A STUDY OF FACTORS ASSOCIATED WITH POTENTIAL HUMAN EXPOSURE TO PESTICIDES AND LEVELS OF LEAD, COPPER AND ORGANOCHLORINE RESIDUES IN FISH AND SOIL SEDIMENTS IN KIRINYAGA SOUTH DISTRICT

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ABSTRACT

Exposure to pesticides, heavy metals and other chemical residues poses health risk to human beings and farm animals. This may occur directly or indirectly especially during pesticide application by farmers when carrying out various agricultural activities. This study was therefore carried out in Kirinyaga South district with an overall objective of identifying factors that are associated with potential exposure of farmers and farm workers to commonly used pesticides and determining levels of copper, lead and organochlorine pesticide residues in fish and soil sediments.

Information was gathered from one hundred and fifty two (152) farmers and farm workers on the extent of possible exposure to pesticides. Data were gathered using structured questionnaires, on some agricultural practices that may lead to exposure of human to pesticides. The levels of copper, lead and organochlorine residues were determined in tilapia, catfish and soil sediments which were sampled during the months of December 2009 and May 2010 from Thiba and
Nyamindi Rivers and the Canal joining the two rivers. The concentration of Lead (Pb) and Copper (Cu) in each sample was determined using Atomic Absorption Spectrophotometry technique. The types and quantities of organochlorines were determined using Gas Liquid Chromatography technique.

The data was subjected to descriptive statistics and Analysis of variance (ANOVA) to tests level of significance at 95% confidence limit using Statistical Package for Social Scientists Statistics 17.0 version. The results showed that commonly used pesticides belonged to chemical groups of organophosphates, pyrethroids, carbamates, Ivermectin, amitraz, strobilurin and neonicotinoid. The biological pesticide used was Bacillus thurigiensis. Farmers who reported having been trained on handling of the pesticides were 13.8%. Majority (85%) of the farmers kept farm chemicals in a store away from the living house. Use of Personal Protection Equipment was reported by 49.3% of the farmers. Types of Personal Protection Equipment used by farmers included gumboots, coats and jackets 19.1%, gumboots and overall 17.1 % and gumboots, overall and facial masks 8.55%. Disposal methods of empty pesticide containers were burning 27.6%, burying 16.5%, and both burning and burying 37.5%. A total of twenty nine (29) health effects were reported, where itchy skin accounted for 20.8 %, runny nose 13.1 %, eye problems 9.8% and dry throat 9.3 %.

The mean concentration of lead in tilapia was 5.61±1.81 ppm ranging from 2.50 to 9.66 ppm and in catfish was 5.64±1.79 ppm ranging from 2.00 to 9.00 ppm. The mean concentration of copper in tilapia was 8.28±8.87 ppm, ranging from 0.50 to 33.33 ppm and in catfish was 3.63±5.20 ppm, ranging from 0.50 to 25.66 ppm. The mean concentration for copper was significantly different (p <0.05) between tilapia and cat fish such that tilapia had significantly high levels.
Concentration of copper was also significantly different (p <0.05) between the sampling months of December and May such that December had significantly high levels.

The mean concentration of lead in soil sediment was 18.73±9.59 ppm ranging from 6.80 to 66.40 ppm. The mean concentration of copper in soil sediment was 19.26±5.75 ppm ranging from 11.20 to 34.40 ppm. Soil sediment from Thiba River had the highest amount of lead, 66.40 ppm while the lowest level of 6.80 ppm was from Nyamindi River. The Canal soil sediment had the highest amount of copper, 34.40 ppm and the lowest level of 11.20 ppm was from Nyamindi river. The mean level of copper was significantly different (p <0.05) between the sampling sites such that the canal had significantly high levels.

In the analysis of organochlorines in fish samples, p,p’DDE was the only detected organochlorine in 38% of the samples. The mean p,p’DDE concentration in fish from Nyamindi river was 16.9 ±5.4µg/g ranging from 9.1 to 21.6 µg/g while that in Thiba river was 24.1± 11.48 µg/g ranging from 10.3 to 50 µg/g. Since p, p’DDE is a metabolite of DDT; the results imply earlier use of DDT in the environment.

The information gathered indicates there was lack of training on handling of pesticide to majority of the farmers which may contribute to agricultural practices with potential for exposure of humans to pesticides directly or indirectly. A comparison of levels of copper and lead in fishes with the recommended safe limits by FAO (1983) and EC (2001) shows that the levels of copper are within the recommended safe limits. However the levels lead exceeded the permissible safe limits. The levels of p, p’DDE were higher than the recommended safe limit by FDA (2001). It is, therefore, recommended that training on handling of farm chemical be offered in training institutes accompanied by regular analysis for concentration of heavy metals organochlorine residues and other pesticides in foodstuff and environment.