NUTRITIONAL VALUE OF LIME AND LEMON IN HYPERCHOLESTEROLAEMIC INDUCED RATS

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ABSTRACT

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"Lime and lemon can lower serum cholesterol"

OBJECTIVE: People generally use lime and lemon when weight reduction is anticipated. This work was carried out to determine the effect of these fruits in hypercholesterolaemic induced rats.

MATERIALS AND METHOD: Sixteen (16) albino rats were used and grouped into four groups of four (4) each. The rats were allowed to acclimatize and fed with egg yolk for seven days to induce hypercholesterolaemic state. Water, lemon, lime and lime+lemon were administered to these groups respectively. Cholesterol level was analyzed in all the groups after two (2) weeks of the administration of the fruits.

RESULTS: The result showed a statistical decrease in the groups treated with lime, lemon and lime+lemon. The lime+lemon group showed a more significant decrease (p<0.05) in both cholesterol level and body weight when compared with the control group and other groups. This reduction may be as a result of the contents of the fruits.

CONCLUSION: It can therefore be concluded that lime and lemon helps in the lowering of blood cholesterol level and body weight.

KEY WORDS: Hypercholesterolaemic, Nutritional value, lime, lemon and body weight.

INTRODUCTION

Cholesterol is a sterol (a combination of steroid and alcohol). Cholesterol is a lipid found in cell membranes of all the tissues and transported in the blood plasma of all animals.

Cholesterol was first identified in solid form in gall stones by Francis Poulletier de la Salle in 1769. However, it is only 1815 that chemist Eugene Chevrent named the compound cholesterine [1].

Cholesterol in the blood is made by the liver from foods, especially saturated fats, although a small amount is absorbed directly from cholesterol-rich foods. Food not containing animal fats either contains no cholesterol or negligible amounts. Major dietary source of cholesterol include eggs, beef, poultry and shrimps[2].

Hypercholesterolaemia is the presence of high cholesterol level[3], especially small dense LDL particles are associated with atheroma formation in the walls of arteries, a condition known as arteriosclerosis, which is the primary cause of coronary heart disease and other forms of cardiovascular diseases. Hypercholesterolaemia has been linked with high dietary intake of saturated fats and cholesterol. While part of the circulating cholesterol originates from diet, restricting cholesterol intake may reduce blood cholesterol levels. High cholesterol raises the risk for heart diseases, heart attack and stroke [4].

Hypercholesterolaemia may be inherited or the liver may produce too much cholesterol or the body may not remove low density lipoprotein (LDL) from the blood as efficiently as normal. Increased concentration of HDL correlates with lower rates of atheroma progression and even regression[5]. Some factors may increase the risk of having high cholesterol level. These factors include obesity, eating a diet high in saturated fat and trans fatty acids (found in processed and fried foods). Other factors include family history, inadequate exercise, diabetes, etc. When the total cholesterol level is above 240 mg/dl, LDL above 160 mg/dl and HDL below 40 mg/dl the individual is at risk of developing hypercholesterolaemia.

Lime and lemon are fruits of the citrus group. They are rich in vitamin C. Lemon has some antimicrobial activity and contains sugar, organic acid, carotenoid, flavonoids and pectin. Lime contains flavonoid and limonoids. It is also used in the treatment of scurvy which is due to deficiency of vitamin C.

MATERIALS AND METHODS

ANIMALS: Albino wistar rats weighing 200 – 268g of both sexes were used. The animals were procured from the animal house of Madonna University Elele and allowed to acclimatize for two (2) weeks.They were subjected to 12hours dark/12 hours light during acclimatization and the duration of the research.

INDUCTION OF HYPERCHOLESTEROLAEMIA: Hypercholesterolaemic state was induced by the administration of egg yolk for seven (7) days. The baseline cholesterol level was determined.

TREATMENT: The first group (control) received water on daily basis while group II received 1ml of fresh lemon juice. Group III received 1ml of fresh lime juice while group IV received 1ml of the mixture of lime and lemon. This treatment was carried on for seven (7) days. The weight of each animal was determined pre and post - treatment.

SAMPLE COLLECTION: Blood samples were collected through the supraorbital vein and heart puncture under chloroform anaesthesia. Cholesterol level was determined using standard methods [6, 7].

STATISTICAL ANALYSIS: SPSS version 16 was used in the analysis. Anova was used to arrive at p-value. A value less that 0.05 was considered as significant while values greater than 0.05 was considered as not significant.

RESULT

Table I shows the mean+ SD of the cholesterol level for the four groups

Groups	Cholesterol (mg/dl)	p value
Control	269.2 ± 22.5	<0.05
Lemon	181.0 ± 44.5	<0.05
Lime	105.5 ± 8.5	<0.05
Lemon + Lime	95.5 ± 11.1	<0.05

Table 1 gives the mean ± SD of cholesterol levels. Before the commencement of the experiment, some of the animals were picked randomly and their baseline cholesterol level determined. This baseline cholesterol level was 236 mg/dl (cholesterol level without induction). The control group which was treated with water had a significant increase in cholesterol level. Lemon and lime group have significant reduction in the cholesterol level while lemon+lime group was far reduced (p<0.05) when compared to the other groups.

Table II shows the mean ± SD of the pre and post treatment weights of the animals

Groups	Weight before (g)	Weight after g)	p value
Control	251.5 ± 17.3	248.5 ± 14.0	>0.05
Lemon	248.5 ± 8.1	132.3 ± 6.4	<0.05
Lime	258.5 ± 13.1	116.3 ± 4.9	<0.05
Lemon + Lime	268.5 ± 7.0	108.0 ± 0.96	<0.05

Table II gives the weight (g) of the animals before and after the experiment. The control group though had a little reduction after but was not statistically significant. Lemon, lime, lemon+lime groups all had significant reduction (p<0.05). The lemon+lime group had the highest reduction of 160g, followed by lime group (142g), lemon group (116g) and the control group (3g).

DISCUSSION

Hypercholesterolaemia results from increased levels of cholesterol. Blood cholesterol levels are influenced by diet, heredity and metabolic diseases such as diabetes mellitus, and can be measured by blood tests.

Administration of egg yolk was used to achieve hypercholesterolaemic state in albino wistar rats.

The untreated group which served as the control showed a significant increase (p <0.05) in the cholesterol level (269.2 ± 22.5 mg/dl) when compared with the baseline result of 236mg/dl. This shows that the egg yolk administration indeed increased the blood cholesterol levels. The second group (Lemon) showed a significant decrease (p<0.05) of 181.0±44.5 mg/dl when compared with the baseline. Other works attributed this to the presence of flavonoid in citrus fruits [8].

The third group (Lime) also showed significant decrease in cholesterol levels (105.5 ± 8.5 mg/dl). Lime is rich in vitamin c and vitamin c helps in the peroxidation of cholesterol. This probably could be the reason for the significant reduction in cholesterol levels.

The combined group (Lemon + Lime) showed a far more significant (p<0.05) reduction of the cholesterol level (95.5 ± 11.1mg/dl) when compared with the baseline value of 236 mg/dl. This shows that the mixture of lemon and lime is more effective when cholesterol level reduction is desired. Some researchers[9,10] attributed the presence of pectin in lime as the reason for this reduction while others attributed this reduction to cholesterol transformation to bile acids [11]. High doses of vitamin c reduced serum cholesterol levels in patients with hypercholesterolaemia[12] and also reduced serum low-density lipoprotein cholesterol and triglyceride[13, 14]. Some researchers claimed that this reduction failed to occur in the elderly [15] while in another study out of 14 patients only 1 had a significant reduction of serum cholesterol after such administration[16]. This reduction was achieved in guinea pigs using vitamin c [17].

The weights of the rats were also determined before and after the treatment. There was (p<0.05)

insignificant difference in the control group while the other groups showed statistical significant difference when the pre and post weights were compared. Hence, weight reduction was achieved. In the lemon+lime group it was reduced by 160g, 142g for the lime group, 116g for the lemon group and 3g for the control group. In the lemon+lime group it was reduced by 160g, 142g for the lime group, 116g for the lemon group and 3g for the control group.

CONCLUSION

Lime and lemon helps in the reduction of blood cholesterol levels and body weight. They should therefore be recommended in hypercholesterolae--mic and in over-weight situations where weight reduction is desirable.

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