CHAPTER - VI

SUMMARY AND CONCLUSIONS
Direct participation of retinol in the process of visual excitation is definitely established whereas the general molecular function other than visual process is still being investigated. Retinol deficiency and infection are serious combinations for ill-effects as the deficiency of this nutrient depresses the immune response.

Ground dried rhizome of the plant curcuma longa has been used for centuries for the treatment of inflammation and other diseases in India, but its exact mode of action has not been well understood.

Retinol deficiency was induced in the weanling male albino rats in 6-8 weeks time, by feeding a synthetic diet devoid of retinol. Retinol deficiency was characterized by loss of weight, eczema of the tail, paralysis of the hind limbs, bleeding in the nose and eyes and in some cases total loss of vision was observed.

When retinol deficient rats were fed with 0.1% (w/w) curcumin or 0.1% (w/w) turmeric separately in the diet, the weight was markedly improved and the animals looked healthy. This diet was fed for 3 weeks.

**CHAPTER III**

1. Retinol deficient rats showed an increase in microsomal Na$^+$ K$^+$ATPase activity in liver, kidney, spleen brain, RBC and RBC ghosts. The abnormally increased activity showed a marked reduction in curcumin or turmeric treated retinol deficient groups.

2. The fragility test revealed that RBCs from the retinol deficient rats were less susceptible to lysis, than
to the controls probably due to the accumulation of $Na^+$ in the retinol deficient group. Curcumin or turmeric treated rats showed less resistance to lysis.

(3) The kinetic parameters like $K_m$ and $V_{max}$ of $Na^+ K^+$ ATPase showed an increase in the retinol deficiency, which was reduced in curcumin or turmeric treated retinol deficient rats.

The Arrhenius plot of the enzyme revealed variations in the activation energies in retinol deficient and control group.

(4) Concanavalin-A interaction with the enzyme caused an increase in the activity in retinol deficient as well as in the control groups. However, the control group showed a higher increase in the activity than in the retinol deficient group. Curcumin or turmeric treated retinol deficient rats showed better response to Con-A.

(5) Variation in the lipid part of the microsomal membrane was revealed through enzyme interaction, which showed less stimulation in the activity of the enzyme in the retinol deficient group, compared to the control group. When the retinol deficient rats were treated with curcumin or turmeric, the enzyme showed a better stimulation with the detergents.

(6) One of the factors that controls the maintenance of membrane integrity and fluidity is the cholesterol: phospholipid ratio. This was markedly reduced in retinol deficiency compared to the controls. On feeding retinol deficient rats with curcumin or turmeric, the ratio was elevated considerably.
(7) The fatty acid analysis revealed a decrease in essential as well as non-essential fatty acids in retinol deficiency compared to the controls. Curcumin or turmeric treated retinol deficient rats showed an increase in essential fatty acid and non-essential fatty acid contents.

(8) Physical stress on the cell membrane like freezing and thawing over a period of 30 min, decreased the Na⁺ K⁺ ATPase activity more in the retinol deficient group than in the control group.

CHAPTER-IV

Chapter IV

In this chapter, the results on the effects of retinol deficiency and food additives on alkaline phosphatase activity are presented.

(1) The activity of alkaline phosphatase showed a significant reduction in retinol deficiency compared to the control. Curcumin or turmeric treated retinol deficient group revealed an increase in the enzyme activity bringing the values closer to the controls.

The $K_m$ and $V_{max}$ were increased in retinol deficiency, while there was a marked reduction in curcumin or turmeric treated retinol deficient rats.

(2) Interaction of the lectins, like Con-A and PHA decreased the enzyme activity in both control and retinol deficient groups. The decrease was more in the retinol deficient group, probably due to the disintegration of the membrane. Curcumin or turmeric treated retinol deficient group showed a decrease in the enzyme activity to almost the same extent as in the control group.
(3) To further assess the alterations in the lipid moiety, the detergent action on alkaline phosphatase was studied. Results revealed a reduction in the activity of the enzyme. The activity was reduced more in the control group. Curcumin or turmeric treated retinol deficient rats showed the decrease in the enzyme activity to the same extent as in the control.

(4) Freezing and thawing over a period of 30 min, with 10 min interval decreased the enzyme activity more in the retinol deficient group than the controls.

CHAPTER-V

This chapter deals with the studies on the effect of retinol deficiency on rat tissue microsomal membrane bound 5' nucleotidase activity.

(1) Retinol deficiency decreased the activity of 5' nucleotidase. The decreased activity showed an improvement in curcumin or turmeric treated retinol deficient rats.

(2) Since 5' nucleotidase is a glycoprotein in nature, the lectin interaction with the enzyme caused an increase in the activity in retinol deficient as well as in the control group. The increase in the activity was more in the retinol deficient group. Upon feeding curcumin or turmeric to the retinol deficient rats, there was moderate increase in the enzyme activity, compared to the retinol deficient group.

(3) Detergent interaction with the enzyme caused an increase in 5' nucleotidase activity in the control as well as in the retinol deficient group. The control group revealed
high increase in the activity compared to the retinol deficient group. Detergent actions improved the activity in curcumin or turmeric treated retinol deficient rats.

CONCLUSION

Retinol deficiency in rats induced changes in the membrane structure/function of tissue microsomes.

Membrane bound enzymes like Na\(^+\) K\(^+\) activated adenosine triphosphatase, alkaline phosphatase and 5′nucleotidase activities showed changes in retinol deficiency. The kinetic parameters of some of these enzymes were also affected. The activities of these enzymes could be modified by lectins, detergents and physical stresses like freezing and thawing. These modifications showed differences between control and the retinol deficient groups indicating the susceptibility of the membranes from the deficient group to these treatments.

The cholesterol: phospholipid ratio showed a marked decline in the retinol deficient group. The fatty acid composition of these membranes was also affected. These observations suggest that the membrane structure in retinol deficiency is altered, leading to the observed biochemical changes.

On feeding retinol deficient rats with curcumin or turmeric, the above observed changes could be reverted to control levels. Curcumin or turmeric may be ineffective in curing the vision, but it can improve the biochemical changes induced in the membranes by retinol deficiency.