

## Special Article - Pesticides

# Handling Conditions and Pesticide-Related Signs/Symptoms among Agrochemical Sellers in Bafoussam Municipality, West-Cameroon

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Many untrained pesticide sellers in Cameroon sell pesticides in agro-shops and warehouses narrow and poorly ventilated. The aim of this study was to evaluate the knowledge, practices, pesticide-related diseases and handling conditions among pesticide sellers in Bafoussam municipality (West Region, Cameroon). 70 Agro-shops were systematically visited and questionnaires were administered to the selected pesticide sellers who were more experienced and who spend more time in the shop. As results, it was observed that headaches (38%), skin irritation (19.7%), nausea (39.6%), shortness of breath (28.1%) and running nose (23.9%) were symptoms exhibited by pesticide sellers; pesticides were stored either in the shops or in warehouses; safety measures generally applied by pesticide sellers were sitting outside the shop, taking charcoal solution, drink palm oil, and the use of protective clothing; only 41.14% of sellers had less than 5 years of experience in selling pesticides; permanent pesticide sellers were exposed to chronic intoxication; some of the employees in some shops were not trained on pesticides handling and will manipulate pesticides with no protection. Most respondents were exposed to pesticide related symptoms and there is a need to focus further studies on analyzing pesticide residues in biological fluids and to evaluate damages occurred because of occupational exposure. It becomes more necessary for employees to be trained before they handle pesticides and selling conditions being ameliorated.

**Keywords:** Pesticide sellers; Signs/symptoms; Pesticide exposure; Pesticide handling

**Abbreviations**

DDT: Dichlorodiphenyltrichloroethane; AChE: Acetyl Choline-Esterase; NGO: Non-Governmental Organization; PPE: Personal Protective Equipment; GAP: Good Agricultural Practices; WHO: World Health Organization.

**Introduction**

Pesticides are poisonous chemicals known to produce adverse effects in humans. There are many sources of pesticide contamination to humans including food, water, and air. Chemical pesticides are widely used in Cameroon and other countries for agricultural production. In 2018, more than 600 pesticide products were approved for use in various food stuffs in Cameroon [1]. It has become an integral part of present-day farming and plays a major role in increasing agricultural productivity. According to standards set by World Health Organization [2], only pesticides that are safe to farmers and farm-workers, other non-target species and the consumers should be used in agricultural production. But the safer pesticides are often either more expensive or less efficacious. Consequently, farmers purchase contraband pesticides from shop owners and other fraudulent means. However, the unsafe, indiscriminate and extensive use of pesticides represents one of the major environmental and public health problems all over the world [3]. Their harmfulness has been demonstrated by previous studies, such as the deleterious effects

of DDT-related compounds on Lake Apoka (Florida) alligators [4].

Exposure to pesticides evidenced by storage of related residues in human tissues and excretion in urine [5,6,7] were demonstrated to be associated with immune suppression, hormone disruption, cancer, and reproductive abnormalities [8]. Active pesticide molecules belonging to various chemical groups are able to interact with the normal functioning of living systems, and therefore can alter various metabolic pathways to create numerous pathologies [1]. In the same light exposure to chemical pesticides is one of the most significant occupational risks among users in developing countries as they can easily get in contact with the pesticides, for example, when mixing the chemicals [9]. Also, the carelessness, together with the handling conditions of these chemicals, which very often are unfair [10,11], make the population living in these countries, good candidates for hazards by pesticides.

Pesticide poisoning is gradually becoming a major public health concern in Cameroon. Studies of exposure to pesticides in Cameroon are still in infancy, yet this country with a population of about 20 million inhabitants is heavily relying on agriculture for its economy [11]. Many reports state that about 75% of total employment is in agricultural sector, and pesticide subsector was liberalized in 1990 [12]. Previous studies [13] found that the main cause of pesticide poisoning was ignorance about its dangers. Users confront a particularly high risk of pesticide poisoning due to the added risk

from their occupational exposure through pesticide management when mixing, applying, spraying, transporting, storing, taking care of equipment, reentering into the field, spillage, and doing careless disposal. The incidence of pesticides poisoning can result from them is use, storage of pesticides close to consumable food stuff, the use of pesticide containers for household, improper disposal of used containers, treatment of food stuff with pesticides, transport of food and pesticides in the same lorry and cars [14]. Approximately 98% of all insecticides and 95% of herbicides that are sprayed do not reach the target destination [15]. They reach non-target specie by pesticide drift which occurs when pesticides suspended in air as particles are carried by wind to other areas potentially polluting them, water pollution, bottom sediments, and food.

The effects of pesticides on humans has been demonstrated by many authors. It is known that, organ phosphorus and the carbamates insecticides are inhibitors of Acetyl Cholinesterase (AChE). This action induce an accumulation of the neurotransmitter acetylcholine at the nervous terminal after short (acute) or long term (chronic) exposure, with the potential to alter neurological development in humans [16,17]. Many pesticides sold in shops are volatile and confined environment will increase the health risk of workers who are frequently exposed. Sonchieu et al., (2006) [18] reported that pesticides sellers in Bamenda and surroundings present some health concerns.

This study was aimed to bring into light affection from people who are permanently exposed in agrosops in Bafoussam municipality which is known to be the one of the most important city of Cameroon with many such specific shops. The objectives were to investigate on pesticide related diseases among sellers in Bafoussam municipality. Results gotten from this study will be used to confirm or to infirm what presented some of pesticide sellers in Bamenda and to show the needs of governmental intervention to this sector of activities.

## Material and Methods

### Area of study

The area of study was Bafoussam municipality. Bafoussam is the capital of the West Region of Cameroon located in the central-western part of the Republic of Cameroon. Economically Bafoussam is the third most important city in Cameroon after Yaounde and Douala. It extends over an area of 91 km<sup>2</sup> distributed in its urban and the rural areas respectively [19]. It lies between latitudes 5° 28'40" to the North of the equator and between longitudes 10° 25'3" to the East of the Meridian. The altitudinal range is from 1310m to 1470m. The climate is constantly cool with a temperature oscillating between 15°C and 22°C. With climate change in recent years, Bafoussam sometimes reaches 28°C. Bafoussam is the West regional center of trade, and people cultivate coffee, potatoes, tomato, maize and beans. Bafoussam is made up of 07 villages (Bamendzi, Ndiangdam, Ndiangsouoh, Ndiangbou, Toukouop, Noueng and Banengo city B) with 46 districts or sub-villages. The city has an urban population of 347,517 inhabitants. Bafoussam municipality was chosen because of intensity of agricultural activities which depend on pesticide high demand and use. This area constituted part of the concentration points of pesticide sellers. The map of the study area is presented below (Figure 1).

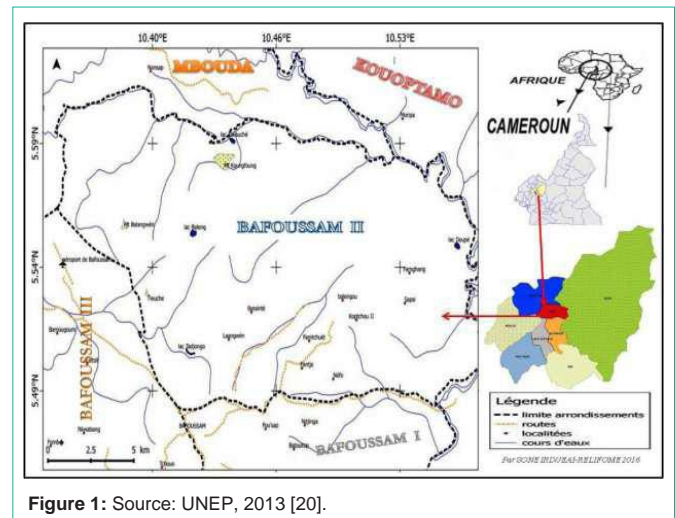


Figure 1: Source: UNEP, 2013 [20].

### Data collection

Seventy (70) structured questionnaires were systematically distributed in 70 agrochemical shops around the selling place in different markets to collect information. The questionnaire was made up of open and closed answers to be filled by pesticide sellers. Those who were available filled it immediately and for those who were occupied; it was done orally while they answered. Only one person was selected, because he/she is the most permanent in the shop and had more experience in pesticide selling, to fill the questionnaire. Data was daily collected from 15th April to 15th May 2018 from 8am to 4pm. Information was gathered from one place to another. After having issued a questionnaire to one person, the same person was strictly observed for personal hygiene, and behavior. Physical inspections of premises were done to evaluate the environmental and occupational conditions. The following aspects were analyzed: The socio-demographic characteristics of study participants, handling conditions, Signs and symptoms of pesticide related diseases, personal hygiene, first aids assistance, safety measures and ability to handle pesticides.

## Results

### Socio-demographic characteristics of the respondents

The studied population involved in this work included men and women who were distributed according to their age, educational level, other occupation, longevity and time spent in the shop per day. Table 1 presented below shows details on data collected.

The study constituted a total of 70 participants, among them 26 (37.1%) females and 44 (63%) males. With respect to age, majority (70%) were within the age group 13-28 years. Also, more than half (53%) of the study population attended secondary school whereas those who attended primary and high school constituted 13% and 34.3% of the study population respectively. More than half (57.1%) of the respondents were farmers whereas 12% and 31.4% were teachers and business persons respectively. Concerning marital status, 60% of the participants were single while 27.1% were married and widows made up 13%. Time spent in the shop per day varied among pesticide sellers and it ranged from 8am to 10pm. 93.05% reported that they sell in the shop every day except Sunday. Also, the number of years they

**Table 1:** Socio-demographic characteristics of study participants.

Variable	Frequency (n=70)	Percentage (%)
<b>Age</b>		
[13-28]	49	70
[29-44]	14	20
[45-60]	7	10
<b>Sex</b>		
Females	26	37.1
Males	44	63
<b>Level of education</b>		
Primary	9	13
Secondary school	37	53
High school	24	34.3
<b>Main Occupation</b>		
Farming	40	57.1
Teaching	8	12
Business	22	31.4
<b>Marital status</b>		
Married	19	27.1
Single	42	60
Widow	9	13
<b>Time spent daily (hours)</b>		
10	42	60
8	28	40
<b>Longevity (years)</b>		
[1-5]	33	41.14
[6-10]	21	30
[11-15]	16	23.05
<b>Type of sellers</b>		
Whole sellers	19	27.14
Retailers	41	59.07
Small scale retailers	7	10
Trained sellers	3	4.3
<b>Number of days/week</b>		
7	65	93.05
4	5	7.14

have been selling pesticides also varied. Following the data mentioned here, more than 60% of the sellers interviewed spend about 9 to 10 h/day in the shop. In addition, many sellers interviewed (41.14%) have less than 5 years of experience compared with (30%) and (23.05%) who have been selling pesticide for about 6 to 10 years and 10 to 15 years respectively (Table 1). Looking at what precedes; many pesticide sellers in Bafoussam were educated and self-employed. Storage and visual observation around the selling places were also investigated and are presented in table 2 below.

### Storage and occupational conditions

Pesticides sold by respondents were stored in different places and the premises were presenting various aspects as described in table 2 showed below as well as inside or around.

**Table 2:** Storage and visual observation around the selling place.

Variable	Frequency (n=70)	Percentage (%)
<b>Storage</b>		
Store pesticide in their shop	58	83.05
Have a warehouse connected to the shop	12	17.14
<b>Ventilation</b>		
Spacious shop		
Yes	69	99
No	1	1.4
<b>Well ventilated shop</b>		
Yes	54	77.14
No	16	23.05
<b>Surrounding activities</b>		
Restaurant	11	17.01
Selling uncooked food	38	54.28
Selling puffpuf	6	9
Bar	16	21.42
<b>Safety measure</b>		
Sellers sitting outside	38	54.28
Sellers sitting inside	32	46.01

**Table 3:** Signs and symptoms exhibited by sellers of pesticides after handling.

Variables	Yes (%)	No (%)
Running nose	17 (23.9)	53 (76.1)
Blurred vision	05 (7)	65 (93)
Nose irritation	16 (22.5)	54 (77.5)
Increased salivation	0(0)	0(0)
Nausea	28 (39.6)	45 (60.4)
Stomach cramps	14 (19.7)	56 (80.3)
Diarrhea	8 (11.3)	62 (88.7)
Skin irritation	14 (19.7)	56 (80.3)
Cough	21 (29.6)	49 (70.4)
Shortness of breath	20 (28.1)	50 (71.9)
Headache	27 (38)	43(62)
Dizziness	15 (21.4)	55 (79.6)
<b>Vomiting</b>	<b>21 (29.6)</b>	<b>49 (70.4)</b>

The number in parentheses represents the percentages (%).

Regarding the shop, 77.44% were well ventilated and spacious while 27.14% were not well ventilated and 23.05% were not spacious. Ventilation was evaluated according to the number of openings presented by the premise. It varies from one to three. Things around the selling place were restaurant 15.71%, uncooked food 54.28%, selling puff 9% and bar 21.42%. Sellers selling out of the shop were 54.28% while those selling in were 46.01%. The majority (83.05%) of the sellers' stored pesticides in their shop. 17.14% stored pesticides in a warehouse or in a room that was connected to the shop (17.14%), (Table 2). The statistics above give a good impression on the awareness of safety measures and bad impression on things around the shops. Many signs and symptoms were exhibited by pesticide sellers. Table 3

**Table 4:** Hygienic cares and practices after handling of pesticides.

Parameters	Frequency (n=70)	Percentage (%)
<i>Clean the selling place</i>		
Yes	62	89
No	08	11
<i>Frequency/week</i>		
Once	08	13
Twice	09	15
As need arises	45	72
<i>Washing hand after handling</i>		
Yes	67	96
No	03	4
<i>Eating, drinking while handling</i>		
Yes	07	10
No	63	90
<i>Managing of expired pesticides</i>		
Return to wholesalers	52	74
Dump at waste site	02	4
Dispose in sewer	08	11
Bury	08	11
<i>Use of absorbent material (spilling)</i>		
Yes	51	73
No	19	27

**Table 5:** First aid practices used in case of accident during manipulation of pesticides.

Contamination/Actions	Frequency (n=70)	Percentage (%)
<i>Ingestion of pesticide (cases)</i>		
Drink charcoal solution	42	60
Drink palm oil	09	13.03
Drink milk	19	27.14
<i>Eye irritation</i>		
Washing off with water	58	83.05
Go to hospital	04	06.01
Wipe off	08	11.42
<i>Contact with skin</i>		
Clean with water and soap	12	17
Remove affected dresses	58	83

portrays the signs and symptom exhibited by pesticide sellers.

### Pesticide related diseases signs and symptoms among sellers

Many signs and symptoms were evaluated among pesticide sellers, to estimate their health risks. It varies from physical presented symptoms to some frequently faced since respondents work. One respondent may present more than one symptoms or signs. Table 3 below gives more details about it.

As concerns the signs and symptoms experienced by participants after exposure to pesticides, 30% reported that they experienced

vomiting, 28.1% experienced shortness of breath while 21.4% had dizziness, 30% experienced cough, 40% experienced nausea. Another most frequent signs experienced was headache where 38% reported to have experienced headache (Table 3). The presence of symptoms among pesticide sellers may be due to the fact that sellers do not respect safety measures when handling pesticide. Some hygienic factors and practices are usually carried out by pesticide sellers. Those hygienic practices are shown in (Table 4).

### Hygiene practices among pesticide sellers

Handling among respondents and precautions taken by them was varying from one to another. Some may be eating inside the shop, clean their place or frequently washing their hands after services (Table 4).

Majority (87%) reported that they clean their environment whereas 11.2% indicated they do not clean their environment frequently. Among those who clean their environment, 73% said they do so as soon as need arises. Almost all (96%) reported that they wash their hands after handling pesticides meanwhile only 10% reported they eat or drink during handling of pesticides. Regarding the management of expired pesticides, 74.2% reported that they return them to the wholesalers while 2.8% reported that they dump them on waste sites and 12% said they bury them (Table 4). Also, 73.05% of the participants reported to have absorbent materials in case of pesticide spill and 27.14% of them do not have it. These give a good impression regarding safety measures. Pesticide handlers/sellers use some first aid practices in the case of accident during the manipulation of pesticides. These first aid practices are presented in (Table 5).

### First aid practices in case of accident

The assistance brought by the seller or the assistant was noticed among sellers. It varies as recommended according to the site of affection. Table 5 presents how the accident is managed to save the life of affected persons.

The study also seeks to identify first aid practices that are taken into consideration when manipulating pesticides. 60% reported that they drink charcoal solution in case they swallow pesticide during pesticides manipulation, 13.03% reported that they drink palm oil while 27.14% said they drink milk. In the case where a pesticide gets contact with their eyes, 83.05% indicated they wash with water 06.01% go directly to the hospital and 11.42% wipe off. In case they get pesticide on their skin, 83.05% indicated that they clean contaminated part with water and soap while 17.14% removed the affected clothes. These results showed that safety measures were taken into consideration by the majority of them. Some pesticide sellers were aware of their toxicity and their routes of contamination. They read pesticide labels, repackage/mix them and manage empty pesticide containers as presented in (Table 6).

### Awareness of sellers on pesticide toxicity

The knowledge of sellers on pesticide toxicity conditions the precautions when manipulating chemicals. They may do it from experience or from instruction given by manufacturers. Table 6 gives more indications on that.

Participant's awareness on pesticides toxicity was also assessed. 77.1% were aware that pesticides are toxic while 23% were unaware about the toxic nature of pesticides. Also 93% of the participants said

**Table 6:** Awareness on pesticide toxicity.

Factors/actions	Frequency (N=70)	Percentage (%)
<i>Awareness on pesticide toxicity</i>		
Yes	54	77
No	16	23
<i>Reading of labels</i>		
Yes	65	93
No	5	7
<i>Repackaging/mixing</i>		
Yes	18	26
No	52	74
<i>Managing of empty containers</i>		
Reuse	3	4
Bury	57	81
Throw in water	1	1
Leave in the field	5	7
Throw in the garbage	4	6
<i>Knowledge of Route of contamination</i>		
Nose	9	13
Skin	9	13
Eyes	2	3
All routes	45	64
Ignorant	5	7

they read labels on pesticide containers. Concerning the repackaging/mixing of pesticides in the shop, 26% agreed that they do repackaging in the shop while 74.3% refused that they do not do repackaging in the store. Majority (81.4%) reported that they simply bury the empty containers while 4.3% said they reuse them and 6% indicated that they throw them into the garbage. As much as 7.1% reported that they do not know how pesticides can enter the body while only 13% reported that they can enter the body through nose and skin (Table 6). These results show that they have good awareness on pesticide toxicity. Most pesticide sellers have been trained on pesticide management via seminars, companies, and by family and friends. They obtain information on pesticide management from suppliers, friends and family, read instruction labels and from other agro-dealers as indicated in (Table 7).

### Specialization of sellers

Sellers were professionally trained or not. Some got their one training from relatives, or from NGO and may still assisted by professionals as shown in (Table 7).

96% of the respondents agreed that they have received training on pesticide management among which 56% indicated they have received the training twice whereas 44.3% said they received the training only once. Among those who agreed that they have received training on pesticide management, 73% said they were trained in a seminar while 11.4% said they were trained in a private company. Regarding the source of pesticides, 64.3% reported they get them from agro-dealers while 16% said they get them from extension service providers. Also, regarding access on knowledge on pesticides usage and whether

**Table 7:** Training on pesticide management.

Variable	Frequency	Percentage (%)
<i>Trained on pesticide management</i>		
Yes	67	96
No	03	4
<i>Frequency</i>		
Once	30	44
Twice	37	56
<i>Training organization</i>		
NGO	00	00
Seminar	51	73
Private companies	08	11
Relatives	11	16
<i>Source of information</i>		
NGOs	00	0
Friends and family	04	4
Read instructions label	10	14
Agro-dealers	45	64
Supplier service	11	16
Those with employees	20	29
<i>Function</i>		
employees	60	86
Owners	10	14
<i>Employees/owner status</i>		
Trained	14	20
Untrained	56	80
<i>Use of homologated list</i>		
Yes	59	84
No	11	16
<i>Use of PPE (at least one)</i>		
Yes	69	99
No	01	1

PPE: Personal Protective Equipment; NGO: Non-Governmental Organization.

participants have certificates to sell pesticides, 84.3% agreed that they have certificates to sell pesticides while just 15.7% indicated that they do not have certificate to sell pesticides. In the same line, 29.07% of the participants declared they have an employee, also 20 of them reported to have employees. Among the employees 70% were trained while 30% were untrained (Table 7), and the majority of them have a certificate or an authorisation to sell pesticide, but 30% of employees were trained regarding those who have employees. A vast majority of participants (99%) reported that protective equipment is absolutely important in handling pesticides. Equally, 99% indicated that they usually use the list of pesticides information. These results give a good impression regarding the training of the majority of pesticide sellers as they were well trained during a seminar.

### Discussion

This study was similar to that of Sonchieu et al., (2018) [21] in Bamenda (Cameroon) that reported that more than 62% of the sellers

spent about 10 h/day in the shop and in addition, many sellers (56%) had less than 5 years of experience. This permanent time spent in the agro-shop increases the rate of exposure of pesticide sellers to pesticide [18].

Levels of knowledge among pesticide sellers depends on type of training they had received. The majority of the farmers had not received any training or technical support on the judicious use and safe handling of pesticides. However, practices are similar among them in handling pesticides among farmers since their perception to pesticides is the same because they are trained by relatives or by practicing [1].

The educational level seems to be the factor affecting their knowledge, attitude and practices because few of them are having a good educational background as reported by Sonchieu et al., (2018) [17] in similar population in Bamenda. Generally, by the experience gained by years on risks linked to pesticides handling, since they are more aware of it, they will be able to counsel farmers (buyers) if necessary. Then, their limitation in knowledge will be to advice farmers on agrochemicals spraying good practices in the field. The presence of the most qualified person who can serve as an excellent counselor to buyers is always absent. Consequently, this will lead to misuse and high amount of residues in harvested crop produces exposing consumers including themselves.

Repackaging of pesticides was less common among sellers in this area of study as it illustrates one of the bad practices of pesticide sellers. This shows how whole sellers package pesticides in various volumes or mass to avoid abusive manipulations. Most repackaging is observed when the chemical is no authorized for sale or use in Cameroon [19]. A minority of pesticide sellers agreed that they do repackaging in the shop because illegally, they sell banned pesticides or authorized active ingredient but found in adulterated formulations imported from neighboring countries. In Cameroon, repackaging is very common and generally reported by many authors to alert the local and national authorities [1,22]. In most cases, repackaging of pesticides in small quantities is to meet customer's demand who at times is not able to buy original packaged products. Consequently, many pesticide poisoning cases have been reported in the North West and in Adamawa Regions as well as in other parts of the country [22]. Few safety measures are applied among them despite their awareness of the toxicity of these chemicals.

The study also shows that the minority of them still disposed expired pesticides on refuse side and sewer while few still eat and drink when manipulating pesticides. This miss practices finding is one of the factors that contributes to food poisoning and of acute poisoning frequently observed among sellers and users when handling or using pesticides. Certainly this is due their ignorance about the routes of contamination and lack of means to buy personal protective clothing [23], while many of them sell at least one personal protective equipment in their shop as it was observed. This is because most of sellers are employees and the employer at time does not mind about their life. It is true that a vast majority reported that they wear at least one protective material as a safety measure but all the routes of contamination are not all protected as the manipulation is going on. For example when sitting in the shop for long duration, many will not wear face mask to avoid inhalation despite the narrowness and poor

ventilation of the shop [22, 23].

On the other hand, the results of this study revealed that participants used gloves, aprons, hats, nose masks to protect themselves. Despite the fact that those participants were wearing PPE, some signs and symptoms still appearing after the handling of pesticides. Vomiting, shortness of breath, dizziness, cough, nausea and headache were symptoms experienced. This can be due to poor uses and the quality of the materials because the most efficient ones are very expensive; and locally, there is no adequate clothing material develops to be cheaper and effective for good health of sellers and users. The finding is on line with the report done by made by [24,25] in China who reported that, skin irritation and watery eyes were common health effects among pesticide users. Then most of their visceral organs maybe affected and an analysis of biological fluid has never been done in this particular area following the available scientific data.

The safety measures that they apply, the cleaning of their environment and washing hands with soap after handling pesticides. This measure is insufficient because the other body parts are not protected. Sitting outside of the shop and using absorbent materials in case of pesticide spill such as the sand or dirt are reported to be some preventive measures. But this cannot avoid vaporization and inhalation as reported by Zijian and Aaron (2017) [26]. These activities practiced by sellers can slowdown the prevalence of signs and symptoms among them but still less effective.

Regarding first aid practice, many drink charcoal solutions in case they accidentally ingest pesticides when manipulating. Some of them drink palm oil while others go directly to the hospital and some drink water. This result corroborates with that of Poakam et al., (2017) [1] who found that farmers in rural areas of Cameroon declared that they take palm oil or drink milk, palm wine or citrus juice depending on the gravity of the incident when they ingest pesticides before going to the hospital. These practices are adopted due to the fact that pesticides may have a high degree of toxicity to damage the digestive system of an individual who ingests them. Those attitudes can slow down the effect of the product ingested [27].

## Conclusion

The purpose of this study was to evaluate the knowledge and practices of pesticide sellers toward handling of pesticides in Bafoussam municipality. It can be concluded that, the sellers do not have adequate knowledge to handle and to counsel the buyers who are not always participants of Good Agricultural Practices (GAP). This study is reinforcing the scientific report given by others authors in the risks found alongside the food chain of the most agricultural basins of production in Cameroon such as Foumbot, Santa and many others. However, insignificant assistance is continuously observed from the agri-technician of the country to all people that intervene in the selling and using chain. More actions need to be taken for the protection of the health of consumers.

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