

## Effects of *Gymnema lactiferum* leaf on serum glucose and cholesterol levels of normo-glycaemic Wistar rats

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### Abstract

*Gymnema lactiferum* var. *lactiferum* is a twining plant which belongs to the family *Asclepiadaceae* (milk weed family). This plant is distributed in many South Asian countries including, Assam, Malay Peninsula, Malaysia and Sri Lanka. It is reported that *G. lactiferum* leaf powder is used popularly by the people in Jaffna, as a treatment for diabetes. The present study indicates that the leaf powder does not result in a significant reduction of FBS ( $p=0.64$ ) or serum total cholesterol levels ( $p=0.49$ ) when tested with normo-glycaemic Wistar rats following feeding for 4 weeks. Further the leaf extract did not produce any significant effect on blood glucose levels on the glucose challenge ( $p=0.26$ ) in the normo-glycaemic Wistar rats.

**Keywords:** *Gymnema lactiferum* var. *lactiferum*, normo-glycaemic rats, blood glucose, cholesterol

### Introduction

*Gymnema lactiferum* var. *lactiferum* (Sinhala- *Kuringnan*) is a green leafy vegetable. The leaf of this plant is used in curries, salads and in herbal gruels. The diabetic people in Jaffna, Sri Lanka have been using *G. lactiferum* leaves as a treatment for diabetes for several decades. Further it has been reported that this treatment could improve the serum lipid profiles of diabetic patients (folklore). However, scientific data is unavailable on the efficacy of the leaves in reducing blood sugar or serum lipids of diabetic patients. The

present study was designed to study the effects of *G. lactiferum* leaf powder on the serum glucose and cholesterol levels in normo-glycaemic Wistar rats.

## **Materials and methods**

### **Preparation of the leaf powder**

Identification of the plant was done at the National Herbarium, Royal Botanical Garden, Peradeniya, Sri Lanka. Plants were grown in Jaffna, Sri Lanka, supplied with organic compost and without application of insecticides and/or fungicides. After washing, mature leaves were dried hygienically under sunlight (about 4-5 days), ground and sieved to prepare the leaf powder.

### **Experimental Animals**

Male normo-glycaemic Wistar rats bred at Medical Research Institute, Sri Lanka were used for the animal model.

### **Ethical clearance**

Ethical clearance was obtained from the Ethical Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura (Approval no: A-229).

### **Study of the effect of *G. lactiferum* leaf powder on glycaemic status and cholesterol levels of normo-glycaemic Wistar rats**

Male Wistar rats (8-10 weeks old) were separated into two groups (n=6 for each group and the mean body weights of both groups were similar). Animals were supplied with food and water *ad libitum*. The basal levels of FBS (Kunst *et al.*, 1984) and serum total cholesterol (Allain *et al.*, 1974) were determined using the relevant enzymatic kits. The control group was fed WHO recommended rat and mouse breeding feed (Sabourdy, 1988). The test group was fed with *G. lactiferum* leaf powder, incorporated in WHO standard diet, at a dose of 0.2g leaf powder/kg B.W./day/rat (dose was calculated related to the human dose; 10g/day). Added amount of leaf powder was substituted for grass powder in the WHO standard diet to maintain caloric value and fibre content. Food intake and body weights of the rats were measured daily and weekly respectively. The serum total cholesterol levels and the FBS levels of the rats were determined after four weeks of feeding.

Some hypoglycemic agents even though they do not demonstrate a pronounced effect on FBS, have been shown to have the ability to improve the body's tolerance against a given glucose load (Rokeya *et al.*, 1999). Thus a glucose challenge was performed on the last day of the experiment to study whether the treated animals have gained any better tolerance against a glucose load in comparison to the control group, at the end of the period of

feeding with the powder. The glucose challenge was performed as stated below.

### **Glucose challenge**

Rats were fasted for 14 h. Blood (0.1mL) was drawn from the tail vein to determine FBS levels. A dose of leaf extract (0.2g/kg B.W./day) was administered orally to test group and the control group was treated with distilled water. After 30 min, an oral glucose load (3g/kg B.W./day) was administered to each rat and after 1 h blood samples were drawn for glucose analysis. As it was difficult to administer a high dose of leaf powder in the form of a suspension, a water extract of the leaf powder prepared as mentioned below, was administered.

### **Preparation of the extract**

Leaf powder (20g) was mixed with distilled water (200mL) and heated in a shaking water bath at 60°C for 6 h. The sample was centrifuged at 26 000 rpm for 10min and filtered using a Whatman filter paper (No 4). Filtrate was frozen and freeze-dried.

### **Animal model**

Glucose challenge was conducted as described above. Each rat in the test group was treated with 200mg of the extract in 1mL distilled water whereas the controls were treated with distilled water. Blood samples were drawn at 1 h and 2 h time intervals after the glucose load (3g/kg B.W. /day).

### **Statistical analysis**

Results are presented as mean  $\pm$  standard deviation (SD). Groups of data were compared using student's t-test. Differences were considered significant at  $p < 0.05$ .

## **Results**

### **The effect of *G. lactiferum* leaf powder on glycaemic status and serum total cholesterol levels of normo-glycaemic Wistar rats**

As shown in table 1, *G. lactiferum* leaf powder did not reduce the serum cholesterol levels in normal Wistar rats ( $p=0.49$ ). Relative body weights of the rats in both groups did not vary significantly (the mean body weight of the test group changed from 310 to 360g in four weeks, whereas in the control group the change was from 312 to 361g). Feed intake of the rats, was similar (in test animals it was 17g /day/ rat while for control group it was 18g /day/rat).

As shown in table 2, feeding of *G. lactiferum* leaf powder did not reduce the fasting blood sugar levels ( $p=0.64$ ) in normo-glycaemic Wistar rats after four weeks. Further it did not produce a significant effect ( $p=0.26$ ) on glucose challenge in normo-glycaemic Wistar rats ( $64.46 \pm 11.40$  vs  $121.66 \pm 6.12$  in control and  $61.63 \pm 15.83$  vs  $116.40 \pm 7.07$  in test group)

**The effect of the water extract of *G. lactiferum* leaf powder on glucose challenge in normo-glycaemic Wistar rats**

As shown in the table 3, after 1 h the control group showed a 74.3% increment in the blood glucose levels whereas in the test group the increment was 65.4%. However, this reduction in increment was not significant ( $p=0.09$ ).

**Table 1.** Effect of *G. lactiferum* leaf powder on serum total cholesterol levels of normo-glycaemic Wistar rats

<i>Group</i>	<i>Serum total cholesterol levels (mg/dL)</i>	
	<i>Mean ± SD</i>	
	Day zero	After 28 days
Control (n=6)	59.78 ± 5.06	64.53 ± 8.91
Test (n=6)	66.43 ± 10.54	68.38* ± 5.56

\*  $p= 0.49$  in comparison to the control

**Table 2.** Effect of *G. lactiferum* leaf powder on fasting blood glucose levels of normo-glycaemic Wistar rats

<i>Group</i>	<i>Fasting blood glucose levels (mg/dL)</i>	
	<i>Mean ± SD</i>	
	Day zero	After four weeks
Control (n=6)	64.46 ± 11.40	72.29 ± 11.27
Test (n=6)	61.63 ± 15.83	74.28* ± 14.54

\*  $p= 0.64$  in comparison to the control

**Table 3.** Effect of water extract of *G. lactiferum* on glucose challenge in Wistar rats

Group	Blood glucose levels mg/dL		
	FBS	Mean $\pm$ SD	
		1 h after glucose load	2 h after glucose load
Control (n=6)	52.12 $\pm$ 11.86	90.86 $\pm$ 11.52	97.87 $\pm$ 6.68
Test (n=5)	45.44 $\pm$ 17.51	75.15* $\pm$ 14.01	96.42 $\pm$ 10.75

\* p=0.09 in comparison to the control

### Discussion

Scientific data on the bioactivity of *Gymnema lactiferum* are scarce but extensive literature is available on *Gymnema sylvestre*. The hypoglycemic effect of the plant *G. sylvestre* is well known and has been established with both animals and humans (Baskaran *et al.*, 1990). *Gymnema lactiferum* var. *lactiferum* closely resembles *G. sylvestre* (morphologically). Both plants belong to the same family *Asclapiadaceae* and both plants are known as 'Kuringnan' in Sinhala.

According to Balasubramanium *et al.* (1992) *G. sylvestre* leaf powder produced a significant reduction (11.3%) in FBS levels in normal subjects after 7 days of administration (Balasubramanium *et al.*, 1992). According to Rokeya *et al.* (1999), though *G. sylvestre* leaf did not produce any significant hypoglycaemic effect in normo-glycaemic rats when the extract was fed simultaneously with the glucose load, when the extract was given 30 min before the glucose load it produced a significant effect in normo-glycaemic rats (Rokeya *et al.*, 1999). In comparison to above mentioned reports on *G. sylvestre*, the present study was undertaken to study if there is any effect of *G. lactiferum* on serum glucose and cholesterol levels of normo-glycaemic rats.

Dyslipidemia, characterized by low levels of HDL-cholesterol and high levels of total cholesterol, triacylglycerol and LDL-cholesterol, is an important risk factor for atherosclerotic complications of diabetes (Laakso and Lehto, 1997). Thus it is much valuable if a medicinal plant could possess both hypoglycemic and cholesterol lowering potentials. This study is the preliminary study conducted on *G. lactiferum* leaf powder on this regard.

The data obtained revealed that the *G. lactiferum* leaf could not produce any significant reduction in the normal serum cholesterol and fasting blood sugar levels of normo-glycaemic Wistar rats. Further it could not exert any effect on the glucose challenge of the normal rats.

### Conclusions

*Gymnema lactiferum* var. *lactiferum* leaf powder or extract did not produce any significant effect either on serum glucose or serum cholesterol levels of normo-glycaemic Wistar rats.

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