Anti-Obesity Effects of Aloe Vera Whole Leaf and Sitagliptin in Diabetic Rats

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¹ Conception of study, Designing, Planning experimentation, Study conducton, Analysis, interpretation, Discussion, Manuscript writing, Procurement for reagents, Material analysis and bearing all expenses of study

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Supervised the whole study, Critical review

ABSTRACT

Background: Aloe Vera, a medicinal herb, has been used for centuries in therapeutics and cosmetology. Objective: To compare Antidiobesity effects of Aloe Vera whole leaf with new anti diabetic drug, Sitagliptin on streptozotocin induced diabetic rats. Study Design: Randomized Control Trial. Settings: Department of Pharmacology, Islamic International Medical College, Rawalpindi in collaboration with NIH, Islamabad, Pakistan. Duration: One year from September 2019 to August 2020. Methodology: Young Sprague Dawley rats, n=40, weighing 220-250 grams were taken and randomly divided into Groups A and B. Group B was fed on high fat diet for two weeks to develop insulin resistance. After induction of diabetes, with low dose streptozotocin, Group B was subdivided into: Group B1 (Diabetic Control), Group B2 (Aloe Vera whole Leaf treated), Group B3 (Sitagliptin treated). Body weight was measured in all rats every week to assess progress of study, and finally on completion of study (on Day 60). SPSS version 25 was applied for statistical analysis. One-way ANOVA test was used for assessing any difference in the mean values. Post-hoc Turkey analysis was done to compare inter-group mean differences. P value of <0.05 was considered significant. Results: Mean body weight of Group A was 235.50g, Group B1 272.00g, B2 249.90g and B3 248.70g respectively. Rats in each of Group B2 and Group B3 had significant reduction in body weight compared to Group B1, with no statistically significant intergroup differences in results of Group B2 and B3. Conclusion: Aloe Vera whole leaf extract significantly decreased body weight with almost similar efficacy to Sitagliptin in diabetic rats.

Keywords: Aloe Vera, Hypoglycemic agents, Sitagliptin, Streptozotocin.

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INTRODUCTION

Obesity and type 2 diabetes mellitus are conjoint, emergent, and unified health issues of today’s world. According to World Health Organization (WHO) estimates, near about 171 million people are suffering from diabetes worldwide, with 82 million diabetics, clustered in the South East Asian regions.¹ Obesity, endorses insulin resistance and accounts for 80% of the population-attributable risk for developing type 2 diabetes mellitus.² Unluckily, various existing therapies for type 2 diabetes, particularly sulphphonylureas, thiazolidinediones and insulin, result in weight gain and may intensify the adverse effects of Visceral adipose tissues (VAT) in patients with type 2 diabetes mellitus.³,⁴ Although lifestyle changes lead to early weight loss, weight regain is common. Consequently, clinical strategies for consistent weight loss remain unmet needs of type 2 diabetes management.⁴ Orally administered dipeptidyl-peptidase-IV (DPP-IV) inhibitors have emerged as a new class of oral hypoglycemic agents with the potential of enhancing the biological effects of incretin hormones via inhibiting their inactivation by dipeptidyl-peptidase-4 enzyme.⁵ Sitagliptin, the 1st orally available DPP-IV inhibitor, developed in 2006, is successfully being used for better glycemic control in a broad range of patients with type 2 diabetes, including obese, elderly and those with deranged cardiovascular and kidney profile.⁶ The enzyme dipeptidyl-peptidase-4 (DPP-4) is expressed in various tissues including visceral adipose tissue and promotes adipogenesis. Sitagliptin, with its DPP-4 inhibitory activity, abolishes fat proliferation and markedly diminishes visceral adiposity in obese type 2 diabetic patients.⁷ It helps in maintaining body weight via delayed gastric emptying; decreased fat absorption from the GIT; increased lipid breakdown in adipose tissue along with increased oxidation of fatty acids in skeletal muscles.⁸

Aloe Barbadensis Miller (Aloe Vera), a member of the genus Aloe, is a kind of traditional medicinal plant belonging to the family Liliaceous.⁹ It is a semitropical to tropical, perennial succulent xerophyte, with water storage tissues in leaves to pull through dry conditions and places with low rainfall. Aloe Vera is given the title “Pharmacy of
Nature” because of its multiple magical wonders in therapeutics since pre-biblical times. Nowadays, it is successfully being used for regulating blood glucose levels in diabetic patients because of the complex interplay of its numerous biologically active ingredients. Further, its hypoglycemic property is often linked to pancreatic insulin synthesis and release. In present study, comparative antiobesity effects of Aloe Vera whole leaf extract with standard antidiabetic drug, Sitagliptin were observed. As far as we know, no comparative studies on antiobesity effects of Aloe Vera whole leaf with sitagliptin are done till date.

METHODOLOGY

Study Design: Randomized Control Trial.

Settings: Pharmacology Department of Islamic International Medical College, Rawalpindi in collaboration with National Institute of Health (NIH), Islamabad Pakistan.

Duration: One year from September 2019 to August 2020.

Sample Size: 40 male albino rats.


Exclusion Criteria: Female albino rats and rats below 220 grams.

Data Collection Procedure: 2 months old, healthy adult Sprague Dawley rats, of 220-250 g weight were procured from animal house of NIH and housed in standard cages under standard laboratory conditions. Ten rats received normal standard diet and the remaining thirty rats received high fat standard diet (protein=20%, carbohydrates=20%, lipids=60%), prepared at NIH as standard food pellets according to the recommendations approved by the universities federation for animal welfare. The care and handling of subjects was in harmony with the internationally accepted standard guidelines of use of animals. After 1 week of acclimatization, the rats were randomly distributed into two main groups; 10 rats in group A and the remaining (30) in experimental group B. Group A was labelled as Normal Control and took normal saline and normal standard diet while the Group B received high fat standard diet for two weeks. Rats in group B were found to have significant increase in body weight after two weeks of dietary manipulations. Streptozotocin single I/P injection at a low dose of 35 mg/kg, diabetes was successfully induced in group B rats. Treatment was started in Group B2 (Aloe Vera whole leaf) and Group B3 (Sitagliptin). Body weight was checked every week in all rats. After completion of study, at day 60, Mean body weight of Group A was 235.50g, Group B1 272.00g, B2 249.90g and B3 248.70g respectively. Rats in each of Group B2 (Aloe Vera whole leaf treated) and Group B3 (Sitagliptin treated) had significant reduction in body weight in comparison to the Group B1 (diabetic control), P value <0.001, with no statistically significant intergroup differences among B2 and B3, P value >0.05.

RESULTS

At the start of study (Day Zero), body weights were comparable to each other in all groups. After two weeks of HFD, significant increase in body weight of group B rats was seen. On administration of Streptozotocin single I/P injection at a low dose of 35 mg/kg, diabetes was successfully induced in group B rats. Treatment was started in Group B2 (Aloe Vera whole leaf) and Group B3 (Sitagliptin). Body weight was checked every week in all rats. After completion of study, at day 60, Mean body weight of Group A was 235.50g, Group B1 272.00g, B2 249.90g and B3 248.70g respectively. Rats in each of Group B2 (Aloe Vera whole leaf treated) and Group B3 (Sitagliptin treated) had significant reduction in body weight in comparison to the Group B1 (diabetic control), P value <0.001, with no statistically significant intergroup differences among B2 and B3, P value >0.05.

Table 1: Comparison of mean value + SEM (standard error of mean) of mean weight (g) of all groups on day 60 (n=40)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Group A</th>
<th>Group B1</th>
<th>Group B2</th>
<th>Group B3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>control</td>
<td>disease</td>
<td>Aloe Vera</td>
<td>Sitagliptin</td>
</tr>
<tr>
<td>Mean</td>
<td>235.50</td>
<td>272.00</td>
<td>249.90</td>
<td>248.70</td>
</tr>
<tr>
<td>SEM</td>
<td>2.49</td>
<td>0.87</td>
<td>0.31</td>
<td>0.34</td>
</tr>
<tr>
<td>P Value</td>
<td>&lt; 0.001*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Comparison of mean + SEM (standard error of mean) of weight (g) of all groups on day 60 (n=40)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean Difference</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vs B1</td>
<td>36.50 ± 1.71</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>A vs B2</td>
<td>14.40 ± 1.71</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>A vs B3</td>
<td>13.20 ± 1.71</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>B1 vs B2</td>
<td>22.10 ± 1.71</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>B1 vs B3</td>
<td>23.30 ± 1.71</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>B2 vs B3</td>
<td>1.20 ± 1.71</td>
<td>0.955</td>
</tr>
</tbody>
</table>

CONCLUSION

Aloe Vera whole leaf extract and Sitagliptin significantly lowered body weight in HFD-STZ – T2DM rat model and both treatments had almost similar efficacy with minor statistically insignificant differences (P value > 0.05) in controlling metabolic changes in HFD-STZ – T2DM rat model. Therefore, both Aloe Vera whole leaf extract and sitagliptin can be used interchangeably in treatment of obesity in type 2 diabetes mellitus. This will help obese diabetic patients to regulate body weight through safe and cost effective means.

LIMITATIONS

Owing to time constrains, cost and availability issues mRNA expression levels in the experimental Rat’s liver and other tissues was not done.

SUGGESTIONS / RECOMMENDATIONS

Combined effects of Aloe Vera extract with sitagliptin should be explored.

ACKNOWLEDGEMENTS

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