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Perceived Impact of Agrochemicals on Human Health and Environment among Farmers in Nsukka Agricultural Zone, Enugu State

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Abstract

The aim of this study was to determine the impact of agrochemicals on human health and environment. Three specific objectives and one hypothesis guided the study. Descriptive cross-sectional survey research design was adopted for the study. The study was conducted in Nsukka agricultural zone among farmers. Population for the study was 5800 full-time farmers in Nsukka agricultural zone. Multi-stage sampling was used to draw a sample of 400 farmers. Instrument for data collection was a researcher designed questionnaire consisting of 15 items. The face validity of the instrument was established by three experts from the department of Human Kinetics and Health Education. Reliability of the instrument was established using split half method and reliability coefficient of .78 was obtained using Cronbach alpha. Data was collected by the researcher with the help of two research assistants from each community. Frequencies and percentages were used to analyze the data. Results indicated that high proportions (66.4%, 63.1%) of farmers indicated that agrochemicals impact negatively on health and environment respectively, and there was significant difference in the impacts of agrochemicals among farmers based on levels of education. The findings of the study concluded that high proportions of the farmers indicated that agrochemicals impact negatively on human health and environment. The study recommended that farmers association should periodically organize workshops to share opinions on the benefits, dosage and type of agrochemicals to reduce exposure to agrochemicals and its adverse effects on human health and environment.

Keywords: Perceived impacts, Agrochemicals, Health, Environment, Farmers, Nsukka

Introduction

Farming is an occupation and source of livelihood for many people in Nigeria especially among rural dwellers. Agriculture employs over 70% of the active labour force in Nigeria (Jones, et al., 2015). People engage in farming for family consumption as well as for commercial purposes. Agriculture provides food, employment and raw materials for other industries. However, in other to increase agricultural yields for family consumption, make economic gains and ensure food security, farmers have to deal with various threats such as controlling weeds and pests. Muhibbullah and Sarwar (2018) referred to pests as natural enemies affecting crops and may include weeds, insects, slugs, snails, rats and mice. Weed is any

plant growing in cultivated ground to the injury of the crop or desired vegetation or to the disfigurement of the place; an unsightly useless, or injurious plant (Meena et al. 2020). Weeds and insects, if left unabated are capable of destroying entire crops and animals resulting in waste of efforts and economic loss. At subsistence level of agriculture, farmers use local methods to control pests such as fencing, setting traps, and building scare crows to scare birds and other animals. Farmers also used animal dung and household waste to enrich the soil, and fed animals with local grasses. But when farming is for commercial purposes, vast farm land is usually involved, requiring more extensive approach to controlling pests and weeds, and improving yield through the use of agrochemicals.

Agrochemicals are substances used to control weeds and pests as well as improve agricultural yields. Muhibbullah and Sarwar (2018) defined agrochemicals as a generic term for various chemical products, such as fertilizer, hormone, fungicide, insecticide, or soil treatment that improves the production of crops. Meena et al. (2020) indicated that any substance used to control, repel, or kill plant or animal life is a pesticide, and the group includes herbicides, insecticides and fungicides which are being used indiscriminately for ensuring higher productivity by eliminating or suppressing pest population. Sharma et al. (2019) stated that currently, two million tonnes of agrochemicals are used per year on the global basis, most of which are herbicides (50%), insecticides (30%) and fungicides (18%) and other types such as rodenticides and nematicides. These farmers applying the agrochemicals may be ignorant of the toxic effects on the human health and environment, but focused on increasing agricultural products to maximize profits. Pesticide exposure even at low levels over a long period of time, can cause a variety of chronic human health problems, such as cancers, reproductive and endocrine disruption, neurological damage and immune system dysfunction (Awadh et al., 2018). Jallow et al. (2017a) observed that agrochemicals have become an integral part of present-day farming and play a role increasing agricultural productivity. Extensive use of agrochemicals can result in detrimental impacts on human health and environment.

Impacts of agrochemicals can be studied under the impacts on human health (farmers and consumers) and environment (air, water and soil). Detrimental effects of agrochemicals on farmers and consumers are enormous. World Health Organization (2019) noted that about (20%) of the approximately 800,000 people who die from suicide every year do so by ingesting pesticides. According to Huvistendahi (2013), farmers and agricultural workers are exposed to a wide range of pesticides in concentrations capable to impose adverse health effects. Furthermore, living very close to farm areas has been found to increase the risk of suffering from agrochemical pollution (Bombadi, 2017). Sharafi et al. (2018) reported that the most prevalent health symptoms among the respondents were irritation of eye, skin, throat and nose. Lekei et al. (2014) reported that the prevalent symptoms among the farmers studied in Tanzania were skin irritation, headache and flu and that 68 per cent of farmers have felt sick after regular use of pesticides. Jallow et al. (2017b) reported that most farmers agreed that pesticide

use, pose some risks to human health and the environment. These risks include eye, respiratory, skin, headache and breathing problems as a result of inhalation, mixing with food and exposed parts of the body (Muhibbullah & Sarwar, 2018). The minor health problems emanating from agrochemical applications among farmers can culminate to serious health problems such as skin cancer, throat cancer, blindness and even death.

Inappropriate use of agrochemicals affects not only the farmers and agricultural workers but also the consumers who use the agricultural products. This is because food crops moved into market for human consumption may still retain residue of the agrochemicals. High concentration of pesticides on agricultural products impact negatively on the human health and environment as has been reported by several studies (Franklin et al., 2017; Ighayebzadeh et al., 2016; Pasder et al, 2017; Pirsahel et al., 2016; & Sharafi et al., 2018). Excessive use of agrochemicals has also been found to affect the surrounding environment. Other researchers, Muhibbullah and Sarwar (2018) noted that pesticides can contaminate the soil, the air, water used for domestic purposes, the grasses for domestic animals and overall environment; Sharafi et al. (2018) noted that pesticides can enter fish and meat if there are livestock breeding places and fish ponds around the crop farm while Ram et al. (2020) summarized that prolonged and indiscriminate use of agrochemicals adversely affected the soil biodiversity, agricultural sustainability and food security, bringing in long-term harmful effects on nutritional security, human and environment. This is because agrochemicals sprayed in agricultural fields can volatized into the air contaminating the air and making it unfit for health. The agrochemicals can also be carried by run-off waters into the streams and rivers affecting the fishes and making the water unfit for human consumption. In addition, farmers often wash their tools and work clothes in nearby streams and river banks, which can as well contaminate the water sources. Nsukka agricultural zone, have different streams, rivers and springs which the indigenes depend on for agricultural and domestic purpose. There is the tendency that the agrochemicals can contaminate the water and its habitat.

Level of education and knowledge of farmers is a crucial factor in the selection and application of agrochemicals. Previous studies by (Franklin et al., 2017; Gaber & Abdel-Latif, 2012; Oliverira et al., 2012; Sharma et al., 2019; & Sheikh et al., 2014) which indicated that education is related to the impacts of agrochemicals among the farmers. The authors observed that educated farmers are more likely to attend training on agrochemicals and tend to observe the producer's instructions to minimize the adverse outcome and ensure safety, unlike the illiterate farmers.

Farmers in Nsukka agricultural zone produce different types of food crops such as yams, cocoyams, rice, maize, watermelon, cassava, cucumber, pepper, vegetables and others; and rear animals such as cows, goats, sheep, and poultry. They are not left out in the use agrochemicals to improve yield. Yet there are very limited studies on the perception of these farmers on the negative impacts of agrochemicals on human health and environment. Therefore, this study aims at filling this research gap.

Objectives of the study: Specifically, the study examined the:

1. perceived impacts of the use of agrochemicals on human health among farmers in Nsukka agricultural zone;
2. perceived impacts of the use of agrochemicals on environment among farmers in Nsukka agricultural zone and
3. determine the relationship between educational qualification and perceived impacts of use of agrochemicals on human health among farmers in Nsukka agricultural zone.

Hypothesis: There is no significance difference on the perceived impacts of use of agrochemicals on human health among farmers based on level of education.

Methods and Materials

Study design: Descriptive cross-sectional survey research design was adopted for the study.

Population for the study: Population for the study was all full-time farmers in Nsukka agricultural zone totally 5800 (Nsukka Agricultural Zone, 2021). Nsukka agricultural zone is one of the six agricultural zone in Enugu State. This zone is made up of three local government areas which are Uzo-Uwani, Nsukka and Igbo-Etiti. Majority of the people in these areas are farmers who depend on farming as a source of livelihood.

Sample and Sampling Techniques: The sample for the study consisted of 400 farmers. The sample was selected using the formula described by Cohen, et al., (2018). Multi-stage sampling technique was used to draw the sample for the study. The first stage involved the use of purposive sampling technique to select two Local Government Area (L.G.A) out of three L.G.A's. in the Nsukka agricultural zone. Thus, Nsukka and Uzo-Uwani L.G.As were selected. Stage two involved the use of proportional sampling technique to select only the communities in the two L.G. As that have full-time farmers. Proportionate sampling was deemed necessary because majority of the people in Uzo-Uwani L. G.A. are full-time farmers. Four communities were selected from Nsukka LGA (Lejja, Ede-Oballa, Okpuje and Okutu while in Uzo-Uwani six (6) communities were selected thus: Adani, Nkpologwu, ogurugwu, Ugbene-Ajima, Ukpabi and Adabaa. Third stage involved the use of simple random sampling technique of balloting without replacement to select ten villages. The fourth stage is the use of purposive sampling to select 400 farmers comprising of 160 from Nsukka L. G. A. and 240 from Uzo-Uwani L.G.A.

Instrument used for data collection: Instrument for data collection was a researcher's structured questionnaire called perceived impacts of agrochemicals on human health and environment among farmers (PIAHHE), consisting of sixteen items. Ten items determined the impacts of agrochemicals on human health while six items determined the impacts of agrochemicals on environment. Response options are "Yes" and "No". Percentages of 0-19% was interpreted as very low, 20-39% as low, 40-59% as moderate, 60-79% as high and 80% and above as very high proportions

Validation of the Instrument: The face validity of the instrument was established by three experts from the

department of Human Kinetics and Health Education.

Reliability of the instrument: Reliability of the questionnaire was established using split half method and reliability coefficient of .78 was obtained using Cronbach alpha.

Data Collection Techniques: Permission letter duly approved was obtained from the Chairmen of Farmers association and traditional rulers of the selected communities. Data were collected by the researcher with the help of two research assistants from each community.

Data Analysis: Frequencies and percentages were used to analyze the data. Percentages of "Yes" 0-19% was interpreted as very low, 20-39% as low, 40-59% as moderate, 60-79% as high and 80% and above as very high proportions. The hypothesis was verified with Chi-square analysis at .05 level of significance.

Results

Result in Table 1 shows that generally, a greater proportion (66.4%) of farmers indicated that agrochemicals impact negatively on human health. The most perceived impacts of agrochemicals on human health were chest pain (69.5%), headache (68.5%), physical weakness (63.0%), eye irritation (75.5%0, skin rashes and itching (75.2%) and throat and nose irritation (76.5%).

Table 1: Percentage response on perceived impacts of use of agrochemicals on human health among the farmers

Health symptoms	Yes F (%)	No F (%)	Decision
Chest pain	278(69.5)	122(30.5)	High
Eye Irritation	302(75.5)	98(24.5)	High
Headache	274(68.5)	126(31.5)	High
Skin rashes/itching	301(75.2)	99(24.7)	High
Excessive salivation/ vomiting	247(61.7)	153(38.2)	High
Difficulty in breathing	241(60.2)	159(39.7)	High
Dizziness	236(59.0)	164(41.0)	Moderate
Coughing	221(55.2)	179(44.7)	Moderate
Physical weakness	252(63.0)	148(37.0)	High
Throat and Nose irritation	306(76.5	94(23.5)	High
Overall %	**66.4**	**33.5**	**High**

Key: 0-19% -= very low, 20-39% = low, 40-59% = moderate, 60-79% = high while 80% and above is interpreted as very high, (N=400).

Result in Table 2 shows that high proportions (66.4%) of farmers asserted that agrochemicals impacted negatively on the environment. Pollution of the air (62.5%), contamination of the streams and rivers (65.0%), damage to the soil fertility (70.0%) and remnants of agrochemicals on food crops (73.5%) were the most perceived agrochemical impacts on the environment.

Table 2: Percentage response on perceived impacts of the use of agrochemicals on environment among farmers

Impacts on environment items	Yes f (%)	No f (%)	Decision
Agrochemicals pollute the air.	250 (62.5)	150 (37.5)	High
Agrochemicals can contaminate streams and rivers.	260 (65.0)	140 (35.0)	High
Agrochemicals can kill fishes in the streams and rivers.	221(55.2)	179 (44.7)	Moderate
Bystanders and those living close to farm lands can be affected by agrochemicals.	210 (52.5)	190 (47.5)	Moderate
Agrochemicals can damage the soil fertility	280 (70.0)	120 (30.0)	High
Agrochemicals remaining on food crops and livestock are harmful to human health	294 (73.5)	106 (26.5)	High
Overall %	**63.1**	**36.8**	**High**

Key: 0-19% -= very low, 20-39% = low, 40-59% = moderate, 60-79% = high while 80% and above is interpreted as very high, (N=400).

Table 3 shows that very high proportions (92.5%, and 84.7%) of farmers with no formal and primary education asserted that agrochemicals impacts negatively on health, while low proportions (35.5% and 28.8%) of farmers with secondary and tertiary levels of education indicated that agrochemicals impact negatively on human health. Table 3 also shows that there was a significant difference in the perceived impacts of the use of agrochemicals on human health among farmers (p = .024).

Table 3: Percentage responses on perceived impacts of use of agrochemicals on human health among farmers and summary of chi-square analysis based on level of education

	Levels of education					
Health symptoms	**No formal (n=130) f (%)**	**Pri. (n=110) f (%)**	**Sec. (n=90) f (%)**	**Ter.(n=70) f (%)**	**χ2**	**P value**
Chest pain	122(93.8)	98(89.0)	36(40.0)	22(31.4)		
Eye Irritation	126(96.9)	104(94.5)	42 (46.6)	30 (42.8)		
Headache	121(93.0)	100 (90.9)	32 (35.5)	21 (30.0)		
Skin rashes/itching	123 (94.6)	103 (93.6)	47 (52.2)	28 (40.0)	9.47	0.024*
Excessive salivation/ vomiting	120 (92.3)	92(83.6)	25 (27.7)	10 (14.2)		
Difficulty in breathing	119(91.5)	86 (78.1)	22 (24.4)	14 (20.0)		
Dizziness	118 (90.7)	81 (73.6)	23 (25.5)	15 (21.4)		
Coughing	108 (83.0)	72 (65.4)	25 (27.7)	16 (22.8)		
Physical weakness	122 (93.8)	93 (84.5)	21(23.3)	16 (22.8)		
Throat and Nose irritation	125 (96.1)	104 (94.5)	47 (52.2)	30 (42.8)		
Overall %	**(92.5)**	**(84.7)**	**(35.5)**	**(28.8)**		

Key: 0-19% -= very low, 20-39% = low, 40-59% = moderate, 60-79% = high while 80% and above is interpreted as very high, (N=400).

Discussion

The finding of the study showed that high proportions (66.4%) of the farmer asserted that use of agrochemicals impacts negatively on human health. This finding indicates that the farmers might be generally knowledgeable about the negative effect of indiscriminate and extensive use of the agrochemicals on farm lands. This also may be due to the non-compliance with the use of personal protective equipment in agrochemical applications among farmers. This is consistent with the findings of previous studies by (Jallow et al., 2017a; Lekei et al., 2014; & Sharafi et al., 2018) that reported impacts of agrochemicals on human health among the respondents. The finding of the study showed that high proportions (75.5%) of the respondents are of the opinion that the use of agrochemicals causes eye irritation. This could be that the farmers mix and apply the agrochemicals without wearing eye glass or google to protect their eyes. This is in line with the findings of Sharafi et al. (2018) which observed that high proportion (80.70%) of the respondents in their study also reported eye irritation as an effect of use of agrochemicals among the farmers.

The result of the study further indicated that high proportion (75.2%) of the farmers reported skin rashes/ itching as impact of agrochemicals on human health. This might be that the farmers do not wear the aprons or overalls meant to protect their body from the adverse effect of agrochemicals. This is in support of the study of Lekei et al. (2014) which indicated that the most prevalent health symptom was skin irritation but in contrast with the findings of Muhibbullah and Sarwar (2017) which observed that very low proportion (13.63%) of the farmers in

their study reported skin irritations as an outcome of agrochemicals on human health. The findings of the study also showed high proportion (76.5%) of the farmers reported that throat and nose irritation are among the effects of agrochemicals on human health. This might be that the respondents were not using face masks to prevent inhalation of the chemicals. This is similar to the findings of Sharafi et al. (2018) which observed that high proportion (72.2%) of the participants reported that throat and nose irritation are outcomes of agrochemicals on human health. The similarity may be due to the similarity of the respondents with intention to increase productivity and maximize profit.

The finding of the study also showed that greater percentage (68.5%) of the participants reported headache as one of the impact of agrochemicals on human health. This could be due to absorption of the chemicals into the nervous system which can cause nervousness and headache. This is in congruence with the study of Miah et al. (2014) which noted that respondents reported that excessive use of chemicals can damage the nervous system of the body and that the toxicity and dust particles as residues of agrochemicals may create headache among the users through inhaling system. The similarity may be due to the fact that all the farmers are interested on how to increase productivity to maximize profit forgetting to protect themselves with personal protective equipment from the adverse effect of the agrochemicals.

The result of the study showed that impact of agrochemicals on environment is enormous. The respondents in the study unanimously asserted that agrochemicals have negative impacts on environment (plants, soil, water, air, fishes, livestock, and others). This could be due to the fact the farmers spray the agrochemicals with the sprayers which can be carried by the wind or rain water to contaminate the environment. This is in support of the findings of the previous studies by Muhibbullah and Sarwar (2018), Sharafi et al. (2018) and Ram et al. (2020) which noted that excessive use of these agrochemicals is creating detrimental effects on plants, soil, water, fish ponds, feeding grasses sand overall environment. This may be due to the run-off water carrying the agrochemicals and partly because farmers bath and wash clothes worn during farming activities in the streams and banks of the rivers. Another reason could be due to extensive and repeated use agrochemicals affecting the soil fertility.

The findings of the study further showed that high proportion (73.5%) of farmers reported that agrochemicals residue on crops and animals are harmful to health. This corroborates with the findings of several studies by (Franklin et al., 2017; Ighayebzadeh et al., 2016; Pasder et al., 2017; Pirsahel et al., 2016; & Sharafi et al., 2018) which observed that high concentration of pesticides on agricultural products are harmful to human health and environment. The food crops with high concentrations of the agrochemicals when consumed repeated for prolonged period can result to more serious health problems such as asthma and skin /throat cancer, blindness and even death.

Result of the study presented the impacts of agrochemicals on human health among farmers based on level of education. Findings of the study showed

that there was significant difference in the impacts of agrochemicals on human health based on level of education. This result is not surprising as the educated farmers are more likely to attend training on agrochemicals and tend to observe the producer's instructions to minimize the adverse outcome and ensure safety unlike the uneducated counterparts. This corroborates with the findings of previous studies by Olverira et al. (2012) that stated that educated farmers are more knowledgeable about pesticide safety, have better ability to read, understand pesticide safety, understand and follow hazard warnings on labels and conceptualized the consequences of poor pesticide usage practices. Shekh et al. (2014) also observed that low level of education could result in using agrochemicals that are not appropriate for a specific service. Gaber and Abdel-Latif (2012) further noted that farmers who received school education had more knowledge about the negative effects of pesticides on health and routes of contaminations with pesticides, and Sharafi et al. (2018) noted that relationship between level of education and pesticide use are statistically significant. Educated farmers had higher tendency to read labels of pesticides containers, follow the instructions in the application of the agrochemicals, wear the personal protective equipment and to take precautions after coming in contact with pesticides.

Conclusion

Agrochemicals are essential in the present day's farming to protect the crops from pests and to increase productivity. However, the agrochemicals impact negatively on human health and environments. The findings of the study concluded that high proportion of the farmers confirmed that agrochemicals impact negatively on human health and environment. Greater impact was reported among the less educated farmers indicating the role of education in adequate safety precautions and proper use of agrochemicals in the production of plants and animals for human consumption.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Farmers association should periodically organize workshops to share opinions on the benefits of using dosage and type of agrochemicals to reduce exposure to agrochemicals and its adverse effects on health and environment.
2. Agricultural extension workers should make periodic visits to the farmers to inculcate in them the proper use of agrochemicals.
3. Government in collaboration with the ministry of health, agriculture and environment should ensure that farmers adhere to the agrochemical guidelines and principles. Government should also endeavour to organize pesticide training for the farmers.

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