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# *The effects of chloroquine on the enzyme activity of Cyclic- AMP independent casein kinases Sprague Dawley rats liver cytosol*

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## ABSTRACT

Ten male rats were exposed to chloroquine phosphate injection intraperitoneally /IP) for three days. The treated rats received 0.125ml/100g body weight of chloroquine phosphate injection intraperitoneally. Control rats received the same amount of normal saline intraperitoneally.
Enzyme assay was carried out on the liver and compared with controls. It was observed that chloroquine caused significant reduction in the enzyme activity of the cyclic -AMP Independent casein kinases from rats liver cytosol of the treated rats compared with controls.

## INTRODUCTION

Approximately 50-70% of chloroquine in plasma is bound to plasma proteins. The tissues exhibit particularly high binding to chloroquine especially those containing melanin, for example the retina. Significant binding also occurs in the liver, kidney and spleen. Chloroquine (Resochin,Avloclor, Nivaquine, Arelen) $C_{18}H_{26}CIN_3$ 7- Chloro -4- (4'- diethlyamino-1'-methylamino0 quinoline. Chloroquine is a white powder with a bitter taste, prepared by chemical synthesis .it is available as sulphate and phosphate salts. The sulphate (1 in 3) and the phosphate (1 in 4) are soluble in water. Chloroquine is best known as an antimalarial agent but it is also used in the treatment of rheumatoid arthritis. Chloroquine is effective against the erythrocytic stages of all four plasmodium species which cause human malaria with the exception of matured plasmodium falciparum gametocytes. The exact mechanisms of the action of chloroquine against malaria parasites are not fully understood. Parasitized red cells accumulate approximately 100-600 times as much chloroquine. The concentration of chloroquine in malaria parasite requires energy and is thought to require a membrane. There are three theories on the way state as that chloroquine, being a basic compound, is protonated in the lysosomes thus raising lysosomal pH. This effect may raise the intralysosomal pH above a critical level all bring about loss lysosomal function. This would reduce the parasite's digestion of heamoglobin, and thus prevent its growth.

Chloroquine intercalates into double stranded DNA and inhibits both DNA and RNA synthesis. The intercalation theory suggests that chloroquine may be bound with increased affinity by certain parts of the genome and be toxic to the malaria parasite by selective accumulation in specific genes, inhibiting their expression. The ferriprotorphyrin IX (FP) which inhibits sequestration of FP into malaria pigment. This could impair heamoglobin degradation and permits damage to the food vacuole sufficient to discharge its Ph gradient.antimalaria activity is possessed equally by the enantiomers of chloroquine and the main metabolite desethlychloroquine is also active against chloroquine- sensitive Plasmodiam. Chloroquine also has anti-inflammatory activity. The concentrations of chloroquine or hydrochloroquine found in serum in the treatment of rheumatoid disease raise the pH of acid vesicles in mammalian cell within 3-5 min in vitro. This and the observation that the view that chloroquine and hydoxychloroquine act in the rheumatic disease by raising the pH of acid vesicles. Effects of raised vesicle pH include inhibition lysosomal proteolysis, interference with the targeting of acid proteases and inhibition of cellular maturation .raise pH in the

macrophage vesicle can interfere with antigen processing. This is thought to be the explanation for the impaired antibody response to pre-exposure to human diploid cell rabies vaccine found in individual receiving concurrent chemoprophyaxis with chloroquine. In addition, chloroquine inhibits the chemotactic response of mononuclear cells and suppresses lymphocytes transformation.

## MATERIALS AND METHODS

The twenty female Sprague- Dawley rats were collected from the Animal House of the College of Medicine University of Lagos Akoka, Lagos State.

They weighed between 100-150g and were fed with the normal rat feed from Pfizer PLC Ikeja Lagos. Weight of animals was taken twice daily throughout the duration of the experiment. Ten female rats were used as controls. The remaining ten female rats were labelled by ear puncture as treated rats and kept in cages. Administration of drug was 0.125ml of chloroquine /100g body weight for 3 days intrapertoneally. Chloroquine phosphate injection was obtained from the community pharmacy of the Lagos university teaching hospital (40mg/ml chloroquine phosphate injection).The control received the same quantity of normal saline.

### Animal Sacrifice

At the expiration of the treatment the animals were sacrificed by diethyl ether decapitation and the rats liver was removed for enzyme activity assessment.

Protein Determination In Mg/Ml Was Determined Using Buiret Methods

### Determination Of Enzyme Activity Of Rats Liver Casein Kinase 1 And Casein Kinase 2

0.5 ml pooled fractions labeled casein kinase 1 and casein kinase 2 was added to 1 ml of substrate ( casein, bovine serum albumin and children albumin 1% in a test tube incubated at $37^0$c in a water bath for 5,10,15,20,25 and 30minutes .

Then 3ml of 0.3M picric acid was added to stop the reaction by precipitating the proteins. This was done for both treated and control samples. The samples was then centrifuged in a bench centrifuge for 10 minutes the supernatant was then measured against a water blank using spectrophotometer

## RESULTS

TABLE1:ENZYME ACTIVITIES OF TWO CYCLIC AMP- INDEPENDENT CASEIN KINASES FROM RATS LIVER CYTOSOL

| ENZYME | TREATEMENT | SUBSTRATE A | SUBSTRATE B | SUBSTRATE C |
|---|---|---|---|---|
| CK-1 | CO n=10 | $0.2\pm0.04^a$ | $0.1\pm0.01^a$ | $0.25\pm0.11^a$ |
| CK-1 | CQ n=10 | $0.15\pm0.01^b$ | $0.05\pm0.02^b$ | $0.12\pm0.02^b$ |
| CK-2 | CO n=10 | $0.41\pm0.20^a$ | $0.17\pm0.01^a$ | $0.18\pm0.01^a$ |
| CK-2 | CQ n=10 | $0.2\pm0.01^b$ | $0.08\pm0.002^b$ | $0.04\pm0.09^b$ |

a=Mean±S.E.M

b=$p<0.05$

CO=CONTROL RATS

CQ= CHLOROQUINE TREATED RATS

CK-1=CASEIN KINASE 1

CK-2 =CASEIN KINASE 2

A= 1% CASEIN

B= 1%BOVINE SERUM ALBUMIN

C=1% CHICKEN ALBUMIN

TABLE2:RELATIVE ACTIVITIES (%) OF CASEIN KINASE1 AND CASEIN KINASE 2 FROM RATS LIVER CYTOSOL

| ENZYME | TREATMENT | SUBSTRATE A | SUBSTRATE B | SUBSTRATE C |
|---|---|---|---|---|
| CK-1 | CO n=10 | 32.79±16.67[a] | 16.40±4.17[a] | 41.00±45.58[a] |
| CK-2 | CQ n=10 | 24.60±5.00[b] | 8.20±8.33[b] | 19.67±8.33[b] |
| CK-2 | CO n=10 | 67.21±83.33[a] | 27.90±2.50[a] | 29.51±0.21[a] |
| CK-2 | CQ n=10 | 32.80±2.08[b] | 13.10±0.83[b] | 6.56±37.50[b] |

a=Mean±S.E.M

b=$p<0.05$

CO=CONTROL RATS

CQ= CHLOROQUINE TREATED RATS

CK-1=CASEIN KINASE 1

CK-2 =CASEIN KINASE 2

A= 1% CASEIN

B= 1%BOVINE SERUM ALBUMIN

C=1% CHICKEN ALBUMIN

## DISCUSSION

There was a significant increase in the enzymatic activities of casein kinases for control using substrate A,B and C except that the value are higher with substrate a followed by substrate C and lastly substrate B. The value are reduced for chloroquine treated animal using substrate A, B and C

## CONCLUSION

Chloroquine reduced the enzyme activity of cyclic AMP independent. Casein kinases from the rats liver a very important enzyme concerned with carbohydrates metabolism and having a relationship with insulin which can lead to glycogen storage diseases like hypoglyceamia, hyperglyceamia and diabetes mellitus if possible.

 

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