

Effect of Acetaminophen And Caffeinated Energy Drink on the Serum Protein Levels of Wistar Albino Rats During Sub-Chronic Alcohol Consumption.

¹Bassey, N. O; ²Ekam, V. S., ³Essien, N.U; ⁴Ekam, N.V.
Department of Biochemistry, University of Calabar, Calabar, Nigeria
Corresponding author: *Bassey, N.O

Abstract: The effect of administering acetaminophen and energy drink on serum proteins during sub-chronic alcohol consumption was investigated on 42 Wistar albino rats that were divided into seven groups of six rats each. Group 1 served as the normal control and received 1ml of bottled water, group two received alcohol (2.5ml/kg body weight), group three was given energy drink (5ml/kg body weight), group four received paracetamol (28.55mg/kg body weight), group five received same dose of alcohol and energy drink, group six received same dose of alcohol and paracetamol, and group seven received same dose of alcohol, energy drink and paracetamol. The administration was carried out twice daily for 14 days. From the result, there were non-significant increases ($p > 0.05$) in serum total protein (g/dl) of the groups treated with alcohol (59.75 ± 1.93), energy drink (62.20 ± 2.03), alcohol + energy drink (60.40 ± 3.33) and alcohol + energy drink + paracetamol (61.20 ± 1.85) compared to the control group (58.67 ± 1.36) and non-significant decreases ($p > 0.05$) in the groups receiving paracetamol (58.00 ± 1.34) and alcohol + paracetamol (57.00 ± 1.29). Serum albumin levels (g/dl) were significantly decreased ($p < 0.05$) in groups treated with energy drink (19.20 ± 0.20), alcohol + energy drink (19.80 ± 0.85) and alcohol + paracetamol (22.25 ± 0.25) compared to the control group (25.33 ± 0.21). Serum globulin levels (g/dl) were significantly increased ($p < 0.05$) in groups treated with energy drink (43.00 ± 2.02) and alcohol + energy drink (40.60 ± 3.36) compared to the control group (33.33 ± 1.38). The results show that sub-chronic consumption of alcohol alone or in combination with energy drink and paracetamol does not alter serum protein levels adversely since values obtained were within reference ranges.

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I. Introduction

Alcoholic beverage is created when grains, fruits, or vegetables are fermented. It is a depressant, which means it slows the function of the central nervous system. It actually blocks some of the messages trying to get to the brain. This alters a person's perceptions, emotions, movement, vision, and hearing. (Jones–Webb, 1998) Alcoholic beverages are divided into three general classes: beers, wines, and spirits. They all contain different percentage of alcohol. When large amounts of alcohol are consumed in a short period of time, alcohol poisoning result, this is a process whereby the body becomes poisoned by large amounts of alcohol. Violent vomiting is usually the first symptom of alcohol poisoning. Extreme sleepiness, unconsciousness, difficulty in breathing, dangerously low blood sugar, seizures, and even death may result (Shapiro and Robert, 2008). Due to the toxic effect of alcohol, people tend to mix it with energy drink in order to reduce the level of intoxication. The Caffeine in energy drink is a central nervous system stimulant that temporarily increases attention, alertness and motor activity, while alcohol is a depressant, which slows down brain and motor activity. Individually, the two substances serve completely opposite functions. However, in combination, they can magnify negative effects in the body such as increased heart rate, blood pressure, headache and urine elimination (Shapiro and Robert, 2008). Also, Short term side effects such as headache, nausea, and anxiety have been shown as symptoms of mild caffeine consumption (Ferreira *et al*, 2006). These energy drinks claim to stimulate the mind and body, provide a boost of energy but can have adverse effects when mixed with alcohol. However, power horse for instance, is an energy drink which contains up to 80 mg or more of caffeine per can (O'Brien *et al*, 2008).

High levels of caffeine can boost heart rate and blood pressure, causing palpitations. Mixing these drinks with alcohol further increases the risk of heart rhythm problems. It has also been reported that although energy drinks have stimulants in it, the alcohol still has similar effects. Energy drinks have a lot of stimulants in them like ginseng, since alcohol is a depressant, in mixing the two; a mixed message is being sent to the nervous system which can cause cardiac related problems (Alford *et al*, 2001). Alcohol causes dehydration, which is one of the reasons why people have hangovers, and the caffeine in the energy drinks is a diuretic which also causes loss of water, thereby worsening the effects of dehydration (Alford *et al*, 2001). Paracetamol is one of the drugs used as a hangover cure, by millions of people worldwide but mixing caffeine in the energy drink with paracetamol could be deadly (Nelson, 2005).. Combining large quantities of the pain-killer and caffeine in the

energy drink appeared to increase the risk of liver damage. Also it has been shown that Caffeine in the energy drink tripled the amount of toxic by-product created when paracetamol is broken down. (Roland *et al*, 2007).

Caffeine addicts are being warned against mixing the drink with paracetamol because caffeine can react with the painkiller to cause liver damage. The effect could be fatal for susceptible people if taken in large amount. Scientists have also shown that combining coffee with the drug could also prove deadly, (Nelson, 2005). However, some people would be more susceptible, such as those taking anti-epilepsy medicines, or St John's wort, a herbal antidepressant as both of these boost levels of the enzyme involved. Those who drink a lot of alcohol are also at higher risk, while people should be aware that many paracetamol-based painkillers also contain caffeine. (Nelson, 2005).

II. Materials And Methods

Collection and preparation of materials

Smirnoff vodka (40% v/v) and power horse obtained from sparkz shop in Calabar were used as alcohol and energy drink respectively. Emzor paracetamol was obtained from Obel pharmacy in Calabar.

Laboratory animals

Forty-two wistar albino rats weighing between 180 to 220g were obtained from the animal house of the Department of Biochemistry, University of Calabar. They were housed in plastic cages in the animal house, and fed with rat pellets and tap water *ad libitum*. The animals were acclimatized for two weeks and their weights noted before the commencement of experimental treatment. They were then divided into seven groups of six rats each. Group 1 served as the normal control and received 1ml of bottled water, group two received alcohol (2.5ml/kg body weight of Smirnoff vodka (40% v/v)), group three was given energy drink (5ml/kg body weight of power horse) while group four received paracetamol (28.55mg/kg body weight), group five received same dose of alcohol and energy drink, group six received same dose of alcohol and paracetamol, and group seven received same dose of alcohol, energy drink and paracetamol. The administration was carried out twice daily for 14 days. At the end of the treatment period, the rats were weighed and fasted overnight. They were then anaesthetized with chloroform, dissected and their blood collected with sterile syringes by cardiac puncture into heparinized screw-cap bottles for haematological analysis.

III. Statistical Analysis

The data obtained were analysed statistically using analysis of variance (ANOVA) and the student's t-test to determine whether or not the null hypothesis should be rejected so as to accept the alternative hypothesis corresponding at 95% (0.05) probability level.

IV. Result

The effect of administering energy drink and paracetamol during sub-chronic alcohol consumption in Wistar albino rats was investigated in this research. The results show the effect of the treatments on serum protein levels. There were non significant increases ($p > 0.05$) in total serum protein level of rats in groups receiving alcohol (59.75 ± 1.93), energy drink (62.20 ± 2.03) alcohol + energy drink (60.40 ± 3.33) as well as alcohol + energy drink + paracetamol (61.20 ± 1.85) compared to the control group (58.67 ± 1.36). There were also non-significant reductions in groups receiving paracetamol (58.00 ± 1.34) and alcohol + paracetamol (57.00 ± 1.29) compared to the normal control group. However, values obtained for total serum protein in both control and test groups were within the reference range of 60-80 g/dl (Toa and Viska, 2007).

The result also showed that the administration of alcohol caused a significant decrease ($p < 0.05$) in serum albumin level (g/dl) (23.25 ± 0.25) compared to the normal control group (25.33 ± 0.21). There were also significant decreases ($p < 0.05$) in groups treated with energy drink (19.20 ± 0.20), alcohol + energy drink (19.80 ± 0.58), alcohol + paracetamol (22.25 ± 0.25) and alcohol + energy drink + paracetamol (23.40 ± 0.24) compared to the normal control group (25.33 ± 0.21). The group receiving paracetamol however showed a significant increase ($p < 0.05$) in serum albumin level (26.33 ± 0.21) compared to the normal control group. There was a non significant increase ($p > 0.05$) in albumin level in the group receiving alcohol and energy drink (19.80 ± 0.58) compared to the energy drink group. However, the group on alcohol, energy drink and paracetamol had significantly increased ($p < 0.05$) serum albumin level (23.40 ± 0.24) compared to the energy drink group. There were also significant decreases ($p < 0.05$) in the level of albumin in groups receiving alcohol and paracetamol (22.25 ± 0.25) and alcohol + energy drink + paracetamol (23.40 ± 0.24) compared to the paracetamol group (26.33 ± 0.21). However, the values obtained for serum albumin in both control and test groups were above the reference range of 3.5- 5.0 g/L (Toa and Viska 2007).

From the result it shows that there were non significant increases ($p > 0.05$) in globulin level in the groups treated with alcohol (36.50 ± 1.94), alcohol + paracetamol (34.75 ± 1.25), alcohol + energy drink + paracetamol (37.80 ± 1.98) compared to the control group (33.33 ± 1.38). However, the groups administered with

energy drink (43.00±2.02), and alcohol + energy drink show significant increases (p<0.05) in globulin level (g/dl) compared to the normal control group. Also, the paracetamol group showed a non significant decrease compared to the control group.

There were non significant increases (p> 0.05) in groups receiving alcohol+ energy drink, and alcohol+ energy drink +paracetamol (40.60±3.36, and 37.80±1.98) respectively compared to the group treated with alcohol (36.50±1.94). There was also a non significant decrease (p > 0.05) in the level of globulin in the group treated with alcohol + paracetamol compared to the group treated with alcohol.

However, groups treated with alcohol and energy drink (40.60±3.36), and alcohol+ energy drink + paracetamol(37.80±1.98) showed non significant decreases(p> 0.05) in globulin level compared to the group on energy drink (43.00±2.02). From the result also, there was a non significant increase (p> 0.05) in globulin level in the group which received alcohol and paracetamol (34.75±1.25) compared to the group receiving paracetamol (31.67±1.43) However, the values obtained for serum globulin in both control and test groups were within the reference range of 23-35g/L (Toa and Viska 2007).

Table1 Effect administration energy drink, paracetamol protein levels

	Total Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)
Gp. 1 (Normal Control)	58.67 ± 1.36	25.33 ± 0.21	33.33 ± 1.38
Gp. 2 (Alcohol)	59.75 ± 1.93	23.20 ± 0.25	36.50 ± 1.94
Gp. 3 (Energy drink)	62.20 ± 2.03	19.20 ± 0.20 ^{*-a}	43.00 ± 2.02 ^{*-a}
Gp. 4 (Paracetamol)	58.00 ± 1.34	26.33 ± 0.21 ^{-a, b}	31.67 ± 1.43 ^b
Gp. 5(Alcohol+ Energy Drink)	60.40 ± 3.33	19.80 ± 0.58 ^{*-a, c}	40.60 ± 3.36 ^{*-c}
Gp. 6(Alcohol + Paracetamol)	57.00 ± 1.29	22.25 ± 0.25 ^{*-b, c, d}	34.70 ± 1.25 ^b
Gp. 7(Alcohol + Energy drink + Paracetamol)	61.20 ± 1.85	23.40 ± 0.24 ^{b, c}	37.80 ± 1.98 ^c

of alcohol, and on serum

Values are expressed as mean ± SEM, n = 6.

*significantly different from NC at p<0.05

a = significantly different from alcohol at p<0.05

b = significantly different from energy drink at p<0.05

c = significantly different from paracetamol at p<0.05

d = significantly different from alcohol + energy drink at p<0.05

e = significantly different from alcohol + energy drink + paracetamol at p<0.05

V. Discussion

The results of this research showed that administration of energy drink and paracetamol during chronic alcohol consumption in Wister albino rats did not cause any significance effect in total serum protein level of rats both in the control group and the treatment groups. The total protein test is a rough measure of all the proteins found in the fluid portion of the blood. Its measurements can reflect nutritional status and may be used to screen for and help diagnose kidney disease, liver disease, and many other conditions. Low total protein levels can suggest a liver disorder, a kidney disorder, or a disorder in which protein is not digested or absorbed properly. Low levels may be seen in severe malnutrition and with conditions that cause malabsorption, such as Celiac disease or inflammatory bowel disease (IBD) (Burgener *et al*, 2010) However, there were non significant increases (P> 0.05) in total serum protein level of rats in groups receiving alcohol, energy drink, alcohol + energy drink as well as alcohol + energy drink + paracetamol. There were also non significant reductions (P> 0.05) in groups receiving paracetamol + alcohol + paracetamol compare to the normal control group. The non significant reduction in these groups could be attributed to the depressant actions of alcohol and paracetamol interfering with synthetic processes hence a reduction in total protein (Lieber, 1991). The insignificant change is also in line with the earlier report by Cheul Do *et al*. 1997 who reported that caffeine has no effect on total protein. Albumin is the most abundant protein in the blood, it is synthesized in the liver and

it's used as indicator of liver function. It is also a medium through which hormones, enzymes, drugs and other constituent of the blood is transported (Shaklai *et al*, 1984).increased albumin levels could be as a result of dehydration. While a decrease in albumin gives rise to liver disease, malnutrition etc..In this research, the group Treated with alcohol showed a significant decrease in serum albumin level (g/dl). Compared to the normal control group. There were also significant decreases in groups treated with energy drink, alcohol + energy drink, alcohol + paracetamol + alcohol as well as energy drink + paracetamol compared to the normal control group. This reduction in serum albumin could have been as a result of malnutrition or liver disease. This is in support of the earlier report by Lodgson , (1994), Which said that alcoholism is a major cause of malnutrition. Reasons are, first alcohol interferes with central mechanisms that regulate food intake and causes food intake decreases. Second, alcohol is rich in energy (7.1 kcal/g), and like pure sugar most alcoholic beverages are relatively empty of nutrients. Increasing amounts of alcohol ingested lead to the consumption of decreasing amounts of other foods, making the nutrient content of the diet inadequate, even if total energy intake is sufficient. Thus chronic alcohol abuse causes primary malnutrition by displacing other dietary nutrients.

The group receiving paracetamol however showed a significant increase in serum albumin level compared to the normal control group. Globulin plays an important role in body immune system. An Increase in globulin level can result from inflammatory diseases, hypercholesterolemia, iron deficiency anemia as well as infections. Also, decreased globulin levels can result from liver dysfunction, immune deficiencies etc. (Chatterjea and Shinde, 2007). From table 4.1, the result shows that there were non significant increases ($P > 0.05$) in globulin level in the groups treated with alcohol, alcohol + paracetamol as well as alcohol + energy drink + paracetamol compared to the control group. However, the groups administered with energy drink, and alcohol + energy drink show significant increases ($P < 0.05$) in globulin level (g/dl) compared to the normal control group. The increase in globulin level in these groups was suspected to be as a result of iron deficiency anemia which was in line with the earlier report by Du *et al*, (2005).

VI. Conclusion

In conclusion, consumption of alcohol mixed with energy drink or paracetamol does not affect total protein, albumin and globulin levels adversely within a 14- days period.

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