HYPOCHOLESTEROLAEMIC EFFECT OF SPIRULINA
AND LIV-52 IN LEAD INDUCED TOXICITY IN
ALBINO RATS

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ABSTRACT:

Effect of spirulina and Liv-52 on lead induced hypercholesteroleamia in albino rats was studied. Oral administration of lead acetate(10mg/kg body weight/day) for 30 days resulted in a significant increase(P<0.01) in the level of serum total cholesterol, triglycerides, LDL Cholesterol and a significant decreases in the level of serum HDL cholesterol, when compared to normal and control group of albino rats. Administration of either Liv-52 alone or in combination with spirulina produced a well pronounced protective effect against lead induced hypercholesterolemia in rats. Although administration of spirulina alone caused an appreciable protective effect in lead toxicated rats, further study is needed with increased doses to evaluate its optimal effect.

INTRODUCTION

Lead is a ubiquitous pollutant in the global ecosystem because of its natural occurrence and industrial use. It is one of the most common environmental pollutants known to cause poisoning. Lead is not known to have any necessary biological functions in the body and its presence in the organism has always been considered as a sign of environmental pollution (1). Many plant products are increasingly recognized as having protective role in coronary artery disease and stroke through several mechanisms including antioxidant and hypocholesterolemic properties (2).

Liv 52, an ayurvedic multiherbal formulation is widely used in various hepatic disorders (3). Spirulina is microscopic, multicellular filamentous blue green algae (cyanobacterium). It is also know to have a protective role against toxic effects of various chemicals (4). However, very limited scientific data is available regarding the role of Liv-52 and spirulina in heavy metal induced hypercholesteroleamia in rats. Therefore, the present study has been carried out to delineate their protective role against lead induced hypercholesterolemia in albino rats.

MATERIALS AND METHODS

Chemicals-Lead acetate, ferric chloride, trichloroacetic acid, sodium acetate and metol were purchased form sigma chemical Co, (St, and Louis, Mo, USA). Other chemicals used were of analytical grade. Liv-52 tablets (500 mg each) were obtained commercially form Himalaya Drug Co. Bangalore, India. Each Liv-52 tablet is composed of Cappers spinosa (65mg), Cichorium intybus (65mg), Solanum nigrum (32mg), Cassia occidentalis (16mg). Spirulina tablets (100mg) each were obtained commercially form Parrys neutraceuticals Ltd, Chennai, India.
Animals and treatment – male albino rats (Wistar strain) weighing 150-175g were obtained from animal breeding centre, P.S.G. Institute of Medical Sciences & Research, Coimbatore, TamilNadu, India. They were housed in KMCH college of pharmacy, Coimbatore, Tamilnadu, India, in controlled temperature (27±2°C), humidity (55± 10%) and light. Animals were fed with standard pellet (Hindustan Lever Ltd, India). They were given a week’s time to get acclimatized with laboratory conditions.

After acclimatization the animals were divided into the following groups of six rats each.

Group A:- Normal control
Group B:- Animals were given lead acetate (10mg/kg body weight/day) orally for 30 days.
Group C:- Animals were treated with spirulina (500mg/kg body weight/day orally for 30 days.
Group D:- Animals were treated with lead acetate (10mg/kg body weight/day) and spirulina (500mg/kg body weight) orally for 30 days.
Group E:- Animals were given Liv-52 (500mg/kg body weight/day)orally for 30 days.
Group F:- Animals were treated with lead acetate (10mg/kg body weight /day)=Liv 52 (500mg/kg body weight/day) orally for 30 days.
Group G:- Animals were given Liv-52 (500mg/kg body weight/day)+spirulina (500mg/kg body weight day) orally for 30 days.

Group H:- Animals were treated with lead acetate (10mg/kg body weight /day)+Liv 52 (500mg/kg body weight/day )+ spirulina (500mg/kg body weight/day) orally for 30 days.

At the end of the experimental period, the rats were deprived of food overnight and sacrificed by light ether anaesthesia. Serum was collected for the estimation of total cholesterol (5), triglycerides (6), HDL and LDL cholesterol (7).

Statistical Analysis- Statistical analysis was performed by one way analysis of variance (ANOVA). Critical difference (CD) was calculated at1% level according to the method of Gomez et al (8) and results were expressed as mean ± SD of six rats in each group.

RESULTS AND DISCUSSION

Table 1 shows the level of serum total cholesterol, triglycerides in different experimental groups of rats. Table 2 shows the level of serum HDL and LDL cholesterol in different experimental groups of rats. In lead treated rats (group B), there was a significant increase (P<0.01) in the level of serum total cholesterol, triglycerides, LDL cholesterol and a significant decrease (P<0.01) in the level of HDL cholesterol, as compared to normal control (group A). This could be possible due to the peroxidation of membranes and alteration of cellular structure by lead. Lipids are the most important constituent of the organs. Inorganic lead is a prooxidant and peroxidative damage to cellular membrane containing lipids and fatty acids leads to membrane fragility and
permeability and is likely consequence of lead poisoning. The increase in the level of total cholesterol, triglycerides in the liver, lung, heart and kidney of rats treated with lead might be due to the ability of lead to alter the cellular structures (9).

Kopp et.al (1988) have reported that degenerative structural and biochemical changes affecting the musculature of the heart and hypertension, hypercholesterolemia, atherosclerosis are linked to lead poisoning (10). Result of the present study is supported by Gatagonova et.al (1994) and Skoczynska et.al (1993) who have reported that lead causes increase in the level of total cholesterol, LDL cholesterol, triglycerides and decrease in the level of HDL cholesterol in rats (11,12). Decrease in the level of HDL Cholesterol in rats (11, 12). Decrease in the level of HDL cholesterol on lead exposure has been reported by Dessi et.al (1989) (13).

Simultaneous administration of either spirulina (Group D) or Liv – 52 (group F), or both Liv-52 and spirulina (group H), along with lead caused a significant decrease (P<0.01) in the level of serum total cholesterol, triglycerides, LDL cholesterol and a significant increase (P<0.01) in the level of HDL cholesterol when compared to rats treated with lead alone (group B). This might be due to antiperoxidative and hypocholesterolemic effects of Liv -52 spirulina.

It was documented that Terminalia arjuna (a constituent of Liv-52) caused a lowering of plasma lipids and it is used in the management of hypercholesterolemia(14). Torres-Duran et.al (1990), reported the hypocholesterolemic effect of spirulina in CCI4 induced fatty liver in rats (15). Dwivedi et.al (1994) have reported that Terminalia arjuna bark extract decreases fat content in rat liver and heart which indicated a decreased availability of fat to these organs(16). A recent study in rats was attempted to find the compound in spirulina that lowered serum cholesterol. Iwata et.al (1990) has indicated that administration of spirulina reduced the level of cholesterol in the serum and liver of rats (17).

Reduction in LDL cholesterol and increase in HDL cholesterol are significantly related to lipid lowering therapy. Drug which increase HDL/LDL ratio by either decreasing LDL cholesterol or increasing HDL cholesterol are therefore desirable (18).

In conclusion, the results of the present study indicated the hypocholesterolemic effects of spirulina and Liv-52 in lead induced toxicity in rats. Although the individual administration of either Liv -52 or spirulina produced an appreciable effect, administration of both Liv-52 and spirulina produced a significant (P is <0.01) and well pronounced hypocholesterolemic effect in lead induced toxicity in albino rats.

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Table 1
Effect of spirulina & Liv-52 on serum cholesterol and triglycerides in lead induced toxicity in albino rats. (Values are mean ± SD of six rats)

| Groups & treatment                      | Serum total cholesterol (mg/dl) | Serum triglycerides (mg/dl) |
|----------------------------------------|--------------------------------|-----------------------------|
| Normal control (A)                     | 69.44±0.321a                   | 27.39±2.020a                |
| Lead acetate treated (B)               | 102.44±7.20b                   | 74.69±1.85b                 |
| Spirulina treated (C)                  | 68.70±2.29a                    | 26.82±0.73a                 |
| Lead acetate + spirulina Treated (D)   | 83.55±1.89c                    | 33.41±1.24c                 |
| Liv-52 tread (E)                       | 68.30±4.58a                    | 26.30±1.18a                 |
| Lead acetate + Liv-52 (F)              | 80.32±2.68c,d                  | 31.29±1.40 c,d              |
| Liv-52+spirulina (G)                   | 67.21±2.16a                    | 25.74±1.26a                 |
| Lead acetate+Liv-52 + Spirulina (H)    | 72.28±1.66a,c,d                | 28.97±1.69a,d               |
| CD (0.01)                              | 7.020                          | 3.033                       |

Values with same superscript did not differ significantly at 1% level.

Table-2
Effect of spirulina& Liv-52 on serum HDL and LDL cholesterol in lead induced toxicity in albino rats. (Values are mean ± SD of six rats)

| Groups & treatment                      | HDL cholesterol (mg/dl) | LDL cholesterol (mg/dl) |
|----------------------------------------|-------------------------|-------------------------|
| Normal control (A)                     | 21.57±2.71a             | 30.52±0.51a             |
| Lead acetate treated (B)               | 9.96±1.10b              | 61.7±1.45b              |
| Spirulina treated (C)                  | 22.38±2.78a             | 29.2±0.88a              |
| Lead acetate + spirulina Treated (D)   | 15.18±0.65c             | 37.91±2.13c             |
| Liv-52 tread (E)                       | 23.45±2.87a             | 28.2±1.81a              |
| Lead acetate + Liv-52 (F)              | 15.82±1.81c             | 37.4±1.20c              |
| Liv-52+spirulina (G)                   | 24.07±1.20a             | 28.7±2.4a               |
| Lead acetate+Liv-52 + Spirulina (H)    | 19.43±2.73d             | 33.88±1.14d             |
| CD (0.01)                              | 3.535                   | 3.514                   |

Values with same superscript did not differ significantly at 1% level.