Chapter IV

RESULTS
The diabetes mellitus, induced in rabbits by administration of alloxan and streptozotocin, was confirmed by blood biochemical levels and behavioural changes in the animals. The biochemical changes in blood sugar (F) level, blood urea and serum creatinine were observed in both alloxan-induced and streptozotocin-induced groups of rabbits and compared with the values obtained from normal rabbits. Histomorphological alterations were observed in the different organs like pancreas, liver, alimentary canal, kidney, heart, lungs and brain.

**Alloxan-Induced Diabetes Mellitus**

The induction of diabetes mellitus in Group II rabbits, by intraperitoneal administration of four doses of alloxan @ 80 mg/kg. b.w., was observed after first week by increased values of blood sugar (F), blood urea and serum creatinine. These rabbits also exhibited changes in behaviour and pathoanatomical features.

**Behavioural Alterations**

The behavioural changes included dullness, lethargy, decreased physical activity, polyuria, polydipsia and a tendency to lie down.
Biochemical Alterations

The biochemical levels showed a significant change in alloxan-induced diabetic rabbits (Group II) in comparison to control rabbits (Group I). The blood sugar (F) levels increased steadily up to sixth week reaching 292.75 ± 8.87 mg/dl compared to the values of Group I rabbits which remained almost constant at 105.25 ± 4.65 mg/dl till the end of the experiment (Fig. 1). In the seventh week the blood sugar level was comparable to that of the sixth week but started to show fluctuations with a decreasing tendency thereafter.

Fig 1: Effect of Alloxan Administration on the Blood Glucose Level (F) of Rabbits.

The alterations in other biochemical parameters viz., blood urea and serum creatinine were also observed in the Group II rabbits which increased in parallel with blood sugar level. A significant increase of blood urea and serum creatinine from 21.08 ± 1.27 mg/dl to 53 ± 1.54 mg/dl and 1.52 ± 0.25 mg/dl to 3.32 ± 0.16 mg/dl respectively was observed in Group II rabbits in contrast to Group I rabbits which showed almost a consistency of 21.03 ± 1.00 mg/dl and 0.99 ± 0.09 mg/dl in blood urea and serum creatinine respectively up to the sixth week [Fig. 2 and 3]. Blood urea and serum creatinine levels were highest in 6th week as with blood sugar level. Thereafter fluctuations were recorded.
Body Weight Profile

The body weight of Group II rabbits decreased significantly in comparison to Group I rabbits which showed an increased body weight throughout the experimental period (Fig. 4). In Group II rabbits the rapid decrease in body weight was recorded after the first week of alloxan administration from 1.68 ± 0.11 kg to 1.46 ± 0.02 kg. Later on there was a fluctuations and on the sixth week it was 1.65 ± 0.02 kg. However, in Group I rabbits, there was a steady and significant increase in body weight from 1.15 ± 0.09 kg to 1.58 ± 0.05 kg. The statistical evaluation of the data showed a level of significance (p<0.50).
A significant increase of blood sugar (F), blood urea and serum creatinine levels starting from one week that peaked in sixth week (Table I). The comparative changes of Group I and Group II rabbits showed a level of significance (p< 0.001) for blood sugar, blood urea and serum creatinine whereas (p< 0.50) for body weight.

Histomorphological Changes on Alloxan-Induced Diabetic Rabbits

The histological study of different organs viz., pancreas, kidneys, liver, alimentary canal, lungs, heart and brain of Group II rabbits showed pathoanatomical features in contrast to Group I rabbits which showed normal histomorphological features.

Histomorphological Changes of Pancreas

Pancreatic sections stained with Haematoxylin and Eosin showed that alloxan caused severe necrotic changes of pancreatic islets, vacuolation, increased eosinophilia, islet congestion and pancreatic congestion. However, chronic pancreatitis, haemorrhage and proliferation of fibroblasts in some pancreatic lobules and disorganization of pancreatic acini were observed in pancreatic sections of five month old Group II rabbits. Using modified Gomori’s aldehyde fuchsin staining techniques (Halmi, 1952 and Scott, 1952)
for pancreatic sections, nuclear changes, karyolysis, disappearing of nucleus and rarefaction of nuclear contents were visible. The reduction in the number of β cells of diabetic rabbits was obvious (Fig. 84, p. 95). These histomorphological changes [Fig. 5 to 13, pp. 99-103] of Group II rabbits were significant in comparison to Group I rabbits which showed normal histomorphology [Fig. 14 to 16, pp. 103-104].

**Histomorphological Changes of Kidneys**

Histological examination of the sections of kidneys of Group II rabbits showed degenerative changes. Nephrosis, occlusion of tubules, lower nephron nephrosis and degeneration in cortex, subcapsular region, collecting tubules and tubular epithelium. However, in five months old Group II rabbits, the kidney sections showed chronic nephritis, interstitial nephritis, tubular nephrosis and chronic changes in medullary sites. The histomorphologic changes [Fig. 17 to 23, pp.105-108] in Group II rabbits were significant in contrast to Group I rabbits which showed normal morphology of tissues [Fig. 24, p.108 and 25, p.109].

**Histomorphological Changes of Liver**

The liver sections of group II rabbits showed degenerative changes in comparison to Group I rabbits with normal morphological features. Biliary hyperplasia and hepatosis (degeneration of hepatocytes) was observed in alloxan-induced diabetic rabbits [Fig. 26, p.109 and 27, p.110]. However, in five month old Group II rabbits the liver sections showed changes of chronic hepatitis [Fig. 28, p.110]. The changes were significant in contrast to control rabbits (Fig. 29, p.111).

**Histomorphological Changes of Heart**

Heart sections stained with H&E in Group II rabbits showed edema and histiocyte proliferation at certain places [Fig. 30, p.111] in contrast to Group I rabbits with normal histological features [Fig. 32, p.112]. However, in five
months old group II rabbits, the heart sections showed myocarditis or inflammation of cells [Fig. 31, p.112].

**Histomorphological Changes of Brain**

Haematoxylin and Eosin stained brain sections of Group II rabbits showed degenerative changes in neurons and purkinji cells in cerebellum, and brain edema [Fig. 34, p.113 and 35, p.114] in contrast to normal histologic sections [Fig. 36, p.114] of Group I rabbits. Moreover, cerebellum showed edema in brain sections of 5 months old Group II rabbits [Fig. 33, p.113].

**Histomorphological Changes of Lungs**

The lung sections of Group II rabbits stained with H&E showed edema, haemorrhage and bronchial hyperplasia [Fig. 37 to 39, pp.115-116] in contrast to Group I rabbits (Fig. 41, p.117). Further, emphysema (breakdown of alveoli) of lungs was observed in five months old Group II rabbits [Fig. 40, p.116].

**Histomorphological Changes of Alimentary Canal**

Haematoxylin and Eosin stained sections taken from different parts of alimentary canal of Group II rabbits showed intestinal congestion and mild gastritis [Fig. 42, p.117 and 43, p.118] in contrast to normal histomorphology of Group I rabbits [Fig. 44, p.118].

**Streptozotocin-Induced Diabetes Mellitus**

The induction of diabetes mellitus in Group IV rabbits by intravenous administration of streptozotocin @ 65 mg/kg b.w. was confirmed biochemically on day 2\textsuperscript{nd} of the experiment. Further, streptozotocin-induced diabetic rabbits showed a change in behaviour in comparison to saline treated normal rabbits. The histomorphological changes were also observed in different organs of the diabetic rabbits.
Behavioural Changes

The streptozotocin-induced diabetic rabbits (Group IV) exhibited excessive thirst, frequent urination and decreased physical activity in comparison to Group III rabbits, which showed usual behavioural patterns.

Biochemical Changes

The streptozotocin-induced diabetic rabbits (Group IV) showed alterations in biochemical parameters viz., blood sugar (F), blood urea and serum creatinine in comparison to saline treated (Group III) rabbits. The blood sugar (F) level was highest on day 2\textsuperscript{nd} in Group IV after streptozotocin administration with a mean value of $233.25 \pm 9.17$ mg/dl followed by a decreasing trend (Fig. 45). However, the values of blood sugar level on day 5\textsuperscript{th}, day 10\textsuperscript{th} and day 15\textsuperscript{th} were significant in Group IV rabbits in comparison to Group III rabbits.

Blood urea and serum creatinine level of Group IV rabbits showed alterations with highest values on day 2\textsuperscript{nd} recorded to be $39.75 \pm 0.84$ mg/dl and $2.25 \pm 0.32$ mg/dl respectively in contrast to Group III rabbits which showed normal values during the entire experimental period. However, these values
later on started to show decline and were consistent with blood sugar level [Fig. 46 and 47].

A significant value of blood sugar (F), blood urea and serum creatinine starting after streptozotocin administration showed a level of significance (p< 0.01) for blood sugar and (p< 0.10) for blood urea and serum creatinine in comparison to saline treated (Group III) healthy rabbits (Table II).
Body Weight Profile

The body weight of Group IV rabbits started to fall on day 2\textsuperscript{nd} which was recorded to be 1.227 ± 0.10 kg from an initial value of 1.275 ± 0.14 kg in comparison to Group III rabbits which showed an increased trend throughout the experimental period. Later on, there was an increase in the body weight of Group IV rabbits and in the day 15\textsuperscript{th} it was recorded to be 1.380 ± 0.06 kg almost similar to 1.377 ± 0.06 kg for Group III rabbits (Fig. 48). However, statistical evaluation of the data did not show any significance.

![Fig 48: Effect of Streptozotocin Administration on the Body weight of Rabbits.](image)

Histomorphological Changes of Streptozotocin-induced Diabetic Organs

Haematoxylin and Eosin stained sections of different organs of streptozotocin-induced diabetic rabbits (Group IV) showed histopathological features in contrast to saline-treated (Group III) healthy rabbits.

Pancreatic sections of group IV rabbits showed slight congestion and mild degenerative changes in the acini. The acinar epithelium was swollen. The islets of Langerhan's revealed decreased cellularity and in some islets the cells
appeared to be fusiform. However, using modified Gomori’s aldehyde fuchsin stains (Halmi, 1952) for quantitative analysis of beta cells, their number was found to be reduced in Group IV rabbits in contrast to Group III rabbits (Fig. 84, p.95). The histopathological changes in Group IV rabbits [Fig. 49 to 51, pp.119-120] were found to be significant in comparison to Group III rabbits.

The lung sections of Group IV showed congestion and haemorrhage in alveoli and bronchioles [Fig. 52, p.120 and 53, p.121], congestion in kidneys [Fig. 54, p.121], degeneration and congestion in liver [Fig. 55, p.122], haemorrhages and myopathy in heart [Fig. 56, p.122] and mild neuronal damage was observed in the brain [Fig. 57, p.123] sections of Group IV rabbits. However, H&E stained sections of alimentary canal revealed no pathological features but the stomach stained sections showed proliferation of yeasts [Fig. 58, p.123].

Effect of *Syzygium jambolanum* on Diabetic Rabbits

The extract of *Syzygium jambolanum* given by oral administration was effective in improving behavioural, biochemical and histopathological alterations in alloxan induced diabetic rabbits.

Effect of *Syzygium jambolanum* on Behavioural Patterns

The *Syzygium jambolanum* treated diabetic rabbits (Group IV) showed a significant improvement in behaviour in contrast to alloxan-induced diabetic (Group II) which exhibited polyuria, polydipsia, lethargy, dullness and a tendency to lie down. Further, Group IV rabbits showed comparatively active behaviour.

Effect of *Syzygium jambolanum* on Biochemical Patterns

The biochemical levels showed a significant improvement in Group IV rabbits in comparison to Group II rabbits. The blood sugar of Group IV rabbits decreased steadily upto 21st day reaching $111 \pm 4.43$ mg/dl in contrast Group II
rabbits with a level of $192 \pm 9.41$ mg/dl. A decrease of blood sugar from $298 \pm 7.90$ mg/dl to $111 \pm 4.43$ mg/dl up to 21st day was observed during the experimental period. The blood sugar level of Group IV rabbits was almost comparable to Group I rabbits (Fig. 59) on day 21st.

![Fig 59: Effect of Syzygium jambolanum on the Blood Glucose of Alloxanized Rabbits.](image)

Blood urea and serum creatinine levels decreased consistently in Group IV rabbits. A significant decrease of blood urea and serum creatinine from $49.75 \pm 1.31$ mg/dl and $3.10 \pm 0.10$ mg/dl to $22 \pm 0.91$ mg/dl and $1.75 \pm 0.08$ mg/dl respectively was observed up to 21st day in Group IV rabbits in contrast to Group II rabbits which showed a fluctuation during the entire period and in the 21st day the values were $40.1 \pm 1.16$ mg/dl and $2.80 \pm 0.14$ mg/dl respectively. The improvement in blood urea and serum creatinine levels in group IV rabbits was almost comparable to Group I rabbits [Fig. 60 and 61].
An improvement in blood sugar, blood urea and serum creatinine in Group IV rabbits was comparable to Group I rabbits and was significant in contrast to Group II rabbits (Table III).
Effect of *Syzygium jambolanum* on Histomorphological changes of Alloxan-induced Diabetic rabbits

*Syzygium jambolanum* treated alloxanized diabetic rabbits showed amelioration of histomorphological changes in contrast to Group III rabbits. Haematoxylin and Eosin stained sections of pancreas of Group IV rabbits showed almost normal islets. Using modified Gomori's aldehyde fuchsins stain (Halmi, 1952) the less number of beta cells was observed in Group IV rabbits compared to Group I rabbits. However, the number of beta cells in Group IV rabbits was significant in contrast to Group II rabbits (Fig. 62, p.124 and 84, p.95). The kidney sections of Group IV rabbits showed normal tubular epithelium, normal collecting tubules but slight degenerative changes in tubules [Fig. 63, p.124 and 64, p.125] in comparison to Group I rabbits. Congestion and degenerative changes [Fig. 65, p.125] in liver and slight congestion [Fig. 66, p.126] in lungs of Group IV rabbits were observed. However, H&E stained sections of heart, brain and alimentary canal of Group IV rabbits were normal comparable to Group I rabbits. The slight changes in pancreas, kidneys, liver and lungs were significant in contrast to Group II rabbits.

Effect of *Abroma augusta* on Diabetic Rabbits

The extract of *Abroma augusta* given orally to alloxan-induced diabetic rabbits showed an improvement in behavioural, biochemical and histomorphological alterations.

Effect of *Abroma augusta* on behavioural patterns

Alloxan-induced diabetic rabbits (Group III) showed improvement in behaviour comparable to saline treated normal healthy rabbits (Group I). The behavioural improvement was significant in contrast to saline treated alloxanized diabetic rabbits (Group II).
Effect of *Abroma augusta* on Biochemical parameters

The biochemical parameters viz. blood sugar (F), blood urea and serum creatinine levels showed a significant improvement in Group III rabbits by the oral administration of *Abroma augusta*. The blood sugar level of Group III rabbits decreased consistently from an initial value of $291 \pm 10.50$ mg/dl to $120.25 \pm 3.89$ mg/dl upto 21st day. The blood sugar level of Group III rabbits was almost comparable to Group I rabbits and significant to Group II rabbits (Fig. 67).

**Fig 67: Effect of *Abroma augusta* on the Blood Glucose of Alloxanized Rabbits.**

![Graph showing blood glucose levels over time for different groups.](image)

Blood urea and serum creatinine levels in Group III rabbits decreased from an initial values of $46.75 \pm 1.65$ mg/dl and $3.10 \pm 0.14$ mg/dl to $24.75 \pm 0.62$ mg/dl and $1.93 \pm 0.13$ mg/dl respectively upto 21st day of the treatment. These values were significant in contrast to Group II rabbits which showed a value of $36.1 \pm 1.16$ mg/dl and $2.11 \pm 0.14$ mg/dl respectively and almost comparable to Group I rabbits [Fig. 68 and 69].
An improvement of blood sugar, blood urea and serum creatinine was thus observed in Group III rabbits in contrast to Group II rabbits (Table III). The comparative changes in bio-chemical parameters of Group I, Group II and Group III rabbits showed a level of significance.

Effect of *Abroma augusta* on Histomorphology of Diabetic Rabbits

Haematoxylin and Eosin stained sections of pancreas of Group III rabbits showed comparatively normal histomorphology in contrast to Group II
rabbits. However, using modified Gomori’s aldehyde fuchsin stain (Halmi, 1952) the number of beta cells were found to be less in comparison to Group I rabbits but significant in contrast to Group II rabbits (Fig. 70, p.126 and 84, p.95). The other organs stained with Haematoxylin and Eosin in Group III rabbits showed congestion and mild degenerative changes [Fig. 71, p.127] in kidneys, congestion and haemorrhage [Fig. 72, p.127] in lungs, degenerative changes [Fig. 73, p.128] in liver and haemorrhage in subendocardial portion [Fig. 74, p.128] in heart. However, alimentary canal and brain sections of Group III rabbits showed normal histomorphology.

**Effect of Glimipiride on Diabetic Rabbits**

The efficacy of Glimipiride given orally at 2 mg/kg body weight to alloxan-induced diabetic rabbits showed improvement in diabetic complications with regard to behavioural, biochemical and histomorphological alterations.

**Effect of Glimipiride on Behaviour**

The Glimipiride treated diabetic rabbits (Group V) showed a significant improvement in behaviour in contrast to alloxan-induced diabetic (Group II) rabbits which exhibited polyuria, polydipsia, lethargy, dullness and a tendency to lie down. Further, Group V rabbits showed an active behaviour comparable to saline-treated normal (Group I) rabbits.

**Effect of Glimipiride on Biochemical Patterns**

The biochemical levels showed a significant improvement in Group V rabbits in comparison to Group II rabbits. The blood sugar level of Group V rabbits decreased steadily upto 21st day reaching 86 ± 8.39 mg/dl in contrast to Group II rabbits with a level of 192 ± 9.41 mg/dl. A decrease of blood sugar from 271 ± 9.11 mg/dl to 86 ± 8.39 mg/dl upto 21st day was observed during the experimental period. The blood sugar level of Group V rabbits was almost comparable to Group I rabbits (Fig. 75).
Blood urea and serum creatinine levels decreased consistently in Group V rabbits. A significant decrease of blood urea and serum creatinine from 46.25 ± 1.54 mg/dl and 3.13 ± 0.08 mg/dl to 18.75 ± 0.84 mg/dl and 0.98 ± 0.05 mg/dl respectively was observed upto 21st day in Group V rabbits in contrast to Group II rabbits which showed a fluctuation during the entire period and in the 21st day the values were 40.1 ± 1.16 mg/dl and 2.80 ± 0.14 mg/dl respectively. The improvement in blood urea and serum creatinine levels in Group V rabbits was almost comparable to Group I rabbits [Fig. 76 and 77].
Effect of Glimiperide on Histomorphological Alterations

Haematoxylin and Eosin stained sections of different organs of Group V rabbits showed amelioration in histomorphological alterations when compared to Group II rabbits. The pancreatic sections showed normal islets (Fig. 78, p.129) but using modified Gomori's aldehyde fuchsin stain (Halmi, 1952) the number of beta cells was found to be less than Group I rabbits but significant to Group II rabbits (Fig. 79, p.129 and 84, p.95). The other H&E stained sections of Group V rabbits showed mild degenerative changes [Fig. 80, p.130] in kidneys, haemorrhage in heart [Fig. 81, p.130], congestion and haemorrhage [Fig. 82, p.131] in lungs and mild congestion but regenerative hepatocytes [Fig. 83, p.131] in liver. These histomorphological changes were significant in comparison to Group II rabbits. However, brain and alimentary canal of Group V rabbits did not show any histopathology.

Quantitative Study of Beta Cells

Histological examination of the pancreatic islets in all groups of rabbits using modified Gomori's aldehyde fuchsin (Halmi, 1952) showed that majority of the beta cells in alloxan-induced diabetic rabbits were greatly shrunken and
even some cells coalesced into almost homogenous debris in which individual cells could not be recognized. In streptozotocin-induced diabetic rabbits the number of beta cells were comparatively more as compared to alloxan-induced diabetic rabbits. However, in both the groups of rabbits the number of beta cells was reduced when compared with saline-treated (control) rabbits. The other groups of rabbits viz, diabetic-treated showed a higher percentage of beta cells than untreated groups of rabbits. The relative percentage of beta cells in different groups of rabbits is given in figure 84.

**Fig 84: Comparative percentage of beta cells in different groups of rabbits**

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Alloxan</th>
<th>STZ</th>
<th>A.A</th>
<th>Syz</th>
<th>Glm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline-treated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>healthy rabbits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alloxan-induced</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diabetic rabbits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptozotocin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>induced diabetic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rabbits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abroma augusta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>treated alloxan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ized diabetic rabbits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syzygium jambolanum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>treated alloxanized diabetic rabbits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glimiperide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>treated alloxanized diabetic rabbits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE-I: Changes in Blood Glucose (F), Blood Urea, Serum Creatinine and Body Weight Profile of Alloxan-induced Diabetic Rabbits

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Initial Value</th>
<th>1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>4&lt;sup&gt;th&lt;/sup&gt;</th>
<th>5&lt;sup&gt;th&lt;/sup&gt;</th>
<th>6&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>T</td>
<td>C</td>
<td>T</td>
<td>C</td>
<td>T</td>
</tr>
<tr>
<td>Blood Glucose (F)</td>
<td>103.25 ± 3.19</td>
<td>106.75 ± 4.71</td>
<td>98 ± 5.18</td>
<td>192.5 ± 4.97</td>
<td>101.5 ± 5.28</td>
<td>94.5 ± 4.80</td>
<td>234.75 ± 9.19</td>
</tr>
<tr>
<td>(mg/dl)</td>
<td>103.75 ± 3.63</td>
<td>149 ± 6.26</td>
<td>195.25 ± 7.41</td>
<td>257.5 ± 8.68</td>
<td>195.25 ± 6.80</td>
<td>257.5 ± 8.68</td>
<td>292.75 ± 8.87*</td>
</tr>
<tr>
<td>Blood Urea</td>
<td>19.75 ± 0.84</td>
<td>20 ± 1.07</td>
<td>20.5 ± 1.12</td>
<td>37.25 ± 1.17</td>
<td>19.25 ± 1.17</td>
<td>19.5 ± 1.04</td>
<td>46.25 ± 1.43</td>
</tr>
<tr>
<td>(mg/dl)</td>
<td>21.08 ± 1.27</td>
<td>31.75 ± 1.17</td>
<td>42.5 ± 1.04</td>
<td>50 ± 1.43</td>
<td>53 ± 1.54*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Creatinine</td>
<td>0.91 ± 0.04</td>
<td>0.97 ± 0.13</td>
<td>0.98 ± 0.18</td>
<td>2.78 ± 0.08</td>
<td>0.94 ± 0.14</td>
<td>0.95 ± 0.10</td>
<td>3.29 ± 0.14</td>
</tr>
<tr>
<td>(mg/dl)</td>
<td>1.52 ± 0.05</td>
<td>2.26 ± 0.18</td>
<td>2.97 ± 0.13</td>
<td>3.29 ± 0.14</td>
<td>3.16 ± 0.09</td>
<td>3.32 ± 0.16*</td>
<td></td>
</tr>
<tr>
<td>Body Weight</td>
<td>1.15 ± 0.09</td>
<td>1.21 ± 0.07</td>
<td>1.29 ± 0.06</td>
<td>1.96 ± 0.03</td>
<td>1.51 ± 0.06</td>
<td>1.96 ± 0.03</td>
<td>1.65 ± 0.05</td>
</tr>
<tr>
<td>(Kg)</td>
<td>1.68 ± 0.11</td>
<td>1.46 ± 0.06</td>
<td>1.56 ± 0.04</td>
<td>1.51 ± 0.06</td>
<td>1.51 ± 0.06</td>
<td>1.51 ± 0.06</td>
<td>1.51 ± 0.06</td>
</tr>
</tbody>
</table>

C = Control (Saline-treated normal rabbits), T = Treated (alloxan-induced diabetic rabbits). Values are mean ± SEM, *p < 0.001, **p < 0.50 compared to control.
Table - II: Changes in Blood Sugar (F), Blood Urea and Serum Creatinine and Body Weight of Streptozotocin-Induced Diabetic Rabbits

| Parameters          | Initial Value | C | T | C | T | C | T | C | T | C | T |
|---------------------|---------------|---|---|---|---|---|---|---|---|---|---|---|
| Blood Glucose (mg/dl) | 100 ±5.08     | 96.25 ±8.16 | 102 ±3.37 | 233 ±9.17 | 99 ±2.68 | 198 ±6.97 | 100 ±3.32 | 182 ±8.21 | 101 ±2.73 | 159 ±6.51* |
| Blood Urea (mg/dl)  | 18.75 ±0.62   | 20.5 ±1.32  | 17.5 ±0.86 | 39.75 ±0.84 | 18.5 ±0.64 | 36.75 ±1.10 | 17.5 ±1.01 | 28.25 ±1.51 | 17.74 ±1.46 | 25 ±2.07** |
| Serum Creatinine (mg/dl) | 0.93 ±0.07     | 1.02 ±0.12  | 0.94 ±0.04 | 2.25 ±0.32 | 0.95 ±0.08 | 1.98 ±0.21 | 0.92 ±0.08 | 1.87 ±0.18 | 0.95 ±0.087 | 1.54 ±0.19** |
| Body Weight (Kg)    | 1.177 ±0.08   | 1.275 ±0.14  | 1.242 ±0.07 | 1.227 ±0.10 | 1.302 ±0.05 | 1.251 ±0.07 | 1.320 ±0.05 | 1.270 ±0.08 | 1.377 ±0.06 | 1.380 ±0.06 |

C = Control (Saline-treated normal rabbits). T = Treated (Streptozotocin-induced diabetic rabbits). Values are mean ± SEM. *p < 0.01, **p < 0.10 compared to control.
<table>
<thead>
<tr>
<th>Factor Group</th>
<th>Initial Value</th>
<th>Days 7th</th>
<th>Days 14th</th>
<th>Days 21st</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BS(F)</td>
<td>BU</td>
<td>SC</td>
<td>BS(F)</td>
</tr>
<tr>
<td>NC</td>
<td>94</td>
<td>19.5</td>
<td>1.25</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>±6.06</td>
<td>±0.64</td>
<td>±0.20</td>
<td>±5.95</td>
</tr>
<tr>
<td>DC</td>
<td>292</td>
<td>53</td>
<td>3.32</td>
<td>285</td>
</tr>
<tr>
<td></td>
<td>±10.60</td>
<td>±2.11</td>
<td>±0.16</td>
<td>±9.46</td>
</tr>
<tr>
<td><em>Abroma augusta</em> treated</td>
<td>291</td>
<td>46.75</td>
<td>3.10</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>±10.50</td>
<td>±1.65</td>
<td>±0.14</td>
<td>±4.02</td>
</tr>
<tr>
<td><em>Syzygium jambolanum</em> treated</td>
<td>298</td>
<td>49.75</td>
<td>3.10</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td>±7.90</td>
<td>±1.31</td>
<td>±0.10</td>
<td>±5.76</td>
</tr>
<tr>
<td><em>Glimperide</em> treated</td>
<td>271</td>
<td>46.25</td>
<td>3.13</td>
<td>154</td>
</tr>
<tr>
<td></td>
<td>±9.11</td>
<td>±1.54</td>
<td>±0.08</td>
<td>±4.96</td>
</tr>
</tbody>
</table>

Values represent mean ± SEM. Each experiment was performed on a group of four rabbits. BS(F): Blood Sugar (Fasting), BU: Blood Urea, SC: Serum Creatinine, NC: Non-diabetic control rabbits treated with normal saline, DC: Diabetic rabbits (Alloxanized) treated with normal saline. *p < 0.02, **p < 0.01, *p < 0.01, **p < 0.001 compared with DC.
Figure 5: Pancreatic section of alloxan-induced diabetic rabbits showing vacuolation of cells in the islets of Langerhan's (H&E ×400).

Figure 6: Pancreatic section of alloxan-induced diabetic rabbits showing increased eosinophilia in the islets of Langerhan's and disorganization of pancreatic acini (H&E ×400).
Figure 7: Pancreatic section of alloxan-induced diabetic rabbits showing congestion and degenerative changes in acini (H&E ×400).

Figure 8: Pancreatic section of alloxan-induced diabetic rabbits showing cellular infiltration in interlobular septa (H&E ×100).
Figure 9: Pancreatic section of alloxan-induced diabetic rabbits showing haemorrhage in interlobular septa (H&E x400).

Figure 10: Pancreatic section of alloxan-induced diabetic rabbits showing pancreatitis (H&E x100)
Figure 11: Pancreatic section of alloxan-induced diabetic rabbits showing chronic pancreatitis, proliferation of fibroblasts in some pancreatic lobules and disorganization of acini (H&E ×400).

Figure 12: Pancreatic section of alloxan-induced diabetic rabbits stained with modified Gomori's aldehyde fuchsin (Halmi, 1952). The degenerative changes and reduction in the number of beta cells is evident ×100.
Figure 13: Pancreatic section of alloxan-induced diabetic rabbits stained with modified Gomori's aldehyde fuchsin (Scott, 1952). The beta cells show degeneration $\times 400$.

Figure 14: Pancreatic section of saline-treated (control) rabbits showing normal morphology of acini and islets of Langerhan's (H&E $\times 100$).
Figure 15: Pancreatic section of saline-treated (control) rabbits stained with modified Gomori's aldehyde fuchsin (Halimi, 1952). The beta cells (B) appear purple and alpha cells (A) appear yellow in the photograph ×1000.

Figure 16: Pancreatic section of saline-treated (control) rabbits stained with modified Gomori's aldehyde fuchsin (Scott, 1952). The beta cell granules appear deep purple in the photograph ×1000.
Figure 17: Kidney section of alloxan-induced diabetic rabbits showing occlusion of tubules by polygonal cells. Some polygonal cells appeared to have lost nuclei (H&E ×400).

Figure 18: Kidney section of alloxan-induced diabetic rabbits showing lower nephron nephrosis (H&E ×400).
Fig. 17  
Polygonal Cell Occlusion  
Polygonal Cells without Nuclei

Fig. 18
Figure 19: Kidney section of alloxan-induced diabetic rabbits showing hypertrophy of glomerulus (H&E x400).

Figure 20: Kidney section of alloxan-induced diabetic rabbits showing nephritis (H&E x400)
Figure 21: Kidney section of alloxan-induced diabetic rabbits showing subcapsular degeneration (H&E x400).

Figure 22: Kidney section of alloxan-induced diabetic rabbits showing haemorrhage in tubules and chronic nephritis (H&E x400).
Figure 23: Kidney section of alloxan-induced diabetic rabbits showing haemorrhage in medullary region (H&E ×400).

Figure 24: Kidney section of saline- treated (control) rabbits showing normal histomorphology (H&E ×400)
Figure 25: Kidney section of saline-treated (control) rabbits showing normal tubular epithelium (H&E x400).

Figure 26: Liver section of alloxan-induced diabetic rabbits showing biliary hyperplasia (H&E x400).
Fig. 25
Kidney Tubules

Fig. 26
Figure 27: Liver section of alloxan-induced diabetic rabbits showing hepatosis (H&E x400).

Figure 28: Liver section of alloxan-induced diabetic rabbits showing chronic hepatitis (H&E x100)
Figure 29: Liver section of saline-treated (control) rabbits showing normal histomorphology (H&E x100).

Figure 30: Heart section of alloxan-induced diabetic rabbits showing histocyte proliferation and edema (H&E x400).
Figure 31: Heart section of alloxan-induced diabetic rabbits showing inflammation of myocardium (myocarditis) (H&E ×400).

Figure 32: Heart section of saline-treated (control) rabbits showing normal histomorphology (H&E ×100).
Figure 33: Brain section of alloxan-induced diabetic rabbits showing edema (H&E x400).

Figure 34: Brain section of alloxan-induced diabetic rabbits showing degenerative changes in neurons (H&E x400).
Figure 35: Brain section of alloxan-induced diabetic rabbits showing degeneration of purkinji cells in cerebellum (H&E x400).

Figure 36: Brain section of saline-treated (control) rabbits showing normal cerebrum with neurons (H&E x100).
Fig. 35

Fig. 36

Neurons
Figure 37: Lung section of alloxan-induced diabetic rabbits showing edema (H&E ×100).

Figure 38: Lung section of alloxan-induced diabetic rabbits showing haemorrhage (H&E ×400).
Figure 39: Lung section of alloxan-induced diabetic rabbits showing bronchial hyperplasia (H&E ×100).

Figure 40: Lung section of alloxan-induced diabetic rabbits showing breakdown of alveoli (emphysema) (H&E ×100).
Figure 41: Lung section of saline-treated (control) rabbits showing normal histomorphology (H&E x100).

Figure 42: Intestinal section of alloxan-induced diabetic rabbits showing congestion (H&E x100)
Figure 43. Stomach section of alloxan-induced diabetic rabbits showing inflammation of mucosa (H&E $\times 100$).

Figure 44. Intestinal section saline-treated (control) rabbits showing normal histomorphology (H&E $\times 400$).
Figure 49: Pancreatic section of streptozotocin-induced diabetic rabbits showing decreased cellularity within the islets of Langerhan's. The acinar epithelium shows swelling (H&E x400).

Figure 50: Pancreatic section of streptozotocin-induced diabetic rabbits showing fusiform shape of cells within the islets of Langerhan's. (H&E x400).
Figure 51: Pancreatic section of streptozotocin-induced diabetic rabbits stained with modified Gomori's aldehyde fuchs in (Halmi, 1952). The photograph shows reduced number of beta cells in the islets of Langerhan's $\times 1000$.

Figure 52: Lung section of streptozotocin-induced diabetic rabbits showing congestion (H&E $\times 100$)
Figure 53: Lung section of streptozotocin-induced diabetic rabbits showing haemorrhage in alveoli and bronchioles (H&E ×100).

Figure 54: Kidney section of streptozotocin-induced diabetic rabbits showing congestion (H&E ×100)
Figure 55: Liver section of streptozotocin-induced diabetic rabbits showing congestion and degeneration (H&E ×100).

Figure 56: Heart section of streptozotocin-induced diabetic rabbits showing haemorrhage and myopathy (H&E ×100).
Figure 57: Brain section of streptozotocin-induced diabetic rabbits showing mild neuronal damage (H&E x100).

Figure 58: Stomach section of streptozotocin-induced diabetic rabbits showing yeast cell proliferation (H&E x100).
Figure 62: Pancreatic section of *Syzygium jambolanum*-treated diabetic rabbits stained with modified Gomori's aldehyde fuchsin (Halmi, 1952). The photograph shows reduced number of beta cells in the islets of Langerhan's ×1000.

Figure 63: Kidney section of *Syzygium jambolanum*-treated diabetic rabbits showing normal collecting tubules (H&E ×100).
Figure 64: Kidney section of *Syzygium jambolanum*-treated diabetic rabbits showing slight degenerative changes in some kidney tubules (H&E ×100).

Figure 65: Liver section of *Syzygium jambolanum*-treated diabetic rabbits showing congestion and degeneration (H&E ×100).
Figure 66: Lung section of *Syzygium jambolanum*-treated diabetic rabbits showing slight congestion (H&E ×100).

Figure 70: Pancreatic section of *Abroma augusta*-treated diabetic rabbits stained with modified Gomori's aldehyde fuchsin (Halmi, 1952). The photograph shows reduced number of beta cells in the islets of Langerhan's ×1000.
Figure 71: Kidney section of *Abroma augusta*-treated diabetic rabbits showing congestion and mild degenerative changes (H&E x100).

Figure 72: Lung section of *Abroma augusta*-treated diabetic rabbits showing congestion and haemorrhage (H&E x100).
Figure 73: Liver section of *Abroma augusta*-treated diabetic rabbits showing congestion and degeneration (H&E x100).

Figure 74: Heart section of *Abroma augusta*-treated diabetic rabbits showing haemorrhage in sub-endocardial portion (H&E x100).
Figure 78: Pancreatic section of glimepiride-treated diabetic rabbits showing normal histomorphology (H&E ×100).

Figure 79: Pancreatic section of glimepiride-treated diabetic rabbits stained with modified Gomori's aldehyde fuchsin (Halmi, 1952). The photograph shows reduced number of beta cells in the islets of Langerhan's ×1000.
Fig. 78

Fig. 79 β-Cells
Figure 80: Kidney section of glimepiride-treated diabetic rabbits showing mild degenerative changes (H&E x100).

Figure 81: Heart section of glimepiride-treated diabetic rabbits showing haemorrhage (H&E x100).
Figure 82: Lung section of glimepiride-treated diabetic rabbits showing congestion and haemorrhage (H&E ×100).

Figure 83: Liver section of glimepiride-treated diabetic rabbits showing congestion but regenerative hepatocytes (H&E ×100).