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## Efficacy of $\alpha$ -hydroxy citric acid in *Garcinia indica* health drink for obesity

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### Abstract

*Garcinia indica* (Kokam) is an Indian spice. The rinds of garcinia fruit are the richest source of  $\alpha$ -hydroxycitric acid and is having a nutraceutical potential for obesity. Taking into account the nutraceutical properties of Kokam, a health drink was prepared as a therapeutic food supplementation. About 100 ml diluted health drink was given for six months of period to ninety adolescents (18 to 21 years in age) from Kolhapur, Sangli, and Ratnagiri districts in western Konkan of Maharashtra. The efficacy of the Kokam health drink was assessed after examining and comparing the data about the nutritional status of obese adolescents after supplementation. The result found that the supply of 0.5 mg/100 ml alpha hydroxycitric acid among grade I obese adolescents was effective in reducing the percent of body weight (from 160.0 to 142.0) and triglycerides level (from 157.2 to 150.0) whereas high-density lipoproteins (HDL) level increased (from 52.0 to 68.8) among the selected obese adolescents.

**Keywords:** Obesity, Kokam health drink, supplementation, anthropometric measurement, biochemical analysis

### Introduction

Indian spices have much more medicinal and nutraceutical properties. *Garcinia indica* (Kokam) is a moderate-sized, evergreen tree. It bears sweet-sour mixed fruits native to South East Asia and India. The fruit of *Garcinia indica* (Kokam) has been traditionally used in food preparations. The fruit rind of Kokam has commercial importance. It is used to prepare Kokam products (Dudaja R, 2008) [2]. Hydroxycitric acid is the main active component present in the rinds of the Kokam fruits. This component prevents weight gain by inhibiting the synthesis of fatty acids. It impairs activities of the enzyme ATP citrate lyase that converts unspent calories into fat (Wills, 2000) [6]. Such medical value and nutraceutical potential of Kokam and its food products cannot be over-emphasized.

Hence Kokam health drink was prepared and supplemented for obese adolescents to assess the impact on their nutritional status, especially body weight reduction and lipid profile.

### Materials and Methods

Kokam health drink were prepared with the emphasis on alpha-hydroxycitric acid content. Kokam health drink was made by using the following procedure.

### Kokam Stock Solution

Fully ripened and equal-sized Kokam fruits were procured from the local market. They were washed thoroughly with potable water. The rinds of the Kokam fruit were separated by a sharpened stainless steel knife. These rinds are crushed with an equal amount of glass distilled water. Salt was added at the ratio of 5:100 ml in the stock and it was strained. It was collected in glass jars. The jars of Kokam stock solution were labelled, sealed, and stored at a cool temperature.

### Kokam Health Drink

1000 ml Kokam stock was diluted with an equal amount of glass distilled water 20 g of cumin seed powder and 500 g of sugar were added to the stock. This solution was boiled on 150 g of artificial sugar and added to the stock. This solution was boiled at 150 °C, at medium flame for 20 minutes and cooled.

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**Addition of  $\alpha$ -hydroxycitric acid**

The stock solution of Kokam was enriched with  $\alpha$ -hydroxycitric acid by variations such as 0.5, 1.0 and 1.5 mg/100 ml of stock solution.

**Preparation of Kokam Health Drink**

Stock solution was diluted by the use of diluting factor *i.e.* glass distilled water. 100 ml of stock solution was diluted with 100 ml of glass distilled water. This health drink was filled in a multi-layered pouch and sealed.

**Nutritional quality evaluation**

Major nutrients like carbohydrates, crude protein, and fat were determined by using AOAC methods (1978) [1].  $\alpha$ -Hydroxycitric acid, anthocyanin, pectin, tannin (AOAC 1990) [1], and ascorbic acid content in Kokam Health Drink were also analysed (Raghuramulu *et al.* 2003).

**Selection of Samples**

One hundred and twenty adolescent boys (60) and girls (60) who were in grade II of BMI and 18-21 years in age were selected by using the purposive random sampling method. About 40 adolescents from each *i.e.* Kolhapur, Sangli, and Ratnagiri districts of western Konkan of Maharashtra were selected for this study. 120 experimental groups of adolescents were again divided into three groups depending on their supplementation of  $\alpha$ -hydroxycitric acid *i.e.* 0.5, 1.0 and 1.5 mg/100 ml of Kokam health drink. The selected obese adolescents were supplied with Kokam health drink for the duration of six months. The supplementations of Kokam health

drink continued for the duration of six months. The supplementation of Kokam health drink was supplied in the diluted form of 100 ml in amount before one hour of their mid lunch per day including holidays.

**Assessment of health and nutritional status of adolescents**

The health and nutritional status of selected adolescents were evaluated before and after experimental feeding programs for six months period. The nutritional and health status of adolescents were assessed through BMI (Jelliffe, 1966) [7] and biochemical analysis especially lipid profile by using methods described in AOAC (1978) [1].

**Statistical Analysis**

The data were analysed statically by applying standard mean, critical difference, and percentage. The significant difference was examined before and after the supplementation in the experimental groups by using the 'Z' test (Gomez, 1984) [3].

**Result and Discussion**

The data about the effect of  $\alpha$ -hydroxycitric acid supplementation through Kokam health drink on the BMI and lipid profile of obese adolescents are present in Tables I to IV. Table 1 describes the nutritional potential of kokum health drink. It shows that this health drink contains less amount of carbohydrates *i.e.* 38.6 g, energy *i.e.* 53.5 Kcal, protein *i.e.* 2.2 g, fats *i.e.* 0.83 g, and tannin 0.70mg. Whereas it was found rich sources of vitamin C (mg) *i.e.* 30.1, Pectin *i.e.* 3.4 mg, anthocyanin (percent) *i.e.* 2.8, and  $\alpha$ -hydroxycitric acid *i.e.* 2.36 mg.

**Table 1:** Nutritional quality assessment of Kokam health drink

Sr. No	Nutritional Quality	Content
1.	Carbohydrates (g)	38.6
2.	Energy (Kcal)	53.5
3.	Protein (g)	2.2
4.	Fats(g)	0.83
5.	Pectin (mg)	3.4
6.	Anthocyanin (%)	2.8
7.	Vitamin C (mg)	30.1
8.	Tannin (mg)	0.70
9.	Hydroxycitric acid (mg)	2.36

Table II depicts the average mean body mass index of different groups of obese adolescents who are supplied 0.5, 1.0, and 1.5 mg/100 ml of  $\alpha$ -hydroxycitric acid. It clearly indicated that the supply of  $\alpha$ -hydroxycitric acid is 0.5 mg/100 ml in Kokam health drink (*i.e.* group I) reduced most

significantly the body mass index *i.e.* from 31.6 $\pm$ 1.7 to 28.1 $\pm$ 2.3. However, obese adolescents from group III noted a non-significant reduction in BMI after the supply of 1.5 mg/100 ml  $\alpha$ -hydroxycitric acid for six months of the experimental period.

**Table 2:** Average body mass index of adolescents

Group	Body Mass Index		
	Before Supplementation (Mean $\pm$ SD)	After Supplementation (Mean $\pm$ SD)	'Z' value
I (0.5 g/100 ml)	31.6 $\pm$ 1.7 (160.0)	28.1 $\pm$ 2.3 (141.8)	(3.48)**
II (1.0 mg/100 ml)	31.8 $\pm$ 1.6 (161.4)	30.6 $\pm$ 1.9 (155.0)	(1.92) NS
III (1.5 mg/100 ml)	31.4 $\pm$ 1.4 (156.2)	29.8 $\pm$ 3.1 (150.9)	(2.89)*

\*Significant at 5 per cent

\*\* Significant at 1 per cent level

NS-Non-Significant

Figures in parentheses indicates percentage

The data regarding lipid profile of these three different groups of obese adolescents after supplementation of varying levels of  $\alpha$ -hydroxycitric acid was reported in Table III. It gives an idea that blood cholesterol (mg/100 ml) was drastically decreased in group I obese adolescents than in group II and group III. It indicates that more than twenty percent of blood cholesterol (from 130.0 to 109.7), and LDL levels (from

160.0 to 142.0) were reduced due to the supply of 0.5 mg/100 ml  $\alpha$ -hydroxycitric acid. Triglycerides (mg/100 ml) were also found significantly reduced from 173  $\pm$  2.9 to 165  $\pm$  2.6 in this group. Whereas high density lipoproteins (HDL) (mg/100 ml) level increased from 25  $\pm$  1.1 to 33  $\pm$  2.3 among this group of adolescents.

**Table 3:** Lipid profile of obese adolescents

Sr. No	Lipid Profile	Group (0.5 mg/100 m)			Group-II (0.5 mg/100 m)			Group-III (0.5 mg/100 m)		
		(Mean ± SD)			(Mean ±SD)			(Mean ± SD)		
		(a)	(b)	'Z' Value	(a)	(b)	'Z' Value	(a)	(b)	'Z' Value
1.	Blood Cholesterol (mg/100 ml)	260±5.6	239.4±4.7	(3.11)**	258.0±4.7	242.0±3.8	(1.88)NS	261±3.8	256±3.2	(1.22)
		(130.0)	(109.7)		(129.0)	(121.0)		(130.5)	(128.0)	NS
2.	LDL level(mg/100 ml)	160±3.1	142±2.5	(3.08)**	163±2.8 (163.0)	156±2.1	(2.49)*	163±2.8	157±2.6	(1.40)
		(160.0)	(142.0)			(2.49)*		(163.0)	(157.0)	NS
3.	HDL level (mg/100 ml)	25.0±1.1	33.0±2.3	(3.30)**	27±2.0	38±1.8	(3.71)**	24.0±1.9	31.6±2.2	(2.83)*
		(52.0)	(68.8)		(56.3)	(79.2)		(50.0)	(65.8)	
4.	Triglycerides (mg/100 ml)	173±2.9	165±2.6	(2.82)*	173.0±2.9	166±2.4	(1.90)NS	175±2.7	169±2.1	(1.56)
		(157.2)	(150.0)		(157.2)	(157.0)		(159.0)	(153.6)	NS

A-before supplementation

B-after supplementation

Significant at 5 percent

\*\*-Significant at 1 percent level

NS-Non significant

Figures in parentheses indicate percentage

Supply of 1.0 mg/10 ml of  $\alpha$ -hydroxycitric acid has shown positive impact in the reduction of LDL level *i.e.* 163 ± 2.8 to 156 ± 2.1. Otherwise, its effect was noted non-significant in relation to a reduction in blood cholesterol and triglyceride level. However, a highly significant increase in HDL level (from 27± 2.0 to 38 ±1.8) was noticed among group II of

adolescents. The impact of 1.5 mg/100 ml  $\alpha$ -hydroxycitric acid has not shown very significant in lowering the values of blood cholesterol, LDL levels, and triglycerides among the III group of adolescents. Whereas HDL only reported an increase (from 24±1.9 to 31.6 ± 2.2 ) due to the supply of 1.5 mg/100 ml  $\alpha$ -hydroxycitric acid to this group of adolescents.

**Table 4:** Correlation of  $\alpha$ -hydroxycitric acid supplementation with the Nutritional Profile of adolescents:

Sr. No	Nutritional Profile	Correlation of $\alpha$ -hydroxycitric acid Supplementation		
		I (0.5 mg/100 ml)	II (1 mg/100 ml)	III (1.5 mg/100 ml)
1.	BMI	(3.91)**	(2.78)*	(1.59)NS
2.	Blood Cholesterol (1.0 mg/100 ml)	(3.88)**	(2.48)*	(1.30)NS
3.	LDL level (mg/100 ml)	(4.21)**	(2.66)*	(1.36)NS
4.	HDL level (mg/100 ml)	(3.91)**	(1.39)NS	(1.2)NS
5.	Triglycerides (mg/100 ml)	(4.40)**	(3.72)**	(1.78)NS

▪ Significant at 5 percent

▪ \*\* Significant at 1 percent level

▪ NS-Non significant

The data in correlation to  $\alpha$ -hydroxycitric acid supplementation and the nutritional status especially BMI and lipid profile of these experimental groups of adolescents are given in Table IV. It reveals that reduction in BMI, blood cholesterol, LDL, triglycerides level and increase in HDL level strongly correlated with 0.5 mg/100 ml supply of  $\alpha$ -hydroxycitric acid and BMI, the lipid profile of group III obese adolescents.

### Conclusion

In a nutshell, it can be concluded that supplementation of 0.5 mg/100 ml of  $\alpha$ -hydroxycitric acid through Kokam health drink was found directly correlated with the reduction of BMI and lipid profile of the experimental obese adolescents. The increasing level of  $\alpha$ -hydroxycitric acid was not found more associated with weight loss and decreasing higher lipid levels. Hence, Kokam health drink with 0.5 mg/100 ml,  $\alpha$ -hydroxycitric acid is recommended for body weight reduction and maintaining lipid profile in the obese population.

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