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Slower Rise and Smaller Peak Level of Blood Glucose in Healthy Young Male Adults Pre-Fed Moringa Oleifera Seed Powder

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Abstract
Ingestion of food with high glycaemic index is known to stress the insulin release mechanism that can produce Insulin resistance and eventually Diabetes Mellitus. How fast the end product of digestion of carbohydrate glucose surges into the bloodstream and the peak level attained are equally important for the glucose control mechanism of the body and ultimately the health of the individual involved. This study aims at exploring the effect of *Moringa oleifera* seed on the post-prandial rate of absorption of glucose and the peak glucose level attainable. Five healthy young male adult (18-35) volunteers had their Oral Glucose Tolerance Test (OGTT) conducted the first day as a control group followed the next day by a second OGTT with a pre-treatment with *Moringa oleifera* seed powder in a fix dose of 0.0175 gram per Kilogram body weight as the test/case group. The results indicate that it takes 60 minutes for the blood glucose to reach the peak concentration of 118.6 mg/dl in treatment group as against 30 minutes in the control group reaching 135mg/dl optimal concentration. The difference in this concentration and rate of surge are significant ($p<0.05$) A slower rise and a smaller optimal concentration of glucose are demonstrated as response to *Moringa oleifera* powder ingestion, a potentially clear beneficial effect.
Keywords: *Moringa Oleifera,* Seed, Slower, Smaller, Glucose, Insulin-resistance

Introduction

Moringa oleifera is a pantropical tree. It is locally call various names according to the geocultural setting. Such names include Horseradish, Benolive, Morongo, Mulangay, Saijhan or sajna, Benoil or Benoil tree (Duke JA, 1987). Moringa oleifera is a rich source of nutrient and helps in ecological management. It is cheap and grows well in various climates. *Moringa oleifera* is one of the 14 species In the Moringaceae family. They grow fast and remarkably resist adverse conditions. The seed of Moringa oleifera is often remove from the mature pod and consume like peas or groundnut. It is rich in ascorbic acid, lots of the B vitamins and mineral. There several report on the benefits of the use various parts of *Moringa oleifera* plant on blood glucose level and thus widely held belief that it is useful in the treatment of diabetes mellitus (Mossa, 1985). The seed is of particular importance because of its ability in reducing blood glucose level (Makonnen et al, 1997). In Indian traditional system of medicine, *Moringa oleifera* Lam Sayan. Moringa Pteryosperma Gaerth (Moringaceae) is commonly used as healing herbs to treat diabetes.

The phytochemical screening and toxicity studies on the methanol extract of the seeds of *Moringa oleifera* show signs of acute toxicity observed at a dose of 4,000mgkg^{-1} in the acute toxicity test and mortality was recorded at 5000mgkg^{-1} (Ajibade et al 2013). No adverse effect was observed at concentration lower than 3,000mgkg^{-1}. The median lethal those of the extract in rat was 3,873mgkg^{-1}. Subacute administration of the seed extract caused significant ($p<0.05$) increase in the level of Alanine and aspartate transferases (ALT and AST), and significant ($p<0.05$) decrease in weight of experimental rats, at 1600mgkg^{-1}. The study concludes that the extract of seeds *Moringa oleifera* is safe both for medicinal and nutritional uses.

Insulin resistance and relative deficiency in insulin secretion are the major pathophysiological features of impaired glucose tolerance and type-2 diabetes (Simonson, 2015). Although the euglycaemic-hyperinsulinaemic clamp and the hyperglycaemic clamp are the 'gold standards', respectively, for measuring these metabolic defects, there has been an active search during the past few decades for simpler and less expensive surrogate measures of insulin resistance that can be applied more globally in epidemiological studies or large clinical trials. These surrogate markers primarily rely on plasma insulin and glucose levels measured either in the fasting state or after an oral glucose challenge. Although many of these surrogate measures correlate well with the clamp (with r values frequently as high as 0.60-0.70) within racially and ethnically homogeneous populations, it is not clear how well they can be used to compare insulin action across different groups.

The surge in blood Glucose level following ingestion of carbohydrate rich meal is important at two levels. First it is the speed with which the glucose is absorbed into the bloodstream and secondly the peak concentration of glucose that is attained. The rapid surge in blood glucose level stress the insulin release leading hyperinsulinaemia, and abnormally high lipids concentration in blood, eventually insulin resistance and higher level of glucose may result and that produce symptoms and signs similar to what is obtainable in full blown diabetes mellitus. Any food material capable of reducing the rapid surge in blood glucose may be viewed beneficial in management of diabetes mellitus. The reduction in the postprandial peak level of glucose is also of

importance. Abnormally high level of lipids that may follow high level of Insulin concentration in the blood is also a risk factor in the pathogenesis of cardiovascular diseases (Mehta et al, 2003

Materials and Methods

The seed of the *Moringa oleifera* is de-shelled and powdered and dry weight measured. Estimated dose usually consume by individuals in this environment (four average sized seeds) is match against safety range from results of toxicology studies to validate the safe and suitable dose for administration in this study test group. The test group is six healthy young male adult volunteers.

Oral Glucose Tolerance Test (OGTT) series are conducted as a control in the first day, and the next day a second OGTT series are performed on the same individuals, now as test group that ingest powder *Moringa oleifera* seed powder in the same dose according to their body sizes.

Inclusion criteria

The subjects were young male adults with normal body mass indices (BMI) and who had no history of any endocrine metabolic disease or recent febrile illness. They also had no previous history of reaction to *Moringa oleifera* seeds.

Exclusion Criteria

Presence of Diabetes mellitus or glycogen storage disease, febrile illness or any major disorder was excluded. The subjects were not also taking any medications.

Methodology

After obtaining ethical clearance from the University of Jos ethical committee, five young male adults were chosen for the study. The subjects were instructed to fast overnight (not to eat or drink water for at least 12 hours). The weight of each subject was recorded first. The fasting blood sugar levels were evaluated on the blood taken by finger tip pricking. The finger was properly disinfected using a chorhexidine-swab, allowed to dry and then pricked carefully to avoid piercing the underlying artery. A drop of blood from the finger was then placed on the indicator on the Glucometer strip. When the coding clip was properly fixed into the glucose meter, the strip is fixed as the indicator light flashes. The result is displayed on the screen within 3-5 seconds. 0.0175g/kg body weight of each subject of glucose D solution was given to the subjects. The blood glucose level of each subject was recorded at 0 min, 20 min, 1 hour, 1.5 hours, 2 hours, 2.5 hours and 3 hours seven sample in all.

The next day, fasting blood sugar of each subject was taken again to obtain a baseline. Each subject is given 5 seeds of *Moringa oleifera* (each seed has an average weight of 0.3g) to chew and a little water to wash it down after chewing. Five minutes later, glucose solution was given to them to drink according to their individual body weights. Blood glucose level is repeated at 30, 60, 90, 120, 150 and 180 minutes and recorded accordingly. The mean of these values was calculated and the graph of mean (mmol/L) was plotted against time (hours).

Day 1

The first day was for control evaluation. Each subject was given glucose D solution only and OGTT performed.

Day 2

The second day was a test for with Moringa oleifera. Each subject was given *Moringa oleifera* seed first then after 5 minutes later glucose D solution was administered.

Combi-2 urinalysis test strips were used to check the urine of each of the subjects. This is to check if urine glucose is normal.

Results

The results of this study are presented on the tables and figures below.

Table 1: Table showing Computation of *Moringa oleifera* doses for administration to subject volunteers

Subject No	Body weight	MO 0.0175g/kg	Glucose 2g/kgBWt	No. of teaspoon
1.	79	1.3825	158	11
2.	63	1.1025	126	8
3.	72	1.26	144	10
4.	70	1.225	140	9
5.	86	1.505	172	12

Table 2: Table Showing Glucose Levels Across Periods in the Absence of Treatment/Control

Time (Minutes)	N	Mean Blood Glucose mg/dl	Std. Deviation	Std. Error
0	5	89.20	11.883	5.314
30	5	135.00	21.552	9.638
60	5	114.00	8.216	3.674
90	5	109.00	12.042	5.385
120	5	106.40	5.550	2.482
150	5	92.40	11.803	5.278
180	5	93.40	12.740	5.697
Total	**35**	**105.63**	**19.019**	**3.215**

Table 3: Table showing Comparative values of Glucose levels in OGTT Across Periods without Treatment/Control and with *Moringa oleifera* pre-treatment/Cases/Tests

Time (Minutes)	Blood Glucose level in Control Group(mg/dl) + SEM	Blood glucose Level in Test Group (mg/dl) + SEM
0	89.2 + 5.31	87.6 + 4.88
30	135 + 9.63	111.4 + 11.61
60	114 + 3.67	118.6 + 4.70
90	109 + 5.38	94 + 4.37
120	106.4 + 2.48	95.8 + 3.94
150	92.4 + 5.27	90 + 3.17
180	93.4 + 5.69	84 + 2.54
Mean	**739.4**	**680**

Table 4: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups Within Groups Total	7695.771	6	1282.629	7.803	0.0001 (0.05)
	4602.400	28	164.371		
	12298.171	34			

Table 5: Comparing Oral Glucose Tolerance Test values between cases and controls Descriptive

	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Range
Control	105.63	19.019	3.215	99.10	112.16	72-162
Case	97.34	16.800	2.840	91.57	103.11	71-151
Total	101.49	18.295	2.187	97.12	105.85	71-162

Table 6: ANOVA

	Sum of Squares	df	Mean Square	F	P-Value
Between Groups	1201.429	1	1201.429	3.731	0.058(>0.05)
Within Groups	21894.057	68	321.971		
Total	23095.486	69			

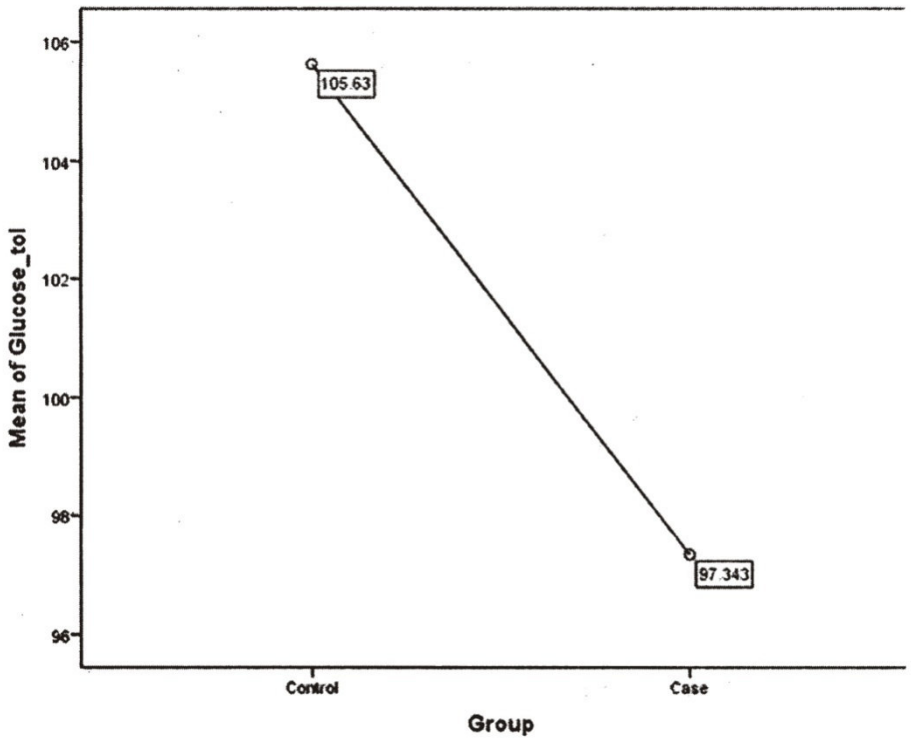

Figure 1. Line graph comparing Group means of Glucose levels between cases and controls

Table 7: Comparing Glucose tolerance levels between cases and controls

Descriptive Statistics

	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Range
				Lower Bound	Upper Bound	
Control	105.63	19.019	3.215	99.10	112.16	72-162
Case	97.34	16.800	2.840	91.57	103.11	71-151
Total	101.49	18.295	2.187	97.12	105.85	71-162

Table 8: ANOVA

	Sum of Squares	df	Mean Square	F	P-Value
Between Groups	1201.429	1	1201.429	3.731	0.058(>0.05)
Within Groups	21894.057	68	321.971		
Total	23095.486	69			

Analysis of Variance was performed to compare the means of glucose tolerance levels across the periods of cases without the administration of the seed powder. As observed from the ANOVA test below, there was a significant difference across and between the respective period as proven by the probability value (P<0.05)

Table 9: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups Within Groups Total	7695.771	6	1282.629	7.803	0.0001 (0.05)
	4602.400	28	164.371		
	12298.171	34			

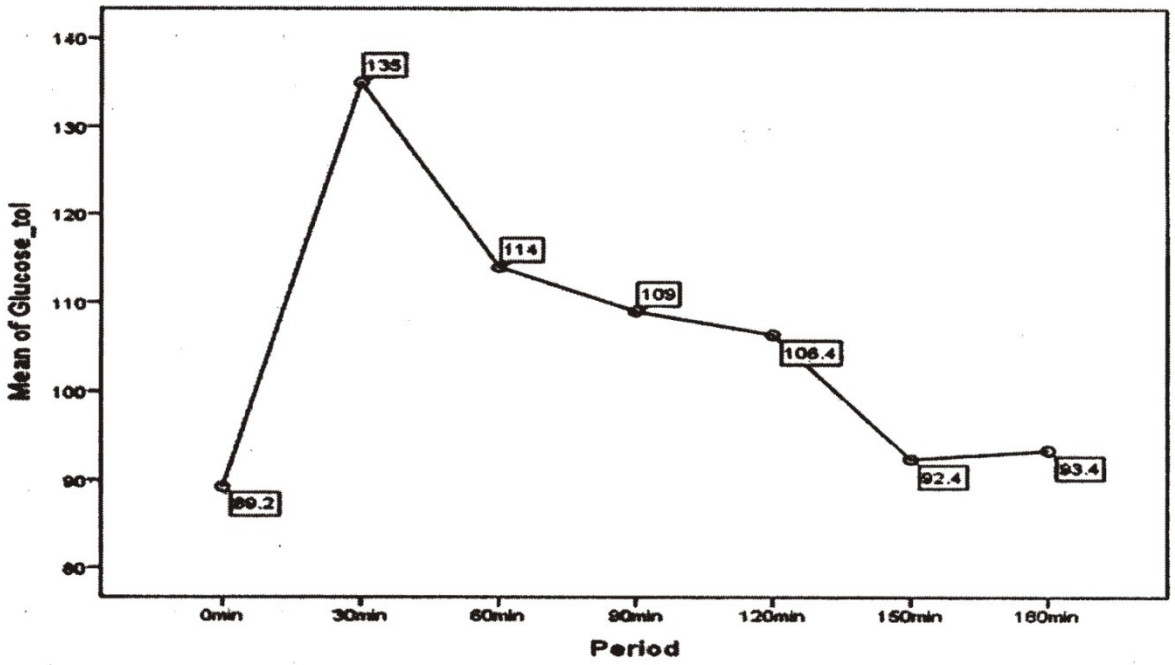

Figure 2: Graph of Mean Glucose Levels in Subjects against Time

Table 10: Comparing Glucose tolerance levels between cases and controls
Descriptive

	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Range
				Lower Bound	Upper Bound	
Control	105.63	19.019	3.215	99.10	112.16	72-162
Case	97.34	16.800	2.840	91.57	103.11	71-151
Total	101.49	18.295	2.187	97.12	105.85	71-162

Table 11: ANOVA

	Sum of Squares	df	Mean Square	F	P-Value
Between Groups	1201.429	1	1201.429	3.731	0.058(>0.05)
Within Groups	21894.057	68	321.971		
Total	23095.486	69			

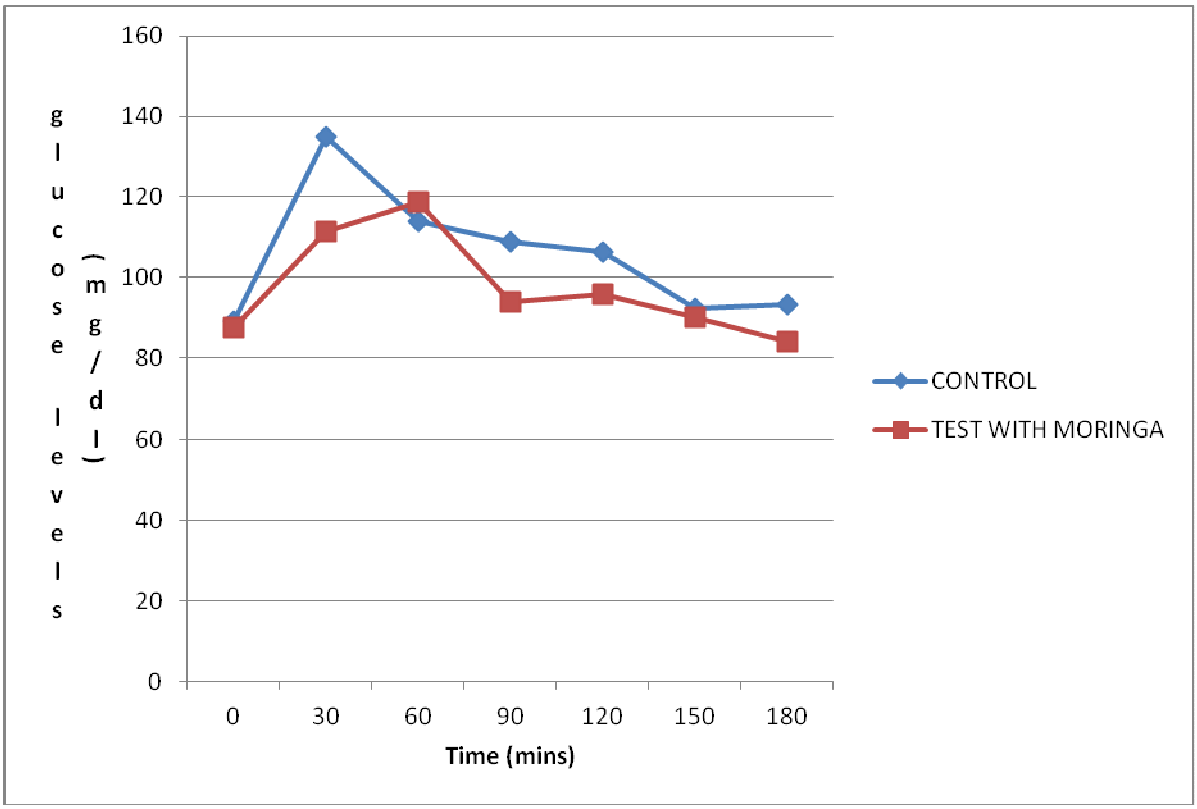

Figure 3: A Line Graph Showing OGTT Curves in Control and Test Subjects

Discussion

The study shows that *Moringa oleifera* seed slows the rate of Post-Prandial surge in blood glucose level and the peak concentration of blood glucose level attainable. Analysis of variance is performed to compare the mean of glucose levels across the time frame of each of the subject cases after the administration of *Moringa oleifera* seed. As observed on the graph, there was a significant difference across between the respective periods as proven by a probability value of 0.001 ($p<0.05$). The results also show that *Moringa oleifera* slows down the rate at which glucose enters the blood as seen within the first 1hour of administration. From the next 2 hours, the glucose levels of the control and test show no significance difference. This shows that *Moringa oleifera* doesn't cause a significant crash in glucose level which could result in hypoglycaemia in the long run even in healthy subjects. *Moringa oleifera* could therefore possibly be used as a supplement in diabetic treatment

Hyperinsulinaemia is a condition in which there is excess level of insulin circulating in blood than expected relative to the level of glucose. Hyperinsulinemia can be seen in a variety of conditions such as pre-diabetic state and type 2 diabetes mellitus. It is associated with hypertension, obesity, dyslipidaemia and abnormal Oral Glucose Tolerance Test (metabolic syndrome). Insulin resistance occurs in type 2 DM. The slower and smaller rise in glucose in response to *Moringa oleifera* seed ingestion suggest that it may indirectly play a role in antihyperlipedemic effect and as hypoglycaemic agent, thereby curbing risk of lipid-abnormality related diseases such as stroke, coronary heart diseases etc.

Conclusion

The slowing down of the rate of surge in blood glucose level by *Moringa oleifera* seed and the reduction of the optimal glucose level attainable may be beneficial in reducing insulin resistance and all its attendant bad effects. Consumption of *Moringa oleifera* seed as food supplement may be useful in controlling blood glucose level and thus the management of diabetes mellitus.

References

Duke JA (1997). Moringaceae: Horseradish-tree, benolive-tree, drumstick-tree, Sohnja, Moringa, Murunga, Malunggay, p. 19-18. In: M. Benge(ed.) Moringa: A multipurpose vegetable and tree that purifies water. Sci & Technol,/ For., Environ., & Natural Resources Agro-Forestation Tech. Ser.. US AID, Washington DC.

Mossa JS (1995). The study on crude antidiabetic drugs use in Arabian folk medicine. International Journal of Crude Drug Research 23(3): 137-145

Makonnen E, A Hunde, G Damecha (1997). Hypoglycaemic effect of Moringa stenopetala aqueous extract in rabbits. Physiotherapy Research 11:147-148

Ajibade TO, Arowolo R, Olayemi FO (2013). Phytochemical Screening and Toxicity Studies on Methanolic Extract of the Seeds of *Moringa oleifera.* J complement Intgr *Med 7;10 pii*

Simonson DC (2015). Surrogate measures of Insulin resistance: does one size fit all? Diabetogia. 58(2) Feb, 207-10.

Mehta LK, R Balaraman, AH Amin, PA Bafna, OD Gulati (2003). Effect of the fruit of Moringa oleifera on the lipid profile of normal and hypercholesterolaemic rabbits. Journal of Ethnopharmacology 86:191-195

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