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Original Research Article

Moringa oliefera Leaves Powder Controlling Blood Glucose Level in Diabetes Mellitus Patients , No Side Effect in Kidney and Liver Enzymes

Noor Elsham A. Yousif[1], Shaza O. Mustafa[2], Eman. Z. E.Yassin[3], Fania. A. Albdari[4], Mosab Nouraldein Mohammed Hamad[5*]

[1]Assistant Professor, College of Education, Department of Chemistry, Shendi University, Sudan
[2]Assistant Professor, College of Education, Department of Biology, Nile Valley University, Sudan
[3]Assistant Professor in Critical Care Nursing, Dean of Health Sciences College, Elsheikh Abdallah Elbadri University, Sudan
[4]Assistant Professor in Obstetrics and Gynecology, Elsheikh Abd Allah Elbadri University, Sudan
[5]Lecturer of Parasitology and Medical Entomology, College of Health Sciences, Elsheikh Abdallah Elbadri University, Sudan

***Corresponding Author:** Mosab Nouraldein Mohammed Hamad
Lecturer of Parasitology and Medical Entomology, College of Health Sciences, Elsheikh Abdallah Elbadri University, Sudan

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Abstract: *Moringa oleifera* grown and used in many countries around the world is a multi-purpose tree with medicinal and nutritional values. This study evaluates the effect of taking *moringa oleifera* leaves powder on blood sugar levels in humans, and study side effect on kidney (urea, creatinine) and liver enzyme (AST, ALT) after taken leaves powder for a month. The study targeted patients who their blood glucose not lowering by drugs. Blood glucose, urea, creatinine, AST and ALT for all diabetic patients was determined before and after taking 0.5g leaves powder. Results showed blood sugar levels decreased statistically significant ($p<0.001$) for all diabetic patients, and no statistically significant difference in the mean values of urea, creatinine, (AST) and (ALT) before and after taking leaves powder ($p>0.001$). This study concluded that leaves powder have a significant impact on anti-diabetic property for the selected patients, so it's promising in the prevention for risk of diabetes mellitus.

Keywords: *Moringa oleifera*, nutritional values, Blood glucose, (AST) and (ALT).

INTRODUCTION

Moringa Oleifera belongs to the monogeneric family of shrubs and trees, called *Moringaceae* (J.M. Dalziel, 1955). The tree originated from Agra and Qudh in Northwestern region of India, South of the Himalayan Mountain. The tree has spread to almost all tropical belt because it is drought- resistant (F.R. Irvine, 1961). The leaves, fruits, flowers and immature pods are edible and they form part of traditional diets in many countries of the tropics and sub-tropics (D. Odee, 1998). It is estimated that at least three hundred diseases can be cured by taking this supplement along with hundreds of other health benefits, it contain more than 90 nutrients, different antioxidants, and all eight essential amino acids (L.J. Fuglie, 2006). *Moringa Oleifera* is rich in many vitamins, including vitamin A, several forms of vitamin B, vitamin C, vitamin D and vitamin E. In fact, it has more of these vitamins than a variety of foods (such as carrots, oranges and milk) that claim to be excellent source of these vitamins (C.G. Zarkada *et al*., 1997). *Moringa Oleifera* leaves contain a lot of protein and beta-carotene is known as antioxidants, so it is widely used to meet the nutritional needs of the food. The use of *Moringa Oleifera* leaves as traditional medicine used to treat a variety of diseases including malaria, typhoid fever, a disease caused by parasites, arthritis, swelling, ulcers, skin diseases, urinary tract disease, hypertension, diabetes, management of symptoms decreased immunity of AIDS, cardiac stimulant and contraception. *Moringa Oleifera* leaves contain the compound of polyphenols, phenolic acids, flavonoids, alkaloids, glucosinolates,

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isothiocyanates, tannins, saponins and oxalic (Leone *et al*., 2015). Flavonoids are known to be highly effective antioxidants by scavenging oxygen radicals (Braca *et al*., 2002). Moreover, the protective effects of flavonoids in biological systems are attributed to their capacity to scavenge free radicals, chelate metal catalysts, activate antioxidant enzymes, reduce alpha-tocopherol radicals, and inhibit oxidases (Heim *et al*., 2002). Oxidative damage due to free radicals was associated with vascular disease in people with types 1 and 2 diabetes mellitus (Oberley, 1988). Flavonoids can be efficacious as anti-diabetic (Nerdy, 2015). (William *et al*., 1993) examined how *M. oleifera* addition to a standardized meal, taken after an overnight fast, affected the1- and 2-h, relative to the standard meal alone or a 75-g oral glucose load. Suggesting that the hypoglycemic effect of *M. oleifera* leaves supplementation was not due to increased insulin secretion. **(**Kumari, 2010) examined the hypoglycemic effect of *M. oleifera* leaves dietary consumption over a 40 -day period in T2DM patients, 30–60 years of age, not on anti-hyperglycemic medication. Final values did not differ much from baseline in the control group. They were significantly reduced in the experimental group (−28%, P <0.01., −26%, P <0.05). (Keenoy *et al*., 1999) studied the effect of supplementation of flavonoid based antioxidant medication to 28 diabetic patients while following a standardized 1,800 - 2,000 calorie diet. The results showed that decrease in initial and final values of glycated hemoglobin was significant in experimental group, whereas in control group the decline was non-significant. Moreover, an anti-diabetic property is also included among the medicinal benefits of *M. oleifera* (Anwar *et al*., 2007). Similar observation was found in present study due to feeding of *M. oleifera* leaves tablet to experimental group. Severe diabetic disorders have been found in arsenic-intoxicated humans (Longnecker *et al*., 2001), (Tseng *et al*., 2002). Arsenic, a naturally occurring toxicant, is present in food, soil and water (Chowdhury *et al*., 1997), (Mukherjee *et al*., 2005). Kidney dysfunction is one of the major health effects of the long term arsenic exposure, and elevated levels of serum urea have been reported to be associated with renal dysfunction and excessive protein catabolism (Wang *et al*., 2009), (Tuot *et al*., 2011). Food supplementation of *Moringa Oleifera* leaves significantly (P<0.05) protected arsenic-induced elevation of serum urea levels (Sheikh *et al*., 2014). Due to its anti-inflammatory properties, *Moringa Oleifera* has been used in ancient systems of medicine such as Ayurveda to prevent or treat stomach ulcers, liver disease and kidney damage (Jillian Levy and CHHC, 2018). From these basic tenets, this study was designed to evaluate the efficacy of the *M. oleifera* leaves powder in lowering the blood sugar levels for diabetic patients, and study side effect on kidney (Urea, Creatinine) and liver enzyme (AST, ALT) after taken *M. oleifera* leaves powder for a month.

MATERIALS AND METHODS

Plant Collection and Preparation

The plant leaves were collected from River Nile State Atabra town .The leaves were harvested green then washed by distilled water, air-dried at room temperature, and milled into powder. They were stored in well-dried plastic containers at room temperature.

Selection of Patients

Eighty three volunteers of diabetic patients visiting Atabar hospital were selected for this study. The study targeted patients who their blood sugar not lowering by taking drugs. They were asked to take 0.5g *Moringa oleifera* leaves powder beside drugs. The subjects age between 30-80 years. Prepared *Moringa oleifera* leaves powder was supplied to all subjects in 40g plastic containers were taken to every one of patients . All subjects were asked to take this powder after breakfast regularly for 30 days.

Samples Collection

Two ml of venous blood samples were collected from each diabetic patients by laboratory staff of the hospital. The blood samples were centrifuged for 15 minutes at 1000 rpm, and then the top layers, which contain the serum, used for measured glucose parameter, urea, creatinine, AST and ALT before and after taking *Moringa oleifera* leaves powder.

Bio Chemical Analysis

Kits used in biochemical measures of glucose was obtained from biosystem laboratory products; these parameter was determined by Kinetic-Spectrophotometeric methods which were described by (Young, 1997).

Statistical Analysis

The following statistical tools were used in this study for analysis and interpretation of data (Rangaswamy,1995): Independent T-Test. Statistical analysis compared rate of decreased on blood glucose, urea, creatinine, AST and ALT before and after taking 0.5g *Moringa oleifera* leaves powder.

RESULTS AND DISCUSSION

The results showed decrease on blood glucose all of diabetic patients. The high percentage of the decrease (51%) is observed in young diabetic patients who medicated with tablets, and low percentage of the decrease (2%) is observed in old diabetic patients who medicated with tablets. The high percentage of the decrease for the men is (51%), and low percentage of the decrease is (2%). For women the high percentage of the decrease is (51%), and low percentage of the decrease is (10%) (Table 1).

Table 1: Measurement of blood sugar levels two hours after breakfast for all patients before and after taking (0.5g) *M. oleifera* leaves powder

Sex	Age	Drugs	Blood sugar before taking (mg/dl)	Blood sugar after taking (mg/dl)	Percentage of decrease %
Man	19	insulin	240	150	38
Man	45	tablets	200	154	23
Man	45	insulin	318	224	28
Man	45	tablets	175	130	26
Man	47	insulin	388	190	51
Man	48	insulin	312	280	10
Man	50	tablets	195	152	22
Man	51	insulin	290	220	24
Man	52	tablets	222	216	2
Man	57	tablets	203	148	27
Man	58	insulin	200	183	8
Man	60	tablets	188	166	12
Man	62	tablets	272	202	26
Man	66	insulin	333	215	35
Man	70	tablets	200	120	40
Man	73	tablets	216	145	33
Woman	25	tablets	300	251	16
Woman	29	tablets	358	200	44
Woman	35	insulin	200	154	23
Woman	35	insulin	216	81	63
Woman	35	insulin	340	188	45
Woman	39	insulin	270	200	26
Woman	41	tablets	300	266	11
Woman	44	tablets	400	190	51
Woman	48	tablets	200	180	10
Woman	50	tablets	170	150	10
Woman	50	tablets	243	145	40
Woman	56	insulin	340	225	34
Woman	62	insulin	213	142	33
Woman	66	tablets	225	114	49
Woman	70	tablets	240	170	29

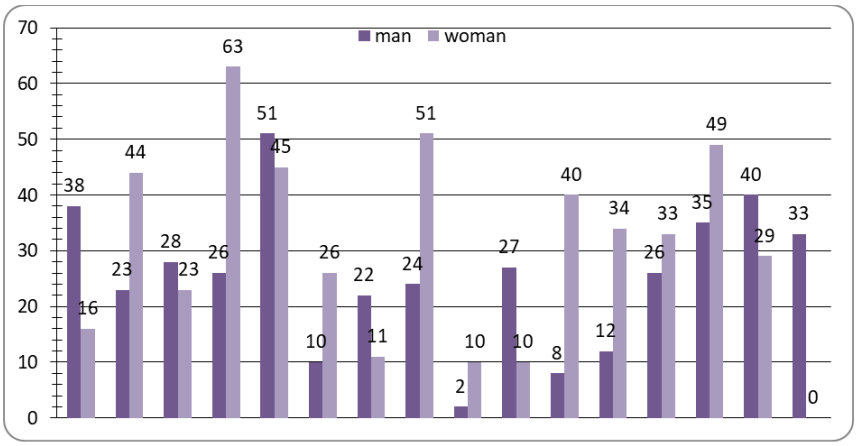

Fig. 1: Percentage of the decrease for the men compared to the women (after taking 0. 5g)

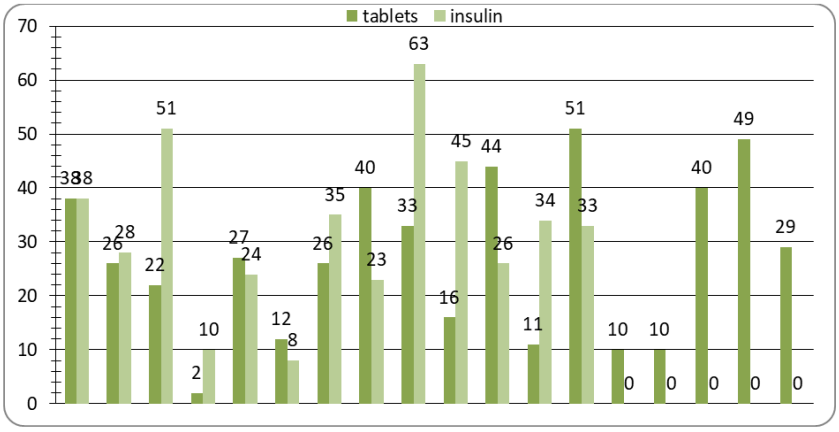

Fig. 2: Percentage of the decrease for patients who medicated with tablets compared to patients who medicated with insulin (after taking 0. 5g)

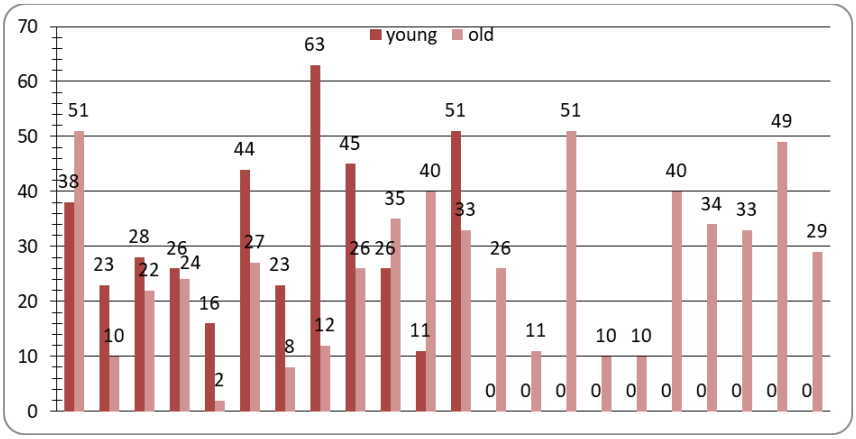

Fig 3: Percentage of the decrease for young diabetic patients compared to old (after taking 0. 5g)

Results indicating *M. oleifera* leaves powder effect on blood sugar. These values showed significant decrease on blood sugar ($p<0.001$). The mean of glucose for diabetes patients before taking of *M. oleifera* (242.58mg/dl ± 6.91), and after taking (170.12mg/d l ± 4.91) (Table 2).

Table 2: Effect of *M. Oleifera* leaves powder on blood sugar in diabetic patients (Mean ± SE)

	Mean of glucose
Before	242.58mg/dl ± (6.91)
After	170.12mg/dl ± (4.91)
P-value	**0.000**

The results showed no difference between measurement of creatinine, urea and AST, ALT enzymes before and after used *M. oleifera* leaves powder (Tables 3, 4, 5 and 6).

The results indicated no statistically significant difference in the mean values of creatinine before and after taken leaves powder ($p>0.001$) table (7).

Table 7: The effect of *Moringa oleifera* leaves powder on creatinin for diabetic patients (Mean ± SE)

	Mean± SE
Creatinine before taken *Moringa*	0.760±(0.030)
Creatinine after taken *Moringa*	0.843±(0.032)
P-Value	**0.065**

The mean values (table 8) showed no significant effect of *Moringa Oleifera* in urea levels ($p>0.001$).

Table 8: The effect of leaves powder on urea for diabetic patients (Mean ±SE)

	Mean± SE
Urea before taken *Moringa*	24.80±(1.29)
Urea after taken *Moringa*	25.97±(1.12)
P-Value	**0.497**

The results showed no statistically significant difference in the mean values of AST before and after taken *Moringa* leaves powder (p>0.001) table 9.

Table 9: The effect of *Moringa* leaves powder on AST for diabetic patients (Mean±SE)

	Mean± SE
AST before taken *Moringa*	31.70±(1.48)
AST before taken *Moringa*	34.53±(1.53)
P-Value	**0.189**

The results indicated no statistically significant effect of *Moringa* leaves powder on ALT for diabetic patients (p>0.001) presented in table 10.

Table 10: The effect of *Moringa* leaves powder on ALT for diabetic patients (Mean±SE)

	Mean± SE
ALT before taken *Moringa*	36.70±(1.60)
ALT before taken *Moringa*	39.63±(1.59)
P-Value	**0.198**

(Kumar and Mandapaka, 2013) concluded that supplementation of the powder of *Moringa oleifera* leaf decreased serum glucose and LDL. These values were also found to be statistically Significant. And it is concluded that the leaves of *Moringa oleifera* have definite hypoglycemic and hypocholesterolemic activity in type II diabetes mellitus in obese people. (Sagum *et al*., 2014) determined the changes in glucose, lipid profile and antioxidant capacity in humans with moderately raised serum glucose and cholesterol levels after consumption of *Moringa oleifera* leaves supplemented- food products. Test foods are buns, fish sausage and veggie soup with and without *Moringa oleifera* leaves powder. The results indicated that Malunggay leaves supplemented-food products decreased fasting blood sugar and may have a promising effect for cholesterol-lowering. (Ghiridhari *et al*., 2011) studied a group of 60 T2DM patients age 40–58 years. The patients were equally divided into an experimental and a control groups. Patients in the experimental group were prescribed two *M. oleifera* leaves tablets/day, one after breakfast, the other after dinner for 90 days. *M. oleifera* leaves powder constituted 98% (w/w) of the tablet content, but the average weight of tablets was not specified, making the total daily dose unclear. Blood glycated hemoglobin (HbA1c) was measured before and after the regimen. In the control group, HbA1c progressed downwardly with time, but the change was not significant. In the experimental group, in contrast, relative to the baseline, HbA1c decreased by 0.4% point (from7.8±0.5 to 7.4±0.6., *P*<0.01). Compared to the starting levels (210±49 mg/dl), indicating that *M. oleifera* medication can induce with time better glucose tolerance. AST and ALT are the major serum hepatic enzymes used for liver function test. The elevated activities of these enzymes in serum are an indication of liver damage. Arsenic administration substantially increased serum ALP, AST and ALT activities (Islam *et al., 2011).* Co-administration of *Moringa* leaves as a food supplementation significantly reduced arsenic-induced elevation of ALP, AST and ALT activities. Sheikh *et al*., 2014 results indicated that *Moringa* leaves had a protective effect on arsenic-induced liver injury. (Ezejindu and Chinweife, 2014) was carried out to determine the effect of aqueous extract of *Moringa oleifera* on liver enzymes of mercury induced hepatotoxicity in adult wistar rats. Group A served as the control and received 0.5ml of distilled water, group B received 0.5ml of moringa extract, group C received 0.35ml of mercury while group D received 0.35ml of mercury and 0.5ml of *Moringa oleifera* extract. The levels of mean aspartate aminotransferase (AST), Alanin aminotransferase (ALT) and alkaline phosphotase (ALP) in group C was significantly higher (p<0.001) than the control and groups B and D. The result from this study shows that no adverse biochemical changes are associated with the use of *Moringa oleifera* extract even when administered with mercury. The result also shows the hepatoprotectivity of *Moringa oleifera* on mercury induced hepatocytes. Suleiman *et al*., 2017 was designed to evaluate the effect of *Moringa oleifera* against Salmonella typhimurium infected changes in liver and kidney function parameters in albino rats. Albino rats were divided into four groups of five rats each (groups A-D). Groups B, C and D were exposed to 0.1ml (3.0x104 CFU) of Salmonella typhimurium. Six hours post-infection, Groups B and C were treated with 50 and 100mg/kg of *Moringa oleifera* aqueous leaf extract respectively and continued for 21 days. Group D was not treated while group A was neither infected nor

treated. Serum alkaline phosphatase (ALP), alanine transaminase (ALT), aspartate transaminase (AST), urea and creatinine were estimated using standard methods. Results showed S. typhimurium infection significantly ($p<0.05$) increased the levels of ALP, ALT, AST, urea and creatinine when compared with control levels (Group A). Total protein and albumin concentrations were significantly ($p<0.05$) reduced following the infection. However, *Moringa oleifera* supplementation was associated with significant ($p<0.05$) decrease in the levels of ALP, ALT, AST, urea and creatinine. It is also associated with decrease in concentrations of total protein and albumin, the study showed S. typhimurium infection induced changes in liver and kidney function parameters and also revealed possible amelioratory effects to these changes after *M. oleifera* supplementation. This study suggested that *M. oleifera* leaves powder-supplemented foods promising in the prevention for risk of diabetes mellitus, and no side effect in liver enzymes and kidney after taking *M. oleifera* leaves powder for diabetic patients.

CONCLUSIONS

The study indicated taking of *M. oleifera* leaves powder help control blood sugar levels and allows cells to take up or release glucose as needed, this gives *M. oleifera* natural anti diabetic and hormone-balancing properties. The results indicated the suitable dose to consume beside drugs to reduce blood glucose of diabetic patients who their blood glucose not lowering by drugs is 0.5g (percentage of the decrease on blood glucose is 63%). The results showed no side effect on liver enzymes and kidney for diabetic patients after taking leaves powder. The study concluded *M. oleifera* leaves have potential for medicinal to human needs.

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