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# Effect of Aloe vera extract on some physiological parameters in diabetic albino rats.

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## Abstract

The present study aimed to clarify antidiabetic activity of aqueous extract from Aloe vera on thirty adult male albino rats were divided into three groups, the first served as a control group, the second was injected with alloxan (120*mg / kg B.wt.* ) and served as diabetic group and the third was injected with alloxan and treated with Aloe vera water extract ( 0.5 *ml* / 100 *g B.wt.* ). After thirty days of treatment half of each group were scarified and the other one were left for 15 days without any additional treatment as a recovery period .

The results revealed highly significant decrease ( $p < 0.01$) in blood glucose, and highly significant increase in both liver glycogen content and serum insulin level in the diabetic group treated with aqueos extract of A. vera when compared with the diabetic untreated group.

It seems, therefore that water extract of A. vera results in a definite hypoglycemic, hyperinsulinemic effect. On the other hand, a significant increase of body weight gain and liver glycogen content was achieved. The results of this study clarify the role of Aloe vera active as antidiabetic plant and suggest a relationship between drenching. A. vera extract and insulin production which needs further investigation .

**Key words:- Aloe vera – Diabetic rats – Physiological parameters .**

## Introduction

Diabetes mellitus is one of the most common noncommunicable world wide diseases . When compared with the general population, mortality and morbidity increase in diabetes due mainly to the associated chronic complications both specific microvascular as nephropathy and nonspecific as atherosclerosis. Acute metabolic complications , e.g. diabetic ketoacidosis, continue to be cause of mortality in developing countries *( Motala et al., 2000 ).*

Traditional antidiadetic plants might provide new oral hypoglycemic compounds which can face the high cost and the poor availability for many rural populations, particularly in developing countries *( Merles and Fransworth, 1995).*

Aloe vera (L) Burm-fil (A. barbadensis Miller) ( Liliaceae ) is native to North Africa and also cultivated in Turkey. Aloes have long been used all over the world for their various medicinal properties. In the past 15 year, There have been controversial reports on the hypoglycemic activity of Aloe species, probably due to differences in the parts of the plant used or to the model of diabetes chosen *( Okyar et al; 2001 ).*

The present study was a trial to clarify the antidiabetic effect of Aloe water extract on alloxan-induced diabetes in rats.

## Material and Methods

Thirty adult male albino rats of local strain ( weighing 120 – 140 *gm* ) were used. They were divided into three groups :

1- control group ( 10 rats ),

2- Diabetic group : received alloxan only ( 10 rats ).

3- Diabetic treated group : received alloxan and Aloe vera water extract ( l0 rats ).

All animals were weighed at the beginning of the experiment and before decapitation for body weight determination. Diabetes mellitus was induced in overnight fasted animals by a single subcutaneous injection of alloxan ( B.OH chemical LID., England ) in a dose of *120mg/kg* body weight dissolved in 0.5ml a acetate buffer ( PH 5.5 ) immediately prepared before usage *( Fayed et al., 1998 and Helal, 2000)*. After 7 days of alloxan injection, the level of glucose was measured by glucometer *( Al - Awadi et al., 1985 )*. Rats with serum glucose level, ranging between 180 - 250 *mg/dl* were considered as diabetic in this experiment .

The aqueous extract was prepared by boiling 50 *gms* of the plant with l00*ml* dist. Water for 10 min. After cooling to room temperature, the extract was filtered and stored in refrigerator. The dose was (½ *ml*/100 *gm* body weight) orally and daily for 30 days. After 30 days of treatment with plant extract 5 animals of each group were decapitated. The other 5 animals were kept for 15 days without any additional treatment as a recovery period .

Blood sera were collected for the determination of glucose *( Siest-Schielf, 1981)*, glycogen *(Joseph,1955)* insulin *(Reeves 1983 )*. Student's t-test was used to compare between mean of different experimental animal groups. Significant differ-ences between the means of control and treated groups were considered at $p< 0.05$ *( Sokal and Rohif, 1981 )*.

## Results

Control rats showed an increase in body weight throughout treated and recovery periods , i.e. about 36 and 34.1 respectively. A. vera treated group showed no significant increase in body weight after the treated and recovery periods as compared with that of control rats. On the other hand, highly significant decrease ($p< 0.01$ ) was showed in body weight gain in rats treated with alloxan and this decrease continued after the recovery period ( *Table. 1 and Fig 1a,b )*.

The diabetic group showed marked increase of glucose concentration as compared with normal ones [ where control group has blood glucose level of 136.8 *mg/dl* and 137.6 *mg/dl* after the treated and recovery periods respectively. Correspon-dingly, the diabetic group has blood glucose level of 266.4 *mg/dl* and 264.8 *mg/dl* respectively , which showed a highly significant increase ( $p< 0.01$ )]. After 4 weeks of treatment with the aqueous extract of Aloe vera, a noticeable decrease of serum glucose level was recorded as compared with that of diabetic rats after both treated and recovery periods ($p<0.01$ ). While , no significant change was determined in plant extract treated group when compared with non- diabetic rats. *( Table 2 and Fig 2a,b )*.

The contents of glycogen in the liver were 173.24 *mg/dl* and 171.48 *mg/dl* in the control rats after treatment and recovery periods respectively. Alloxan- diabetic group showed a highly significant decrease ( $p< 0.01$ ) as compared with that of control rats throughout the experimental period. Aloe vera treatment resulted in no significant change, i.e. 176.11 *mg/dl* and 177.98 *mg/dl* after treatment and recovery periods as compared to control group, while showed highly significant increase ($p <0.01$ ) when compared with diabetic group during the experimental period *( Table 3 and Fig . 3a,b )*.

Alloxan caused severe hypoinsulin-emia which was highly significant decrease ($p< 0.01$) as compared to that of control rats. The administration of A. vera extract increased the insulin level of the diabetic animals in treatment period as compared to diabetic group and normal rats after treated and recovery periods *(Table 4 and Fig. 4a,b)*.

**Table ( 1 ): Percentage changes in body weight in control, diabetic and diabetic-treated with Aloe vera groups after treatment and recovery periods .**

| Groups / parameter | | Treated period ( 4 weeks ) | | | Recovery period ( 2 weeks ) | | |
|---|---|---|---|---|---|---|---|
| | | Control | Diabetic | Diabetic + Aloe vera | Control | Diabetic | Diabetic + Aloe vera |
| Body weight change % | Mean± SE | 35.994± 1.02 | 9.42 ± 0.96 | 37.39 ± 0.37 | 33.908± 0.29 | 9.32± 0.35 | 33.18± 0.49 |
| p.value | A | | P< 0.01 | N . S | | p< 0.01 | N . S |
| | B | | | p< 0.01 | | | p< 0.01 |

A- in compared with control group.
B- in compared with diabetic group.

**Table ( 2 ): The changes in the level of serum glucose in control, diabetic and diabetic-treated with Aloe vera groups after experimented and recovery periods .**

| Groups / parameter | | Treated period ( 4 weeks ) | | | Recovery period ( 2 weeks ) | | |
|---|---|---|---|---|---|---|---|
| | | Control | Diabetic | Diabetic + Aloe vera | Control | Diabetic | Diabetic + Aloe vera |
| Serum glocse mg/dl | Mean ± SE | 136.8± 0.86 | 266.4± 0.41 | 139.2± 0.75 | 137.6± 0.68 | 264.8± 0.86 | 138.7± 0.59 |
| p.value | A | | P< 0.01 | N . S | | p< 0.01 | N . S |
| | B | | | p< 0.01 | | | p< 0.01 |

A- in compared with control group.
B- in compared with diabetic group.

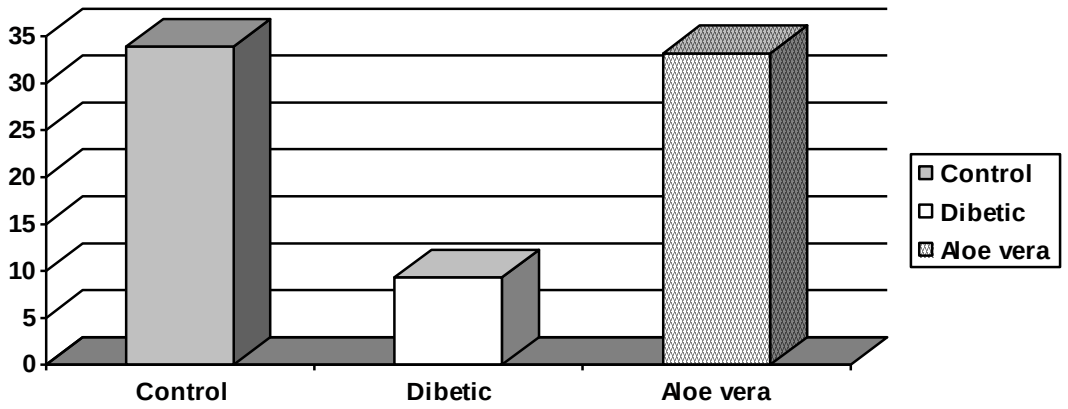


**Fig . 1 ( A ): the percentage of body weight change after treated period ( 4 weeks ).**

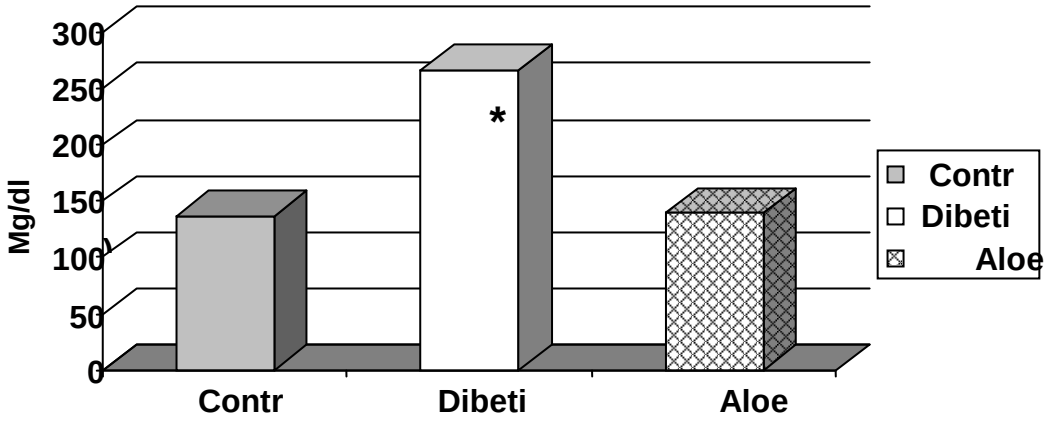


**Fig . 1 ( B ) : the percentage of body weight change after recovery period ( 2 weeks ).**

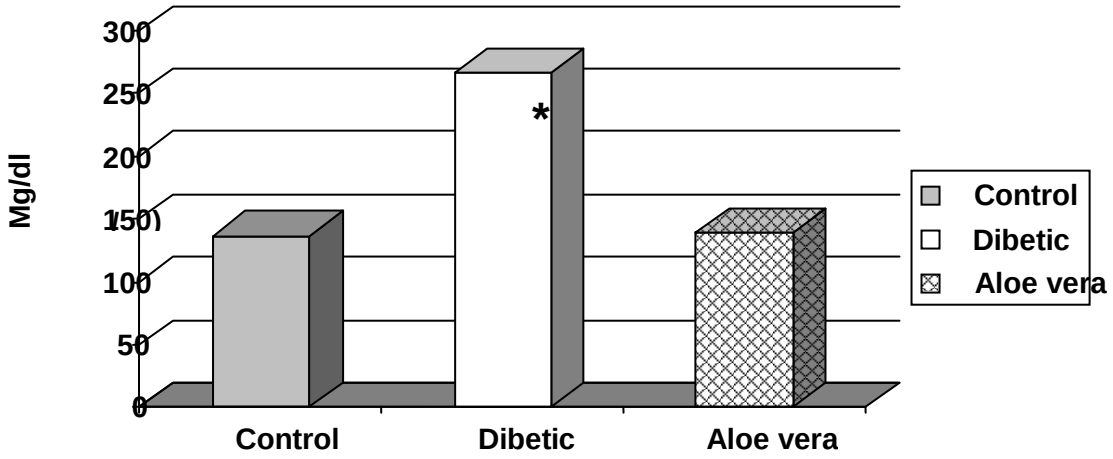


**Fig . 2 ( A ): The changes in the level of serum glucose after treated period (4 weeks ).**

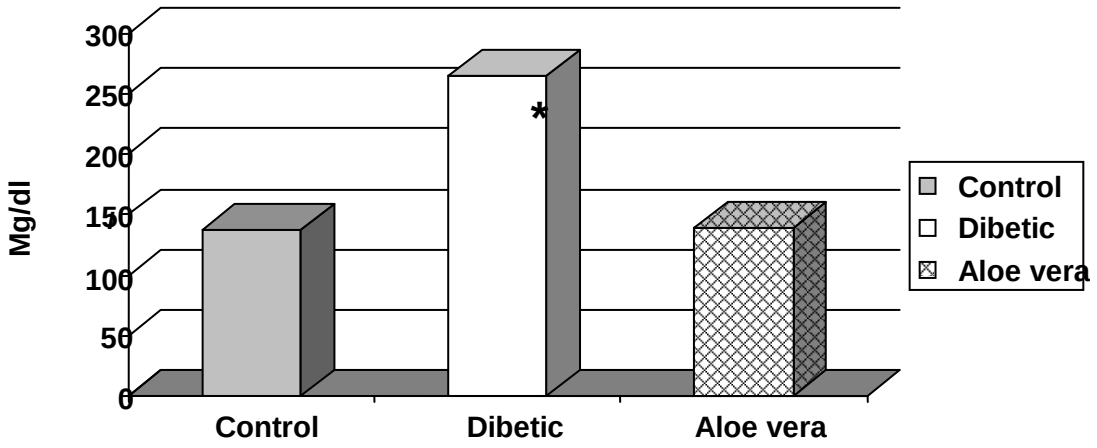


**Fig . 2 ( B ): The changes in the level of serum glucose after recovery period ( 2 weeks ).**

**Table ( 3 ): Liver glycogen content in control , diabetic and Aloe vera treated albino rats after treated and recovery periods.**

| Groups / parameter | | Treated period ( 4 weeks ) | | | Recovery period ( 2 weeks ) | | |
|---|---|---|---|---|---|---|---|
| | | Control | Diabetic | Diabetic + Aloe vera | Control | Diabetic | Diabetic + Aloe vera |
| Glycogen content ( mg/ dl ) | Mean± SE | 173.24± 0.875 | 162.69±0.715 | 176.11± 0.48 | 171.48±0.55 | 161.71± 0.41 | 177.98± 0.53 |
| p. value | A | | P< 0.01 | N . S | | p< 0.01 | N . S |
| | B | | | p< 0.01 | | | p< 0.01 |

A- in compared with control group.

B- in compared with diabetic group.

**Table ( 4 ): Serum insulin level in control , diabetic and Aloe vera Treated albino rats after treatment and recovery periods in albino rats .**

| Groups / parameter | | Treated period ( 4 weeks ) | | | Recovery period ( 2 weeks ) | | |
|---|---|---|---|---|---|---|---|
| | | Control | Diabetic | Diabetic + Aloe vera | Control | Diabetic | Diabetic + Aloe vera |
| Serum insulin U / L | Mean ± SE | 41.6± 0.21 | 20.6± 0.81 | 39.2± 1.32 | 40± 0.48 | 24± 0.71 | 37.2± 1.17 |
| p. value | A | | P< 0.01 | N . S | | p< 0.01 | N . S |
| | B | | | p< 0.01 | | | p< 0.01 |

A- in compared with control group.

B- in compared with diabetic group..

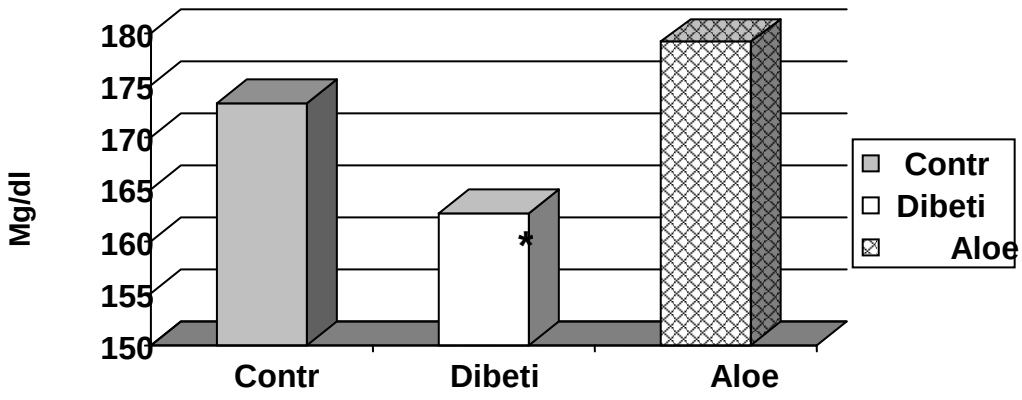


**Fig . 3 ( A ): liver glycogen content after treated period ( 4 weeks ).**

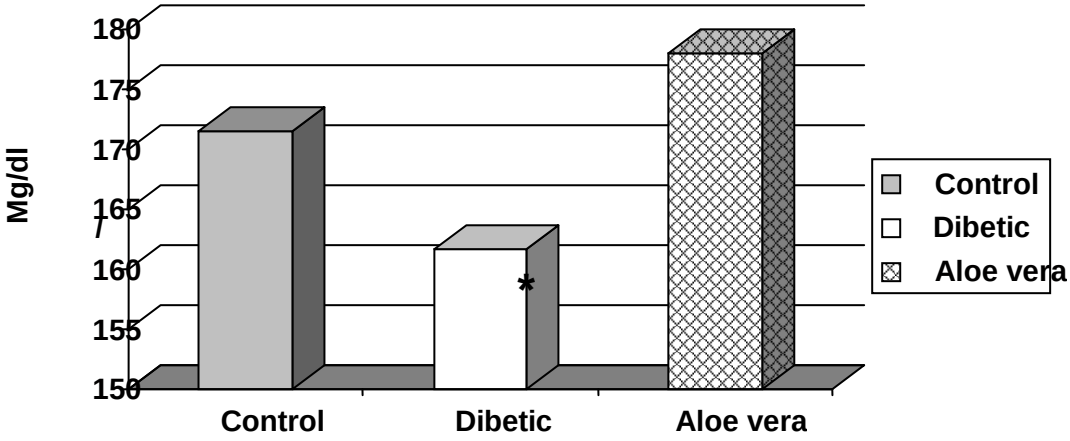


**Fig . 3 ( B ) : liver glycogen content after recovery period ( 2 weeks ).**

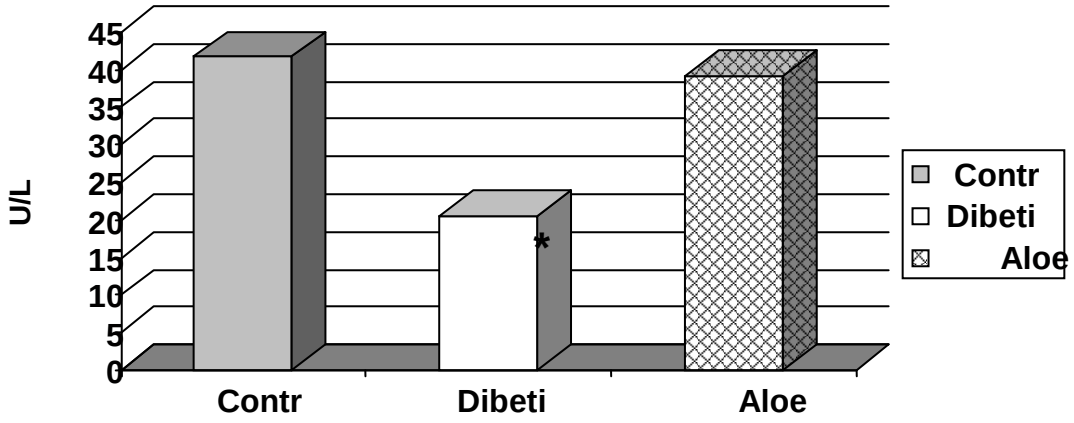


**Fig . 4 ( A ): Serum insulin level after treated period ( 4 weeks ).**

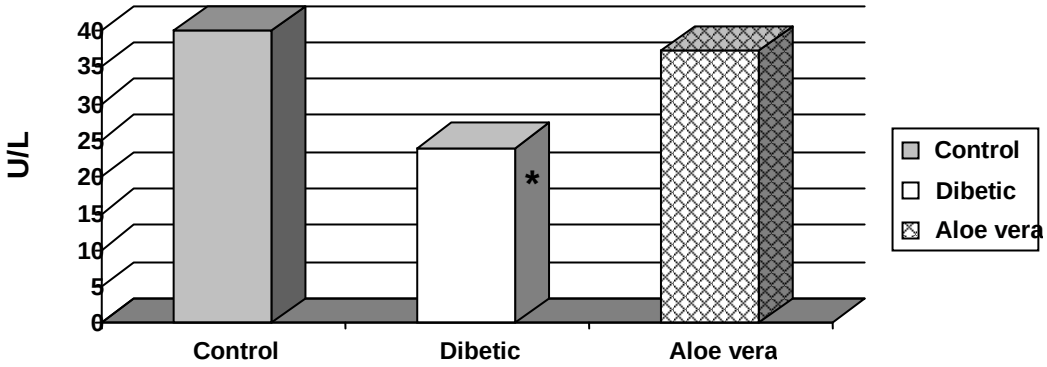


**Fig 4 ( B ): serum insulin level after recovery period ( 2 weeks ).**

## Discussion

The present study demonstrated that alloxan induced a decrease in body weight , hyperglycemia associated with decreased liver glycogen and inhibition of pancreatic B-cell activation. The decrease in body weight following alloxan injection is in agreement with previous study *( Rungby et al., 1992 and Helal 2000 a,b )*. It is attributed to different side effects of inability to use carbohydrates including lypolysis, glycognolsis and acidosis *(Ganong,1995)*. The hyperglycemia and decrease in liver glycogen content observed in diabetic group are due to lack of insulin, increased gluconeogenesis and/or glycogenolysis *( Masahi and Olefsky, 1979, Dfranza and Simonson, 1992 )*. Such suggestion agree with the present results, which indicated decrease and inhibition of pancreatic B-cells activities of alloxan diabetic male animals. In support of this, studies reported that alloxan has a destructive cytotoxic effect on the pancreatic B- cell *( Bollafi et al., 1986 )*. Anather study indicated that diabetic animals were a ccompanied with deficiency in the production of the insulin like growth factor *( Browa et al., 1997)*.

The clinical use of Aloe vera as antidiabetic drug succeeded when applied to diabetic women. Blood sugar dropped significantly in women taking Aloe vera in comparison to these who received placebo from an average of 250 *mg/dl* to 141 *mg/dl*, which approaded normal *( Jackie Hart, 1996 )*. Such finding agree with the present study , which indicates that Aloe vera administration to male rats showed an increase of pancreatic B-cells activity. It is concluded that, the decreased serum glucose level and increased liver glycogen content may be a result of the pancreatic B-cells activity which leads to stimulation of insulin biosynthesis and secretion. Moreover, insulin has a patent effect on the metabolism which increases glycogensis and glycolysis.

The present results indicate of that treatment with Aloe vera attenuated the alloxan induction of hyperglycemia, improved the decrease in body weight , increased the liver glycogen and improved pancreatic B-cells activities .

Aloe vera contain high calcium level *( Blumenthal et al.,1998* ). In the present study decreasing hyperglycemia by Aloe vera may be due to the increase in calcium level *( Login et al., 1985 and Terao et al., 1989 )*. which in turn stimulates the B-cells of Langerhans that lead to increase insulin secretion and to increase liver glycogen level *( Abu-Sinna et al., 1993 and Abu-Amra , 1994)*. In support of this idea *Fyles et al. (1986)* reported that the stimulation of B- adrenergic receptors on the islets of Langerhans increases insulin secretion. Also, insulin stimulates the metabolism which increases glycogenesis and glycolysis *( Mulhoera, 1980 )*.

On the other hand, cellular growth is controlled by several factors, such as insulin , insulin like growth factors and nerve growth factors *( karp, 1984 )*. It is suggested that the activation of pancreatic B-cells of diabetic rats by aloe vera water extract could be attributed to Aloe vera constituents which may contain some growth factors and/or a component with insulin like effect, which in turn inhibits epinephrine induced lipolysis and decreased body weight ( *Takaku et al., 1990 )*. More over, it may be that Aloe vera water extract may have an active ingredient which can stimulate and help in the recovery of the injured B-cells induced by alloxan.

In conclusion, water extract of Aloe vera could be useful and safe agent in reducing hyperglycemia induced by alloxan. More detailed studies on A. vera using different doses and covering longer periods of observation are needed before reaching a clearcut conclusion about the future of A. vera for the treatment of diabetes mellitus.

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# تأثير مستخلص الصبر علي بعض المعايير الفسيولوجية في الجرذان البيضاء المصابة بمرض السكري التجريبي .

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يهدف هذا البحث الي توضيح تأثير المستخلص المائي لنبات الصبر كمخفض لسكر بالدم المستحدث في ذكور ثلاثين من الجرذان البيضاء ، والذين تم تقسيمهم الي ثلاث مجموعات . الأولي اعتبرت مجموعة ضابطة ، والثانية تم حقنها بعقار الألوكسان ( 120 مجم / كجم من وزن الجسم ) واعتبرت مجموعة مريضة بالسكر والثالثة تم حقنها بعقار الألوكسان ثم عولجت بالمستخلص المائي لنبات الصبر ( 2/1 مل / 100 جم من وزن الجسم ) وبعد ثلاثين يوم من العلاج تم ذبح نصف عدد الجرذان من كل مجموعة وترك باقي الجرذان لمدة 15 يوم بدون أي علاج إضافي كفترة نقاهة .

وعلي الصعيد الأخر فهناك زيادة ملحوظة في وزن الجسم وانخفاض كبير في سكر الدم كما أوضحت ارتفاع كبير في كل من محتوي الكبد من الجليكوجين و نسبة الأنسولين في الدم في المجموعة التي تم معالجتها بالمستخلص المائي لنبات الصبر إذا ما قورنت بالمجموعة المصابة بمرض السكر والتي يتم معالجتها . مما يوضح فاعلية نبات الصبر في تخفيض مستوي السكر وزيادة نسبة الأنسولين في الدم .