Hypocholesterolaemic Effect of Okra on Cholesterol Induced Wistar Rats

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Abstract

Okra or Lady's fingers (Hibiscus esculentus) which belongs to the Family Malvaceae is a mucilaginous vegetable frequently included in the diet of Sri Lankans. There is currently great deal of interest in the hypoglycaemic effect of various vegetables. It has been reported that the cholesterol lowering effect of H. esculentus in Senegalese adult men. Abelmoschus esculentus (L.) Moench., synonym of H. esculentus which is available in all over the world, popular and has been claimed to have various health benefits and include anti – diabetic properties. According to our studies it shows that okra fruit possesses hypoglycaemic activity and the anti-hyperglycaemic compound present in okra fruit is heat labile. The aim of this study was to investigate the hypocholestrolaemic effects of the water extract of okra fruit on Wistar rats. Weanling male Wistar rats (100g – 150g) were separated in to groups (test and control) with 8 rats in each group. Hypercholesterolaemia was induced by giving a diet containing 10% butter (Highland), 90% WHO recommended rat and mice feed pellets and water ad libitum for 28 days. Induction of Hypercholesterolaemia was verified after 28 days by measuring fasting (12-14hrs) blood cholesterol levels. These animals were used as positive control and for the test groups. The negative control animals were fed on WHO recommended rat and mice feed formula and water ad libitum. The positive control group and the test groups were given hypercholesterlomic diet continuously while the test groups were orally feeding the water extract of okra (with 500 and 1000mg/Kg dose) for 7 days. After one week the rats were fasted (12-14hrs) and anesthetized and blood was collected from tail vein for determination of fasting serum cholesterol levels. All the results were compared by using the Student's t-Test in Microsoft Excel. Administration of water extract of Okra at the dose of 1000mg/Kg showed significant reduction ($p<0.05$) in the level of serum cholesterol in Wistar rats while the dose 500mg/kg was not. Therefore okra can be used as a vegetable with hypoglycaemic and hypocholesterolomic properties.

Keywords - Okra, Hibiscus esculentus, Abelmoschus esculentus

I. INTRODUCTION

Okra Abelmoschus esculentus (L.) Moench., synonym of Hibiscus esculentus or Lady's finger which belongs to the Family Malvaceae is a flowering plant and is cultivated throughout the tropical and temperate regions of the world. Sri Lankan name of Okra is Banndakka and other names of Okra are Okro, Ochro, Okoro, Quimgombo (Cuba), Quingumbo, Gombo, Kopi Arab, Kacang Bendi, Bhindi (South Asia), Bendi (Malaysia), Bamia, Bamya or Bamieh (Middle East), Gumbo (Southern USA), Quiabo, Quiabos (Portugal and Angola), okura (Japan) and Qiu Kui (Taiwan). Okra traces its origin from what was known as Abyssinia (Ethiopia) spreading right through to Eastern Mediterranea, India, Africa, North America, South America and the Caribbean. Though long popular in the South, it is becoming increasingly common and well known in Western Countries *(http://newedgepublishing.com).*

In 1977 it has been reported the effect of okra (Hibiscus esculentus) mucilage on the plasma cholesterol level in rats. There is no clear literature based on this study (Woolfe, J. A. (1997). It has been reported that the cholesterol lowering effect of okra (Hibiscus esculentus) in Senegalese adult men. It is a fruit high in water- soluble fibre and widely consumed in Africa investigated as a potential candidate to decrease cholesterol (Bangana et al., 2005). The extracts from total plant

of by dichloromethane or methanol and extracts from fruit by dichloromethane or methanol possessed hypolipidemic activity in tyloxapol-induced hyperlipidemia in mice. (Huynh Ngoc, H. *et al* 2008). It has been reported the antidiabetic and antihyperlipidemic potential of Abelmoschus esculentus peel and seed powder (AEPP and AESP) in streptozotocin (STZ)-induced diabetic rats. Administration of AEPP and AESP at 100 and 200 mg/kg dose in diabetic rats showed significant reduction in blood glucose level and increase in body weight than diabetic control rats. This study results the antidiabetic and antihyperlipidemic potential of A. esculentus peel and seed powder in diabetic rats (Sabitha, V. et al., 2011).This study was undertaken to investigate the effects of water extract of okra on plasma cholesterol level on Wistar rats. The water soluble fraction was studied first as the related studies are mostly based on it.

II. MATERIALS AND METHODS

A. Collection of plant materials

The fruits of *H. esculentus* were obtained from the local market of Kelaniya, Sri Lanka. A specimen of the plant and fruit was deposited in the National Herbarium, Department of National Botanic Gardens, Peradeniya, Sri Lanka after identification of the plant by a botanist.

B. Animal model

The feeding trials were conducted using out bread Wistar rats (originally from the Clea animal breeding company, Tokyo, Japan). The colonies have been bread and maintained at the Animal Center of Medical Research Institute, Colombo, Sri Lanka for 10 years. Weanling male Wistar rats (4 weeks) were separated in to groups (test and control) with 6 rats in each group. The animals (150g – 200g) were housed separately and the groups are selected so that the average weights in each group were similar. The rats were fed on WHO recommended breeding feed formula (Sabourdy, 1988). The test group was given the water extract of the fruit of okra for one week. The rats were fed with the standard WHO feed, water *ad libitum* maintained under standard conditions at Animal Center, University of Sri Jayawardenepura. The oral administration was done by using Sondi needles.

C. Preparation of the water extract of the fruit

Fresh fruits of okra were collected from a local market of Kelaniya, Sri Lanka. Then, the pods were thoroughly washed with distilled water, cut into small slices by a sharp knife. About 1Kg of the sliced pods was crushed by a blender. The mixture was then stirred gently for 10 to 15 minutes with a glass rod; filtered using a thin layer of cotton to remove the insoluble matters and filtrate was collected. Water extract was freeze-dried using the freeze-dryer to obtain dry sample.

D. Animal doses

Animal doses were derived by considering the dry extract powder in mg to the body weight (Kg) of the rats. Freeze - dried water extract powder was dissolved distilled water to make the water extractives. Okra extractives were given in two different doses separately for each group. The two doses, 500, 1000, (mg/Kg body weight) was orally administered to the test group of rats (n=8) for one week. The control group was given water.

E. Collection of fasting blood cholesterol and separation of serum

Animals were fasted for 12-14 hours and anaesthetized using diethyl ether. The blood samples (0.5 ml) were collected by tail veinpuncture. Clear, non – haemolyzed serum was separated by centrifugation at 3000rpm for 10 minutes using a centrifuge. (Jawaki CFM-100, Japan). The cholesterol concentrations were analyzed immediately.

F. Determination of fasting blood cholesterol

The serum samples were analyzed by kits commercially available cholestrol esterase and cholesterol Oxidase Reagent (Pointe cholesterol (liquid) reagent, Canton, USA)).Cholesterol (liquid) reagent (1ml) was pipette into labeled tubes followed by the addition of sample, control or standard (0.01ml each). The tubes were incubated at 37^{o}C and absorbance was measured in the spectrophotometer (Shimadzu-UV200, Japan) at 500nm.

G. Hypercholesterlomic inducer

Butter was used as the hypercholesterlomic inducer. The animal feed was used for induction of hypercholesterlomia in rats. Hypercholesterolaemia was induced by giving a diet containing 10% butter (Highland), 90% WHO recommended rat and mice feed pellets and water ad libitum for 28 days. Induction of hyperlipidemia was verified after 28 days by measuring fasting (12-14hrs) blood cholesterol levels.

II. EXPERIMENTAL DESIGN

Weanling male Wistar rats (100g – 150g) were separated in to groups (test and control) with 8 rats in each group. The negative control animals were fed on WHO recommended rat and mice feed formula and water *ad libitum* (Sabourdy, 1988). Hypercholesterolaemia was induced by giving a diet containing 10% butter (Highland), 90% WHO recommended rat and mice feed pellets and water *ad libitum* for 28 days. Induction of Hypercholesterolaemia was verified after 28 days by measuring fasting (12-14hrs) blood cholesterol levels. These animals were used as positive control and for the test groups. The positive control group and the test groups were given hypercholesterlomic diet continually.

The test group was given water extractives of okra (with 500 and 1000mg/Kg dose) and water *ad libitum* for 7 days. The Freeze - dried sample was dissolved in water to obtain the extraction. Animal doses were derived by considering the dry extract powder in mg to the body weight (Kg) of the rats. Extractives were freshly prepared daily and the aliquots were taken each day to administer the rats orally by using sondi needles. Okra doses of 500, 1000 (mg/Kg body weight) were administered separately to the test groups of rats (n=8) for one week. The control group was given water. At the end of the time duration (1week) the blood samples were collected.

III. STATISTICAL ANALYSIS

All the results are presented as Mean ±S.E.M. Data pairs, are compared by using the Student's t-Test in Microsoft Excel. Difference will be considered if $p<0.05$

VI. RESULTS

Table 1- The effect of different doses on the blood cholesterol levels in rats

Doses (mg/Kg body weight)	Blood cholesterol levels (mg dl^{-1})		
	Negative Control	Positive Control	Test
500	54.2±8.4	65.5±4.6	62.9±4.9
1000	44.4±7.7	59.0±4.3*	49.5±5.2 *

n=8,
p*<0.05,
±=standard error of mean

P values for blood cholesterol levels were significantly different for the dose of 1000 (mg/Kg body weight). Administration of water extract of Okra at the dose of 1000mg/Kg showed significant reduction ($p<0.05$) in the level of serum cholesterol in Wistar rats.

V. DISCUSSION

Hypercholesterolaemia leads many health problems in worldwide which cause important risk factors like atherosclerosis, stroke ect. Many hypercholesterlomic drugs have already been proved to be useful in lowering serum lipid levels in patients. However, its side effects in long-term treatment have been frequently reported and its prices are still expensive. Thus, efforts to develop effective and better hypocholesterlomic drugs had led to the discovery of natural agents (Huynh Ngoc, T., 2008). The hypocholesterlomic activity of water extract of okra fruit (*Abelmoschus esculentus*) was studied on high fat diet induced models of Hypercholesterolaemia in Wistar rats. Hypercholesterolaemia was induced by giving a diet containing 10% butter (Highland), 90% WHO recommended rat and mice feed pellets and water ad libitum for 4 weeks. Induction of Hypercholesterolaemia was verified after 4 weeks by measuring fasting blood cholesterol level. Water extract showed significant hypocholesterlomic effect by lowering the serum cholesterol levels. Administration of water extract of Okra at the dose of 1000mg/Kg showed significant reduction ($p<0.05$) in the level of serum cholesterol in Wistar rats while the dose 500mg/kg was not. Therefore water extract of okra can be used as a drink as well as vegetable with hypoglycaemic and hypocholesterolomic properties.

VI. CONCLUSION

In conclusion, water extract from the fruit of Abelmoschus esculentus possessed hypocholesterlomic activity in butter -induced Hypocholesterolaemic in rats. Water extract showed significant hypocholesterlomic effect by lowering the serum cholesterol levels.

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