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Research Article

Safety Measures and Health Issues among Pesticide Applicators in Foumbot Agricultural Area, West Region, Cameroon

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Abstract:
Several reports have raised the misuse of pesticides in the protection of crops in the Foumbot agricultural area. This study aims at evaluating the health status of pesticide operators in the said area. 127 farmers were interviewed out of which 30 were selected for medical check-up. A diagnostic was done on the liver status and a physical checkup on the eyes, the respiratory system and the skin of 30 selected pesticide applicators following the medical laboratory routine examination. The skin of users was diagnosed for itching, prickling, irritation and burns; the eyes for sight troubles, stinging, wateriness; the respiratory system for catarrh, cough , difficulties in breathing and chest constriction; the liver status was estimated using two enzymes: Aspartate Amino-Transferase (ASAT) and Alanine Amino-Transferase (ALT). As results: pesticides used are from three main classes and belong to classes II and III toxicity: insecticides (cypermethrin, most used), fungicides (ethylenebisdithiocarbamates) and herbicides (paraquat and glyphosate). 40% of workers showed liver alteration, the skin of workers was affected and revealed itching, prickling, irritation and burns; the eyes showed sight troubles, stinging and wet eyes; the respiratory system was affected with catarrh, cough, difficulties in breathing and chest constriction; 40% of workers showed liver alteration. The poor safety measures observed affects the health of workers. Pesticide users in the Foumbot agricultural area manifested symptoms and signs related to pesticide effects on human beings. A study is now needed to do a follow-up on a particular group of people for a long term toxicity study.

Keywords: pesticides, health status, sprayers, safety measures

I. Introduction

Synthetic pesticides have been widely overused by farmers in Cameroon in general and in the Foumbot agricultural area in particular. In this area, vegetables are the most produced foods alongside maize and beans. They are produced throughout the year and have significantly contributed to food security in the zone [1]. The main vegetable crops cultivated are green beans (*Phaseolus vulgaris* L.), green pepper (*Capsicumannuum*L.), watermelon (*Citrillus lanatus* L.), leeks (*Allium porrum* L.), tomato, lettuce (*Lactucasativa* L.), amaranth (*Amaranthus cruentus* L.), huckleberry (*Solanum scabrum* Mill.), carrot (*Daucus carota* L.), pepper (*Capsicum frutenscens* L.), cabbage (*Brassica oleraceae* var. *capitata* L.) and traditional vegetables. Foumbot is one of the major tomato growing zones in Cameroon together with Santa [2]. Low yields have been observed and may be attributed to many factors including the susceptibility of the crop to diseases (late blight, early blight), insects such as melon fruit fly (*Daucus cucurbitae*), whitefly (*Bemisia tabaci*) and spider mite (*Tetranychus urticae*) [3,4]. It is known that, late blight can cause up to 100% yield losses while early blight which is less dangerous, may cause 30-60 % yield losses [5].The environmental conditions are favorable for the development of these pests and diseases . To fight against these pest attacks, pesticides which today are considered as a vital component and an integral part of modern agriculture are being used. Observations done by Tarla et al. revealed the fact that, there is an abusive and inadequate use of pesticides to manage pests and diseases in the area [1]. This has led farmers to achieve major progress in foodstuff production via the application of pesticides. Farmers' knowledge on pesticides and their safe use is critical for implementing effective pest management programs when considering their education. The following pesticides are reported to be commonly used: insecticides (classes II and III toxicity: Cypermethrin, Chlorpyrifos-ethyl, Lambda-cyhalothrin, Acetamiprid, Imidachloprid and Spinetoram); fungicides such as (Mancozeb, Maneb, Metalaxyl , Copper oxide) and herbicides like (Glyphosate and Paraquat) [1].

The misuse of pesticides is characterized by the wrong application of spraying parameters such as doses, spraying frequencies, time before harvest which are not respected [2,6].

These factors have certainly increased the level of contamination of the environment and affect the farmers/workers [7, 8]. They also increase the amount of residues in food at harvesting time, and the environment that will be certainly affecting consumers, pesticide sprayers, famers and biota due to their toxicity [9]. Farmers are then exposed to these toxins due to a lack of technical knowledge on pesticide handling, mixing, and spraying. In addition, safety measures meant for self-protection from exposure are not always respected. They are poorly dressed when it comes to wear protective clothing. The effects of pesticides on human health have been noticed in many places where they are applied. Some ailments found among similar practices are abdominal pain, dizziness, headaches, nausea, vomiting, skin irritation, cancers, eye problems (eye watering), frequent cough/catarrh and reproductive problems [2]. These symptoms are very common in areas where these pesticides are used and wherever there is a continuous exposure of users with no effective protective clothing. They may be associated with other factors but these signs and symptoms are characteristics of exposure to pesticides.

Some spraying factors have been evaluated and probabilistic effects on operators estimated. Their knowledge, aptitude and practices on pest management have been shown to be very poor and this will surely affect the application of spraying parameters with health risks on applicators and consumers of farm produce. Data from *Programme national de dévelopement participatif* (PNDP) indicates insufficient assistance given to farmers by agri-technicians who do not exist in the area [10]. Consequently, the farmers are not aware of good agricultural practices (GAP). The same data shows the poor quality of agrochemicals used which affected the productivity and exposure of workers because they must give more input if they expect to have good productivity. This may lead to the abusive use of chemicals since farmers are poorly organized and pests may become resistant. This study aims to evaluate some safety measures taken by pesticide operators and the health implications on their liver integrity and their physical (skin, eyes and nostrils) health status. This will throw more light on the database and contribute to the PNDP's guide to make the right decisions in view of training farmers on the application of agrochemicals. This information will be submitted to the Ministry of Agriculture and Rural Development (MARD) for more action on what concerns technical assistance to farmers during cropping.

II. Material and Methods

II-A) Area of Study

Foumbot is a sub-division situated in the Noun Division of the West Region of Cameroon. Its geographical coordinates fall under 5° 16′ to 5° 35′ N; 10° 30′ to 10° 45′ E; 1100-1300 masl with 120 m (390 ft) elevation for a total surface area of 579 Km^2 [10]. The annual rainfall varies between 2500 and 5000mm [11]. There are two seasons: the rainy season which runs from mid-March to mid–November and the dry season which takes place between mid-November and mid–March. The population which is mainly farmers is estimated at 90,406 inhabitants. More than the half of the people live in the rural area where farming is the main activity. Ethnic groups are the Bamoun's, Bamiléké's, Banso's and Mbororo's [10]. Foumbot is a major tomato and other vegetables growing zone in Cameroon [1]. The following villages were visited for for this work (the number of farmers selected is in brackets): Fosset (4), Fossang (7), Kouffen (11), Soukpen (8).

II-B) Data Collection

II-B-1) Survey: Data Collection and Tool.

Three groups of farmers, officially registered at the Ministry of Agriculture and Rural Development (MARD) based in the study area were formally contacted for the project. A total number of 127 farmers were interviewed using a pretest questionnaire and 30 farmers were finally selected to be part of the sampling population. The following criteria were used to select the sample: be free from Hepatitis A, B and C; have a normal body mass index and do not drink alcohol. After selection, 30 questionnaires were administered to them for the first stage of the study (survey on pesticide usage). The questionnaire was made up of open and closed questions based on demographic data, work practices, experiences and safety measures.

The 30 selected farmers were invited to the hospital for an anthropometric physical examination and liver health status testing.

II-B-2) Anthropometric Examination

The 30 selected farmers were submitted to a physical examination for eyes, skin and respiratory tract, which are routes for pesticides to penetrate the body. The following signs and symptoms were searched for by a medical doctor according to clinical facts: skin (itches, tingles, irritation and burns); eyes (vision disorder, tingling, watering) and respiratory tract (rheum, cough, breathing difficulties). This general check-up was carried out according to the day-to-day routine rules in looking for eye, skin and respiratory tract infections and for any abnormalities in a health center.

II-B-3) Evaluation of the Liver Health Status

In order to detect lesions or dysfunction of the liver due to the effects of pesticides, blood samples were collected from the 30 subjects, to determine the quantity of the 2 liver enzymes: Aspartate Amino-Transferase (AST) and Alanine Amino-Transferase (ALT). These are two enzymes that have been identified as serum biomarkers of pesticides toxic effect. All the tests were done within two weeks. Blood was collected at the close fold of the elbow. The two enzymes were analyzed using the Beckman UniCel® DxC800 Synchron method described by Collaborative Laboratory Services L.L.C (CLS)-2008 and 2002 for ALT and AST respectively in the refrigerated serum. This diagnosis was done according to routine medical check-up for a normal patient.

II-C) Statistical Analysis

Data from the survey were manually codified, computerized and processed using Excel software 10.0. Statistical data

analysis was performed using the package SPSS 16.0 software. A descriptive statistical analysis was done to generate frequencies and tables.

III. Results and Discussion

III-A) Characteristics of the Studied Population

Table 1 gives information concerning the sex, age, training and experience of the studied population. Males represented 43% of the sampled population. Their ages vary from 25 to 48 years with the majority found between 31 and 42 (63%) versus 13% of people aged between 42 and 48 years old. The untrained respondents represent the greatest part of the sampled population (70%). The years of experience given by farmers vary from one to thirteen years with more than 46% who have a minimum of 4 years and a maximum of 9 years and 87% with experience varying from 9 to 13 years.

Table 1: Characteristics of the Population Studied

Factor	Parameter	n	Age				Training		Experience (years)		
	N=30		[25-30]	[31-36]	[37-42]	[43-48]	Untrained	Trained	[1-4]	[5-9]	[10-13]
Sex											
	Male	13(43)	2(15)	4(31)	5(38)	2(15)	8(62)	5(38)	1(8)	9(69)	7(54)
	Female	17(57)	5(29)	5(29)	5(29)	2(12)	13(73)	4(18)	3(29)	5(29)	5(29)
	Total	30 (100)	7(23)	9(30)	10(33)	4(13)	21(70)	9(30)	4(13)	14(47)	12(40)

Table 2: Pesticides Used and Using Parameters

Class	Commercial names	Active ingredient	Toxicity class	n (%)	Frequency (time/week/crop cycle) 2	3	4	5
	Cigogne 50 EC	Cypermethrin	II	5(17)	-	2	2	1
Insecticides	Cyperplant 100 EC	Cypermethrin	II	4(13)	1	1	1	1
	Akito 25 EC	Beta-Cypermethrin	II	3(10)	1	-	1	1
	Acarius 018 EC	Abamectin	II	1(3)	-	-	-	1
	Capt Forte 184 WG	Lamda-cyhalothrin	II	3(10)	-	1	1	1
	Eforia 045 ZC	Thiametoxan + Lamda-cyhalothrin	II	2(7)	1	-	1	-
	Titan 25 EC	Acetamiprid	II	1(3)	-	1	-	-
	Cytrine 25 EC	Cypermethrin	II	2(7)	-	-	-	2
	Pegasus 250 EC	diafenthriuron	III	1(3)	-	-	-	1
	Cypercal 50 EC	Cypermethrin	II	5(17)		2	2	1
	Parastar 40 EC	Imidacloprid+ Lamda-cyhalothrin	III	2(7)	1	-	-	1
	Eforia 45 ZC	Thiametoxam	II	1(3.3)	1	-	-	-
	Total : 12	8		30(100)	5(17)	7(23)	8(27)	10(33)
	Plantineb 80WP	Mabeb	III	5(17)	2	-	2	1
Fungicides	Mancoxy plus 720 WP	Metalaxyl + Mancozeb	III	4(13)	-	1	2	1
	Cleanzeb Blue 80WP	Mancozeb	III	3(10)	-	1	-	2
	Penncozeb 80WP	Mancozeb	III	7(23)	-	1	3	3
	Fongistar 72%WP	Metalaxyl + Mancozeb	III	3(10)	1	-		2
	Mancostar 80WP	Mancozeb	III	2(7)	1	-	1	-
	Manco 80WP	Mancozeb	III	4(13)	1	2	-	1
	Trimangol 80WP	Maneb	III	2(7)		2	-	-
	Total : 8	3		30(100%)	5(17)	7(23)	8(27)	10(33)
Herbicides	Suprazone Royal	Paraquat	II	11	2	9	-	-
	Amistar 720 SL	2,4-D Sel Amide	III	8	1	7	-	-
	Casse-tout	Glyphosate	III	15	7	8	-	-
	Total : 3	3		25(83.3%)	10(33)	24(80)	-	-

Toxicity class according to WHO: III = Slightly hazardous, II = Moderately hazardous

III-B) Pesticides Used and Spraying Factors

Pesticides used include fungicides, herbicides and insecticides. Table 2 gives more details of their characteristics. According to these statistics, 12 mixtures with eight different active ingredients are used by sampled farmers as insecticides.

Among this class of pesticides, cypermethrin represents 63% of active ingredients compared to lamda-cyalothrin, imidacropid and others. Their toxicity varies from class II (moderately toxic) to class III (slightly hazardous). This abundant use is also observed with two fungicides (maneb and mancozeb) which are used in all combinations (100%). Only two concoctions contain mancozeb mixed with metalaxyl. They are all classified as slightly hazardous substances according to WHO (1965) toxicity classification. Concerning herbicides used, only three were reported, among which glyphosate is used at 50% followed by paraquat (37% and 2.4-D). It can be said that for the all pesticides, users commit themselves to particular molecules. They can vary the type of mixtures but the contents remain the same with changes in concentration.

The frequency of the number of exposures by spraying per sampled farmer varies from 2 to 5 times per week. This depends of the size or the farm or of the number of farms owed by a given farmer and type of crop cultivated. The distribution is similar between insecticides and fungicides which vary from 17 % to 33%. But herbicides can be used two or three times per crop cycle or for a different field. However, spraying three times (80%) is more frequent than twice (20%).

III-C) Relationship between Factors: Age, PPE Use, Sex and Clinical Status

III-C-1) Liver Health Status.

The livers of 40% of the sampled farmers were both affected following the AST and ALT tests (table 3) Males' livers are more affected than those of females for both tested enzymes. The age seems not to influence the affection since they are equally affected. However respondents aged from 37 to 42 are more affected than others. The protective measures taken up by farmers show a reduction of infections on the health of the liver, at least for the factors measured. It is evident that those who used their simple clothes or adequate clothing in addition to gloves/boots/nose mask; gloves/boots/nose mask/goggles and adequate clothes/gloves/boots/nose mask/goggles were not affected. Contrarily, those with simple clothes only or with added boots or nose mask were the only affected ones; with a majority of farmers who wear simple clothes with no additional accessories. However, only one person who uses PPE during mixing was affected. In terms of years spent doing the activity, the more the number of years of experience increases, the more the liver infection increases too. Only examined farmers with more than 5 years of experience had liver dysfuntioning.

III-C-2) Skin Health Issues.

Among the farmers examined, 77% had skin concerns which varied from itching, tingling, irritation to burning. Tingling was the most frequent symptom. Symptoms cover the all ages. As observed with liver dysfunctioning, skin problems of farmers are linked to the wearing of protective clothing. Those with adequate dressing have no affected skin. Even at the preparation phase, the use of safety clothes is still effective in the sense that few farmers were suffering for tingling and itching (21%). Itching and tingling are almost the only symptoms (75%) found among farmers according to the number of years spent in the activity.

III-C-3) Eye Problems.

Farmers also had eye problems except those who use adequate protective clothes or at least goggles on regular basis (23%). The remaining (77%) were had at least one of the following symptoms: vision disorder, tingling or/and watering which are almost equally manifested. They do not use goggles at all. The same observation was made with mixing. The distribution of affected farmers is not age dependent because, according to table 4, there is no particular age range that is most affected. This remark remains valid with the number of years of experience because affected farmers are distributed all over the ranges of years of experience.

III-C-4) Respiratory Tract Health Status.

The following symptoms were diagnosed among farmers after medical diagnosis: rheum, cough and breathing difficulties. 20 farmers (67%) among the samples had respiratory difficulties. All of them were aged above 37 years old. None of them is used to a nose mask (table 4) since the remaining (33%) were wearing protective clothes, regularly or at least, a nose mask on a regular basis. This observation is confirmed by their regular wearing of a nose mask during mixing because no farmer manifested related symptoms after diagnosis among those who used PPE. However, the number of affected farmers increases with the number of years of experience with a high value for breathing difficulties: 65% for more than ten years' experience.

Table 3: Linkage between Age/PPE Use/Sex and Clinical Status

Factor	Parameter N=30	n (%)	Liver Affected (%)	Skin health status (%)				Eyes health status (%)			Respiratory tracts health status(%)		
Sex				Itching	Tingling	Irritation	Burning	Vision disorder	Tingling	watering	Rheum	Cough	Breathing difficulties
	Male	13(43)	7(58)	2(40)	5(39)	0(0)	3(75)	4(29)	6(75)	9(64)	3(50)	3(75)	5(50)
	Female	17(57)	5(42)	3(60)	8(61)	1(100)	1(25)	10(71)	2(25)	5(36)	3(50)	1(25)	5(50)
	Total affected	30 (100)	12(40)	5(13)	13(43)	1(3)	4(13)	14(47)	8(27)	14(47)	6(20)	4(13)	10(33)
Age	[25-30]	7(23)	1(8)	0(0)	2(15)	0(0)	1(25)	1(7)	2(25)	2(14)	0(0)	0(0)	0(0)
	[31-36]	9(30)	3(25)	3(60)	3(23)	1(100)	0(0)	7(50)	3(38)	4(29)	0(0)	0(0)	0(0)
	[37-42]	10(33)	5(42)	1(20)	6(46)	0(0)	2(50)	5(36)	2(25)	6(43)	5(83)	1(25)	6(60)
	[43-48]	4(14)	3(25)	1(20)	2(15)	0(0)	1(25)	1(7)	1(13)	2(14)	1(17)	3(75)	4(40)

Use of PPE during spraying	Simple clothes only	8(27)	8(67)	2(40)	6(46)	1(100)	0(0)	3(21)	5(63)	7(50)	5(83)	3(75) 7(70)
	+boots	3(10)	3(27)	2(40)	1(8)	0(0)	1(25)	1(7)	0(0)	3(21)	1(17)	1(25) 3(30)
	+nose mask	5(17)	1(8)	0(0)	4(31)	0(0)	0(0)	4(29)	2(25)	3(21)	0(0)	0(0) 0(0)
	+Gloves/boots/nose mask	7(23)	0(0)	0(0)	2(15)	0(0)	0(0)	6(43)	1(13)	1(7)	0(0)	0(0) 0(0)
	+Gloves/boots/nose mask/goggles	3(10)	0(0)	1(20)	0(0)	0(0)	3(75)	0(0)	0(0)	0(0)	0(0)	0(0) 0(0)
	Adequate clothes/Gloves/boots/nose mask/goggles	4(13)	(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0) 0(0)
Use of PPE at mixing		15(50)	1(8)	1(20)	4(15)	0(0)	0(0)	5(36)	0(0)	3(21)	0(0)	0(0) 0(0)
Experience (years)	[1-4]	4(13)	0(0)	0(0)	2(15)	0(0)	0(0)	2(14)	2(25)	4(29)	0(0)	0(0) 0(0)
	[5-9]	14(47)	4(33)	3(60)	9(69)	1(100)	1(25)	12(86)	5(63)	8(57)	5(83)	0(0) 2(20)
	[10-13]	12(40)	8(67)	2(40)	2(15)	0(0)	3(75)	0(0)	1(13)	2(14)	1(17)	4(100) 8(80)

III-D) Safety Measures and Knowledge among Pesticide Users

Factors taken into consideration to evaluate the application of safety measures are training and experience since they can influence other components such as: storage area, validity verification and treatment given to containers. This is evidence since table 4 shows only 30% of the sampled population being trained to use pesticides.

III-D-1)Storage Area.

Farmers store their chemicals mainly in three places: Farms, Warehouses and Living rooms. The three storage places are equally used but warehouses are mostly used by trained farmers while living rooms and farms are mostly used by untrained farmers. It can be noticed that one or more places can be used by one farmer. The living room here refers to any place found in the house. The number of years of experience seems not to influence the keeping place of pesticides since there no significant differences between the storing areas.

III-D-2) Validity Verification and Treatment of Containers

The validity verification is based on the expired date, the intended use and manufacturer instructions. Up to 80% of the sampled population checked for the legitimacy of the pesticide to be used. All of those who did this exercise are trained and some are untrained . However, the more the number of years of experiences increases, the more the attention that is given to the validity value of agrochemicals.

Treatment given to containers after use varies from burning, throwing on the farm, reuse in the house and reuse on the farm. All the trained farmers sampled were either burning or reusing pesticide containers on the farms while there was no particular way to treat containers after use by the untrained population. However, burning and reuse on the farm remain the most used way of managing pesticide containers after usage (90% and 53 % respectively). These two ways are mostly applied by the most experienced farmers (more than 5 years) at 73% and 50% respectively for burning and farm reuse.

III-E) Discussion

The equal number noticed between men and women pesticide applicators, indicates that the activity involves both genders. There is no distinction between farmers in terms of sex. The age of more active groups (25-48 years old) is an indicator of the robustness of the activity. Therefore, people who want to involve themselves should have enough strength. It can then be understood why among the 127 persons interviewed only 30 met the selection criteria. This was also studied by PNDP during the collection of development data to establish the needs of the population [10]. Training here generally is done at many levels like formal training in a formal education system, seminars organized by the Ministry of Agriculture and Rural Development or by Non-Governmental Organizations (NGOs). But if knowledge, attitude and practices are acquired by apprenticing, the person is considered to be untrained. Many are educated as observed by Pouokam et al. but at times do not have the aptitude in practicing agriculture [7]. They have invested themselves in agriculture because of the lack of jobs. The years of experience reflect the age of the studied population with no or less pesticide related symptoms and signs. This is different from what was found among famers in a similar context at the Santa agricultural area where farmers were found to have up to 30 years of experience in using pesticides [2].

The effects of pesticides on the heath of consumers, applicators or occupational population have always been observed among people who have been exposed. The effects of exposure are generally diagnosed or observed after long term contact. Many body parts are generally affected as after a buildup in body parts such as the liver, adipositic tissues or entry routes like the eyes, nostrils, the mouth or skin. It was demonstrated by Somayyeh et al. that the liver is seriously damaged after long exposure to organophosphorous [12]. The liver was then identified to be the primary target organ for organophosphorous pesticide.

The frequent spraying of the above active ingredients testifies to the favorable environment for plant diseases development and their effectiveness. The same molecules have been used since decades in various mixtures or commercial names in which concentrations are often modified or set as a combination of more than one active molecule. It has been reported from the same area that, the choice of a pesticide depends on the availability instead of the specificity of a crop pathogen [1]. This is because farmers do not have regular technical assistance from trained technicians. Many documents have been established to evaluate these needs but very few actions have been taken because these pesticides have the same source as established by Sonchieu et al. and Pouokam et al. in the Santa agricultural area [7,8].

The products are packaged locally by representatives of companies in Cameroon such as: FIMEX, JACO, ADER, PHYTOGRAIN and TROPICASEM amongst others.

Table 4: Safety Measures Taken by Pesticides Users and Knowledge

Factor	Parameter N=30	n (%)	Storage area			Validity verification		Treatment of containers			
			Farm	Ware House	Living room	Yes	No	Burning	Throwing on the farm	Reuse in the ho use	Reuse on the farm
Training	Untrained	21(70)	7(64)	2(18)	6(75)	15(62)	6(100)	18(72)	3(100)	5(100)	13(81)
	Trained	9(30)	4(36)	9(82)	2(25)	9(38)	0(0)	7(28)	0(0)	0(0)	3(19)
	Total	30(100)	11(37)	11(37)	8(27)	24(80)	6(20)	25(83)	3(10)	5(17)	16(53)
Experien ce (years)	[1-4]	4(13.3)	2(18)	2(18)	0(0)	2(8)	2(33)	3(12)	1(33)	1(20)	1(6)
	[5-9]	14(46.7)	6(55)	5(45)	3(38)	13(54)	1(17)	11(44)	1(33)	2(40)	9(56)
	[10-13]	12(40)	3(27)	4(36)	5(62)	9(38)	3(50)	11(44)	1(34)	2(40)	6(38)

The figures in brackets indicate respective percentages

Metalaxil sold in two compositions (Mancoxy plus 720 WP and Fongistar 72%WP) in combination with mancozeb has been banned from use in Cameroon since 2016 and stocks should be exhausted from markets by 2019. But it is still being sold and used, thus exposing consumers and spraying operators who at times are farmers or pesticides workers moving from one farm to another.

The high level of Aspartate Transaminase (AST) and alanine transaminase (ALT) found among farmers is strong evidence that they are facing pesticide application problems. The years of experience and the high percentages of affected people who first declared that they did not have any liver affection show the severity of the risk and chronic diseases that may be encountered in the area. The fact that 97 famers were left out because they did not meet the criteria, may cause more serious liver problems. It is true that the increases in AST and ALT are often accompanied by increases in the inflammatory mediator tumor necrosis factor alpha (TNF-α) but selected samples were not smokers [13]. In humans, higher AST and ALT were also reported in tobacco farmworkers in India [14]. This is a very serious issue. As such, a study can be conducted for any cancer cases since Schmeisser et al. identified an association between occupational pesticide exposure and liver cancer [15]. Work carried out by Patilet al. showed that hematologic parameters, liver and kidney function among exposed pesticide sprayers increased liver function marker enzymes-serum aspartate transaminase, alanine transaminase, and alkaline phosphatase [16].

Lung function and respiratory symptoms have been observed from pesticide exposure among farmers with a low level of lung function (prebronchodilator FEV1, FEV1/FVC); mild and moderate/severe airway obstruction [17]. This can justify the breathing difficulties, rheum and cough observed among farmers since all types of pesticides are involved in the area under study. Ayaz et al. reported that the level of hemoglobin reduces among pesticide sprayers and since these components are responsible for oxygen transportation, obviously, they will face breathing difficulties because of the lack of oxygen [18].

The skin affection is evident because personal protective clothing is poorly worn. The exposure to pesticides has shown increased risk of cutaneous melanoma with the use of maneb/and mancozeb [19].

The severity of pesticide poisoning depends on the pesticide's chemical makeup (active ingredients and chemical properties) and formulation (additives' toxicity); its fate in the body, the amount that enters the body, and the length of exposure. Wearing PPE can greatly reduce the potential for dermal, inhalation, eye, and oral exposure. This significantly reduces the chances of pesticide poisoning, but it does not necessarily eliminate it [20]. The systematic use and the type of material worn during mixing, spraying and care giving after spraying are factors that influence the penetration of pesticides in the body. Many of these pesticides are with vapor pressure and can pollute the environment. This becomes evident when they are stored in a confined environment like a poorly ventilate house, living room or storing room as is the case in this study.

The same diseases have been reported by Sonchieu et al. in similar conditions among pesticide sellers. Many cases of containers being reused have been reported. This increases the exposure and poisoning by digestion. The poor knowledge on checking information concerning the validity of the mixture refers to regulatory safety measures which should keep users away from using expired, unregistered or inadequate plant products [8, 20]. The Institute of Food and Agricultural Sciences (IFAS) [21, 22] recommends to all pesticide handlers (applicators, mixer/loaders, flaggers, and early-entry agricultural workers) to follow all adequate PPE instructions that appear on the products' label. This will help to have minimum PPE application of instructions mentioned by manufacturers during handling [23, 24]. The reused containers are for keeping seeds, drinking water, house use and other domestic usages that are sometimes more responsible for home intoxication [25].

IV. Conclusion

Poor safety measures and ignorance of pesticide operators based in the Foumbot agricultural zone has led to the affection of their skin, eyes and respiratory system and liver. Pesticide related signs and symptoms increase with the number of years of experience. An extended examination can be done to evaluate pesticide residues in their biological fluids and for deeper diagnostics in other organs. Educational programs are necessary for farmers and pesticide operators to improve upon their knowledge of spraying pesticides parameters.

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