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THE COMPARATIVE EFFECT OF BEER AND PALM WINE ON LOCOMOTOR BEHAVIOUR IN SWISS WHITE MICE

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ABSTRACT

Beer and palm wine are "two alcoholic beverages that play an important role in local ceremonies and other social life of Nigerians especially in the southern part of the country". The long term effect of beer and palm wine on locomotor behavior and anxiety is not yet known. Following chronic consumption (4 weeks feeding) of beer and palm wine, patterns of locomotor behavior and exploration was studied in 25 Swiss white mice weighing between (15-30 g), using the open field maze. The control group mice (n=5) were fed normal rodent chow, the palm wine treated groups were fed by gavage 2ml (n=5) and 4ml (n=5) of fresh palm wine while the star beer-treated group were fed by gavage 2ml (n=5) and 4ml (n=5) of star beer. Clean drinking water and normal rodent chow were access freely by all animals. The frequency of line crossing in the open field maze for the palm wine treated group was significantly lower ($p<0.05$) as compared to beer treated and control groups. The frequency of rearing in the open for the beer-treated group was significantly higher ($p<0.05$) when compared to the palm wine treated and control groups. But the frequency of rearing against the wall for the palm wine treated group was significantly higher ($p<0.05$) as compared to control. This was however not significantly different from the beer treated group. Grooming in the palm wine treated group was significantly higher ($p<0.05$) when compared to beer treated and control groups. Freezing duration and frequency in the palm wine treated group was significantly higher ($p<0.05$) as compared to beer treated and control group. The frequency of stretch attend postures in the beer treated group was significantly higher ($p<0.05$) as compared to control. This was not statistically different from the palm wine treated group. The frequency and duration for center square entry for the beer treated group was significantly higher ($p<0.05$) as compared to palm wine treated and control groups. The frequency of defecation in the palm wine treated group was significantly higher ($p<0.05$) as compared to beer treated and control groups. Similar trend was observed in the frequency of urination. These results indicate that consumption of beer increases locomotor and exploratory activity while palm wine consumption increases anxiety but reduces locomotor activity and exploration in the open field.

KEYWORDS: Palm wine, beer, locomotor activity, exploration.

INTRODUCTION

Beer and palm wine are "two alcoholic beverages that play an important role in local ceremonies and other social life of Nigerians especially in Southern part of the country" [1]. "Palm wine is milky in appearance" and is obtained from the fermentation of sugary sap of various palm species in Nigeria [1]. "Palm wine is usually obtained from the sap of *Raphia vinifera, Raphia hooderi* (raphia palm)" and "*Elaeis guineensis* (oil palm) by methods of [3-5]". "Beer and palm wine play an important indispensable role in local ceremonies such as rituals, traditional marriages and other social life in Nigeria [2]". "As a token of regard and respect to the deceased ancestors, many drinking sessions in Igbo land begin with a small amount of palm wine spilled on the ground as a libation to appease the gods [1,2]".

The raffia palm (*Raphia hookeri mann and wendl*) "Palmae is probably the most diversely useful plant of Nigeria [1]". "It is one of the most important sources of forest food species in Southern Nigeria [1]". "It occurs within the fresh water swamp forest [6]". "*Raphia hookeri* grows to height of 9m and is adapted to life with its roots in water-logged soil, by possessing breathing roots [6]". "It has a crown of dark green pinnately divided leaves, which may be over 9m in length [6,1]". The trunk is more fibrous than woody but is used for beams [6, 1].

In 2001, [1] reported that Palm wine is often infused with medicinal herbs to remedy a wide variety of physical complaints. In a report [7], fetal alcohol syndrome – an adverse health effect is associated with alcohol exposed pregnancies, "characterized by growth retardation, facial dysfunction such as learning abnormalities, lower intelligent Quotient (IQ) and behavioral problems". In 2008, [8] reported that palm wine contains bioactive compounds such as saponins, alkaloids, tanninis, flavonoids and phenolic compounds having a stimulating effect on the nervous system. "The cerebral cortex is most directly responsible for consciousness with essential role in perception, memory, thoughts, mental ability and intellect [9]". It is likely that palm wine and beer may have effect on locomotor activity. This study sets out to determine and compare effects of palm wine and beer consumption on locomotor behavior using Swiss white mice as a model.

MATERIALS AND METHODS

Ethical Approval

The authors here in declare that the "Principle of laboratory animal care" (NIH publication No. 85-23, revised 1985) as well as national laws on the care of animals were strictly adhered to during the experiments. Appropriate approval was also obtained from the local ethical committees.

Experimental Animals

A total of twenty-five (25) adult Swiss white mice of varied body weight (15-30g) were obtained from the disease free stock of the animal house in the Department of Pharmacology, College of medical Sciences, University of Calabar, Nigeria and used for the study. The animals were randomly assigned into five (5) groups of five (5) animals per group randomly[10]. Each mouse was housed in a plastic cage which had iron gauze bottom grid and a wire screen top. There was adequate ventilation in the animal room, a room temperature (26 ± 2^0c) and relative humidity (40-70%) was maintained.

Treatment Regimen

Livestock feeds obtained from Lagos, Nigeria was the rodent feed of choice for the animals; clean drinking water was given *ad libitum*. A level of hygiene standard was maintained through daily cleaning and removal of feces and spilled feed from cages. Normal rodent chow and clean drinking water was administered to the control group (A) daily for the period treatment lasted. The palm wine treated groups (B and C) received by gavage 2ml and 4ml of fresh palm wine respectively in addition to rodent chow and drinking water. The star beer-treated groups (D and E) received by gavage 2ml and 4ml of star beer respectively in addition to rodent chow and drinking water. The treatments were conducted twice daily (7:00 am and 6:00 pm).

Acquisition of Alcoholic drink

Fresh palm wine was obtained daily from Edim-Otop in Calabar, Cross River State, Nigeria. Bottled star beer was obtained from Watt market in Calabar South, Cross River State.

Experimental protocol using the open field-maze:

"The open field test was used to provide measures of locomotion, exploration and anxiety [11]". The open field arena was designed as described by Brown et al [12]. The arena is used "to assess the emotionality of in bred animals in a novel environment" [13]. According to Brown et al [12], the experiment was performed in an enclosed laboratory to screen the animals from noise and provide dim light to avoid distraction of the animals. As described by [12, 14-16], animals were placed in the center of the maze and allowed to explore the open field for 5 minutes. Before introducing each animal, the floor of the maze was cleaned using 70% ethyl alcohol in order to eliminate olfactory influences. The behaviors were scored by trained individuals, who were blind to the experiments and therefore unbiased, using stopwatches, as described by Archer [14]. The

following behaviors were scored during the 5 minutes to assess locomotor and exploratory behaviors:

Line Crossing: The frequency with which the mouse crosses one of the grid lines with all four paws [12, 14-16]

Rearing in open: The frequency with which the mice stand on their hind legs in the floor of the apparatus.

Rearing against a wall: Frequency with which the mice stand on their hind legs and the hand against the wall.

Grooming: Frequency and duration of time the animal spend licking or scratching itself while stationary.

Freezing: Duration and frequency with which the mouse is completely stationary.

Stretch-attend postures: Frequency with which the animal demonstrates forward elongation of the head and shoulders follow by retraction to the original position.

Center square entries: Frequency with which the mice crossed one of the red lines with all four paws into the central square [12, 14-16]

Center square *duration*: Amount of time the mice spent in the central square [12, 14-16].

STATISTICAL ANALYSIS

Data collected were expressed as mean ± standard error of mean (SEM), analysis of variance (ANOVA) and the student t test were used for analysis. Values of $p<0.05$ were regarded as significant [17].

RESULTS

Open field-maze:

Fig. 1: The frequency of line cross in the palm wine treated group was significantly lower ($p<0.05$) as compared to beer-treated and control groups.

Figs. 2 and 3: The frequency of rearing in the open for the beer-treated group was significantly higher ($p<0.05$) when compared to the palm wine-treated and control groups. But the frequency of rearing against the wall for the palm wine treated group was significantly higher ($p<0.05$) as compared to control. This was however not statistically significant from the beer treated group.

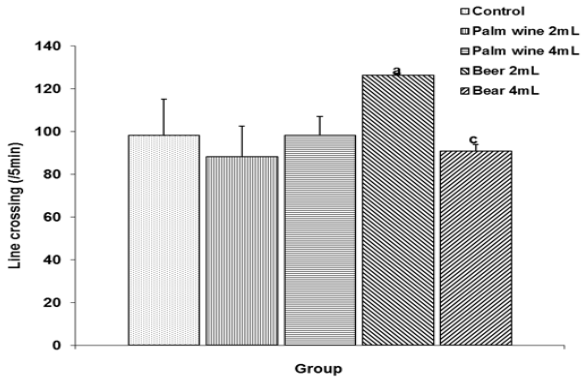

Figure 1: Effect of palm wine and beer on frequency of line crossing during the open filed maze test.
Values are expressed as mean ± SEM, n = 5.
a = p<0.05 vs palm wine 2mL;
c = p<0.05 vs beer 2mL;

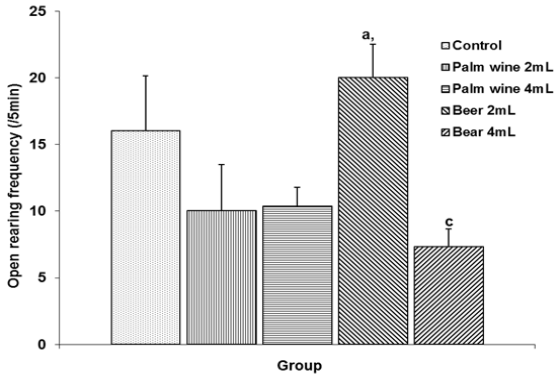

Figure 2: Effect of palm wine and beer on frequency of open rearing during the open filed maze test.
Values are expressed as mean ± SEM, n = 5.
a = p<0.05 vs palm wine 2mL;
b = p<0.05 vs palm wine 4mL;
c = p<0.05 vs beer 2mL.

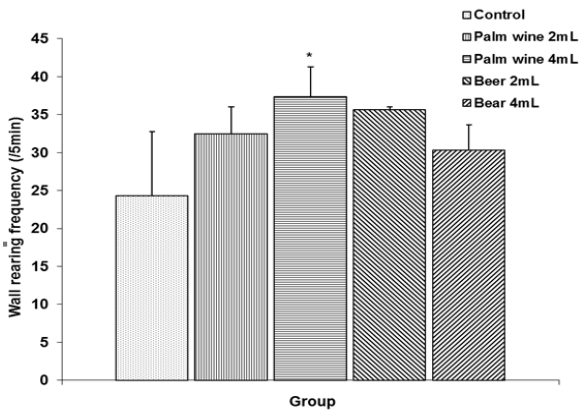

Figure 3: Effect of palm wine and beer on frequency of wall rearing during the open filed maze test.
Values are expressed as mean ± SEM, n = 5
***p<0.05 vs control.**

Figure 4: The frequency of grooming in the palm wine treated group was significantly higher ($p<0.05$) as compared to beer-treated and control groups. Similar trend was observed for duration of grooming though not statistically different among the groups (Figure 5).

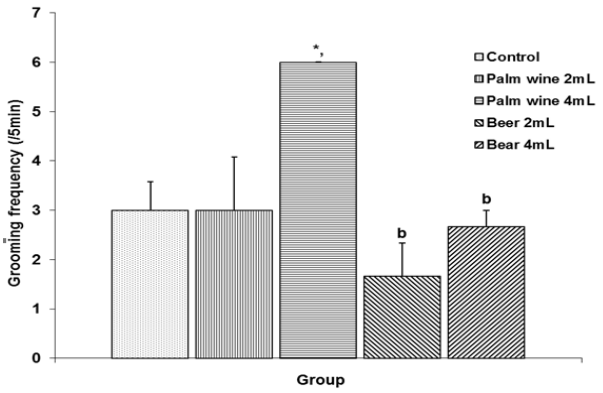

Figure 4: Effect of grooming frequency in control, palm wine and beer fed rats during the open filed maze test. Values are expressed as mean ± SEM, n = 5. *p<0.05 vs control; a = p<0.05 vs palm wine 2mL; b = p<0.05 vs palm wine 4mL.

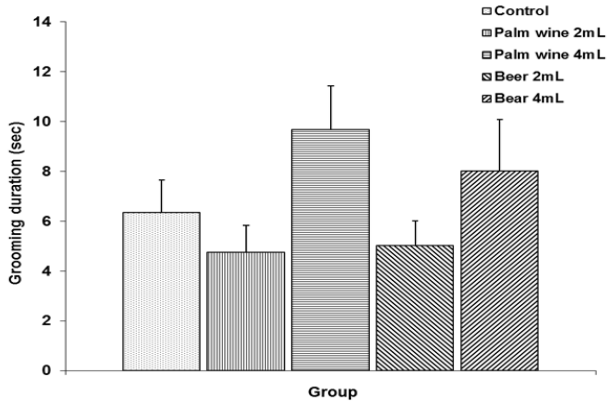

Figure 5: Effect of grooming duration in control, palm wine and beer fed rats during the open filed maze test. Values are expressed as mean ± SEM, n = 5.

Figure 6: Frequency of freezing in the palm wine treated group was significantly higher ($p<0.05$) as compared to control and beer-treated groups. Similar trend was also observed for the freezing duration among the three groups (Figure 7).

Figure 8: The frequency of stretch attend postures in the beer-treated group was significantly higher ($p<0.05$) as compared to control. This was however not statistically different from the palm wine-treated group.

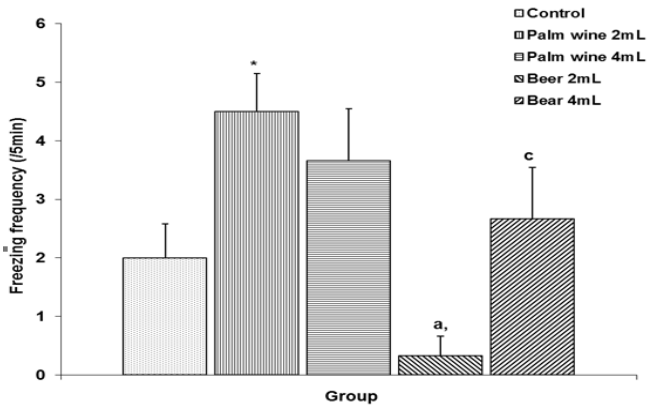

Figure 6: Effect of freezing frequency in control, palm wine and beer groups during the open filed maze test. Values are mean ± SEM, n = 5. *p<0.05 vs control; a = p<0.05 vs palm wine 2mL; b = p<0.05 vs palm wine 4mL; c = p<0.05 vs beer 2mL

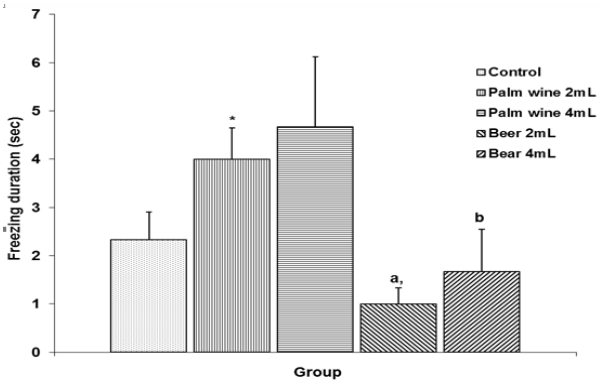

Figure 7: Effect of freezing duration in control, palm wine and beer fed rats during the open filed maze test. Values are expressed as mean ± SEM, n = 5. *p<0.05 vs control; a = p<0.05 vs palm wine 2mL; b = p<0.05 vs palm wine 4mL.

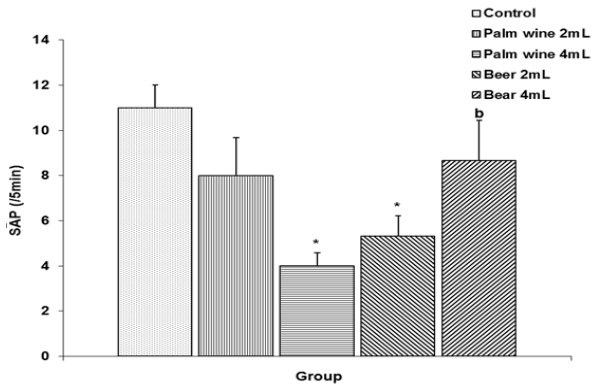

Figure 8: Effect of palm wine and beer on stretch attend postures during the open filed maze test. Values are expressed as mean ± SEM, n = 5. *p<0.05 vs control; b = p<0.05 vs palm wine 4mL.

Figure 9 and 10: The frequency and duration for center square entry for the beer-treated group was significantly higher ($p<0.05$) as compared to palm wine treated and control groups respectively.

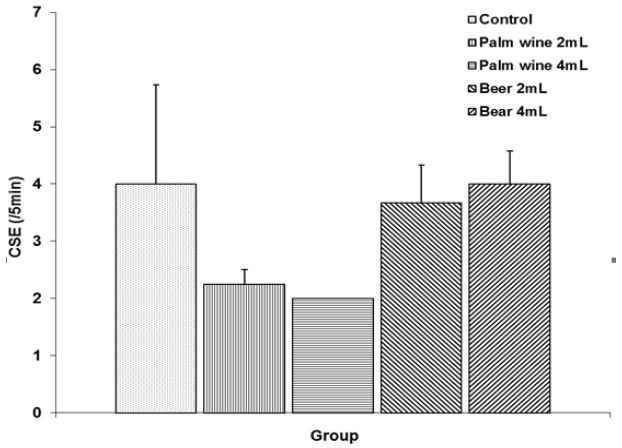

Figure 9: Effect of palm wine and beer on frequency of centre square entry during the open filed maze test. Values are expressed as mean ± SEM, n = 5.

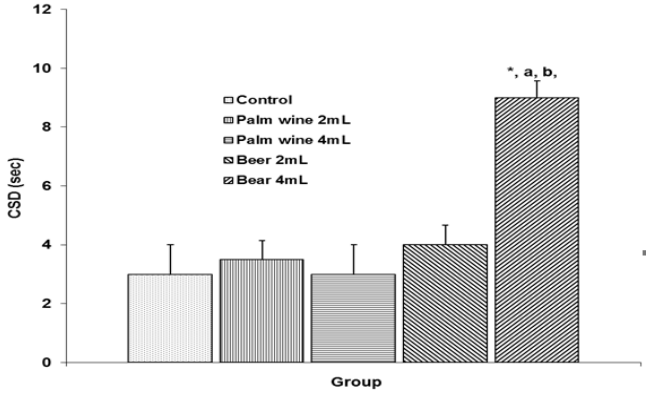

Figure 10: Effect of palm wine and beer on duration in centre squares during the open filed maze test. Values are expressed as mean ± SEM, n = 5. *p<0.05 vs control; a = p<0.05 vs palm wine 2mL; b = p<0.05 vs palm wine 4mL; c = p<0.05 vs beer 2mL.

DISCUSSION

The open field apparatus was used to assess the comparative effects of beer and palm wine consumption on locomotor activity in mice. This method is in line with Brown et al [12, 14-16], who used the open field apparatus to assess the locomotory and exploratory behavior of animals in a novel environment. Line crossing, rearing, grooming, freezing, stretch attend postures, center square entry/duration were the parameters used in scoring locomotor activities in the animals [12, 14-16]. The frequency of line cross and open rearing in the palm wine treated group were significantly lower when compared to beer-treated and control groups. This result shows that beer consumption caused increased locomotion and exploration in the tested animals. The frequency of rearing against the wall, grooming and freezing duration in the palm wine treated group were significantly higher as compared to beer-treated and control groups. This shows that palm wine-treated animals had increased anxiety and decreased exploration when compared to beer-treated and control groups. This suggests a reduction in the confidence of the animals due to a possible anxiety based increased risk assessment [18]. Blanchard posits that when the nature and location of the threat source are uncertain, mammals may show orientation to the potential threat and cessation of ongoing activity (freezing). Frequency of stretch-attend postures in the beer-treated group was higher than the palm wine treated group, though not statistically significant. This shows that the beer-treated animals exhibited high level of anxiety as compared to the palm wine treated group. The frequency of center square entry in the beer-treated group was significantly higher as compared to palm wine treated and control groups. This shows that animals treated with beer exhibited increased locomotion.

CONCLUSION

In comparing the effect of palm wine and star beer (alcoholic beverages) on locomotor behavior in Swiss white mice using the Open Field Maze, results obtained indicates that consumption of beer increases locomotor and exploratory activity while palm wine consumption increases anxiety but reduces locomotor activity and exploration.

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CONFLICT OF INTEREST

Nil.

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