Table 3. Effect of α-HSA on Malondialdehyde (MDA) and Total Antioxidant Capacity (TAC) values.

MDA levels (nmol/L)					TAC levels (µmol/L)	
S. No.	**Groups**	**Dose**	**Week 0**	**Week 6**	**Week 0**	**Week6**
1	Healthy control (A)	Normal Saline	8.5±0.76	8.82±0.58	4.89±0.12	4.58±0.11
2	Diabetic control (B)	Normal Saline	18.35±1.27	20.21±1.67[a]	2.79±0.18	2.16±0.13[a]
3	Diabetic (FIIc) treated (C)	20mg/kg b.w.	16.25±1.45	9.26±1.08[b,d,h]	3.01±0.08	3.48±0.26[b,d,h]
4	Diabetic (α-HSA) treated (D)	20mg/kg b.w.	17.01±1.26	9.1±1.27[c,e]	2.86±0.19	3.56±0.15[c,e]
5	Diabetic (Glibenclamide) treated (E)	600µg/kg b.w.	16.58±1.14	9.98±1.47[f,g]	2.72±0.16	3.82±0.25[f,g]

Values are mean ± S.D. (n=6) ($p<0.001$)
a= Group A vs Group B, b= Group A vs Group C, c= Group A vs Group D, d= Group B vs Group C , e= Group B vs Group, f= Group A vs Group E, g= Group B vs Group E, h= Group C vs Group D

DISCUSSION

Type 2 Diabetes mellitus is considered to be one of the most common chronic diseases and is associated with hyperglycemia and hyperlipidemia. The metabolism of carbohydrates, proteins including lipids and lipoprotein are altered during diabetes.

In the present study, α-HSA was evaluated *in vivo* for its anti-hyperglycemic and antioxidant properties in STZ+NAD induced diabetic rats. Blood glucose, HbA1c, serum insulin and antioxidant/oxidative parameters (TAC & MDA) were analyzed.

In the pancreas, there is partial destruction of β-cells in STZ+NAD induced diabetic rats due to which the levels of serum insulin in the diabetic rats were reduced as compared to normal healthy control rats. After administration of α-HSA to diabetic rats, the serum insulin levels were increased significantly in comparison to diabetic control rats.

The fasting blood glucose levels of diabetic rats after the administration with α-HSA were significantly reduced as compared to diabetic control rats. The anti-diabetic activity of α-HSA is either due to improved insulin secretion or due to enhanced transport of blood glucose to the peripheral tissue [17].

The possible mechanism of action which can be correlated with the way sulphonylureas work i.e. promoting insulin secretion by membrane depolarization, closure of K+ ATP channels and opening of Ca^{2+} channels [18,19]. Glycosylated hemoglobin (HbA1c) is as an excellent marker for overall glycemic control and diabetic complications. α-HSA has significantly reduced the glycosylated level in α-HSA treated diabetic rats indicating its efficiency in glycemic control.

The role of lipid peroxidation in the development of diabetes complications is well mentioned in the literature. According to previous studies, the pace of development of MDA, a significant final result of lipid peroxidation, is altogether higher in diabetic rats contrasted with non-diabetic controls [20].

In T2DM there is a direct correlation between levels of MDA and the severity of the disease [21]. The role of free radicals in the onset of lipid peroxidation during T2DM is well mentioned in several scientific reports [21].

In our study, it has been found that α-HSA possess potent antioxidant properties as it decreases the serum MDA levels in α-HSA treated diabetic rats.

Total antioxidant capacity (TAC) is a widely used method that uses antioxidants as reductants in a redox-linked colorimetric reaction, wherein Cu^{2+} is reduced to Cu^{+}. This ability of plasma to scavenge free radicals can be used to exploit its potential to counter the excess RONS observed in diabetes [22,23]. In our study, we have found that after administration of α-HSA, the plasma antioxidant levels of diabetic rats were significantly enhanced as compared to diabetic control rats.

Hence, chemically synthesized α-HSA has shown beneficial effects on hyperglycemia &oxidative stress. α-HSA improves insulin secretion through β-cells restoration in the pancreas and promotes insulin utilization capability in various peripheral tissues and its free radical scavenging property has potential to prevent diabetes associated complications.

CONCLUSION

In the present study, we have concluded that the α-HSA plays a vital role in the management of Type 2 diabetes. Molecular studies need to be done for elucidating the therapeutic action of α-HSA and before administrating it as possible replacement of insulin therapy or as an adjuvant.

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AUTHOR DISCLOSURE STATEMENT

The authors declare that they have no conflict of interests to disclose.

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