©IDOSR PUBLICATIONS

ISSN: 2550-7931

International Digital Organization for Scientific Research
IDOSR JOURNAL OF APPLIED SCIENCES 9(2) 1-8, 2024.
https://doi.org/10.59298/IDOSRJAS/2024/9.2.17100

IDOSRJAS9.2.17100

Determination of Concentrations of Pesticide Residues in Chevon obtained from Abattoir of Jimeta, Adamawa State, Nigeria

Ndahi *J. A., Modibbo A. U. and Mukhtar H.

Department of Chemistry, Faculty of Physical Sciences, Modibbo Adama University, PMB 2076, Yola, Nigeria
***Corresponding authors Email: jipsy1965@gmail.com**

ABSTRACT

The current work was aimed at determining levels of Organochlorine (OCP) and Organophosphorus pesticide (OPP) residues in goats obtained from the study area. This was to enable the public aware of the presence of hazardous pesticides residues in the food chain. Forty samples were collected from; Chevon, intestines, kidneys and livers of ten sampled goats. The sampled goats were represented by G1 = first goat, G2 = second goat, G3 = third goat, G4 = fourth goat, G5 = fifth goat, G6 = sixth goat, G7 = seventh goat, G8 = eighth goat, G9 = ninth goat and G10 = tenth goat. Quick, Easy, Cheap, Effective, Rugged and Safe (QuEChERS) was used in preparing the samples. Analysis was done with Gas chromatography – Mass spectrometer (GC/MS) Acqmethod pesticide. Results showed that OCP residues were not detected in all the samples. Anthracene, dichlorpyrifos, diazinon, dimethoate, primifos-methyl, and malathion were detected below the threshold value of 0.001 mg/Kg. Likewise, all pesticide residues in G7 and G9 samples were below the threshold limit (0.001) mg/Kg. Dichlorvos was detected in chevon of G1, G3 and G4 with range from 0.043 mg/Kg in G4 – 0.113 mg/Kg in G1. Chlorpyrifos was detected in intestine of G1, G2, G3, G4, G6, G8 and G10. The highest was 0.051 mg/Kg in G4 and lowest was 0.013 mg/Kg in G10. Kidney samples of GI, G2, G3 and G4 contained chlorpyrifos ranging from 0.011 mg/Kg in G8 – 0053 mg/Kg in G4. dichlovos was detected in kidney samples of G1, G2, G3, G4 and G8. Highest concentration of dichlovos in the kidney was; 0.069 00014 mg/Kg in G1 while the lowest was in G8 (0.011 mg/Kg). Liver samples of G2, G4, G6 and G10 contained chlopyrifos ranging from 0,007 mg/Kg in G10 – 0.050 mg/Kg in G4. dichlovos was present in livers of G2, G4 and G6. Highest was in G4 (0.037 mg/Kg) and lowest value was in G6 (0.021 mg/Kg). Apart from in Kidney of G8, concentrations of chlorpyrifos in all the samples were above the maximum residue level (MRL) values of 0.01 mg/Kg. Consumption of which may pose health problem. Concentration of dichlorvos detected in the samples were below the MRL of 1.00mg/Kg, this may not pose immediate health issues but continuous intake may bring about accumulative health risk issues.

Keywords: Chevon, chlorpyrifos, dimethoate, organophosphorus, malathion, dichlorvos, health, risk

INTRODUCTION

A number of persistent organochlorines (OCP) and highly toxic organophosphates pesticides (OPP) which were banned or severely restricted are still marketed and used in many developing countries. [1] Organochlorine pesticides in the environment are characterized by high chemical stability, poor water solubility and low vapor pressures [2] and are consequently referred to as persistent organic pollutants [3]. Pesticides have been in use in Nigeria since 1940 and have tended to accumulate in soils and sediments. Pesticide uses has a positive and dramatic effect on agriculture production through protection of crops against insects, pest and diseases [4]. For pesticides to be effective against pest, they must be biologically active or toxic. The toxicity of a pesticide is a measure of the capacity of such pesticide to cause injury; it is a property of the chemical that it has to include substances with high

toxic effects and persistence in the environment [5]. Pesticide residues in livestock generally accumulate by two ways, either applied to animals as insecticides or Livestock reared on pesticides contaminated soils, crops and fodders may accumulate considerable pesticide residue in edible tissue [6]. Insecticide usage has high growth potential in Nigeria, on the other hand use of pesticide for agriculture is markedly low compare to other places [7]. For instance, pesticides usage in Nigeria was put at 0.25 Kg/ha as against 0.54 Kg/ha in India, 3.7 Kg/ha in USA and 2.7 Kg/ha in China [8] Notwithstanding, the fact that overall consumption in Nigeria is lower than that used in developed countries of the world, there is wider spread of pesticide poisoning among animals and products preserved with pesticide such as, grains, beans, fruits, vegetables. Example, few studies have shown presence of pesticide residues in fruits and vegetables in some developing countries [9], such as; pesticide residues in vegetable from Karachi [10] and in various tissue of fish in the local lakes [11] Pesticide residues also accumulate on cropland soil [12]. Animals accumulate these toxic substances from contaminated feeds and water and due to the lipophilic nature of these pesticides, milk and other fat-rich substances are the key items for their accumulation [13]. Therefore, an indirect source of pesticides accumulation can be represented by animal derived products. Such pesticide contaminated animal foods are ultimately consumed by humans and therefore these toxicants represent a serious risk for human health. In order to avoid these toxic health hazards, it is necessary to determine the level of pesticides in edible tissue like meat, liver, intestine and kidney of goat. This is because goat is one of the most common animal reared where pesticides are used in the environment.

MATERIALS AND METHODS

Materials/reagents

The following materials were used in the current work: acetonitrile, magnesium sulphate ($MgSO_4$) and sodium chloride (NaCl) all pesticide grades were obtained from reagent trade chemical provider. Other materials include distilled water, polythene zipper bag, electric chopper, and centrifuge. Gas chromatography – mass spectrometer (GC-MS).

Sampling and Sample Preparation

Study Area

The study area of the current work was Yola slaughterhouse in Jimeta, Yola North local government Area of Adamawa State, Nigeria. The town lies along River Benue with coordinates; 9°16′45″N 12°6′45″E. The slaughterhouse is the biggest abattoir in Adamawa State; it serves not only the state capital but also some of the satellite towns in its vicinity. The state is known for farming and raring of livestock especially cattle [13].

Sampling

Sampling was carried out according to method outlined by [14]. Ten (10) goats were randomly selected among those slaughtered on each sampling day for ten consecutive weeks. The meat was collected along with the intestine, kidney and liver. A total of forty (40) samples were collected within a span of two and half months. The samples were packed in polythene zipper bags and labeled as; C_1, I_1, K_1, $L_{1.....}$; C_{10}, I_{10}, K_{10}, L_{10}, representing first samples of (chevon, intestine, kidney, liver) up to tenth samples of (chevon, intestine, kidney, liver). Thereafter, the samples were transported to the laboratory for preparation and analysis.

Extraction of pesticide residue in beef/ organs

Extraction of the samples were carried out according to method outlined by [15] in which ten (10) g of each of the samples was weighed chopped and then homogenized. The ground beef was transferred into a 50-mL centrifuge tube. The sample was extracted using 2 mL water and 10 mL acetonitrile (ACN), followed by vigorous shaking for 1 minute. 4g $MgSO_4$ and 1g of NaCl was also added and vigorously shaken for 1 minute. Thereafter the sample was transferred to the centrifuge and run for 3 minutes at 4000 rpm where 1mL aliquot of the supernatant (top layer) was taken for dSPE clean up. Other samples were sequentially treated accordingly.

dSPE Cleanup

One (1mL) aliquot of the supernatant was transferred to a 2-mL dSPE cleanup tube that contained 150mg magnesium sulfate, 50 mg PSA sorbent, and 50 mg C_{18} sorbent (p/n186004830).

The content was shaken vigorously for 1 minute and a portion of the supernatant was transferred to the LCMS Certified Vial for GC/MS analysis.

Analysis

The analysis was carried out according to method outlined by [16] whereby 1 mL aliquot of the supernatant which was transferred into a certified vial for gas chromatography-mass spectrometry where the Pesticides (organochlorine and organophosphates) residue levels in samples was determined with GC condition: system – Agilent 7890A, agilent technologist inert MSD 5975CM Column; Agilent J and W GC columns HP-5MS30(M) 0.250 DIAM (MM) 0.25 film (UM) Temp Limit 60 to 325 degree Celsius and gas – Helium, flow. The software CSW 32 was used to obtained peak of height and area under curve.

Statistical Analysis

The analysis of all the samples was carried out using the software CSW 32 for the GC-MS instrumentation; the peak height, area under curve and the type of pesticide used were obtained. Statistical Packages for Social Sciences (SPSS) was used to arrive at the mean.

RESULTS

Results of analysis of the samples were presented in figures 1-10. Organochlorine pesticide (OCP) was not detected in all the samples analyzed. This may entail that organochlorine pesticides were not possibly used in the environment where these animals were reared. However, the samples contained some OPP detected at trace levels below threshold of 0.001mg/Kg. These were: anthracene, chlorpyrifos, dichlorvos, dichlorpyrifos, diazinon, dimethoate, primifos-methyl, and malathion. Presence of organophosphorus pesticides detected in the samples might be due to frequent usage by most of the rural farmers and domestic activities in homes and institutions. Only chlorpyrifos and dichlorvos pesticides residues were detected with mean concentration values above the threshold value of 0.001mg/kg. Chlorpyrifos was detected in the intestine and kidney in the ranged of (0.031 ± 0.0014) to (0.013 ± 0.0007) while, dichlorvoswas detected in chevon (goat meat), intestine and kidney in the following order; (0.0113 ± 0.0014), (0.050 ± 0.0007), and (0.069 ± 0.0014).

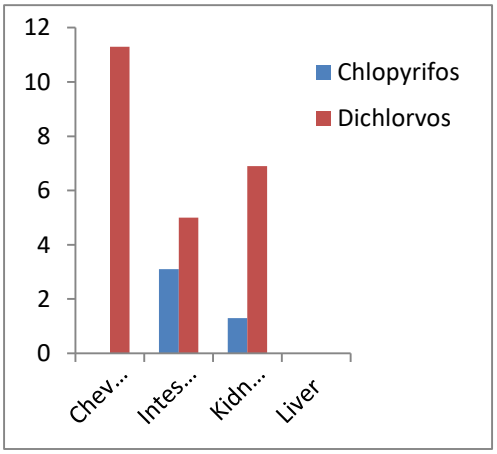

Figure 1: Organophosphate pesticide in sample G 1 (mg/Kg x 10^{-2})

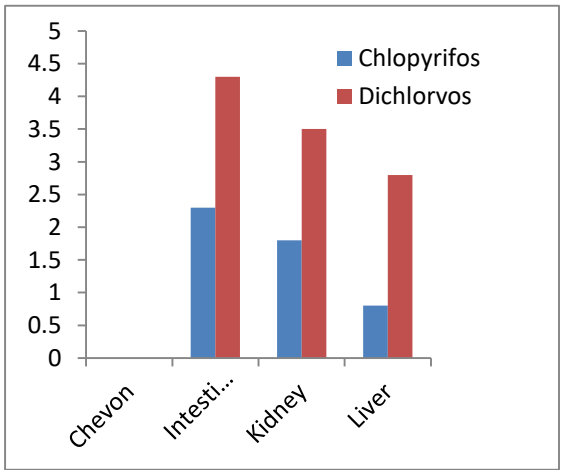

Figure 2: Organophosphate pesticide in sample G 2 (mg/Kg x 10^{-2})

From figure 1, sample G1 contained chlorpyrifos above the MRL values of 0.01 mg/Kg with the corresponding percentage increase of 310% and 130% in intestine and kidney of G1 samples analyzed. This implied that the samples analyzed were contaminated with chlorpyrifos. Dichlorvos determined in G1was significantly below the MRL value of 1.00 mg/Kg, by 1.1%, 5% and 6.9% respectively. G2 samples contained pesticide residues of ; (0.023 ± 0.0014)mg/kg, (0.018 ± 0.001) mg/kg, (0.008± 0.007) mg/kg of Chlorpyrifos in intestine, kidney and liver respectively while; (0.043 ± 0.0014)mg/kg, (0.035 ± 0.0007)mg/kg and (0.028 ± 0.001) mg/kg of dichlorvos were determined in the intestine, kidney and liver respectively. Concentrations of the chlorpyrifos were higher than the MRL values of 0.01 mg/Kg as percentage

increase of 230%, 180% and 130% in the samples analyzed. The sample analyzed for dichlorvos shows, the pesticide residues values to be less than the MRL values of 1.00 mg/Kg with 4.3%, 3.5% and 2.8% less.

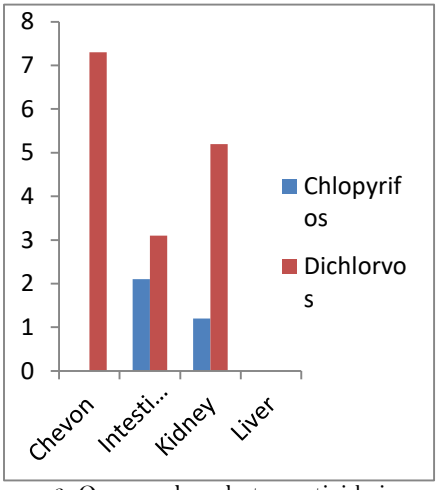

Figure 3: Organophosphate pesticide in sample G 3 (mg/Kg x 10^{-2})

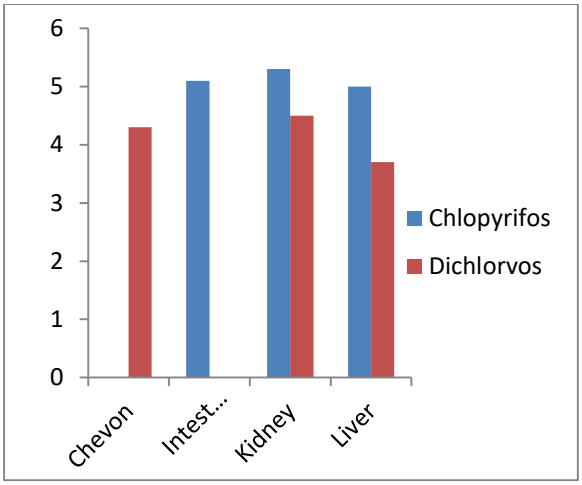

Figure 4: Organophosphate pesticide in sample G 4 (mg/Kg10^{-2})

The following pesticide residues were present in the samples below detection limit of (< 0.001 mg/Kg); Anthracene, dichlorpyrifos, diazinon, dimethoate, primifos-methyl, and malathion. This indicated that pesticides of this nature were not possibly use in the environment where the animals feed chlorpyrifos and dichlorvos were detected in the chevon, intestine and kidney of G3 samples. The mean pesticides residues were; (0.021 ± 0.0014) mg/Kg and (0.012 ± 0.001) mg/Kg of Chlorpyrifos and (0.073 ± 0.0014) mg/Kg, (0.031 ± 0.001) mg/Kg and (0.052 ± 0.0014) mg/Kg of dichlorvos. This shows that the concentrations of the pesticide residues of chlorpyrifos are higher than the MRL values of 0.01 mg/Kg (figure 3). In G4 samples Organophosphorus pesticides residues, with particular emphasis to chlorpyrifos was detected in the intestine, kidney and liver in the following pattern; (0.011 ± 0.0014, 0.009 ± 0.0007 and 0.013 ± 0.007)mg/kg respectively (figure 4) while, dichlorvos was present in Chevon, kidney and liver in the following order; (0.043 ± 0.000, 0.045 ± 0.0014), and 0.037 ±0.0007)mg/Kg. Levels of chlorpyrifos in G4 were above the MRL values of 0.01 mg/Kg with the corresponding percentage increase of 110%, 90% and 130% in intestine, kidney and liver of the G4 samples analyzed. Dichlorvos was significantly below the MRL value of 1.00 mg/Kg, with 4.3%, 4.5% and 3.7% respectively. These low concentrations may be due to the route through which the pesticide entered animal possibly through drinking water and hence might be highly diluted.

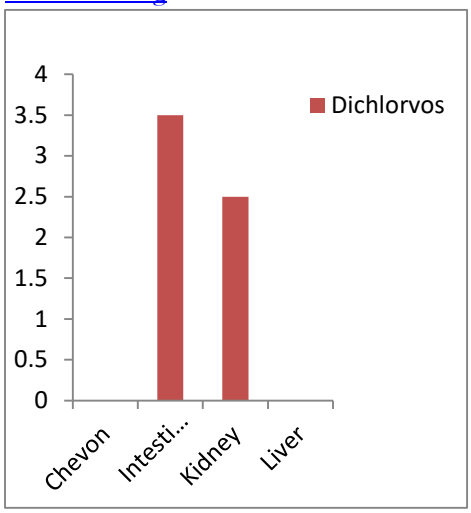

Figure 5: Organophosphate pesticide in sample G5 (mg/Kg x 10^{-2})

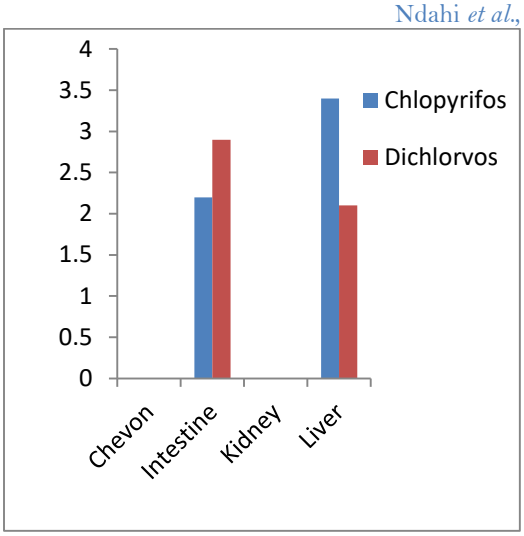

Figure 6: Organophosphate pesticide in sample G6 (mg/Kg x 10^{-2})

Result for analysis of G5 sample as seen in figure 5 yielded only one type of OPP. Dichlorvoswas detected in the intestine, and kidney with values of (0.035 ± 0.0014 and 0.021 ± 0.0007)mg/Kg all the pesticides have residues in G5 samples beyond the detection limit of the device. These were; anthracene, chlorpyrifos dichlorpyrifos, diazinon, dimethoate, primifos-methyl, and malathion.G6 samples contained; (0.029 ± 0.0014 and 0.038 ± 0.0007)mg/Kg Chlopyrifos in intestine and liver samples respectively while, the value of dichlorvos detected in intestine and liver of G6 samples was; (0.029± 0.0014 and 0.021± 0.001)mg/Kg respectively. The Concentration of chlorpyrifos pesticide residues in G6 was above the recommended MRL value of 0.01 mg/kg. However, concentration of dichlorvosis low compare with the MRL values of 1.00 mg/Kg, which translate to percentage decrease of 2.9% and 2.1%.in intestine and liver samples of G6 respectively. According to [16] 2008) the positive decrease in pesticide residues are due to seasonal variation in weather and the low usage of pesticides in the environment or region. G 7 samples contained Anthracene, chlorpyrifos Dichlorvos Dichlorpyrifos, Diazinon, Dimethoate, Primifos-methyl, and Malathion beyond the detection limit of the device. (figure7)

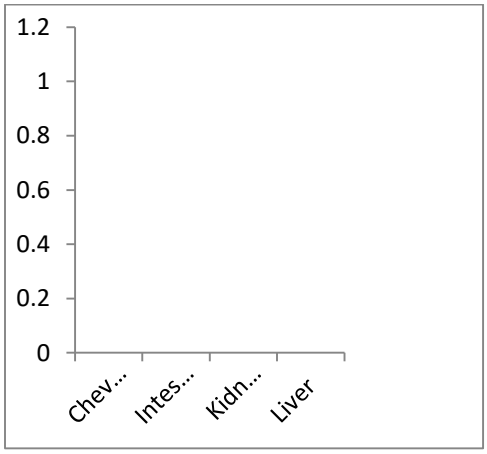

Figure 7: Organophosphate pesticide in sample G7 (mg/Kg x 10^{-2})

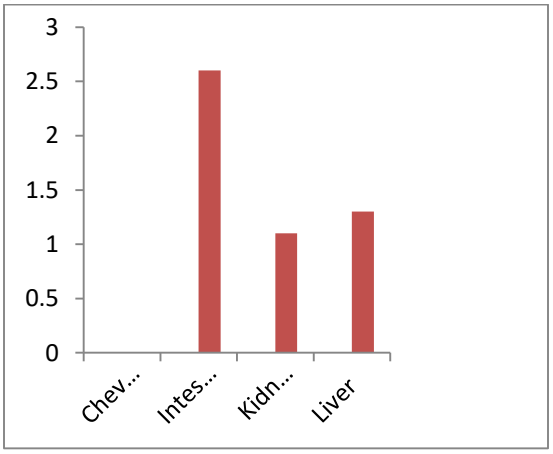

Figure 8: Organophosphate pesticide sample G8 (mg/Kg x 10^{-2})

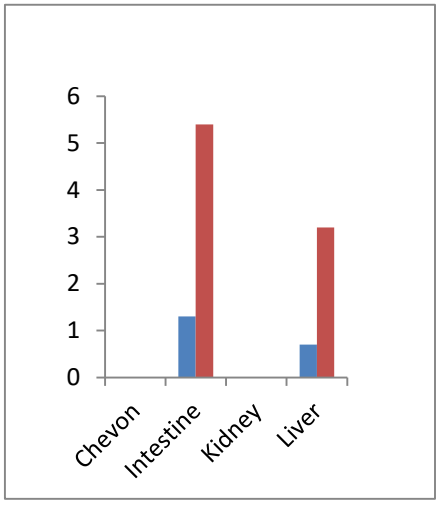

Figure9: Organophosphate pesticide in sample G10 (mg/Kg x 10^{-2})

Figure10: Organophosphate pesticide in sample G9 (mg/Kg x 10^{-2})

Only dichlorvos pesticide residue was detected in samples from G8. This was detected in intestine, kidney and liver as; (0.026 ± 0.0014, 0.011 ± 0.0007 and 0.013 ± 0.0007) mg/Kg. This result shows the concentration of dichlorvos below the MRL values of 1.00 mg/kg with percentage decrease of 2.6%, 1.1% and 1.3%. G9 samples contained OPP too low to be detected by the device. This could either be due to none use of these pesticides in the environment or the systematic error; that deals with faulty instruments or equipment, procedural error, personal error and indeterminate error which deals with irregular and unpredictable occurrences that may affect accuracy [17]. Organophosphorus pesticide residues were detected in intestine and liver of G10 samples as: chlopyrifos, (0.013 ± 0.0014 and 0.007 ± 0.0007) mg/Kg respectively and dichlorvos, (0.054 ± 0.0014 and 0.032 ± 0.001)mg/Kg respectively. The concentration of chlopyrifos pesticide residue was above the recommended MRL value of 0.01 mg/Kg with percentage increase of 130% and 70%. On the hand, concentration of dichlorvos detected was low compared with the MRL values of 1.00 mg/Kg with percentage decrease of 5.4% and 3.2%.

CONCLUSION

Organochlorine pesticide residues were not detected in the current study. Eight Organophosphorus pesticide residues registered their presence in the samples, these were; anthracene, chlorpyrifos, dicchlorvos dichlorpyrifos, diazinon. dimethoate, primifos-methyl and malathion. Only chlorpyrifos and dicchlorvosout of the eight OPP have concentrations within the detection limit of the instrument (0.001mg/Kg). Concentrations of anthracene, dichlorpyrifos, diazinon. dimethoate, primifos-methyl and malathion were below the detection limit of the device. Possibly reasons for the low concentrations of the pesticide residues include; low usage in the vicinity of where the animals were reared, seasonal variation or nature of the chemical composition of the compounds. The concentrations of chlorpyrifos pesticides residues in the internal organs were higher than the MRL. The concentration of dichlorvos residues was lower than MRL. Lower concentrations of pesticide residues entail no acute toxicity while higher concentration such as found in chlorpyrifos from the current study may bring about health risk. Despite the aforementioned, combination of processing steps cause marked reduction of pesticide residues or complete removal in meat [18] for instance, boiling of meat for ninety minutes reduces pesticide residues by 30-55% [19,20].Therefore, concentrations pesticides entering ingested by man may not be as detected by nevertheless, it is recommended that pesticides are threat to public health, livestock and the environment hence usages should be strictly regulated by and occasional monitoring of the animals slaughtered in the abattoirs be intensified.

Acknowledgement

The author wish to thank management of Modibbo Adama University, Yola and Tetfund (IBR) for provision of financial grant for this research work.

REFERENCES

1. Essumang D.K., Togoh G.K. and Chokky l. (2009). Pesticide residues in water and fish (lagoon tilapia) samples from lagoons in Ghana. *Bull. Chem. Soc. Ethiopia. 23(1):19-27*

2. WHO (1986). Organophosphate Insecticides: A general Introduction. *Vol.63. World Health Organisation.* New York.

3. Darko, G., Akoto, O., and Oppong, C. (2008). Persistent organochlorine pesticide residues in water, sediment and fish samples from lake Bosomtwi, Ghana.*Chemospheres 72(1):21- 24*

4. Sharma, N., Lakshmanan, V. & Singh, C.M. (1984). Pesticide Residues in Livestock Products with Special Reference to Meat. *Indian Food Industry. (3):52-56*

5. Ndahi J. A., Maitera O. N., Kubmarawa D. and Joseph J. I. (2020). Studies on levels of pesticide residues in beef obtained from abattoir of Jimeta, Adamawa State Nigeria. *Nigerian Res. J. Chem.Sci. 8(1):339-348.*

6. Tongo, I. & Ezemonye, L. (2015). Humans health risks associated with residual pesticides levels in edible tissues of slaughtered cattle in Benin City, Southern Nigeria. *Toxicology reports 2:1117 – 1135*

7. Banti M., Shukla G. and Taneja A. (2004). Contamination levels of Organochlorine pesticides and farmers' Knowledge, perception, practices in rural India- A case study. *Bull. Environ. Contamination and Toxicology. (73):787-793.*

9. Mathur, H.B., Agarwal, H.C., Johnson, S., and Salkia, N. (2005) Analysis of Pesticides Residues in Blood Samples from Villages of Punjab; *CSE / PML / PR – 21.*

10. Tahir, S., Anwar, T., Ahmad, I., Aziz, S., Mohammad, A., and Ahad, K. (2001 Determination of pesticide residues in fruits and vegetable in Islamabad market.*J. Environ Biol. 22(1): 71 – 4*

11. Perveen, Z., Khubro, M.T and Rafig.N (2005). Monitoring of pesticide residue in vegetable (2000 – 2003) in Karachi, Pakistan

12. Afful S., Anim A.K., and Serfor-Armah Y. (2010). Spectru of Organochlorine Pesticide residues in fish samples from the Densu Basin *Res.J.Environ Earth Sci. 2(3):133-138*

13. Jabbar, A.S.Z. Masud, Z. Perveen and A. Mubarik. 1993. Pesticides residue in Cropland Soils and shallow groundwater in Punjab, Pakistan Bull. Envirn. Contain Toxicol. 51(2): 112 – 8.

14. John P.J., N. Bakore and P. Bhantnagar. 2001. Assessment of organochlorine pesticides Residue levels in dairy milk and buffalo milk from Jaipur city, Rajasthan, India, Environment International 26:231:236

15. Herrera A., Agustin A., Arino A., Conchello M. P., Lazaro R., Bayarri S. and Perez C. (1994) Organochlorine pesticide residues in Spansh meat products and meat of different species. *J. food protection* 57:441-444

16. Maitera, N. O, Hitler, L., Bata, S. Y., Adeleye, T. A., Akakuru, U. O. &Magu, O. T. (2018). Comparative Analysis of the Level of Pesticide Residues in Beef, Chevon and Internal Organs of Cows and Goats Slaughtered in Yola Abattoir of Adamawa State, Nigeria.*Current WorldEnvironmen*t. 13(3):416-423

17.Gazzotti, T. P. Sticca, E. Zironi, B. Logoboni, A. Serraino and G.Paglica, (2008).Determination of 15 organophosphorus pesticides in Italian Raw Milk.*Bulletin of Environmental Contamination and toxicology, 82: 251-524*

18. Christian G. D. (2004). Analytical Chemistry, 6th ed. John Wiley and Sons (Asia,), Singapore. Pp 66-67

19 Hefnawy Y.A., Fathi S., M., Abdullahi A. T. and Gadalla M. N (2001). Accumulation of DDT residues in slaughtered rabbit tissues. *Veterinary medical Journal 44(88):109-118.*

20. Sallama K. I. and Morshedy M. A. A. (2008). Organochlorine pesticide residues in camel, cattle and sheep carcasses slaughtered in Sharkia Province, Egypt. *Food Chemistry 108:154-164*

CITE AS: Ndahi J. A., Modibbo A. U. and Mukhtar H. (2024). Determination of Concentrations of Pesticide Residues in Chevon obtained from Abattoir of Jimeta, Adamawa State, Nigeria. IDOSR JOURNAL OF APPLIED SCIENCES 9(2) 1-8. https://doi.org/10.59298/IDOSRJAS/2024/9.2.17100