International Journal of Advanced Research in Engineering and Applied Sciences
ISSN: 2278-6252
Impact Factor: 7.388

STUDY ON THE HYPOGLYCEMIC PROPERTY OF SUGAR APPLE (*ANONASQUAMOSA*) AQUEOUS LEAF EXTRACT ON ALLOXAN INDUCED WISTAR RATS (*RATTUSNORVEGICUS*)

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ABSTRACT

It is known that the incidence of diabetes mellitus is high all over the world, becoming the third "killer" of mankind after cancer and cardiovascular diseases, because of its high prevalence, morbidity and mortality.

This study was conducted to evaluate the anti diabetic activity of the aqueous leaf extract of Sugar apple via intra peritoneal route against hyper glycemic dose of Alloxan. Results of the study showed that there was a decrease in the blood sugar level of rats which was treated with the different concentrations of extract. However there was no significant difference among the different concentration after 7th day.

Thus the present study indicates that the 100% aqueous leaf extract of Annonasquamosa has significant hypoglycemic activity in Alloxan induced diabetic rats due to the presence of more than one anti hyper glycemic principles.

KEYWORDS: *Acclimatization, Diabetes mellitus, Hyperglycemia, Hypoglycemia, Insulin*

INTRODUCTION

It is well known that the incidence of diabetes mellitus is high all over the world, especially in Asia. Diabetes is a group of metabolic disorders characterized by a chronic hyperglycemic condition resulting from defects in insulin secretion, insulin action or both. It is becoming the third "killer" of mankind after cancer and cardiovascular diseases, because of its high prevalence, morbidity and mortality. According to the World Health Organization (WHO) the number of diabetics has doubled in the past few years and is expected to double once again by the year 2035. Today, there are 387,000,000 diabetics worldwide. **The Philippines is one of the world's emerging diabetes hotspots. Ranked in the top 15 in the world for diabetes prevalence, Philippines is home to more than 4 million people diagnosed with the disease – and a worryingly large unknown number who**

are unaware they have diabetes. The pathogenesis, progress and the possibility of its management by oral administration of hypoglycemic agents have stimulated great interest in recent decades. Numerous therapies designed for the treatment of DM have proven to be fairly effective, but none is ideal due to undesirable side effects and diminution after prolonged use.

Anonnasquamosa according to Pinto et al. (2005) states that it was originated in lowland Central America where it is indigenous, and from there it was distributed to Mexico and throughout tropical America. The Spaniards carried seeds from the New World to the Philippines and the Portuguese are assumed to have introduced the sugar apple to southern India.The plant is reported to contain flavonoids which are reported to possess anti-diabetic activity. Phytochemical analysis of leaves of *Annonasquamosal* revealed the presence of flavonoids. According to the study Beneficial Effects of Anonnasquamosa leaf extract in Streptozotozin induce Diabetic ratsby Kaleem, Medhaetal., (2008)it was observed that there is a significant decrease in blood glucose in *Anonnasquanosa* treated diabetic rats. In addition, the researchers also examined the influence of oral administration of *Anonnasquamosa* extract on the levels of some biochemical parameters and the activities of some enzymes in plasma, liver, and kidney of Strep to zotozin induce diabetic rats.

Diabetes mellitus is one of the most common non communicable diseases globally. According to the Diabetes Atlas (fifth edition) 366 million people have diabetes in 2011, more than 55 million people in the EUR Region have diabetes, 4.6 million deaths are connected with diabetes in 2011 and in 2030 this number is expecting to rise to 552 million especially to people who live in low- and middle-income countries (WHO, 2010). Many middle- and low-income countries have more people under the age of 60 with diabetes compared to the world average. Meanwhile, for high-income countries, a growing population over the age of 60 makes up the largest proportion of diabetes prevalence (IDF, 2012).

OBJECTIVES OF THE STUDY

This study aims to determine the hypoglycemic activity of Aqueous leaf extract of sugar apple (*Annonasquamosa*) in Alloxan induced Wistar rat.

Specifically, it aims to:

1. Determine the glucose level of the Wistar rats before induction of Alloxan.
2. Determine the glucose level of the Wistar rats after induction of Alloxan.
3. Determine if there is significant difference before and after induction of Alloxan.
4. Determine the glucose level of Alloxan induced Wistar rats after 3rd, 5th and 7th day of induction of the different concentrations of Aqueous leafextract.
5. Determine if ther is significant difference among the different concentrations of Aqueous leaf extract after 3rd, 5th, and 7th day of induction.

METHODOLOGY

Research Design

Experimental method of research was performed in this study and the statistical method of computing 95% level of significance was used in the computation of ANOVA and Post Hoc Analysis using Duncan Dunnett's test.

Materials

Tools such as Analytical Balance, Beaker, Erlenmeyer flask, Graduated cylinder, Funnel, Evaporating dish, Gluco meter, Glucose, strips, Mortar and pestle, Rotary evaporator, Scissors, Syringe, Vialswere used in the experiment.

Data Gathering Procedures

Processing of Annona squamosal aqueous leaf extract

Mature sugar apple tree bark were gathered at Amulung, Cagayan. Fresh leaves were utilized for the extraction process. There was no air drying done. Before the extraction, the fresh leaves were washed with distilled water and were cut into pieces. Following this, the solvent (250 ml of ethanol) was added to a round bottom flask, which was attached to a Soxhlet extractor and condenser on an isomantle. Two hundred fifty (250) milligrams of bark, cut into pieces was loaded into the thimble, which was placed inside the Soxhlet extractor. The side arm was lagged with the glass wool. The solvent was heated using the isomantle and began to evaporate, moving through the apparatus to the condenser. The condensate then drips into the reservoir containing the thimble. Once the level of solvent reaches the siphon it pours back into the flask and the cycle begins again. The process ran for a total of 8 hours. Once the process has finished, the ethanol was evaporated using a rotary evaporator, leaving a yield of extracted plant material about a total of 25 ml in the glass bottom flask.

Acclimatization of Wistar Rats and Measurement for the baseline sugar level

Rats were acclimatized for a period of 7 days under standard environmental conditions of temperature, relative humidity, and dark/light cycle. A standard Animal feed that contain enough nutrients was given to maintain the health of the rats. Distilled water was also given to the rats.Fasting was started on the first day. On the second day extraction of blood was done by cutting the end tail of each rat by using surgical scissors then blood was placed on Glucose strip to be read by the Gluco meter (Accu- check Active). Blood sugar was measured and recorded the same time on the 3rd, 5th, and 7th day of the study.

Induction of Alloxan in Experimental Animals and measuring glucose level after induction

Rats were made diabetic by a single intra peritoneal injection of alloxan monohydrate (150 mg/kg). Alloxan was first weighed individually for each animal according to the body weight and then was solubilized with 0.2ml saline (154mmNaCl) just prior to injection. Induction of Alloxan was done. Two days after alloxan injection, the glucose level of the rats was measured and those with plasma glucose levels of 135 mg/dl was included in the study. Treatment with plant extracts was started 48 h after alloxan injection.

Treatment of Sugar Apple (*Annonasquamosa*) aqueous leaf extract

Treatment of the experimental animals with the different extracts of Anonnasquamosa was done. This study has five sets of treatments with three replicates each. Group I served as the Negative control which received no treatment under standard environment conditions. Group II was the positive control and we used human regular insulin (1 unit/kg body weight of rats). Group III-were the treatment of Sugar Apple aqueous leafextract in four different concentrations, 25%, 50%, 75% and 100%.

Measurement of Blood Glucose Level after Induction of *Annonasquamosa*a queous leaf extract

Extraction of blood was done by cutting the end tail of each rat by using a surgical scissors then blood was placed on Glucose strip to be read by the Glucometer (Accu- check Active). Fasting blood glucose estimation was done the following day after induction of *Annonasquamosa*a queous leaf extract, on the third day and finally on the fifth day.

RESULTS AND DISCUSSIONS

This chapter presents the results and interpretation of the study based on experimental method of research done and the statistical method of computing 95% level of significance was used in the computation of ANOVA and Post Hoc Analysis using Duncan Dunnett's test.

The table above shows that there is a significant difference in the blood glucose level before and after induction of Alloxan Monohydrate.

Table 1 Paired Sample T- test for significant difference in the normal blood glucose level before and normal glucose level after induction of Alloxan

Treatment	Concentration	Mean		Mean difference	T-test value	P- value	Decision
		Before/ After					
Aqueous Leaf Extract	25% Extract	94.33	203.33	-109.00	-33.98	0.001	Reject Ho
	50% Extract	91.00	208.67	-117.67	-53.832	< 0.001	Reject Ho
	75% Extract	92.00	192.67	-100.67	-43.143	0.001	Reject Ho
	100% Extract	93.33	208.67	-115.34	-49.429	< 0.001	Reject Ho
Positive Control		81.33		NA	NA	NA	NA
Negative Control		101.33	202.33	-101.00	-87.469	< 0.001	Reject Ho

Table 2 shows that after 3rd day of treatment all extracts except the 25% Aqueous leaf extract, have significant difference with the blood glucose level of wistar rat after induction of alloxan. This implies that these extracts are effective as hypoglycemic agent.

Table 2 Paired samples t- test for Significant Difference in the normal blood glucose level after induction of Alloxan and 3rd day after treatment

Treatment	Concentration	After induction	3rd day after treatment	Mean difference	T-test va-lue	P-value	Decision
Aqueous leaf extract	25% Extract	203.33	195.33	8.000	2.000	.184	Accept Ho
	50% Extract	208.67	184.33	24.333	36.500	.001	Reject Ho
	75% Extract	192.67	176.33	16.333	13.590	.005	Reject Ho
	100% Extract	208.67	174.00	34.667	9.339	.011	Reject Ho
Negative Control			86.67	-84.667		.000	Reject Ho
Positive Control		202.33	171.33	31.000	14.892	.004	Reject Ho

Table 3 shows that after 5th day of treatment all extracts have significant difference with the blood glucose level of wistar rat after induction of alloxan. This implies that these extracts are effective as hypoglycemic agent.

Table 3 Paired samples t- test for Significant Difference in the normal blood glucose level after induction of Alloxan and 5th day after treatment

Treatment	Concentration	After induction	5th day after treatment	Mean difference	T-test value	P-value	Decision
Aqueous leaf	25% Extract	203.33	184	19.333	5.889	.028	Reject Ho
	50% Extract	208.67	171.33	37.333	20.113	.002	Reject Ho
	75% Extract	192.67	161	31.667	17.953	.003	Accept Ho
	100% Extract	208.67	164	44.667	20.435	.002	Reject Ho
Negative Control			89.67	-64.000		.000	Reject Ho
Positive Control		202.33	153	49.333	8.798	.013	

Table 4 shows that there is a significant difference between the glucose level of wistar rat after induction of alloxan and after 7th day of treatment with different concentrations. This implies that all extracts are effective as hypoglycemic agent after 7th day of treatment.

Table 4 Paired samples t- test for Significant Difference in the normal blood glucose level after induction of Alloxan and 7th day after treatment

Treatment	Concentration	After induction	7th day after treatment	Mean difference	T-test value	P-value	Decision
Aqueous leaf extract	25% Extract	203.33	174.33	29.000	13.931	.005	Reject Ho
	50% Extract	208.67	161.33	47.333	17.7510	.003	Reject Ho
	75% Extract	192.67	152.33	40.333	13.614	.005	Reject Ho
	100% Extract	208.67	138.00	70.667	21.525	.002	Reject Ho
Negative Control			101	-25.33		.000	Reject Ho
Positive Control		202.33	126.33	76.000	20.074	.002	

Table 5 shows that 25% aqueous leaf extract as well as the negative control has significant difference with the positive control which means that commercially prepared drug is more effective compared to the said concentrations. On the other hand, 50%, 75% and 100 % aqueous leaf extract, have no significant difference with the positive control. It only indicates that the said concentrations and the commercially available drug have the same level of efficacy in terms of hypoglycaemic property 3rd day after treatment.

Table 5 Dunnett's POSTHOC pairwise comparison of the glucose level of the Wistar Rats between the treatments and the positive control 3rd day after treatment

Dependent variable	(I) Group	(J) Group	Mean Difference (I-J)	P-value	Decision
Blood glucose level of Wistar rats 3rd day after treatment	25%Aqueous leaf extract	Positive Control	24.000	.000	Reject Ho
	50% Aqueous leaf extract	Positive Control	13.000	.103	Accept Ho
	75% Aqueous leaf extract	Positive Control	5.000	.946	Accept Ho
	100% Aqueous leaf extract	Positive Control	2.667	.000	Accept Ho
	Negative Control	Positive Control	-84.667	.000	Reject Ho

Table 6 shows that 75% and 100% aqueous leaf extract, have all the same level of efficacy with the positive control. On the other hand 25% and 50% aqueous leaf extract glucose level shows significant difference with the postivie control, which means commercially prepared drug is more effective than the said extracts after 5th day of treatment.

Table 6 Dunnett's POSTHOC pairwise comparison of the glucose level of the Wistar Rats between the treatments and the positive control 5th day after treatment

Dependent variable	(I) Group	(J) Group	Mean Difference (I-J)	P-value	Decision
Blood glucose level of Wistar rats 5th day after treatment	25%Aqueous leaf extract	Positive Control	31.000	.000	Reject Ho
	50%Aqueous leaf extract	Positive Control	18.333	.006	Reject Ho
	75%Aqueous leaf extract	Positive Control	8.000	.534	Accept Ho
	100%Aqueous leaf extract	Positive Control	11.000	.193	Accept Ho
	Negative Control	Positive Control	-64.000	.000	Reject Ho

Table 7 shows that all treatment groups show significant difference with the positive group. Therefore, commercially available drug is more effective than any of the treatments after 7th day of induction.

Table 7 Dunnett's POSTHOC pairwise comparison of the glucose level of the Wistar Rats between the treatments and the positive control 7th day after treatment

Dependent variable	(I) Group	(J) Group	Mean Difference (I-J)	P-value	Decision
Blood glucose level of Wistar rats 7th day after treatment	25%Aqueous leaf extract	Positive Control	48.000	.000	Reject Ho
	50% Aqueous leaf extract	Positive Control	35.000	.000	Reject Ho
	75% Aqueous leaf extract	Positive Control	26.000	.000	Reject Ho
	100% Aqueous leaf extract	Positive Control	11.667	.048	Reject Ho
	Negative Control	Positive Control	-25.333	.000	Reject Ho

CONCLUSION

Results of the study showed that there was a decrease in the blood sugar level of rats treated with the different concentrations of Aqueous leaf extract. However there was no significant difference among the different concentration after 7th day. The highest concentration of the *Anonnasquamosa* extract was 100% aqueous leaf extract which gave the largest decrease of blood sugar levels among different concentrations.

RECOMMENDATIONS

1. Lengthening the treatment and observation period to further confirm the hypoglycemic activity of the different concentrations of *Annonasquamosa* extracts.
2. Use other glucose measuring device for a better blood glucose reading.

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