

Research Article

THE PHYTOCHEMICAL EFFECTS OF ETHANOLIC EXTRACT OF BEER HOPS ON THE LIVER ENZYMES OF ADULT WISTAR RATS

Anokwulu I.O¹, *Ezejindu D.N¹, Chukwujekwu I.E¹, Nzeako H.C², Akingboye A.J³, Ndukwe G.U⁴,
Sobanke A.O⁵, Ezejindu C.N⁶ and Nwachukwu N.O⁶

¹Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, Nnamdi Azikiwe University, Nnewi Campus

²Department of Surgery, Faculty of Medicine, Nnamdi Azikiwe University, Awka, Anambra State

³Department of Applied Microbiology and Brewing, Faculty of Biosciences, Nnamdi Azikiwe University, Awka, Anambra State

⁴Department of Anatomy, Faculty of Basic Medical Sciences, Abia State University, Uturu, Abia State

⁵Department of Physiology, Faculty of Basic Medical Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria

⁶Department of Microbiology, Faculty of Biological and Physical Sciences, Abia State University, Uturu, Abia State

*Author for Correspondence

ABSTRACT

The hops are the rock star of the drinking world. It is the key to craft beer and those bold India pale Ale, (IPAs) you either love or hate and it is finding its way into wines and ciders. This study evaluates the effect of ethanolic extract of beer hops on the liver of adult wistar rats in various doses. Twenty wistar rats weighing between 190-280g were allocated into four groups (A, B, C and D) of five animals each. Group A serve as the experimental control and orally administered 0.3ml of distilled water, the experimental groups B, C and D were administered 0.2ml, 0.4ml and 0.6ml of ethanolic extract of beer hops respectively for thirty one (21) days. Twenty four hours after the last administration, the animals were weighed and weights were recorded, thereafter the animals were anaesthetized using chloroform inhalation method and dissected. About 5ml of blood was collected from the animals in all the groups by cardiac puncture using sterile syringes and needles and liver organs were also harvested. Blood for serum preparation was collected into sterile plain tubes and stored in the refrigerator for analysis. Serum samples from the blood were analyzed for liver enzymes (AST, ALP, and ALT) activities using radom kit method. The final body weight of the experimental groups (B, C and D) increased significantly ($P < 0.001$) with the control. The relative liver weight of the experimental groups (B, C and D) statistically increased ($P < 0.001$) relative to the control A. The activity levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline aminotransferase (ALP) in the experimental groups (B, C and D) are similar with the control group A. This study therefore suggests that administration or consumption of beer hops extract at various doses may not cause any biochemical alterations in the liver enzymes.

Keywords: Beer Hops, Wistar Rats, Liver Enzymes, Blood Sample, Liver Weight

INTRODUCTION

Hops were first mentioned by pling the elder in his *Naturalis Historica* (Secundus, 2007). The First documented instance of hop cultivation was in 736, in the Hallertan region of present-day Germany, although the first mention of the use of hops in brewing in that country was 1079 (Corran, 1975).

Hops are the female flowers (also called seeds cones or strobiles) of the hop plant *Humulus Lupulus* (University of Minnesota Libraries, 2008). They are used primarily as a flavoring and stability agent in beer, to which they impact a bitter, tangy favor, though they are also used for various purposes in other beverages and herbal medicine. In the middle Ages, beer tended to be of very low alcohol content (small beer). In Europe, many villages had one or more small breweries with a barley field and a hop garden in close vicinity; early documents include mention of a hop garden in the will of Charlemagne's father, Pepin III (Hornsey, 2003; Understanding Beer, 2006).

Research Article

Hops are of interest for hormone replacement therapy and are under basic research for potential relief of menstruation-related problems (Franco *et al.*, 2012; Franco *et al.*, 2012). The characteristics bitterness impacted by the addition of hops to the brewing process is mainly due to the presence of the bitter acids, which are premylated acylphloroglucinol derivatives (Verzele and De-Keukeleire, 1999).

Today, a substantial amount of “dual-use” hops are used, as well. These have high concentrations of alpha acids and good aromatic properties. These can be added to the boil at any time, depending on the desired effect (Hough, 1991).

MATERIALS AND METHODS

Breeding of Animals

Twenty wistar rats were procured from animals house of department of Applied Microbiology and Brewing, Nnamdi Azikiwe University, Awka, Anambra State and bred in the animal house of Anatomy Department, Nnamdi Azikiwe University, Nnewi Campus. They were maintained under standard housing conditions and fed with standard rat chow (Growers mash) and provided with water ad libitum during the experiment. They were allowed for seven days (one week) acclimatization under normal temperature (27-30°C).

Drug Preparation

Beer hops were purchased at Nigeria Brewing Plc, Industrial Road, Aba, Abia State, Nigeria. It was identified at the Department of Applied Microbiology and Brewing and Department of Botany, Nnamdi Azikiwe University, Awka, Anambra State. The beer hops were sun dried and milled to a powder. Extraction was done using ethanol 300mg of this extract/kg body weight was dissolved in 10mls of distilled water and administered to the animals.

Experimental Protocols

Twenty apparently healthy animals were weighed and allocated into four groups (A, B, C and D) of five animals each. Group A served as the control and were administered 0.3ml of distilled water; the experimental groups B, C and D administered 0.2ml, 0.4ml and 0.6ml of beer hops extract respectively for thirty one (31) days. Twenty four hours after the last administration, the animals were weighed and weights were recorded; they were sacrificed using chloroform inhalation method. Liver tissues were removed and weighed, blood samples were collected through cardiac puncture using sterile syringes and needles. Blood for serum preparation was collected into sterile plain tubes without anticoagulation. Serum samples were separated into sterile plain tubes and stored in the refrigerator for analysis. The activities of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) were determined using random kit method.

RESULTS AND DISCUSSION

Results

Morphometric Analysis of Body Weights

Table 1: Comparison of Mean Initial, Final Body Weight and Weight Changes in all the Groups (A, B, C and D)

(Mean \pm SEM given for each measurement)

Groups	Initial Body Weights	Final Body Weights	Weight Changes
Group A	190.00 \pm 4.60	200.00 \pm 5.60	10.00 \pm 1.00
Group B	192.00 \pm 3.20	208.90 \pm 4.00	16.90 \pm 0.80
Group C	195.60 \pm 5.30	213.20 \pm 7.10	17.60 \pm 1.80
Group D	197.60 \pm 2.60	215.10 \pm 4.70	17.50 \pm 2.10
F-Ratio	58.310	46.710	9.520
Prob. Of Sig.	<0.001	<0.001	<0.001

The final body weight for the experimental groups B, C and D increased significantly (P<0.001) relative to the control group A.

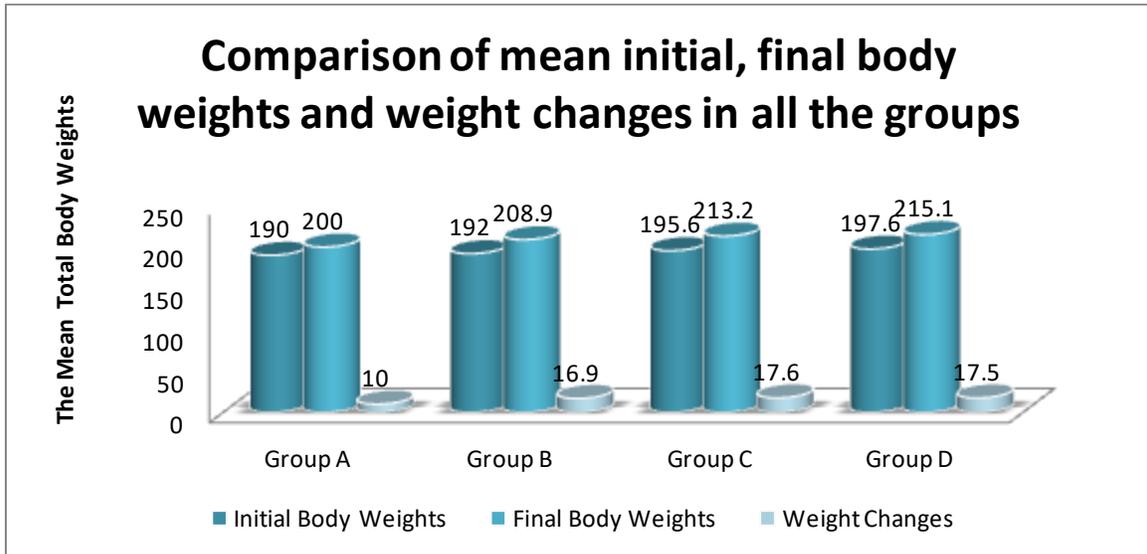


Figure 1: Bar Chart Showing the Mean Initial Body Weight, Final Body Weight and Weight Changes in all the Groups

Morphometric Analysis of Liver Weight

Table 2: Comparison of the Mean Relative Liver Weight of Group A and Experimental Groups B, C and D

(Mean \pm SEM for each measurement)

Groups	Liver Weights
Groups A	3.10 \pm 0.240
Group B	3.20 \pm 0.260
Group C	3.33 \pm 0.320
Group D	3.49 \pm 0.610
F-Ratio	42.70
Prob. Of Sig.	<0.001

The relative liver weight for the experimental groups increased significantly ($P < 0.001$) with the control.

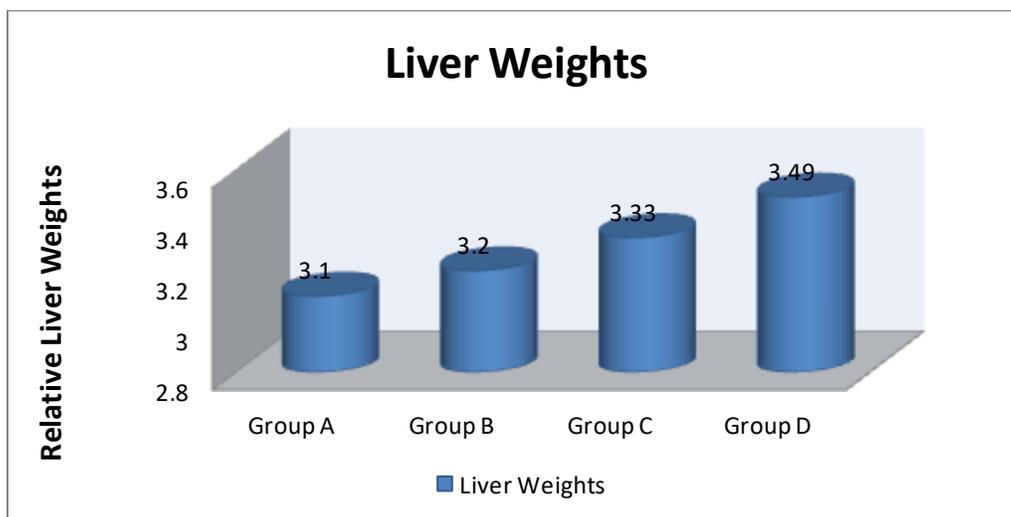


Figure 2: Bar Chart Showing the Liver Weights of all the Groups

Research Article

Activities of Serum Levels of Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT) and Alkaline Phosphatase (ALP)

Table 3: Comparison of Activities of Serum Level of AST, ALT and ALP in all the Groups (A, B, C and D)

(Mean ± SEM given for each measurement)

Groups	AST	ALT	ALP
Group A	44.60 ± 2.20	35.00 ± 4.50	140.40 ± 6.00
Group B	45.10 ± 3.40	36.80 ± 1.70	141.60 ± 3.40
Group C	47.30 ± 1.10	37.20 ± 3.30	142.10 ± 5.20
Group D	48.40 ± 3.10	38.60 ± 4.00	143.80 ± 2.80
F-Ratio	20.07	26.40	13.40
Prob. Of Sig.	<0.001	<0.001	<0.001

The activities of serum aspartate aminotransferase (AST), alanine aminotransferase (ALP) and Alkaline phosphatase levels increased significantly (P<0.001) with the control.

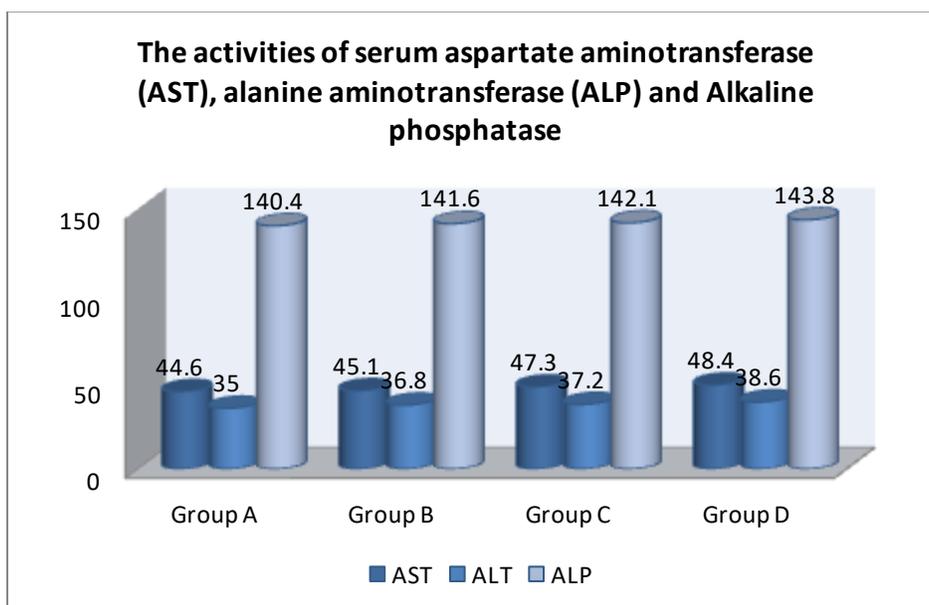


Figure 3: Bar Chart Showing the Comparison of Activities of Serum Level of AST, ALT & ALP in all the Groups

Discussion

Hops are a perennial plant that is used largely as a flavoring in the production of beer. The cones and flowers are used to prepare hops which have a distinctive bitter taste, attributed to lupulin, an aromatic acid, several flavonoids, phenolic acid, volatile oils, tannins and resins (Scelf *et al.*, 2013). Besides its wide use as a flavoring agent for food and beer, hops is used as an ingredient in many cream and lotions, extracts of hops have been used in oral herbal medications predominantly as a sedative for anxiety, tension and difficulty sleeping; while widely used, it has not been proven to be effective either as a sedative or hypnotic (Thomson Healthcare Inc, 2007; Lindahi and Lindwall, 1989; Gyllenael *et al.*, 2000).

In the present study, the mean initial and final body weight for the experimental groups treated with ethanolic extract of beer hops in varying doses increased significantly with the control, hops in this instance function primarily as a dietary supplement and also used to treat all sort of illness, thus enhanced growth.

Research Article

The comparison of the mean relative weights of the experimental groups with the control group shown no significance increase or decrease ($P < 0.001$)

The Activities levels of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) were statistically similar with the control.

Conclusion

From the result, administration of beer hops extract in low and high doses does not induce any adverse alterations in the biochemical parameters of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP)

REFERENCES

- Corran HS (1975)**. A history of brewing. *Journal of Medicine and Medical Sciences* **3**(5) 123-132.
- Franco L, Sanchez C, Bravo R, Rodriguez A, Bariga C and Juanez (2012)**. The sedative effects of hops (*Humulus lupulus*), a component of beer, on the activity/rest rhythm. *Acta Physiologica Hungarica* **99**(2) 133-9.
- Franco Li, Sanchez C, Bravo R, Rodrigue AB, Barriga C, Romero E and Cubero J (2012)**. The sedative effect of non-alcoholic beer in healthy female nurses. *Journal of Biological Sciences* **7**(7) 372-390.
- Gyllenael C, Merritt SI, Peterson SD, Block KI and Gochenour T (2000)**. Efficacy and safety of herbal stimulants and sedative in sleep disorders. *Public Health Medical Journal* **4** 229-51.
- Hornsey IS (2003)**. A history of beer and brewing. *Royal Society of Chemistry* **3**(2) 26-35.
- Hough James S (1991)**. The biotechnology of malting and brewing. *Annals of Anthropometry* **7**(5) 23-42.
- Lindahi D and Lindwall L (1989)**. Double blind study of a valerian preparation. *Journal of Pharmacology and Biochemistry* **32** 1065-6.
- Scelf L, Stickel F and Navaro VJ (2013)**. Hepatotoxicity of hebal and dietary supplements. In, Kaplowitz N, Deleve LD, edition, *Drug-Induced Liver Disease*, 3rd edition, (Netherland, Amsterdam, Elsevier) 631-58.
- Secundus Gains Plinius (2007)**. Naturalis Historia. *Pliny the Elder* **1**(4) 01-26.
- Thomson Healthcare Inc (2007)**. Compliation of short monographs on herbal medications and dietary supplements. Hops in, *PDR for Herbal Medicines*, 4th edition, (Montvale, New Jersey, USA).
- Understanding Beer (2006)**. A broad overview of brewing, Tasting and analyzing beer. *The Brewing Process* **2**(12) 05-20. Available: Jongriffin.com.
- University of Minnesota Libraries (2008)**. *The Transfer of Knowledge Hops- "Humulus Lupulus"* 5-20. Available: Lib.umn.edu.
- Verzele M and De Keukeleire D (1999)**. *Chemistry and Analysis of Hop and Beer Bitter Acids*, (USA, New York, Elsevier) **12**(2) 345-349.