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Effect of Cassava based diet on hepatic proteins in albino rats fed with crude oil contaminated diet

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ABSTRACT: The study was carried out to ascertain the glucose effect of a cassava based diet (garri) on crude oil hepatotoxicity in albino rats by feeding diet contaminated with various concentrations of crude oil mixed with 20% gari to determine the protective effect of gari. The hepatic enzymes aspartate amino transferase (AST), alanine amino transferase (ALT), gamma glutamyl transpeptidase (GGT) and alkaline phosphatase (ALK PHOS) activities with albumin, Total protein and liver /body weight were monitored in the animals. Gari feeding at 20% caused dose dependent reduction in enzymes activities (ALT, AST, GGT and ALKPHOS) with dose dependent increases in albumin and Protein in gari fed albino rats compared with Petroleum fed albino rats ($P<0.05$) suggesting that gari reversed the hepatotoxic effect of crude oil. Dose dependent increase in enzymes activities and dose dependent decrease in proteins was observed in petroleum fed rats compared with their controls ($P<0.05$). The study showed that ingestion of petroleum contaminated diet caused increase activities of liver enzymes namely ALKPHOS, AST, ALT and GGT and decreased Protein concentrations, an indicator of possible liver damage but supplementation of the diet with 20%Gari lowered the increased activities of ALKPHOS, AST, ALT and GGT observed in the Petroleum contaminated diet while increasing the Protein concentration. This study showed that feeding on gari diet reversed the liver damage caused by crude petroleum as evidenced by reduced release of liver enzymes through glucose effect. @JASEM

Crude oil which may be broadly characterised as paraffinic, naphtanic or aromatic (Chapelle, 1993) also contains smaller proportions of non hydrocarbon compounds such as oxygen, thiols, heterocyclic nitrogen and sulphur compounds as well as metalloporphyrins (Chapelle, 1993, Anoliefo, 1991, Traven, 1992). The organic substances are primarily and principally compounds comprising of carbon and hydrogen otherwise referred to as hydrocarbons. Crude petroleum contains hundreds of compounds and the chemical composition varies between geologic formations (Coppock et al 1995). They have also been grouped into types as light, medium (Intermediate) and heavy depending on their density, physical and chemical properties. The route of administration is mostly oral and external application for burns and wounds. In several organs, mainly heart and liver, cell damage is followed by increased activities of a number of cytoplasmic enzymes in the blood, a phenomenon that provides the basis for clinical diagnosis of diseases e.g. liver enzymes are usually raised in acute hepatotoxicity but tend to decrease with prolonged intoxication due to damage to the liver cells. The Nigerian Bonny crude oils are classified as light crude oils, with aromatic hydrocarbons accounting for up to 45% of the total hydrocarbons.

Glucose feeding in both man and microorganism causes profound changes in metabolism including inhibition of induction of several enzymes, stimulation of others and blockage of most effects of glucocorticods (Melvin and Goldberg, 1975). Cassava is a staple food in human diets in over 80 countries (Gomez, et al 1988). Gari a starchy food prepared from cassava (*Manihot utilisima*) tubers is one of the most popular staple foods of the people of the rain forest belt of West Africa and contains mainly starch-20% amylase and 70% amylopectin having lost the soluble carbohydrates (i.e. glucose and sugar) during processing. An overall reduction in the activity of the succinate dehydrogenase and cytochrome c oxidase has been reported in albino mice fed on maize (control) and gari (a dried cassava product) based diets for 5 weeks (Ezeji, et al 2009) while Chilaka *et al*.,(1985) reported changes in the activity rates of glucose-6-phosphatase,NADPH-cytochrome c (P_{-450}) reductase , NADPH-dichlorophenol indophenol reductase, cytochrome P_{450} peroxidase and aniline hydroxylase and glucose-6- phosphatase in rats fed Gari (56%w/w) for 9 weeks. The aim of this study is to determine the effect of gari diet on hepatotoxic effect caused by crude oil in albino rats using aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (Alkphos), Gamma glutamyl transpeptidase (GGT), serum total protein and albumin as indicators.

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MATERIALS AND METHODS

Test Animals: Ninety Wistar albino rats of 0.195kg average body weight on normal rat diet were obtained from the animal house of the department of Pharmacology and Toxicology, University of Port Harcourt. These rats were fed adlibitum with normal rat pellet and water and acclimatized to laboratory conditions for a period of 14days prior to commencement of study. The gari used in this study was purchased from Mile 3 Market, Port Harcourt. The crude petroleum used (Bonny Light) was obtained from the Nigerian National Petroleum Corporation (N.N.P.C.) Zonal Office at Moscow Road, Port Harcourt. Commercially prepared Alanine aminotransferase, aspartate aminotransferase, Total Protein and Albumin reagents were obtained from Randox Diagnostics, London while alkaline phosphatase and gammaglutamyltranspeptidase reagents were obtained from Quimica Clinica Aplicada (QCA) Spain

Animal Studies: Preliminary study was done to ascertain the oral LD_{100} (Akaninwor et al 2006) of crude petroleum by feeding 30 albino rats divided into six groups of five animals each with crude oil at concentrations of 63.90, 109.00, 127.80, 191.70 and 255.60g/kg while the last group was given normal saline to serve as control and the number of death monitored in all the groups and recorded. The LD_{50} was done by Arithmetic method of Karber (Dede, and Igbigbi, 1997). Preliminary study was also done by authors to ascertain the gari concentration that will cause glucose effect by feeding rats with various concentrations of gari and observing the concentration of gari with the lowest enzymes level.

Biochemical Studies: Determination of ALT and AST was done by monitoring the concentrations of pyruvate hydrazone formed with 2, 4 dinitrophenylhydrazine. 0.5ml of buffer solution was dispensed into test tubes labeled blank, sample, control blank and control respectively for AST and ALT respectively. 0.1ml of sample and control was dispensed into their respective test tubes. All the tubes were incubated at 37ºC for 30minutes. 0.5ml of 2, 4 dinitrophenylhydrazine was dispensed into all test tubes. 0.1ml of sample and control was dispensed into their respective blank test tube. The contents of each test tube was mixed and allowed to stand for 20minutes at 25ºC. 5ml of 0.4N sodium hydroxide was added to each tube, mixed and read at 550nm against the respective blank prepared. The activity of the unknown was extrapolated from the calibration curve already prepared (Reitman, and Frankel, 1957).

Alkaline Phosphatase activity was done by Phenolphthalein Monophosphate method .The test tubes were respectively labeled sample, standard and control. 1.0ml of distilled water was pipetted into each tube followed by a drop of the substrate into each test tube. All the test tubes were incubated at 37ºC for 5minutes. 0.1ml of sample, standard and control were dispensed into their respective test tubes. The test tubes were incubated at 37ºC for 20minutes. 5ml of colour developer was added to each test tube, mixed, and read at 550nm using water as blank. The activity of sample was calculated using the absorbance of sample against absorbance of standard multiplied by concentration of standard (Babson et al 1966).

Gamma Glutamyl Transpeptidase was done by Modified Szasz method (Szasz 1969). 2.0ml of working reagent (Substrate dissolved in Buffer according to manufacturer's specification) was pipetted into test tube and incubated at 37 ºC for 3minutes. 0.2ml of serum sample was added into the test tube mixed and transferred into measuring cuvette. The absorbances were read at O, 1, 2 and 3 minutes using water as blank at wavelength of 405nm. The activity of Gamma glutamyltranspeptidase was calculated by multiplying mean change in absorbance per minute with a factor (1158).

Total Protein concentration was carried out using Biuret method. 5.0ml of Biuret reagent was pipetted into tubes labeled blank, standard, test, and control. 0.1ml of distilled water, standard, sample and control were pipetted into their respective tubes, mixed and incubated for 30minutes at 25ºC. The absorbances were measured against the reagent blank at wavelength of 546nm. The concentration of total protein was calculated by dividing the absorbance of sample against absorbance of standard multiplied by concentration of standard (Henry et al 1974).

Bromocresol green (BCG) method by Doumas *et al.*,(1971) was used for albumin estimation. 3ml of Bromocresol green reagent was pipetted into tubes labeled blank, standard, sample and control. 0.01ml of distilled water, standard, sample and control was pipetted into their respective tubes, mixed and incubated at 25 ºC for 5minutes. The absorbances were measured at 578nm against the reagent blank. The concentration of Albumin was determined by dividing the absorbance of sample against absorbance of standard multiplied by concentration of standard.

The liver to body weight ratio was determined by taking the weight of the whole liver and comparing it with the final body weight as described by Sunmonu and Oloyede (2007).

Statistical Analysis: The biochemical data were subjected to some statistical analysis. Values were reported as Mean ± SEM while student's t-test was used to test for differences between treatment groups using Statistical Package for Social Sciences (SPSS) version 16.A value of $P<0.05$ was accepted as significant.

RESULTS AND DISCUSSION

The oral lethal dose 100 (LD_{100}) and lethal dose 50 (LD_{50}) obtained in this study, 255.60± 0.195g/kg and 124.04 ±0.195g/kg respectively is similar to the LD_{100} and LD_{50} obtained by Akaninwor *et al.,* (2006) for Bonny light crude petroleum (254.80g/kg and108.30g/kg) and Forcados crude petroleum (254.60g/kg and 150.70g/kg) respectively as shown in Table 1. Most of the substances contained in crude petroleum occur naturally due to their presence in rock formation or in saltwater deposits from which the crude oil was drawn (Anon, 1973). However some of these are also introduced from the drilling pipes and drilling fluid additives while others are introduced during pumping, preparing and transporting of crude oil (IARC 1989). They are also introduced greatly in the relative concentrations of different components and thus show substantial variability in solubility, dispensability, persistence and toxicity (Anderson et al 1982). LD_{50} values depend on the route of administration as the values are found to increase with the following sequences of route: intravenous, intraperitoneal, subcutaneous and oral (Turner 1969). The highest dose of crude petroleum selected for the study was half of LD_{50} which was considered tolerable for the period of study.

Table 1 Determination Of Median Lethal Dose (Ld_{50}) Of Albino Rats Treated With Bonny Light Crude Petroleum, n = 5, LD_{50} (g/kg) = 124.04 ± 0.195g/kg.

Group	Dose level g/kg	No of death(s) recorded	Average time of Death(Hour)
1	0.00	0	0.00
2	63.90	1	20.00
3	109.00	2	15.00
4	127.80	3	13.00
5	191.70	4	9.00
6	255.60	5	6.00

There were doses dependent increase in Alkaline phosphatase activity (U/L), Aspartate amino transferase activity (U/L) and alanine amino transferase activity (U/L) in both Petroleum treated and gari treated albino rats with gari treated rats lower in activity compared with petroleum treated. The Alkaline phosphatase activity (U/L) showed dose dependent increase. The alkaline phosphatase activity of Petroleum treated albino rats of the control was 43.80 ± 4.37. At 3.88g/kg of petroleum treatment, the alkaline phosphatase activity was 41.80 ± 6.66, while it increased to 51.80 ± 4.94, 64.00 ± 4.57, 63.60 ±8.82 and 66.20 ±9.30 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively. The alkaline phosphatase activity of control in gari treated albino rats was 41.60 ± 4.27. At 3.88g/kg of gari treatment, the alkaline phosphatase activity was 28.20 ± 8.58, while it increased to 32.80 ± 5.23, 43.40 ± 5.07, 40.60 ±6.38 and 44.80 ± 3.43 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively as shown below in table 2.

The Aspartate amino transferase activity (U/L) of 14.40 ± 3.19 was obtained in the control of petroleum treated albino rats which increased to 19.00± 4.72 at 3.88g/kg. The Aspartate amino transferase activity further increased to 27.00 ± 5.27, 32.40 ± 5.24, 38.40 ± 4.96 and 51.40 ± 5.81 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively. The Aspartate amino transferase activity of 14.80 ± 3.40 was obtained in the control of gari treated albino rats which increased to 16.40+ 4.61 at 3.88g/kg. The Aspartate amino transferase activity further increased to 18.80 ± 3.01, 21.60 ± 3.01, 26.00 ± 5.62 and 28.20 ± 4.19 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively as shown below in table 2.

The alanine amino transferase activity of 12.80 ± 0.58 was obtained in the control of petroleum treated albino rats which increased to 14.00± 1.14 at 3.88g/kg. The alanine amino transferase activity further increased to 21.00 ± 3.77, 24.20 ± 5.50, 26.00 ± 4.01 and 29.20 ± 6.26 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively. The alanine amino transferase activity of 11.40 ± 1.50 was obtained in the control of gari treated albino rats which reduced to 10.80±2.82 at 3.88g/kg. The alanine amino transferase activity further increased to 12.20 ± 2.87, 12.90 ± 2.08, 16.80 ± 5.57 and 17.80 ± 2.61 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively as shown below in table 2.

The dose dependent increases in Alkaline phosphatase activity (ALKPHOS), Aspartate amino transferase activity (AST) and alanine amino tranferase activity (ALT) of rats fed crude petroleum

contaminated diet compared with their controls is similar to the studies by Sunmonu and Oloyede (2006), Orisakwe *et al*.,(2005), Ayalogu *et al.,* (2001), Dede *et al.,* (2001) and Ologunde *et al.,* (2008) while the gari study groups showed significant dose dependent reduction in ALKPHOS,AST and ALT compared with petroleum study group. The suppression of enzymes by gari in this study is similar to report of Chilaka *et al*.,(1985) and Ezeji *et al*., (2009). Feeding a diet high in simple carbohydrates to rats or mice results in increased transcription of at least 15 genes involved in glucose uptake, glycolysis and lipogenesis (Towle *et al*., 1997).Feeding on gari might have caused reduction in enzyme induction through lowering cyclic AMP level known as glucose effect. The gari feeding might have lowered cAMP in crude oil treated albino rats thus inhibiting induction of these enzymes.

Table 2. Effect Of Gari On Alkaline Phosphatase, Aspartate Amino Transferase And Alanine Amino Transferase In Albino Rats Treated With Petroleum

	alkaline phosphatase(u/l)			aspartate amino transferase (u/l)			alanine amino transferase (u/l)		
concentration (g/kg)	petroleum treated	gari treated	p value	petroleum treated	gari treated	p value	petroleum treated	gari treated	p value
0.00	43.8 ± 4.37	41.6 ± 4.27	0.650	14.40 ± 3. 19	14.8 ± 3.40	0.939	12.8 ± 0.58	11.4 ± 1.50	0.521
3.88	41.8 ± 6.66	28.2 ± 8.58	0.080	19.00 ± 4.72	16.4 ± 4.61	0.623	14.0 ± 1. 14	10.8 ± 2.82	0.303
7.75	51.8 ± 4.94	32.8 ± 5.23	0.073	27.00 ± 5.27	18.8 ± 3.01	0.207	21.0 ± 3.77	12.2 ± 2.87	0.163
15.51	64.0 ± 4.57	43.4 ± 5.07	0.092	32.40 ± 5.24	21. 6 ± 3.01	0.087	24.2 ± 5.50	12.9 ± 2.08	0.197
31.01	63.6 ± 8.82	40.6 ± 6.38	0.072	38.40 ± 4.96	26.0 ± 5.62	0.016	26.0 ± 4.01	16.8 ± 5.57	0.303
62.02	66.2 ± 9.30	44.8 ± 3.43	0.113	51.40 ± 5.81	28.2 ± 4. 19	0.001	29.2 ± 6.26	17.8 ± 2.61	0.202

The gammaglutamyl transpeptidase activity (U/L) of control in Petroleum treated albino rats was 557.40 ± 52.18. At 3.88g/kg of petroleum treatment, the gammaglutamyl transpeptidase activity was 523.80 ± 97.27, while it increased to 612.00 ± 182.09, 617.60 ± 77.56, 807.60 ± 93.25 and 825.00 ± 131.84 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively. The gammaglutamyl transpeptidase activity of control in gari treated albino rats was 530.80 ± 50.36. At 3.88g/kg of gari treatment, the gammaglutamyl transpeptidase activity was 296.20 ± 92.21, while it increased to 424.60 ± 53.67, 422.00 ± 110.56, 718.00 ±65.30 and 750.40 ± 130.57 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively as shown below in table 3. The enzyme gammaglutamyl transpeptidase (GGT) is widely used as a marker in preneoplastic lesions in the liver during chemical carcinogenesis (Peraino *et al*., 1983) but glucose feeding in both man and microorganisms causes profound changes in metabolism including inhibition of induction of several enzymes, stimulation of others and blockage of most effects of glucocorticoids (Melvin and Goldberg, 1975), thus feeding on gari diet has blocked the induction of GGT. Gari feeding possibly caused inhibition of GGT by lowering cyclic AMP level as shown below in table 3.

Table 3. Effect of gari on gamma glutamyl transpeptidase in albino rats treated with petroleum

Concentration (g/kg)	Petroleum treated	Gari treated	t	P
0.00	557.40 ± 52. 18	530.80 ± 50.36	0.668	0.541
3.88	523.80 ± 97.27	296.20 ± 92.21	1.782	0.149
7.75	612.00 ± 182.09	424.60 ± 53.67	0.808	0.464
15.51	617.60 ± 77.56	422.00 ± 110.56	1.605	0.184
31.01	807.60 ± 93.25	718.00 ± 65.30	1.062	0.348
62.02	825.00 ± 131.84	750.40 ± 130.57	0.369	0.731

The Total protein and albumin concentrations (g/l) showed dose dependent decrease in both petroleum and Gari treated albino rats with the petroleum treated lower in concentration than the gari treated. The control albino rats had protein concentrations (g/l) of 66.00 ± 3.81 and 65.60 ± 5.42 in both petroleum and gari treated rats respectively. The protein concentration at 3.88g/kg of petroleum treated albino rats was 66.20 ± 2.13. At 7.75g/kg the protein concentration was 66.60 ± 1.89 but decreased to 63.00 ± 3.36, 61.00 ± 2.36 and 61.40 ± 2.31 at 15.51, 31.01 and 62.02g/kg respectively. The total protein concentration (g/l) of gari treated albino rats was 73.60 ± 5.03, 71.00 ± 2.78, 66.20 ± 5.38, 66.00 ± 3.96, and 63.60 ± 1.72 at concentrations of 3.88, 7.75, 15.51, 31.01 and 62.02g/kg respectively as shown below in table 4.

The control albino rats had albumin concentrations (g/l) of 38.60 ± 0.68 and 39.40 ± 3.04 in both petroleum and gari treated rats respectively. The albumin concentration at 3.88g/kg of petroleum treated albino rats was 38.40 ± 1.91. At 7.75g/kg the albumin concentration was 36.60 ± 2.31, which decreased to 36.40 ± 0.68, 35.40 ± 1.66 and 35.20 ± 1.02 at 15.51, 31.01 and 62.02g/kg respectively. The

albumin concentration (g/l) of gari treated albino rats was 40.60 ± 2.99, 41.20 ± 3.40, 39.20 ± 3.40, 37.20 ± 4.26 and 37.60 ± 2.09 at concentrations of 3.88, 7.75, 15.51, 31.01 and 62.02g/kg respectively as shown below in table 4. The liver/body weight ratio of Petroleum treated albino rats of the control was 10.00 ± 1.05 while it was 10.60 ± 0.51 in the gari treated albino rats. At 3.88g/kg of petroleum treatment, the liver/body weight ratio was 9.90 ± 0.84 which reduced further to 8.36 ± 0.31, 5.98 ± 1.67, 5.36 ± 0.26 and 5.22 ± 0.48 at concentrations of 7.75, 15.51, 31.01 and 62.02g/kg respectively. The liver/body weight ratio in gari treated albino rats was 9.96 ± 0.67 at 3.88g/kg. At 7.75g/kg gari treatment, the liver/body weight ratio was 9.68 ± 0.45,6.54 ± 1.32,5.46 ± 0.57 and 5.36 ± 0.41 at concentrations of 15.51, 31.01 and 62.02g/kg respectively as shown below in table 4.

The significant dose dependent decrease in total protein (TPROT) concentrations in crude petroleum treated albino rats is in agreement with the work of Sunmonu and Oloyede (2007).The significant dose dependent reduction in total protein and serum albumin concentrations may be a consequence of poor diet, caused by the effect of crude oil or an indication of liver dysfunction amongst others. Thus, it is possible that the contaminated diet consumed by the rats which contains toxic compounds like polycyclic aromatic hydrocarbons (an important constituent of crude oil) may affect the liver thereby preventing it from synthesizing enough total protein and albumins for release into the serum. This effect was also supported by the reduction in the liver to body weight ratio which can be attributed to abnormality in nutrient absorption by the liver from the crude oil contaminated diet. Significant dose dependent reduction in the liver to body weight ratio of the crude petroleum treated has been reported by Berepubo *et al*., (1994),Ovuru *et al.*, (2003) and Sunmonu and Oloyede (2007). Jacob and Al Muzaini (1995) observed that petroleum pollution could range from diffused chronic exposure to considerably large single doses. These subtlethal concentrations may not necessarily lead to outright mortality but may have significant effects which can lead to physiological stress and dysfunctions in animals (Omoregie, 1998). These effects were reversed by the gari diet causing increases in protein and albumin synthesis and increase liver/body weight ratio but not significantly probably as result of the feeding duration.

Table 4 Effect of gari on total protein,albumin and liver/body weight ratio in albino rats treated with petroleum

	total protein(g/l)			albumin (g/l)			liver/body weight ratio		
concentration (g/kg)	petroleum treated	gari treated	p value	petroleum treated	gari treated	p value	petroleum treated	gari treated	p value
0.00	66.0 ± 3.81	65.6 ± 5.42	0.910	38.6 ± 0.68	39.4 ± 3.04	0.817	10.0 ± 1.05	10.6 ± 0.51	0.646
3.88	66.2 ± 2.13	73.6 ± 5.03	0.093	38.4 ± 1.91	40.6 ± 2.99	0.360	9.9± 0.84	9.9 ± 0.67	0.956
7.75	66.6 ± 1.89	71.0 ± 2.78	0.312	36.6 ± 2.31	41.2 ± 3.40	0.442	8.3± 0.31	9.6 ± 0.45	0.086
15.51	63.0 ± 3.36	66.2 ± 5.38	0.305	36.4 ± 0.68	39.2 ± 3.40	0.519	5.9 ±1.67	6.5± 1.32	0.142
31.01	61.0 ± 2.36	66.0 ± 3.96	0.391	35.4 ± 1.66	37.2 ±4.26	0.748	5.3 ± 0.26	5.4 ± 0.57	0.892
62.02	61.4 ± 2.31	63.6 ± 1.72	0.414	35.2 ± 1.02	37.6 ± 2.09	0.294	5.2 ±0.48	5.3 ± 0.41	0.843

Overall, there was significant difference in 57.48 ± 4.66 alkaline phosphatase (U/L) activity of Petroleum fed rats compared with 38.57 ± 2.40 of gari fed rats. Also ALT (U/L) activity of 22.88 ± 2.59 in petroleum treated rats was significantly different from 13.63 ± 1.28 in gari treated rats. The AST (U/L) activity of 33.64 ± 5.47 in petroleum treated rats was significantly different from 20.97 ± 1.83 in gari treated albino rats. The GGT activity (U/L) of 677.20 ±59.24 in petroleum treated rats was significantly different from 523.67 ± 44.94 in gari treated rats. The total protein (g/l) also was significantly different between the 63.56 ± 1.21 of petroleum treated rats and 67.67 ± 1.71 of gari treated rats. There was no significant difference in albumin (g/l) concentration of 36.40 ± 0.57 in petroleum treated rats and 39.20 ± 1.24 of gari treated rats. There was no significant difference in 6.96 ± 0.92 liver/body weight ratio of Petroleum fed rats compared with 7.40 ± 1.01 of gari fed rats as shown in table 5 below.

There was overall reduction in the activities of ALKPHOS, AST, ALT and GGT in gari fed albino rats compared with petroleum fed albino rats. Glucose represses the induction of inducible operons by inhibiting the synthesis of cyclic Adenosine monophosphate (cAMP) a nucleotide that is required for the initiation of transcription of a large number of inducible enzyme systems including the Lac operon. Cyclic AMP (cAMP) is required to activate an allosteric protein called catabolite activator protein (CAP) which binds to the promoter CAP site and stimulates the binding of Ribonucleic acid (RNA) polymerase to the promoter for the initiation of transcription, but cAMP must be available to bind to CAP which binds to Deoxyribonucleic acid (DNA) to facilitate transcription. In the presence of glucose, adenylase cyclase (AC) activity is blocked. AC is required to synthesize cAMP from Adenosine Triphosphate (ATP) (Zubay et al.,1970 and Todar, 2008). Therefore if cAMP levels are low, CAP is inactive and transcription does not occur. Thus the

effect of glucose in suppressing these inducible enzymes is by lowering cyclic AMP level. The gari feeding might have lowered cAMP in crude oil treated albino rats thus causing inhibition of these inducible enzymes.

Table 5 overall effect of gari on biochemical parameters in albino rats treated with petroleum

Parameter	Petroleum treated	Gari treated	P value
ALKPHOS(U/L)	57.48±4.66	38.57±2.40	0.000
ALT (U/L)	22.88±2.59	13.63±1.28	0.003
AST(U/L)	33.64±5.47	20.97±1.83	0.000
GGT(U/L)	677.20±59.24	523.67±44.94	0.027
T. PROT(g/l)	63.56±1.21	67.67±1.71	0.015
ALB (g/l)	36.40±0.57	39.20±1.24	0.107
Liver/Body weight	6.96 ±0.92	7.40± 1.01	0.348

Conclusion: This study has shown that feeding crude oil contaminated diets causes hepatotoxicity while feeding on gari reversed the hepatotoxicity by repressing the induced enzymes caused by crude oil due to glucose effect. Glucose effect of carbohydrate diets could help in reducing liver dysfunction caused by petroleum as shown in this study.

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