicine of Tomorrow and Nanomedicine. Hippokratia. 2006;10(1):7-21.
6. Subramani K, Pathak S, Hosseinkhani H. Recent trends in diabetes treatment using nanotechnology. Dig J Nanomater Biostructures. 2012;7:85.
7. Gordon N, Sagman U. Nanomedicine Taxonomy. Canadian NanoBusiness Alliance. 2003;1-28.
8. Torchilin VP. Recent advances with liposomes as pharmaceutical carriers. Nat Rev Drug Discov. 2005;4(2):45–160.
9. Peer D, Park EJ, Morishita Y et al. Systemic leukocyte-directed siRNA delivery revealing cyclin D1 as an anti-inflammatory target. Science. 2008;319(5863):627-30.

10. Blanco E, Hsiao A, Mann AP et al. Nanomedicine in cancer therapy: innovative trends and prospects. Cancer Sci. 2011;102(7):1247-52.

11. Blanco E, Ferrari M. Emerging nanotherapeutic strategies in breast cancer. Breast. 2014;23(1):10-8.

12. Yih TC, Al-Fandi M. Engineered nanoparticles as precise drug delivery systems. J Cell Biochem. 2006;97(6):1184-90.

13. Hirst SM, Karakoti SK, Tyler RD et al. Anti-inflammatory properties of cerium oxide nanoparticles. Small. 2009;5(24):2848-56.