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Effect of Oral Aministration of Honey on Liver Function Parameters of Albino Rats Treated with Dichlorvos (Sniper)

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ABSTRACT

Background and aim: Dichlorvos, also known as DDVP (2,2-dichlorovinyl dimethyl phosphate) is an organophosphate insecticide cum pesticide. This study is to determine the effect of oral administration of honey on Liver function parameters of albino rats treated with dichlorvos (sniper). **Methodology**: Twenty-five albino rats were divided into 5groups of 5 rats were respectively administered with 15mg/kg dichlorvos, 15mg/kg dichlorvos and 1ml honey, 15mg/kg dichlorvos and 2ml honey, 15mg/kg dichlorvos and 3ml honey while the control group were given only food and water adlibitum for 21days. Serum bilirubin, Alanine amino transaminase (ALT), Aspartate amino transaminase (AST), Alkaline Phosphatase (ALP) Total Protein and albumin were estimated using Jendrassik-Grof method, Reitman, and Frankel method, Phenolphthalein Monophosphate method, Biuret method and Bromocresol Green (BCG) method respectively. ANOVA was used to compare the mean levels across the groups. **Results:** There was significant difference ($P<0.05$) in AST (U/L) activity of 47.60±34.94, 115.80±13.27, 69.20±18.93, 82.60±31.68 and 103.6±17.80 in control, dichlorvos, dichlorvos and 1ml honey, dichlorvos and 2ml honey and dichlorvos and 3ml honey respectively. There was no significant difference ($P>0.05$) in ALT (U/L) and ALP (U/L) activities in all the treatments. Also, no significant difference ($P>0.05$) was observed in Protein (g/l) and albumin (g/l) concentration as well as total bilirubin (Umol/L) and conjugated bilirubin (Umol/L) concentrations in all the treatments. **Conclusion:** The study shows that honey may help reduce liver damage caused by dichlorvos toxicity, with varying effectiveness depending on the dose, suggesting its potential as a protective agent against chemical-induced liver injury.

Keywords: *dichlorvos, honey, liver*

Introduction

Dichlorvos, also known as DDVP (2,2-dichlorovinyl dimethyl phosphate) is an organophosphate insecticide cum pesticide [1] used to control households and stored products insects. It is traded under names such as DDVP, Sniper, Dedevap, Nogos, Nuvan, Phosvit, Vapona and Daksh [2]. Dichlorvos has been used in fish farming to eradicate crustacean ectoparasites [3]. Therapeutically, dichlorvos is used as a fumigant or to treat a variety of parasitic worm infections in dogs, livestock and humans. It acts against insects as both a contact and a stomach poison [4]. Dichlorvos exposure, both acute and chronic, can cause genotoxic, neurological, reproductive, carcinogenic, immunological, hepatic, renal, respiratory, metabolic, cutaneous, and other systemic effects, as well as death. Its toxicity is due to the ability of the compound to inhibit acetyl cholinesterase at cholinergic junction of the nervous system. The liver is the major site of dichlorvos detoxification. It is rapidly metabolized in the liver by esterase to dimethyl phosphate and dichloroacetaldehyde, and the former is excreted by the kidney in the urine [5]. Dichlorvos pesticide self-poisoning is an important clinical problem in the developing world. According to World Health Organization, each year, about 3,000,000 cases of pesticide poisoning and an estimate of about 200 000 deaths are reported developing countries [6].

Natural honey is elaborated by honey-bees as blossom honey by secreting nectars of flowers, and by honeydew honey (forest honey) by secreting the exudates of plant sucking insects [7]. It is a sweet, flavourful liquid food of high nutritional value [8] with immense health benefits [7] [8]. Honey is a substance naturally produced by honeybees especially by the specie of Apis mellifera [9] from the nectar of flowers. It has been used as a food and medical product since the earliest times. Honey is a complex mixture and presents very great variations in composition and characteristics due to its geographical and botanical origin, its main features depending on the floral origin or the nectar foraged by bees [10]. The content and quality of honey are influenced by a variety of circumstances during production, including weather and humidity inside the hive, nectar conditions, and honey treatment during extraction and storage, although the main constituents are the same in all honey.

The acceptance and use of honey cuts across all ages and barriers of culture, religion, race and ethnicity. Its many and varied properties include: growth stimulating [7] [11]; antioxidant [12] [13]; prebiotic promotes oral health and wellness [14]; haematopoietic [7] [15]; cardio-protective [16]; sporting enhancer [17]; effective in acute and chronic gastric lesions in animals [18]; antimicrobial activity [13]; improves memory and growth in children [19] [20] have also documented its gastroprotective activity. Honey has been reported to contain more than 180 substances and is considered as an important part of traditional medicine. Honey has numerous uses and functional applications worldwide such as in food systems, religious and magical ceremonies as well as in human and veterinary medicine [21]. The aim of this study is to evaluate the effect of honey on Liver function parameters of Dichlorvos (sniper) treated albino rats.

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MATERIALS AND METHOD

Experimental Animals

Twenty-five (25) albino rats consisting of both males and females that weighed 150-300g were obtained from University of Port Harcourt College of Health Sciences for this study. They were transported in well-ventilated wired cage to the animal house at Department of Medical Laboratory Science, Rivers State University, Port Harcourt. During this study, the rats were maintained with a 12-hour light/dark cycle and were provided access to solid poultry chow as feed and water from the tap.

Honey

The honey used for the study was purchased from a trusted, certified supplier at mile 3 main market Port Harcourt. The honey was stored at room temperature.

Toxicant (2, 3-dichlorovinyl dimethyl phosphate (DDVP)

A 100ml 1000g/litre 2, 3-dichlorovinyl dimethyl phosphate (DDVP) sold under the trade name and brand sniper, was purchased from a chemical retail store at Rivers State University Back-gate.

Reagent

Commercially prepared Bilirubin, Asparte aminotrasaminase (AST), Alanine amino transaminase, alkaline phosphatase, Total protein and albumin of good quality and analytical grade produced by Randox Limited UK, and Nums reagents were purchased in Port Harcourt and used in this study.

Lethal dose determination

The lethal dose 50 ($LD_{50)}$) of dichlorvos was determined using Arithmetic method of Karber (Dede and Igbigbi, 1997).

Experimental Design

Twenty-five (25) albino rats divided into five (5) groups A, B, C, D and E with each containing five rats. The albino rats in group A were fed rat diet and water *ad libitum* to serve as a control group while albino rats in Group B were administered with 15mg/kg of dichlorvos. Group C albino rats were administered with 15mg/kg of dichlorvos and 1ml of honey while albino rats Group D were administered with 15mg/kg of the dichlorvos and 2ml of honey. Albino rats in groups E were administered 15mg/kg of the dichlorvos and 3ml of honey. The oral administration of the substances was done daily for 21days. At the end of the experimental procedures, the rats were sedated with chloroform, after which a cardiac puncture was performed. 5ml of blood samples was collected aseptically into labelled plain bottles. The whole blood was allowed to clot, spun at 3000RPM for 10minutes. The serum as collected into a plain bottle for analysis of protein, albumin, bilirubin, AST, ALT and ALP.

Biochemical analysis.

Serum Total Protein concentration was determined using Biuret method. Cupric ions, in an alkaline medium interact with protein peptide bonds resulting in the formation of a coloured complex [22].

The Serum Total Bilirubin Concentration was determined using Jendrassik-Grof method [23]. The serum total bilirubin concentration is determined in the presence of caffeine, which releases albumin bound bilirubin, by the reaction which diazotized sulphanillic acid [23] [24].

The Serum direct Bilirubin Concentration was determined using Jendrassik-Grof method [23]. The serum Direct/indirect bilirubins react with diazotized sulphanillic acid in alkaline medium to form a blue coloured complex. [23] [24].

Determination of ALT and AST was done by monitoring the concentrations of pyruvate hydrazone formed with 2, 4 dinitrophenylhydrazine. [25].

Alkaline Phosphatase activity was done by Phenolphthalein Monophosphate method.

Statistical Analysis

The data was analyzed using statistical package for social sciences (SPSS) version 23. Analysis of variance (ANOVA) was used to determine the difference between treatments. The results were expressed as mean ± standard deviation

Results

The p-values indicate significant differences for AST, ALT, ALP, protein, albumin, and bilirubin levels across groups ($p<0.05$).

Table 1: Liver function parameters of Dichlovous treated rats administered with Honey

Group	AST (U/L)	ALT (U/L)	ALP (U/L)	Protein (g/l)	Albumin (g/l)	Total bilirubin (Umol/L)	Conjugated bilirubin (Umol/L)
Control	47.60±34.94	33.40±25.49	36.00±11.34	69.40±4.39	36.40±2.70	7.60±2.07	2.60±0.55
dichlorvos	115.80±13.27[a]	56.60±15.84[a]	41.00±28.11[a]	63.60±6.47	34.80±1.92	8.40±1.14	2.80±0.84
dichlorvos and 1ml honey	69.20±18.93[a,b]	31.20±3.70[b]	56.40±19.46[a,b]	67.80±3.49	40.00±2.65[a,b]	6.80±2.68	3.00±1.00
dichlorvos and 2ml honey	82.60±31.68[a,b]	34.00±14.98[b]	77.60±26.06[a,b]	62.00±4.69	33.60±4.22	6.20±1.09[a,b]	2.40±0.55
dichlorvos and 3ml honey	103.6±17.80[a]	50.40±11.08[a]	52.80±7.43[a],[b]	67.20±3.96	35.80±3.49	9.20±1.64[a]	2.60±0.55
F-value	5.976	2.648	3.228	2.140	3.038	2.168	0.5000
P-value	0.025	0.637	0.338	0.134	0.415	0.109	0.736

Key

a =Control Significantly different ($P<0.05$) compared with other groups
b= Dichlorvous Significantly different ($P<0.05$) compared with honey treated

Discussion

The present study evaluated the effects of honey on hepatic parameters of dichlorvos (snipper) toxicity in albino rats. The results indicate that exposure to dichlorvos, a toxic pesticide, significantly impacted on liver function, as shown by the increased levels of AST, ALT, and ALP compared to the control group [26]. These enzymes are biomarkers of liver damage, meaning dichlorvos caused stress or injury to the liver. Protein and albumin levels, which reflect liver synthetic function, were not significantly affected, but slight variations may suggest mild dysfunction. The bilirubin levels, which reflect liver detoxification ability, also show some protective effects of honey, though not consistently across all doses. The results collectively suggest that honey has a dose-dependent capacity to reduce liver damage caused by dichlorvos, highlighting its potential role in managing pesticide-induced toxicity [27].

When honey was administered alongside dichlorvos, it mitigated some of the enzyme elevations, particularly at 1 ml and 2 ml doses, suggesting a protective or therapeutic effect. This could be due to honey's antioxidant properties, which help counteract the oxidative stress caused by dichlorvos. However, higher honey doses (3 ml) were less effective, potentially indicating that excessive honey might not enhance the protective effect and could even interact with dichlorvos in unexpected ways [28]. The implications of these findings extend to understanding how natural substances like honey can counteract the harmful effects of toxic chemicals such as dichlorvos. Dichlorvos exposure elevated liver enzymes (AST, ALT, and ALP), signaling cellular damage or inflammation in the liver. Elevated bilirubin further indicates that the liver's ability to process and clear waste was compromised. These changes point to oxidative stress and potential structural damage in liver tissues caused by dichlorvos [29].

Honey's ability to moderate these effects suggests it possesses bioactive compounds, including antioxidants, which may neutralize free radicals produced by dichlorvos toxicity. This aligns with the known hepatoprotective properties of honey, which include reducing oxidative stress, inflammation, and apoptosis (cell death). However, the variability in effectiveness across doses indicates a complex interaction. At lower doses (1-2 ml), honey effectively reduced enzyme and bilirubin levels, but higher doses (3 ml) were less effective, suggesting a possible saturation effect or unintended metabolic burden [30].

From a broader perspective, these results underline the therapeutic potential of honey in mitigating chemical-induced organ damage, particularly in scenarios of pesticide exposure [31]. This could have practical implications for populations frequently exposed to pesticides, such as agricultural workers, by proposing honey as a natural, accessible remedy. However, the findings also emphasize the importance of dose optimization, as excessive amounts might not provide additional benefits and could even interfere with normal liver function [32].

Conclusion

The result of the study has shown that dichlorvos induces liver toxicity, while treatment with honey ameliorates the toxicity effect**.**

Refererences

1. United States Environmental Protection Agency (USEPA). Dichlorvos TEACH Chemical summary U.S EPA, Toxicity and exposure assessment for children. 2007;1–13.

2. Owoeye O, Edem FV, Akinyoola BS, Rahaman S, Akang EE, Arinola GO. Toxicological changes in liver and lungs of rats exposed to dichlorvos before and after vitamin supplementation. Eur J Anat. 2012;16(3):190–8.

3. Varò I, Navarro J, Amat F, Guilhermino L. Effect of dichlorvos on cholinesterase activity of the European sea bass (Dicentrarchus labrax). Pestic Biochem Physiol. 2003;75(3):61–72.

4. Draz E, Hassan A, Khalil H, Elomary M. Evaluation of pelvic inflammatory disease potential in cholinesterase inhibitor pesticide-exposed females. [Accessed January 29, 2022].

5. Somia E, Madiha F. Pathological effects of dichlorvos and fenitrothion in mice. Pathol Res Pract. 2012;208(5):286–91.

6. Lah K. Effects of pesticides on human healthcare. Toxipedia. 2011. Available from: http://www.toxipedia.org/display/toxipedia/Effects+of+Pesticides+on+Human+Health [Accessed December 29, 2021].

7. Ajibola A, Idowu GO, Ambali AA, Oyefuga OH, Iquot IS. Improvement of some haematological parameters in albino rats with pure natural honey. J Biol Sci Res. 2007;2(1):67–9.

8. Bogdanov S, Jurendic T, Sieber R, Gallmann P. Honey for nutrition and health: A review. J Am Coll Nutr. 2008;27(1):677–89.

9. Havsteen B. The biochemistry and medical significance of the flavonoids. Pharmacol Ther. 2002;96(2-3):67–202.

10. Machado De-Melo A, Almeida-Muradian L, Sancho M, Pascual-Maté A. Composition and properties of Apis mellifera honey: A review. J Apic Res. 2017;57(1):5–37.

11. Chepulis L, Starkey N. The Long-Term Effects of Feeding Honey Compared with Sucrose and a Sugar-Free Diet on Weight Gain, Lipid Profiles, and DEXA Measurements in Rats. J Food Sci. 2007;73(1):H1–H7.

12. Al-Waili N. Effects of Daily Consumption of Honey Solution on Hematological Indices and Blood Levels of Minerals and Enzymes in Normal Individuals. J Med Food. 2003;6(2):135–40.

13. Alvarez-Suarez J, Tulipani S, Díaz D, Estevez Y, Romandini S, Giampieri F. Antioxidant and antimicrobial capacity of several monofloral Cuban honeys and their correlation with color, polyphenol content and other chemical compounds. Food Chem Toxicol. 2010;48(8-9):2490–9.

14. English HK, Pack AR, Molan PC. The effects of manuka honey on plaque and gingivitis: A pilot study. J Int Acad Periodontol. 2004;6(1):63–7.

15. Chepulis L. The Effects of Honey Compared with Sucrose and a Sugar-Free Diet on Neutrophil Phagocytosis and Lymphocyte Numbers after Long-Term Feeding in Rats. J Complement Integr Med. 2007;4(1).

16. Yaghoobi N, Al-Waili N, Ghayour-Mobarhan M, Parizadeh S, Abasalti Z, Yaghoobi Z. Natural Honey and Cardiovascular Risk Factors; Effects on Blood Glucose, Cholesterol, Triacylglycerol, CRP, and Body Weight Compared with Sucrose. Sci World J. 2008;8:463–9.

17. Earnest C, Lancaster S, Rasmussen C, Kerksick C, Lucia A, Greenwood M. Low vs. High Glycemic Index Carbohydrate Gel Ingestion During Simulated 64-km Cycling Time Trial Performance. J Strength Cond Res. 2004;18(3):466.

18. Mobarok Ali AM, Al Swayeh OA. Honey potentiates the gastric protection effects of Sucralofcte against ammonia-induced gastric lesions in rats. Saudi J Gastroenterol. 2003;9(1):117–23.

19. Chepulis L, Starkey N, Waas J, Molan P. The effects of long-term honey, sucrose or sugar-free diets on memory and anxiety in rats. Physiol Behav. 2009;97(3-4):359–68.

20. Alagwu EA, Nneli RO, Egwurugwu JN, Osim EE. Gastric Cytoprotection and Honey Intake in Albino Rats. Niger J Physiol Sci. 2011;26(2):39–42.

21. Ajibola A, Chamunorwa J, Erlwanger K. Nutraceutical values of natural honey and its contribution to human health and wealth. Nutr Metab. 2012;9(1):61.

22. Henry RJ, Cannon DC, Winkelman JW. Clinical Chemistry Principles and Techniques. 2nd ed. Harper and Row; 1974.

23. Jendrassik L, Grof P. Estimation of total serum bilirubin level by spectrophotometrically in serum and plasma. Biochem Z. 1938;297:81–9.

24. Sherlock S. The liver in heart failure: relation of anatomical, functional and circulatory changes. Br Heart J. 1951;13:273.

25. Reitman S, Frankel SA. Colorimetric method for determination of serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT). Am J Clin Pathol. 1957;28:56.

26. Limdi JK, Hyde GM. Evaluation of abnormal liver function tests. Postgrad Med J. 2003;79(932):551–3.

27. Tanvir EM, Rizwana A, Alamgir ZC, Ibrahim K, Sabir H, Abdul R, Harunur. Honey has a protective effect against chlorpyrifos-induced toxicity on lipid peroxidation, diagnostic markers and hepatic histoarchitecture. Eur J Integr Med. 2015;525–33.

28. Babson LA, Greeley SJ, Coleman CM, Philips GD. Phenolphthalein monophosphate as a substrate for serum alkaline phosphatase. Clin Chem. 1966;12:482–90.

29. Bowler PG. Wound pathophysiology, infection and therapeutic options. Ann Med. 2002;34(2):419–27.

30. Dede EB, Igbigbi PS. Determination of LD50 of Metakelfin in rats. J Sci Metascience. 1997;111(1):1–7.

31. Doumas BT, Watson WA, Biggs HG. Albumin standards and the measurement of serum albumin with Bromocresol green. Clin Chem Acta. 1971;31:87.

32. Hagberg C, Georgi R, Krier C. Complications of managing the airway. Best Pract Res Clin Anaesthesiol. 2005;19:641–59.