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FARMERS KNOWLEDGE, PRACTICES AND HEALTH PROBLEMS ASSOCIATED WITH PESTICIDES USE IN WEST TRIPOLI, LIBYA.

MASTER THESIS

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ABSTRACT

FARMERS KNOWLEDGE, PRACTICES AND HEALTH PROBLEMS ASSOCIATED WITH PESTICIDES USE IN WEST TRIPOLI, LIBYA

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This study focuses on farmers' knowledge, practices and health problems associated with pesticide use in west Tripoli, Libya. 300 respondents were considered using quantitative method and analyzed using SPSS and it shows that pesticide affects the health of humans which indicates that the farmers have knowledge associated with the use of pesticide to health problems. Farmers re-spray the crops with surplus pesticide mixture. They throw away surplus pesticide mixture on uncultivated land wash and reuse emptied pesticide containers to store water, bury or burn emptied pesticide containers and wear protective clothes before spraying and while using the PPEs they feel comfortable wearing the protective clothing. Farmers in the region drink water while spraying. After each use of the PPEs farmers wash their protective clothing with personal clothes. Knowledge associated with pesticide use was not statistically significant and practices associated with pesticide use was also not statistically significant related to attitudes towards educational level. Gender effect on awareness of pesticide use and handling indicates that both gender have awareness of pesticide use and handling and therefore showed that there was no statistically significant difference between a male and female farmers' awareness of pesticide use and handling. Work practices regarding the use of protective measures indicates that farmers use gloves, face masks, respirators, boots and the spraying methods used is knapsack, hand-held can, tractor for the spraying. There is no significant relationship between farmer's monthly income and farmer's knowledge/work practices regarding pesticide use and there was linear relationship practices with respect to pesticides used and symptoms experienced after exposure to pesticides.

Keywords: pesticides, farmers, PPEs, health, sprayer, knowledge, attitude

ÖZ

BATI TRİPOLİ LİBYA'da ÇİFTÇİLERİN, ZİRAİ İLAÇLARIN KULLANIMI İLE İLGİLİ BİLGİLERİ, UYGULAMALARI VE SAĞLIK SORUNLARI

Hamza S Abdalla LAGILI

Yüksek Lisans, Çevre Eğitimi ve Yönetimi

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Bu çalışma, batı Tripoli Libya'da pestisit kullanımı ile ilgili çiftçilerin bilgi, uygulamalar ile sağlıkla ilgili sorunlarına odaklanmaktadır. 300 katılımcı düşünülmüş olup kantitatif yöntem ve SPSS kullanılarak analiz edilmiştir. Çalışma, pestisitin insan sağlığını etkilediğini göstermekte ve bu durum çiftçilerin, pestisit kullanımının sağlık sorunlarıyla ilişkili olduğuna dair bilgileri olduğuna işaret etmektedir. Çiftçiler, fazla miktarda pestisit karışımını mahsulata yeniden püskürtüyorlar, ekilmemiş tarım arazisi üzerine fazladan pestisit karışımı atıyorlar ve suyu depolamak için boşalan pestisit konteynerlerini yıkayarak yeniden kullanıyorlar, boşalan pestisit konteynerlerini gömüyor veya yakıyorlar ve püskürtme yapmadan önce koruyucu giysiler giyiyorlar, ve kişisel koruyucu donanım (kkd) kullanırken koruyucu giysi giymede kendilerini rahat hissediyorlar. Bölgedeki çiftçiler, püskürtme yaparken su içmekte ve kişisel koruyucu donanımının (kkd) her kullanımından sonra koruyucu giysilerini kişisel giysileri ile birlikte yıkamaktadırlar. Pestisit kullanımı ile ilgili bilgi istatistiksel olarak anlamlı değildir ve pestisit kullanımı ile ilişkili uygulamalar da anlamlı değildir; pestisit kullanımı ve idaresi hakkındaki farkındalık, eğitim düzeyine, cinsiyet etkisine yönelik ilgili tutum, her iki cinsiyetin de pestisit kullanımı ve idaresi hakkında farkındalığının bulunduğuna işaret etmekte ve dolayısıyla, pestisit kullanımı ve idaresine ilişkin, erkek ile kadın çiftçilerin farkındalığı arasında istatistiksel olarak anlamlı fark olmadığını göstermektedir. Koruyucu önlemlerin kullanımı ile ilgili çalışma uygulamaları, çiftçinin; eldivenler, yüz maskesi, solunum cihazı, bot kullandığı ve püskürtme için kullanılan püskürtme yöntemlerinin ise sırt çantası, taşınabilir/portatif el tenekesi ve traktör olduğunu göstermektedir. Çiftçilerin aylık geliri ile pestisit kulanımlarına ilişkin bilgi/uygulamaları arasında anlamlı bir ilişki bulunmamakta, ve kullanılan

pestisitlere göre uygulamalar ve pestisitlere maruz kaldıktan sonra tecrübe edilen belirtilere ilişkin doğrusal ilişki bulunmaktadır.

Anahtar kelimeler: pestisitler/zirai ilaçlar, çiftçiler, kişisel koruyucu donanımlar (kkd'ler), sağlık, püskürtücü, bilgi, tutum

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DEDICATION

I hereby declare that, all the information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name:

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ABBREVIATIONS

CNS	:	Central nervous System
DDT	:	Dichlorodiphenyltrichloroethane
GIT	:	Gastrointestinal Tract
KAP	:	Knowledge, Attitudes, and Practices
OC	:	Organochlorines
OP	:	Organophosphates
OPIDP	:	Organophosphate-Induced Delayed Polyneuropathy
PPEs	:	Personal Protective Equipments
%	:	Percentage
<	:	Less than

CHAPTER I

INTRODUCTION

The increment in the populace and rising interest in food utilization has prompted an expansion in pesticide utilize all inclusive. Despite the fact that pesticides are assumed a positive part in securing crops against losses, because of the damaging idea of the distinctive types of pest, they harm human and contrarily influence the environment. In perspective of their forthcoming consequences for people, nations have developed tenets to encourage the safe utilization and control, import and sending out of these chemicals (Lorenz et al., 2012).

Between 1973 -1990, the global consumption of pesticide use averaged 3,850 metric tons annually but had shot to a high 37,712 metric tons worldwide in 2000 (Dey, 2010). For instance in Ghana, in the paste years between 1995 and 2000, an average of 814 tons of pesticides was transported in the nation consistently. This expanded from 7763 metric tons in 2002 to 27,886 metric tons in 2006 (Fianko et al., 2011). Pesticide use in developing nations is expanding, however, its utilization in the developing nations is steady or declining. Henceforth, however, developing nations utilize 80% of the world's aggregate agrochemicals, they encounter around 1% of the total pesticide-related passing around the world. The rate of pesticide poisoning has expanded because of purposeful, unintentional and word related introduction to pesticide (Singh and Gupta, 2009). Pesticides were misused on farms, with not very many i.e. <2% of the farm laborers knowing the names of the pesticide they were utilizing on farms; farmers do not have the idea about the measure of pesticides to be applied on their yields (Fianko et al., 2011).

1.1 Problem

Chemical methods include the utilization of chemicals (pesticides) on a huge scale to moderate pests. It is viable and quicker contrasted with different techniques, but on the other hand, is the most hazardous to humans and the environment. Their careless or inappropriate utilization can bring about

resistance among different pests which could prompt broad outbreak bringing about cost increment of cultivation and losses (Francisco, 2011).

1.1.1 Sub problem

1. What is the farmer's knowledge, practice and health problems associated with pesticide use?
2. Does the level of education affect the farmer's knowledge and practices associated with pesticide use?
3. Does gender affect the awareness of pesticide use and handling?
4. What is the work practices regarding the use of protective measures and hygiene practices with the potential for exposure to pesticides?
5. Is there a relationship between farmer's monthly income and farmer's knowledge/work practices regarding pesticide use?
6. What is the relationship between practices with respect to pesticides used and symptoms experienced after exposure to pesticides?

1.2 Aim of the study

The general objectives of this study was to assess knowledge, work practices and self-reported symptoms associated with pesticide use among vegetable farmers

1. To determine the prevalence of respiratory and non-respiratory symptoms associated with pesticide use.
2. To evaluate farmers' knowledge on the effect of pesticides on human health and the environment.
3. To evaluate work practices regarding the use of protective measures and hygiene practices with the potential for exposure to pesticides.
4. To determine the association between farmers' knowledge/work practices and respiratory symptoms.
5. To determine the association between farmers' knowledge/work practices and non-respiratory symptoms.

1.3 Importance of the study

Knowledge can influence farmers to end up being more aware of pesticide dangers and in this manner prompt changes in deceptive methodologies and unsafe practices. The individuals who are less educated of a condition may be of risk

because of the absence of knowledge, while those with more knowledge will probably have a higher level of risk perception. Knowledge is directly identified with education and training and therefore accomplished and skilled farmers are relied upon to be more averse to be associated with high-risk practices, enhancing farmers' knowledge could lessen pesticide use by 10-15% (Khan and Damalas, 2015).

1.4 Assumptions

- It is assumed that the number of respondents that participated in the study represents the farmers in the study area.
- The participants or farmers in the area have knowledge about the pesticides safety equipment and health effect regarding its misapplication.
- The answer given by farmers who participated in the study were not biased or influenced by the researcher.

1.5 Limitations

The limitations involved in this study is mentioned below:

- This research is limited to farmers in West Tripoli only.
- Was only limited to 300 farmers.

1.6 Definitions

A pesticide is any substance or mixture of substances intended for destroying, preventing or mitigating insects, rodents, nematodes, fungi or weeds, or any other form of life declared to be pests; and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant (Arizona Agricultural Pesticide Applicator Training Manual, 2000).

1948 WHO define health as a state of complete physical, mental and social well-being and not merely the absence of diseases.

CHAPTER II

LITERATURE REVIEW

2.1 Agrochemicals Used in the Libya Agricultural Sector and Their Health Impacts

Agrochemicals are comprised of an active ingredient and latent substances, which can be solvents or surfactants. The active ingredient is part of the compounds that destroys or repels. They are arranged into various classes called the organophosphates, organochlorines, carbamates, organobromides, inorganics, phenoxy herbicides, insect growth controllers, and pyrethroids. The active ingredient, once in a while affect non-target creatures, including humans. This event can bring about the intoxication of the non-target life form (Rother and Jacobs, 2008). Agrochemicals can be characterized into various classifications. These classifications incorporate insecticides, herbicides, fungicides, rodenticides, fumigants, plant growth controllers and a different classification (this class comprises of arsenicals) (London, 1992).

The agrochemicals that are associated with intense occupational intoxications are the insecticides: most prominently organophosphorus and carbamate ester agrochemicals (Ecobichon, 2001). High exposures to agrochemicals can cause both intense and unending health issues. Intense intoxication happens after short-term, yet high, levels of exposure. Constant effects, in any case, are the outcome of considerably more long-term presentation. Endless intoxication from agrochemicals can bring about conceptive issues, carcinogenesis, neurotoxicity, immunotoxicity and hepatotoxicity.

Toxicity testing in the laboratory does not think about different components that would have an effect on harmfulness in South African farming environments, and thus represents a limitation in research. For instance, poisonous quality of chemicals can be improved by dry, dusty and hot climate, particularly in the event that they are not stored correctly (London, 1992). In specific frameworks, more than one agrochemical might be utilized at one time. The toxicity of at least two agrochemicals combined can change the nature and the health impacts of the chemicals. Different variables incorporate the concentration of the agrochemical in

solution. One of the most important factors, be that as it may, is the recurrence and force of exposures (London, 1992). The combination of a hot climate together with the recurrence and force of exposure makes Libya farmers more vulnerable against agrochemical poisonous quality.

Intense pesticide-related toxicological indications incorporate skin irritation, dermatitis, hack, conjunctivitis, metabolic side effects, and in extraordinary cases, casualty (London, 1992). The dominant part of research regarding agrochemical toxicity has been done on intense pesticide intoxication, as fatalities because of intoxication is a social, environmental and health emergency in developing nations. Researches into the risk of intense poisonous quality of pesticides are progressing.
Scientists have been considering an intense poisonous quality side effect called organophosphate-induced delayed polyneuropathy (OPIDP). It is an uncommon indication, and, as the name recommends, caused by abnormal amounts of exposure to organophosphates. Specialists describe the side effect of "distal degeneration of a few axons in both the peripheral and central nervous systems happening once a month after single or short-term exposures." (Lotti and Moretto, 2005). Related indications incorporate muscle cramping, muscle pains, numbness, weakness, and in extraordinary cases quadriplegia. OPIDP can be caused by agrochemicals like chlorpyrifos, which is as yet utilized in Africa, yet extremely limited in other, more developed nations (Dalvie et al., 2009).

Research on chronic health impacts of agrochemical use is much less extensive (Ecobichon, 2001). Many different kinds of agrochemicals, however, are implicated in chronic health impacts including carcinogenic and mutagenic effects. Proving a direct link between these agrochemicals and their chronic health impacts is not easy. However, more research is definitely required (London, 1992). Researchers looking at the link between pesticide use and respiratory illnesses found a positive correlation between the two. They found an association between pesticide use and chronic bronchitis and associated respiratory illnesses, such as asthma (Hoppin et al., 2007). In 2012, Starks et al. found a positive correlation between pesticide exposure and adverse peripheral neurological symptoms, like motor coordination effects, changes in deep tendon reflexes, and reduced muscle strength (Starks et al., 2012).

2.2 The Importance of Cholinesterase

Cholinesterase is a compound found in the blood and plasma that collaborates with a neurotransmitter in the human brain. It is fundamental to neurological movement, and without it, humans would experience the ill effects of neuromuscular paralysis, and then brings about fatality. A few pesticides are cholinesterase-inhibiting compounds. A scope of various sorts of agrochemicals, for example, the organophosphates, carbamates, organochlorines, pyrethroids and bipyridals restrain the creation of cholinesterase in the human body.

In that capacity, levels of cholinesterase in vulnerable populaces can be measured and pesticide exposures can be evaluated utilizing this data (Rama and Jaga, 1992). Cholinesterase testing has ended up being a standardized measure of agrochemical exposure, particularly in developing nations (Naidoo et al., 2010). Moreover, cholinesterase testing can be provided through local healthcare suppliers, enabling agricultural specialists to know their levels of exposure (London and Leslie, 2001). This advancement could mitigate the occupational hazards of pesticide poisoning by going about as a control or preventive measure.

2.3 Obsolete Pesticides

Obsolete or out of date pesticides is profoundly toxic agrochemicals that have been limited from use because of their poisonous quality to humans and the environment. They can never again be utilized for their unique reason and they require disposal. However, basically in the light of the fact that the pesticides were restricted from use, particularly little scale farmers did not have the technology or the way to discard these stores of agrochemicals (Dalvie et al., 2008). An investigation that was led in 2005 caught up with the National Retrieval Project's endeavor to dispose of these pesticides from the agricultural segment.

They found that the pesticides had not been discarded appropriately and were put away on the premises of the farm. These analysts examined a zone called Stellenbosch in South Africa, and studied a total of 75 farms in the territory. The greater part of these farms were in control of obsolete pesticides and moreover, the farmer could not distinguish 30% of the obsolete agrochemicals that were found on the premises (Dalvie et al., 2006).

These conditions show the issues related with obsolete pesticides. Farmers may not utilize these pesticides specifically on their crops, yet they once in a while put away in the best possible way and in this way the danger of exposure is high for the workers around these stores. Besides, the containers can spill, influencing the whole storage space hazardous. Spillages could likewise influence water sources and the encompassing environment, both of which would increase the danger of high pesticide introduction to humans and the environment (Dalvie et al., 2008).

This circumstance is the aftereffect of a wide range of components. Obsolete pesticides are still imported into Africa, and forcefully promoted by the chemical industry (Dalvie et al., 2009). Substantial agribusinesses are compelling little scale, developing farmers, and commercial farmers to obtain huge measure of agrochemicals that are sometimes obsolete and unusable. Farmers are not taught in storage techniques for these agrochemicals and, subsequently, farmers are put at a higher hazard for poisonous exposure. The government needs to implement directions including the presence of obsolete pesticides. Old pesticides ought not to be transported into the nation, and the government ought to give safe disposal systems. The presence of obsolete pesticides mainly shows the ways in which low-salary farm workers are being exploited by industrialist agribusinesses. The circumstance of obsolete pesticides in Libya is adding to the minimization of this susceptible populace, and this is a circumstance that should urgently be tended to.

2.4 Susceptible Populations: The Low Income Farmer

The farming division of Libya incorporates probably the most poverty-stricken individuals in the country. This populace is marginalized by the system set up now, and is at a serious financial inconvenience.

Farm workers, both male and female, are among the minimum instructed, slightest educated sub-populaces in Libya. They do not have any idea about the unregulated system in which they work, they have low awareness of their representative rights and have restricted access to medical benefits (Naidoo et al., 2010). It must be noticed that agrochemical poisoning is a consequence of not just the hazardous chemicals that are being utilized, yet of hidden conditions too. These

conditions incorporate poverty, alcohol reliance (which is alarmingly predominant in Africa's populace of low-pay farm workers), and general states of mind towards agrochemicals and safety in the working environment.

2.5 The Perspective of the Farmer: General Awareness of Negative Impacts of Agrochemicals and Safety Practices

Diverse investigations that have been directed all through Africa, investigated farmers' points of view on the threats of agrochemicals. Diverse indicators of farmers' associations with agrochemicals are their utilization of personal protective wear, their sterile and sanitation practices and their capacities to comprehend names, color codes and pictograms on the sides of agrochemical containers. In one rural farm setting, a specialist found that exclusive 2% of the farmers that were met concurred with the statement that "pesticides have a potential negative effect on waterways and the environment" (Ajayi, 2000). These outcomes plainly show that the environmental toxicity risk caused by agrochemicals are not being appropriately conveyed inside agricultural system in developing nations.

2.6 Personal Protective Wear

A research in Ethiopia, found out that agriculturists on commercial farms were furnished with deficient protective wear. The research demonstrated that 32% of pesticide sprayers in agricultural settings were utilizing the correct protective wear. Also, there was a general negative attitude towards specific protective wear, for example, goggles and gloves. There are many reasons this could happen. It is awkward for farm workers to wear protective equipment since it is so hot and dry in their workplace. Besides, equipment could be costly, and working without it is essentially a cost-cutting system (Mekonnen and Agonafir, 2002). An overview led in KwaZulu-Natal, South Africa revealed that provincial farm workers did not wear individual protective equipment and frequently did not have the best possible protective equipment while mixing, measuring or applying agrochemicals.

They frequently utilized their hands for the application of pesticides. This infers that there is an absence of pesticide health information in this specific circumstance, or potentially that there is an absence of access to defensive equipment. Furthermore, the utilization of hygienic and sanitation practices is quite often specifically associated with access to a perfect/clean water source (Mekonnen

and Agonafir, 2002). Hand washing and showering is not an option in rural water-rare zones. Farming communities ought to have the privilege to clean water from an uncontaminated and available source. In contrary, this is not the situation in numerous communities in developing nations. Furthermore, the water that is available close to farming areas might be polluted with agrochemicals (Konradsen et al., 2003). Indeed, even in situations where farm workers know about general toxicity issues related with agrochemicals, water-shortage displays a key obstacle that forestalls sanitation practices (Ajayi, 2000).

2.7 Pictograms as a Risk Communication Mechanism

Studies have demonstrated that pictograms on pesticide names are not as powerful as they ought to be. The United Nations Food and Agricultural Organization prescribed pictograms as a strategy to convey environmental and toxicological dangers related to agrochemicals (Rother, 2008). Pictograms speak to directions in a way that agrochemicals ought to be utilized, put stored and disposed. If the pictograms do not communicate the idea clearly enough, then they are not working. A study directed on grape farm in the Western Cape Province of South Africa of 115 farm laborers found out that over half of them had misleading, wrong and confused translations of the pictograms given to them on the names of the agrochemicals that they were utilizing (Rother, 2008).

This data basically demonstrates that the risks of pesticides are not being completely conveyed or comprehended in nations like South Africa and other parts of Africa. There is a need for the issue to be conveyed plainly, particularly when the heavy utilization of pesticides is so excitedly supported inside the South African rural area (Rother et al., 2008).

It is a case that farm workers are not being given training and knowledge and access to equipment that would avoid their exposure to occupational related risks. Besides, it demonstrates that serious horticultural technology is not effortlessly transferrable to developing nations, in view of variables like the absence of access to clean water, the absence of access to supplementary safety equipment, and the absence of training and education. Africa's agricultural division is getting to be noticeably subject to agrochemicals, a generally new technology that does not have

the assets to help. The outcomes incorporate unsafe symptoms for farm workers, and the consequent marginalization of this populace.

2.8 Reducing Agrochemical Poisoning: The Importance of Education

The solution for this problem may lie in a wide range sorts of procedures and projects to enhance the safety of pesticide utilize. The introduction of these projects could diminish pesticide poisonings, decrease pollution of water sources, and lessen ecosystem damage.

Education projects and methodologies would urge meticulous adherence to health directions, instead of excessive and unsafe utilization of agrochemicals (Ecobichon 2001). The utilization of education programs has been attempted in other developing nations, and the projects' effectiveness was evaluated. In a specific report in India, occupational hazards of pesticide utilize were considered to be an issue since farmers were regularly not taught as far as the clean practices required for the protected utilization of agrochemicals. It is likewise costly to utilize health equipment, hence it is once in a while utilized as a part of Indian farming groups. The objective of the training programs is to make utilizing individual protective equipment, and following safety guidelines, a viable and reasonable alternative.

Scientists executed education programs in two towns in South India, planning to energize the sheltered utilization of pesticides in rural agricultural areas (Sam et al., 2007). In these two towns, previously the execution of the project, the event of occupational related poisoning was 33% before education programs were actualized. Government funded training programs were found to increase the agriculturists' learning of serious health results of the abuse of agrochemicals. They focused on the significance of individual protective equipment, and urged farmers to utilize low toxicity pesticides, instead of high-toxicity quality pesticides. Members were urged to read labels on the containers before application. The program instructed members to raise awareness of this issue all through the community. After the projects were done, the scientists evaluated the accomplishment of the program through questionnaires. They found that the program prompted a significant change of the system and awareness of principal safety measures (Sam et al., 2007).

Also, researchers in Lebanon considered the impact of educational interventions on the information and adherence to safety measures while having contact with pesticides in the Lebanese agricultural division. They found out that the utilization of safety steps were specifically corresponding to their knowledge. Basically, when there was less knowledge, fewer safety measures were applied (Salameh et al., 2004). Undoubtedly, around the globe, analysts have discovered that the knowledge of pesticide safety measures is identified with gender, geography, literacy levels, and, on account of female farmers, the presence children (Sam et al., 2007). Pesticide safety training (and education) is required to close these gaps in safety knowledge. Education can likewise be utilized to diminish the disparity amongst female and male farmers and amongst rural and urban populaces. Education projects and management techniques involve a short-term solution for the reduction of the antagonistic health impacts caused by the abuse of pesticides.

The long-term procedure, is the rebuilding of the South African rural system into a system that does not rely upon pesticides to increase rural yields, as well as to help the economy (Mather, 1996). The objective of this new rural system would be economical improvement, with least pesticide input (Konradsen et al. 2003). Pests are undesirable plants or animals (which could be microorganisms) that are inconvenient to humans or human concerns; for example, in agriculture or animal production. They meddle with human activities, and cause aggravation and scourges related with high mortality. They could be found in homes, industrial settings and farms. Mechanical control strategies for pest control incorporate picking of pests or their hatchlings by the hand, removing the part or entire plant that is influenced, utilizing traps or getting them with the assistance of nets. Physical control techniques are by warm (high temperature kill/destroys pests), low temperature and by X-rays or Gamma rays. Cultural strategies crop rotation, profound furrowing, clean cultivation, appropriate utilization of manures and water, growing pest resistant varieties of plants, timely or late sowing and proper harvesting. Predators such as parasites, birds, animals and microorganisms e.g., Chilonus, Crysopa, Tricogama, copidosoma, bacillus thuringenesis are used to control pests biologically.

2.9 Alternative Agricultural Systems and Integrated Pest Management (IPM)

Also, analysts in Lebanon contemplated the impact of instructive mediations on the learning and adherence to security measures while associating with pesticides in the Lebanese farming area. They found out that the utilization of precautionary measures was specifically corresponding to their knowledge. Basically, when there was less education, less wellbeing measures were connected (Salameh et al., 2004). Surely, around the globe, specialists have discovered that the learning of pesticide wellbeing measures is identified with gender, geography, literacy levels and, on account of female farmers, the presence kids (Sam et al., 2007). Pesticide (and training) is required to close these gaps in safety knowledge. Education can likewise be utilized to decrease the disparity amongst female and male farmers and amongst rural and urban populaces. Education programs and management techniques encapsulate a short-term solution to the decrease of the adverse health impacts caused by the abuse of pesticides.

The long-term technique is the rebuilding of the South African farming system into a system that does not rely upon pesticides to increase agricultural yields, as well as to help the economy (Mather, 1996). The objective of this new agricultural system would be an economical improvement, with least pesticide input (Konradsen et al., 2003).

For instance, an investigation of IPM practices in Indonesia spared an average of about $1 200 every year for each farm system on which it was executed. These funds are huge for low-salary farmers. In India, there was a diminished utilization of regular pesticides by an average of half. Besides, increase in income thus did agricultural yields. IPM additionally in a good way affects development, and this procedure could accomplish manageable development however enhanced jobs, more cost-effective production, coordinates effort amongst farmers, and enhanced education. Farmers can follow up on their own drive, and they can recognize and resolve pest-related issues. IPM adds to strengthening all through the agricultural community that can directly lead to sustainable development (Atreya et al., 2010).

2.10 Classification of Pesticides

Pesticides can be classified in view of various components. They might be characterized by the kind of pests they destroy, how hazardous they are and their method of activity or chemical properties.

2.10.1 W.H.O classification of pesticides by hazards

Extremely Hazardous (Class 1a), Highly Hazardous (Class 1b), Moderately Hazardous (Class II), Slightly Hazardous (Class III) (WHO, 2010).

2.10.2 Classification of Pesticides Based On Chemical Properties

Pesticides can be mainly classified into but not limited to Organochlorines (OC), Organophosphates (OP), Carbamates and Pyrethroids. Organochlorines, Carbamates, organophosphates and Pyrethroids, the four major types of pesticides in use in Libya.

2.10.2.1 Organochlorines

Despite the fact that commonly utilized as a part of the past, many have been removed from the pesticide market because of their environmental and health repercussions and their persistence in the environment, e.g. DDT, Chlordane. Despite the fact that they are forbidden in Libya because of their health and environmental outcomes and perseverance in the environment, a few farmers unlawfully utilize organochlorines (Donkor et al, 2015).

2.10.2.2 Organophosphates (OP)

These influence the sensory system by disturbing the acetylcholine controller known as the acetylcholinesterase, which is a neurotransmitter. They cause intense muscarinic indications, for example, salivation, lacrimation, micturition, looseness of the bowels, regurgitating, bradycardia, and some nicotinic manifestations, for example, muscle fasciculation and weakness. They are typically insecticides and were produced in the mid-1900s; some can be extremely noxious however are not steady in the environment. They are retained through the gastrointestinal tract (GIT), lungs and skin. Intense side effects of OP exposure are wheezing and hypoxia, bradycardia and hypotension in serious cases. Central nervous system (CNS) toxicity is normal, described by seizures, sensitivity, laziness and extreme lethargies. Pancreatitis is normally combined with cardiac arrhythmias (OA, 2017).

Late symptoms comprise of weakness of the proximal, cranial and respiratory muscles which more often than not resolve in 2-3 weeks. A couple may cause axonal neuropathy. Long term impacts incorporate psychological shortfalls and Parkinsonism (Lu, 2009).

2.10.2.3 Pyrethroids

This is developed as the man-made or artificial varieties of the naturally occurring Pyrethrin from the Chrysanthemum blooms. Throughout the years they have been enhanced to build their environmental stability. Some manufactured Pyrethroids are poisonous to the sensory system. At the point when appropriately utilized, they have been found to pose little or no dangers to human health and the environment. Their recovery occurred together with the distinguishing proof of the issues related to DDT. Pyrethroids are frequently utilized as bug sprays to financially control pests. In view of their method of mixing (i.e. with water or oil), little sums settle on the ground and on level surfaces.

They are debased by the daylight and atmospheric air, and are not effectively taken up by plant roots since they are bound to the soil; consequently they do not pollute ground water or water bodies yet are in the end degraded in the soil.

Exposure to greater amounts may cause dizziness, cerebral pain sickness and diarrhea. There is no confirmation that they are teratogenic, cancer-causing nor influence fruitfulness. Luckily they are instantly discharged through urine, feaces and breathe (Neghab et al, 2014).

2.10.2.4 Carbamates

These are comparable to the organophosphates, following up on the enzymes which regulate acetylcholine. Their impacts are usually reversible.

2.11 Problem Statement

Usage of pesticides to control insect pests, has turned out to be perceived and acknowledged as a fundamental component of present-day agricultural production. Pesticides are applied to vegetables in Libya. The farmers utilize a mix of at least two pesticide brands amid spraying to increase productivity or yield (Ntow, 2009). They are engaged with high – hazard practices, for example, not wearing Personal Protective Equipment (PPE), mixing of pesticides with exposed hands and poor

learning on re-entry periods and so on. (Ntow, 2006). Farmers do not have any significant safety measures, needed information on safe taking care of and use of pesticides (Fianko et al, 2011).

There is additionally deficient training on health measures and chemical application. The Ministry of Agriculture trains Agricultural Extension Officers in accordance with this to train farmers. Farmers utilize Organophosphates (OP) which are inconvenient to human and environmental health. They are prevalently presented to pesticides orally (food/water), dermally and nasally (Fianko et al, 2011).

In an investigation to survey the word related occupational exposure of farmers to pesticides in Akumadan, farmers did not utilize PPEs and needed information on re-entry time after spraying of pesticides. Ninety-seven percent (97%) of the members who were exposed to pesticides experienced weakness and successive cerebral pains (Ntow et al., 2007). Great Knowledge of farmers on pesticide utilization and practices, for example, transfer, storage and transportation will fundamentally lessen the routes in which pesticides influence human health and the environment (Christos and Ilias, 2011).

Ntow et al (2007), revealed that farmers showed self-reported side effects, while great handling with practices among farmers were low in Akumadan. They have poor information about pesticide and comparing works on encompassing its utilization, handling with, PPE utilized and individual cleanliness, (Osterlund et al., 2014). These poor practices considered may bring about a populace who are exceedingly presented to these chemicals.

This study will show the association between farmer safety practices, knowledge on pesticide effects on health and the environment and their resultant self-reported symptoms they experienced when exposed to pesticides. The findings will confirm the various studies carried out and hence the results can be used to make a general inference on vegetable farmers in Libya. This will add to academic knowledge and foster a good basis of policies for bodies that control matters pertaining to pesticides in Libya.

Training and availability of steady practical support through visits are hugely vital to handle dangers of pesticide poisoning. Most pesticides are harmful to non-target species including humans and animals and can bring about negative health impacts which might be short term or long term (Remoundou, 2014). Work related exposure may happen intensely because of mixing, loading, application or contact with spray crops. The danger of exposure gets higher when farmers overlook safety guidelines on the correct utilization of pesticides, PPE utilization and adapting sanitary practices (Damalas, 2008)

The number of years of farming/background, training received or experienced, and level of education could affect one's level of knowledge of the impacts of pesticide in humans and on the environment. Thus the level of knowledge could likewise influence identified with pesticide utilize. In the other way round, the quantity of farming experience, training got or experienced, and level of education can influence practices (Limantol et al., 2016).

Every one of these elements, for example, number of farming background, training received or experienced, and level of education, knowledge and practices may directly affect the self-reported indications of exposure to pesticides; for example, skin disturbances, redness of the eyes, sexual weakness, cough, wheezing, shortness of breath and so forth (Abstracts of the 2012).

2.12 Farmer Knowledge about Effects of pesticides on Human Health and Environment

Knowledge, attitudes, and practices (KAP) review help perceive information gaps, behavioral examples and accepted ways of thinking with a specific end goal to build the understanding of issues and illuminate targets and subjects for interventions that may address any combination of these factors (Lorenz et al., 2012). KAP reviews concentrating on pesticide utilize have been directed in a few nations including Brazil, Ghana, South Africa, Egypt, and Thailand. Farmers have a high hazard perception regarding hazards from pesticides. However, just 30% wear full PPE covering (Ntow et al., 2006) A KAP investigation of farmers by Zyoud et al., (2010) in the Palestine West Bank, demonstrated that 97% of the members knew about the names of the pesticides they utilized on their farms and the elements impacting good knowledge in that review were as per the following: good knowledge

was altogether connected with secondary education level ($p< 0.001$), college education ($p<0.01$), working knowledge more than 10 years ($p= 0.001$), utilizing pesticides for over 10 years ($p= 0.03$). However, poor knowledge was related to primary education i.e. $p<0.001$, but was not statistically significant regarding age and gender. Prior, they had hypothesized that great knowledge among farmers is related with the safe utilization of pesticides while reported symptoms are related with unsafe pesticide utilization. Farmers were more inclined to pesticide utilization guidelines recommended regarding protective measures.

A KAP in Uganda likewise demonstrated farmers on a little scale premise frequently cultivated without legitimate means or the knowledge to appropriately utilize pesticides. A few farmers, despite the fact that had high education levels on health impacts, did not work on as indicated by the knowledge they had (Ousterlund et al., 2014). Likewise, high illiteracy rate of education adds to farmers‟ trouble in understanding and following directions and safety advice on pesticide utilized. Atreya, (2007) analyzed distinction in gender in knowledge on pesticide utilize and practices in Nepal and found out that female farmers had lower levels of education than male agriculturists, making them less inclined to read and comprehend names on pesticides. Education was not found to impact practices in Brazil since greater part of farmers conceded getting data/training from the legislature and asserted reading labels; directions and warning yet do not take satisfactory protective measures. This was credited to low levels of education of members (Remoundou, 2014). Farmer’s education is hence a key in the expansion in knowledge in safety practices (Dey, 2010). "Large amounts of knowledge and perception of hazard are insufficient to impact workers and operators self-protective behavior‟. This should be well-thoroughly considered when arranging training projects to increase or enhance safety. Other financial and sociocultural pressures may likewise be attended to (Remoundou, 2014).

Sosan and Akingbohungbe (2009) on the occupational insecticide exposure and perception of safety measures among cocoa farmers in southwestern Nigeria found out that 44% of farmers wore overalls, 94% wore caps/hats, 28.7% wore rubber boots, and 9.3% wore cover shoes. Only 4.7% and 2.7% used hand gloves and eye goggles, respectively.

Ncube et al. (2011) and Schlosser (1999), confirmed the lack in utilization of PPE, unsafe techniques for pesticide administration and pesticide effect among farmers. Signs noted basically allude to the classification of direct poisoning by pesticides (Thundiyil et al., 2008). These outcomes appear to affirm the consequences of different overviews completed in the Caribbean (Andreatta, 1998) and in Central America (Wesseling et al., 2001), and in this way attracting attention to the local case of health dangers because of the act of dealing with pesticides. As Mansing et al. (2003) remarked that there is no firm confirmation of pesticide inebriation in the light of the way that agriculturists are to a great extent not searching for restorative direction, and as a result of the absence of training among overseers of therapeutic services. A few initiatives to advance the safe utilization of chemical pesticides, for example, pesticide awareness week (Ncube et al., 2011) and the Caribbean Agrochemicals Management Project (NRSP) (Mees et al., 2003) have been propelled in the Caribbean and in Jamaica.

Among farmers, the level of consciousness of insecticide utilized/handling has been accounted for and contrasted and the reception and experience of health hazard segments in a general public with an abnormal state of education. The understanding of the different parts of the utilization of pesticides uncovers a superior understanding of a few perspectives and a frail understanding of some others. Farmers are not instructed enough to understand the level of poisonous quality by taking a look at the shading/color code in the bundle, despite the fact that they know about the diverse alternatives available. Perceptions of toxic quality levels of chemicals that they regularly handle are not proper for the genuine circumstance; they were managing lethal chemicals that protected them. In spite of its high state of education, farmers are not inspired by perusing and following general guidelines. The exploration found out that the majority of the members had an attractive health status as per mass index value. The fleeting wellbeing hazard on word related presentation has been broadly announced the recurrence increments when somebody acquires involvement with work. The harmfulness levels are connected to a deficient understanding of non-scientific practices and poor personal protective equipment. The examination underscored the requirement for focused preparing for farmers and also farmers in embraced the logical administration of pesticides and expansive

mindfulness raising generation programs (Devi, 2009). Pesticide use with critical health impacts explorative study goes for filling this gap and gives a first premise to create a viable intervention to advance a more secure pesticide utilization.

An irregular specimen of 81 farmers was overviewed. The larger part of the farmers answered to experience the ill effects of no less than one health side effect related to pesticide handling. However, safety practices were barely received. There was likewise the hazard that other family members and the more extensive nearby group are exposed to pesticides.

The absence of training on pesticide management, the part of health management and the cost for protective equipment appeared to be the most critical elements that impact current pesticide handling practices in eastern Jamaica (Dwayne and Giuseppe, 2013). The dangers of pesticide exposure have been a developing concern all around the world. Increment of susceptibility of farmers to pesticide intoxication is because of absence of information in regards to safe and legitimate pesticide handling. This examination plans to survey the pesticide utilization and handling, perceptions on the pesticide impacts to health and condition and the self-detailed manifestations of potential pesticide poisoning among farmers in Mindanao, Southern Philippines.

This investigation utilizes a combination of an open-ended and close-ended structured questionnaire where a sum of 701 farmers were interviewed. Larger part of the farmers trusted that pesticide has negative impacts to health and condition. Regardless of this thought, their hazardous treatment of pesticides and resistance to appropriate use of personal protective equipment may build their dangers to the potential threat realized by exposure to pesticides. The most pervasive pesticides were those that have a classification with chemical families pyrethroid and organophosphate which are classified by WHO as Class II toxicity level. The most widely recognized complaint among farmers after the spraying sessions were skin disturbance (32.95%), cerebral pain (29.55%), hack (23.30%), dry throat (15.34%), shortness of breath (14.96%), dazedness (14.20%), sickness (12.69%) and eye bothering (11.36%) which were indications of gentle pyrethroid and organophosphate poisonings (Ian et al., 2015). The need to assess pesticide use in

country populaces, especially in developing nations, is critical. Pesticide utilization related hazard perceptions were considered among 318 arbitrarily chosen farmers from two regions of the cotton belt of Punjab, Pakistan.

An aggregate sum of 4875 kg of pesticide dynamic ingredients was accounted for to be connected by the farmers per annum and a large portion of these dynamic ingredients were delegated respectably dangerous (55%) or exceedingly unsafe (23%) as indicated by WHO characterization. The quantity of pesticide applications per developing season ran from 6 to 16, with a normal of 10 or 11 applications, contingent upon area. Well-educated farmers were found to spray less. Most farmers (52%) considered the hazard from pesticide use to be low, while a strong part (12%) considered there was no hazard at all. To display farmers' conduct on pesticide abuse, a binary probit regression model was utilized communicating conduct as a component of age, education, level of hazard observation, health impacts, pesticide toxicity class, and Integrated Pest Management (IPM) preparing. Awareness of the high toxicity of a pesticide item had a tendency to discourage abuse. Unexpectedly, neither the experience of health impacts nor the levels of hazard perception influenced abuse. Farmers were not all educated in right application and safe handling of pesticides (Muhammad et al., 2015).

2.13 Exposure to pesticides

Exposure is the contact after some time and space between a man and at least one biological, chemical or physical agent or the capacity of bio-available concentration and the time over which the agent applies its effects.

Types of exposures and their biological impacts might be partitioned into:

i. High level, single exposure where signs and side effects are acute or immediate

ii. Moderate and repeated exposure in which there are no intense signs and indications yet subtle (overt) symptoms at some uncertain time after exposure.

Low level yet constant presentation, where there is no genuine or seen dangers to health. These may prompt mutagenicity, cancer-causing nature, debilitated organ function, death or disabled conceptive function. Exposure transport media comprises of air, water, soil, dust, food, product or items. Pathways for exposure incorporate eating polluted food, breathing in a polluted work environment or touching home

surfaces. Courses of exposure contain nasal (breathing), integumentary/skin (dermal), mouth/oral (Ingestion) or various courses.

Length of an exposure could take seconds, minutes, hours, days, weeks, months, years or even a generation. Its recurrence could be consistent, irregular, cyclic and arbitrary or might be uncommon. Occupational exposure to pesticides in agricultural work environment happens amid the preparation (mixing and loading) and application (spraying) of pesticides (Garcia-Garcia et al.,2015).

Most pesticides are poisonous to non-target species including people and animals and can bring about negative health impacts which might be short-term and long-term (Remoundou, 2014). Work-related exposure may happen intensely because of mixing, loading, application or contact with spray yields. The danger of exposure increase when farmers disregard safety directives on the correct utilization of pesticides, PPE utilization and using sanitary practices (Damalas et al., 2008). Dey (2010) discovered considerable extent of respondents (25%) who smoked or consumed different things while applying/spraying, which is an unsuitable practice. Likewise, farmers sprayed in the wrong course concerning the breeze which increases exposure. A large portion of their equipment were not appropriately kept up nor checked for spillage before utilize.

2.14 Effects of Pesticides on Humans (Reported Symptoms)

The utilization of pesticide is a risk to human health and the environment. Their impacts of long-term work-related exposure at low concentration are risky to distinguish since they incorporate transitory and non-specific health repercussions. It might likewise depend on the pesticide utilized, methods of exposure and consistency of exposure, period and application approaches, not overlooking individual protective equipment utilized (Garcia-Garcia et al, 2015). Negative health results that happen because of exposure to pesticides vary as per the pesticide included and the methods of exposure, with the dermal course being the most extreme, particularly for sprinklers or applicators, (MacFarlane et al., 2013). Because of their wide-ranging and well-known use in agronomy and in the home setting, pesticide exposure happens predominantly through the oral (ingestion), dermal, the eyes and nasal (breath); through food or from the environment. Contact with

pesticides has been associated with various health impacts, for example, malignancies, neurodegenerative conditions and reproductive disarrays (Ghisan et al., 2015).

Sosan and his partners, found out that every one of the farmers in their investigation affirmed typical symptoms of insecticide poisoning after each spraying task (Sosan et al., 2012). These indications involved extreme cerebral pain (66%), dazedness (58%), body weakness or being abnormally tired (55%), nausea (53%), restlessness (37%), inordinate sweating (41.3%), and so forth. In an investigation to survey the impacts of Neurotoxic pesticides on hearing loss, Gatto et al., (2014) found out that outcomes from human examinations recommend that exposure to neurotoxic pesticides can initiate harm to the central auditory system. Pesticide sprayers report more noteworthy signs and manifestations of introduction, for example, skin disturbances, stomach poisoning and eye aggravations than other farm workers (Atreya, 2008). An investigation led on 268 married male farmers in Iran demonstrated that 68% of the members reported to their general farmers of suffering from burning and skin irritations, eye burn, headaches, vertigo, nausea and vomiting during spraying. Around 6.3% had offspring with congenital malformations, 7% showed impaired (fecundity) fertility rates after working for over 10 years as sprayers. Still-births among farmers' wives were greater than that of the average population (Neghab et al, 2014).

Chronic disease, for example, diabetes, Cardiovascular sicknesses (Hypertension), Chronic Respiratory ailments (e.g. asthma), Chronic Fatigue Syndrome, Systemic lupus erythematosus, rheumatoid joint pain, malignancies of numerous types, Alzheimer, reproductive disorders, parkinsonism, nephropathy congenital anomalies and so forth are key conditions influencing health of the general population after exposure to pesticides in the 21st century (Moustafalou and Abdollahi, 2013).

One of the reasons for infertility is work-related exposures to unsafe environmental components where the decreased fertility rate in a few occupations is substantially more huge than in the overall public. There is likewise confirm connecting reduced amount of semen to exposure to pesticides including harm to

spermatogenesis (Mehrpour et al., 2014). Likewise, male reproductive activity is profoundly delicate to many man-made physical and chemical agents by agricultural and industrial activities. Formation of pesticides vary in ingestion capacity e.g. emulsifiers are more promptly retained than others.

Consequently the rate of dermal assimilation varies relying upon the part of the body included, e.g. rates of retention are more prominent around the genitals (12 times speedier) than in the fore arms. The fact that neurons cannot regenerate makes neurotoxicity of the neurological system cause irreversible effects in an organism due to cell death and loss of neurons. Due to the subtle affect and slow development of neurological signs and symptoms, most conditions are not recorded or observed.

2.14 Effects of pesticides on the Environment

Each type of pesticide is pest specific. In other words they are intentionally released into the environment to mitigate certain targeted pests. Yet, a large amount of it enter water bodies, air, sediments or food. These occur as a result of run-off after rains, escape tanks or spray drift i.e. the airborne movement of agrochemicals onto non-target areas at or shortly after application either by air or ground level; with the potential of injury or damage to humans, animals, plants or the environment (National Pesticide Information Center, NPIC, U.S.A. 2015).

Pesticide in air, water and food has serious health repercussions for the general public. Pesticides have been found in the air long even after use, leading to effect on humans, wildlife and biodiversity; they mount up and travel worldwide. “Pesticide use has caused domestic animal poisonings, the death of useful predators and parasites, residues in air, fishery and aquatic body losses, the damage of flora and fauna, unintentional crop exposures, death of birds and honeybees and undesirable residue in food items have all credited to pesticides. It has been recognized that the chemical pesticide residues are the key contributor to the destruction threats facing many endangered species” (Khan et al., 2012).

Haarstad recorded in 2008 that a landfill involving mostly of natural waste from a tree nursery and containing an expected 900 kg of DDT was checked since 1994. Afterwards, downstream groundwater was inspected from four wells. Over 10 years of observing of two of the wells notwithstanding examining of the waste were

completed. A sum of seven pesticides was distinguished in the groundwater. In addition to DDT, there were two different bug sprays and four fungicides happening in the groundwater downstream of the landfill (Haarstad, 2008).

CHAPTER III

METHODS

This chapter explains the basic models that are used in this research by looking at the data collection, application of the collected data tools, and data analysis which is carried out to determine farmers knowledge, practices and health problems associated with Pesticides use in West Tripoli, Libya.

3.1 Research Model

This study mainly aim at getting the farmers knowledge, practices and health problems associated with pesticides use in West Tripoli, Libya. This study is based on field research carried out in West Tripoli, Libya in 2017. The method applied in this study to make it more reliable is quantitative method by use of a questionnaire adopted from Devi, (2009) and Akorfa Dzobo, (2016), focus group discussion, articles, textbooks, and studies on the subject and internet source.

3.2 Participants and sample

The study was carried out in part of the West Tripoli. The study is a cross-sectional one among 300 farmers in the West Tripoli district of the Libya. This study concentrated on the adult population. The criteria for eligibility in this study will include (i) The farmer being above 18 years (ii) a permanent resident in the study area and (iii) the respondent's willingness obliged to the study protocols and complete the study.

Every farmer will be given an organized questionnaire obtained from Fianko, (2011) and Devi, (2009). The questionnaire focused on gender, age, education, cultivating background in years, way of life, and knowledge on the impacts of pesticide on human health, the utilization of boots, dust mask, goggles, caps, and face shield. Farmers will be additionally asked whether they mix pesticides with uncovered hands, number circumstances they change their gloves into new sets, regardless of whether they eat or drink water while applying pesticides (See detailed questionnaire).

Table 1 and Figure 1 indicate the results of the farmers demography. 93 (31.0%), 42 (14.0%), 55 (18.3%), 66 (22.0%), 35 (11.7%) and 9 (3.0%) of the farmers were < 20 years, between 21 - 30 years, 31 - 40 years and 41 – 50, 51 - 60 years and above 60 respectively. Again, 157 (52.3%) of the famers were male while 143 (47.7%) were male. This shows that gender was fairly distributed. Furthermore, 81 (27.0 %), 130 (43.3%), and 72 (24.0 %) of them attended high school, college and tertiary respectively. Only 17 (5.7%) did not attend school. As for monthly income, 92 (32.0 %), 12 (4.0%), 13 (4.3%) and 179 (59.7%) of the farmers received monthly income of less than 500, between 5001 – 1000, 1001 – 2001 and above 2000 respectively.

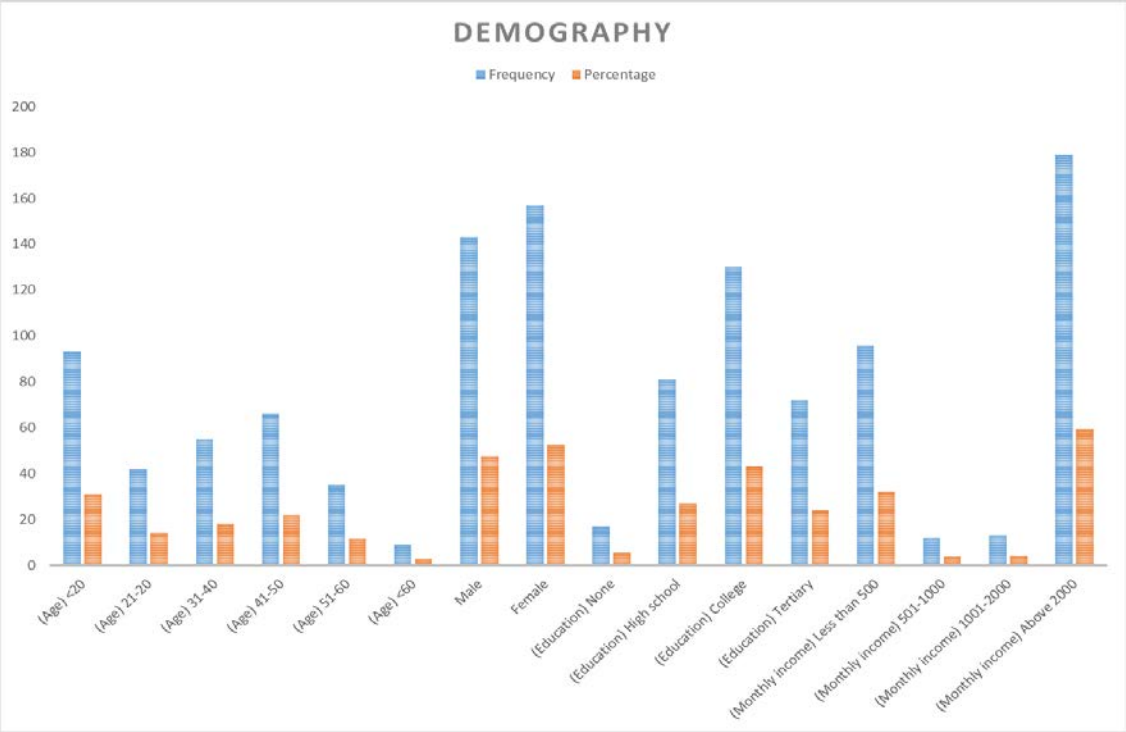

Figure 1: Demography of the study

Table 1:

Demographic distribution (n = 300)

Demographic category	Frequency	Percentage
Age		
<20	93	31.0
21-20	42	14.0
31-40	55	18.3
41-50	66	22.0
51-60	35	11.7
<60	9	3.0
Total	**300**	**100**
Gender		
Male	143	47.7
Female	157	52.3
Total	**300**	**100**
Educational level		
None	17	5.7
High school	81	27.0
College	130	43.3
Tertiary	72	24.0
Total	**300**	**100**
Monthly income		
Less than 500	96	32.0
501-1000	12	4.0
1001-2000	13	4.3
Above 2000	179	59.7
Total	**300**	**100**

3.3 Data Gathering Tools

In this study the data collection tools used are Personal Information, Environmental Perceptions, Knowledge and Behavior Scale Test and Information test.

3.4 Scoring Scale Classification of the Substance

The perception, attitude and practices of farmers in Libya that participated in this study regarding pesticide and its protective measures were revealed and interpreted based on the survey questions.

3.5 Data Analysis

The associations between pesticide-handling practices, knowledge and attitude and factors potentially influencing them were explored by means of t-test,

ANOVA and descriptive statistics. Data will be analyzed using the statistical software SPSS 20.0. No laboratory or medical tests were conducted.

3.6 Research Ethics

For the research to be reliable, valid and scientific process research ethics were considered. The people who participated in the study were given a direct questions. The researchers actually demonstrated an objective attitude during the research by demonstrating good behavior in order not to influence the study.

3.7 Reliability of the study

Table 2 displays the summary of the reliability test of the three constructs. The reliability of the construct was tested using Cronbach's alpha. The construct reliability should be more than 0.7 to fall within recomended level. (Fraenkel, Wallen 2000). The reliability of the construct of this study ranges from .774 to 0.851 which indicates good internal consistency.

Table 2:

Reliability Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Awareness	7.7946	1.710	.798	.774
Knowledge	7.9241	1.681	.649	.851
Practice	7.7749	2.254	.706	.794

CHAPTER IV

RESULTS AND DISCUSSION

This chapter gives detailed statistical analysis of the study on farmers' knowledge, practices and health problems associated with pesticides use in West Tripoli, Libya with its interpretation according to the respondents result from the questionnaire administered to answer all the research questions regarding this study.

4.1 RQ1: What is the farmer's knowledge, practice and health problems associated with pesticide use?

As shown in Table 3 the majority of the farmers agreed with item 13 that pesticide affects the health of humans (190) 63.4% agreed, (79) 26.4% disagreed, item 14 pesticides affect the environment (194) 64.7% agreed, (76) 25.3% disagreed, item 15 pesticide has effect on fish and rivers (206) 68.7% agreed, (64) 21.3% disagreed and item 16 pesticide can remain in soil for a long time (194) 81.0% of the farmers agreed, (37) 12.3% disagreed. Therefore, the farmers have knowledge associated with the use of pesticide to health problems.

Table 3:

Knowledge on the effects of pesticides

Item	Statement	SD	D	Neither agree nor disagree	A	SA
13	Pesticide affects the health of humans?	41 (13.7%)	38 (12.7%)	31 (10.3%)	107 (35.7%)	83 (27.7%)
14	Pesticides affect the environment	34 (11.3%)	42 (14.0%)	30 (10.0%)	102 (34.0%)	92 (30.7%)
15	Pesticide has effect on fish and rivers?	35 (11.7%)	29 (9.7%)	28 (9.3%)	110 (36.7%)	96 (32.7%)
16	Pesticides can remain in the soil for a long time	19 (6.3%)	18 (6.7%)	20 (6.7%)	106 (35.3%)	137 (13.7%)

Note: SD and D = disagreement while SA and A = Agreement

Furthermore, as indicated in Table 4 the majority of the farmers agreed with item 21 that farmers re-spray the crops with surplus pesticide mixture (207) 69.0% agreed while (48) 16.0% disagreed and in item 22, (208) 69.3% agreed that farmers throw away surplus pesticide mixture on uncultivated land while (55) 18.3% disagreed, with item 23 (206) 74.0% agree that farmers wash and reuse emptied pesticide containers to store water while (44) 14.7% disagreed, and in item 24 (245) 81.7% agreed farmers return emptied pesticide containers to dealers, (34) 11.3% disagreed and with item 25, 247 82.3% agreed that farmers reuse emptied pesticide containers to store pesticides while (27) 9.0% disagreed.

Also, high number of the farmers agree to item 26 that farmers bury or burn emptied pesticide containers (218) 72.7% while (56) 18.7% disagreed and in item 27 (228) 76.0% agreed that farmers throw away emptied pesticide containers to rubbish dump while (50) 16.7% disagreed, and in item 28, (227) 75.7% agreed that farmers hire trained sprayer to spray the farm while (44) 14.7% disagreed.

In addition, item 29 (249) 83.0% agreed that farmers in West Libya wear protective clothes before spraying while (33) 11.0% disagreed, item 30 (226) 75.3% agreed that farmers feel comfortable wearing the protective clothing while (49) 16.3% disagreed, item 31 (238) 79.3% agreed that farmers in the region drink water while spraying and then (35) 11.7% disagreed, Item 32 (225) 75.0% agreed that farmers wash their protective clothing with personal clothes while (47) 15.7% disagreed, item 33 (228) 76.0% agreed that all farmers bath with soap and water after pesticide application while (41) 13.7% and item 34 (238) 78.3% agreed that farmers drink water while spraying while (35) 11.7% disagreed. Therefore, farmers practice with respect to pesticide use is high.

Table 4:

Practices with respect to pesticides use

Item	Statement	SD	D	Neither agree nor disagree	A	SA
21	Farmers re-spray the crops with surplus pesticide mixture	18 (6.0%)	30 (10.0%)	45 (15.0%)	105 (35.0%)	102 (34.0%)
22	Farmers throw away surplus pesticide mixture on uncultivated land	18 (6.0%)	37 (12.3%)	37 (12.3%)	112 (37.3%)	96 (32.0%)
23	Farmers wash and reuse emptied pesticide containers to store water	15 (5.0%)	29 (9.7%)	34 (11.3%)	120 (40.0%)	102 (34.0%)
24	Farmers return emptied pesticide containers to dealers	16 (5.3%)	18 (6.0%)	21 (7.0%)	101 (33.7%)	144 (48.0%)
25	Farmers reuse emptied pesticide containers to store pesticides	10 (3.3%)	17 (5.7%)	26 (8.7%)	91 (30.3%)	156 (52.0%)
26	Farmers bury or burn emptied pesticide containers	28 (9.3%)	28 (9.3%)	26 (8.7%)	89 (29.7%)	129 (43.0%)
27	Farmers throw away emptied pesticide containers to rubbish dump	24 (8.0%)	26 (8.7%)	22 (.7%)	107 (35.7%)	121 (40.3%)
28	Farmers hire trained sprayer to spray the farm	25 (8.3%)	19 (6.3%)	29 (9.7%)	121 (40.3%)	106 (35.3%)
29	Farmers in West Libya wear protective clothes before spraying	13 (4.3%)	20 (6.7%)	18 (6.0%)	100 (33.3%)	149 (49.7%)
30	Farmers feel comfortable wearing the protective clothing	22 (7.3%)	27 (9.3%)	25 (8.3%)	108 (36.0%)	118 (39.3%)
31	Farmers in the region drink water while spraying	15 (5.0%)	20 (6.7%)	27 (9.0%)	89 (29.7%)	149 (49.7%)
32	Farmers wash their protective clothing with personal clothes	23 (7.7%)	24 (8.0%)	28 (9.3%)	95 (31.7%)	130 (43.3%)
33	All farmers bath with soap and water after pesticide application	16 (5.3%)	25 (8.3%)	31 (10.3%)	117 (39.0%)	111 (37.7%)
34	Farmers drink water while spraying	14 (4.7%)	21 (9.0%)	27 (9.0%)	120 (40.0%)	118 (39.3%)

4.2 RQ2: Does level of education affect farmer's knowledge and practices associated with pesticide use?

Table 5 shows the standard regression model summary and Table 6 provides the Analysis of Variance (ANOVA) test of statistical significance of regression model. From the ANOVA (Table 6), F = 1.489and p =.000 (> .05) suggests that the test was not statistically significant. Therefore, linear combination of education factors significantly relate to the perceived practice, and knowledge.

Table 5:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.100[a]	.010	.003	.854	.010	1.489	2	297	.227	1.897

a. Predictors: (Constant), Practice, Knowledge

b. Dependent Variable: Educational

The standard regression model summary (Table 6) indicates the value of the regression coefficient (R =.100). This indicates how well all independent factors combined related with the independent factor (practice and knowledge). Moreover, the Adjusted R^2 = .003 shows that all the factors combine contributed only 0.03% of the variances in the dependent factor educational level.

Table 6

Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.171	2	1.086	1.489	.227[b]
	Residual	216.495	297	.729		
	Total	218.667	299			

a. Dependent Variable: Educational

b. Predictors: (Constant), Practice, Knowledge

Table 7.
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.979	.330		9.038	.000	2.331	3.628					
	Knowledge	-.116	.067	-.118	-1.724	.086	-.248	.016	-.086	-.100	-.100	.707	1.415
	Practice	.083	.096	.059	.862	.390	-.107	.273	-.005	.050	.050	.707	1.415

a. Dependent Variable: Educational

As seen in Table 7, Factor 1 (knowledge associated with pesticide use) was not statistically significant (B = -.118, t = -1.724; p = .000 > .05) and Factor 2 (practices associated with pesticide use) was also not statistically significant (B = .059, t = .862; p = .000 > .05) relate attitude towards educational level. Therefore, the level of education does not affect the farmer's knowledge and practices associated with pesticide use?

4.3 RQ3: Does gender affect the awareness of pesticide use and handling?

Table 8 shows the descriptive statistics of gender effect on awareness of pesticide use and handling. The mean values, 3.97 (SD = .787) show that male farmers' awareness was little above the mean value 3.93 (SD = .759) than the females' farmers. In general, the mean values for both genders was above 2.5, indicating that both gender are aware of pesticide use and handling.

Table 8.
Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Awareness	Female	157	3.93	.759	.061
	Male	143	3.97	.787	.066

The Levene's independent sample t-test was used to investigate whether male and female gender affects the awareness of pesticide use and handling at p = 0.05. The results are displayed in Table 11. The t-test results, however, showed that there was no statistically significant difference (t (298) = -.460, p = .664 > 0.05) between male and female farmers' awareness of pesticide use and handling. Therefore, male and female gender do not affect the awareness of pesticide use and handling.

Table 9.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Awareness	Equal variances assumed	.189	.664	-.461	298	.645	-.041	.089	-.217	.135
	Equal variances not assumed			-.460	293.020	.646	-.041	.089	-.217	.135

4.4 RQ4: What is the work practices regarding the use of protective measures and hygiene practices with the potential for exposure to pesticides?

The results of work practices regarding the use of protective measures and hygiene practices with the potential for exposure to pesticides are displayed in Table 10. 17 (5.7%), 30 (10.0%), 43 (14.3%), 100 (33.3%), 101 (33.7%) and 9 (3.0%) of the farmers use gloves, face mask, respirator, boots, coverall and all PPE respectively as protective cloth. Moreover, 63(20.7%) of the farmers keep their working cloths at home and 63(20.7%) of them keep the cloth in the farmhouse. In addition, the farmers were asked which spraying methods they used. 33 (11.0%), 136 (45.3%), 66 (22.0%), and 65 (21.7%), 80 (26.7%), of the farmers indicated that they used knapsack, hand- held can, and tractor for the spraying.

Table 10.

Work practices and hygiene practices with the potential for exposure to pesticides?

Item	Statement	Frequency	Percentage
35	What protective clothing do you wear		
	Gloves only	17	5.7
	Face Mask only	30	10.0
	Respirator	43	14.3
	Boots only	100	33.3
	Overall only	101	33.7
	All of the above	9	3.0
	Total	**300**	**100**
36	Where do you keep your working clothes		
	Home	62	20.7
	Hand- held can	238	79.3
	Total	**300**	**100**
37	What spraying methods do you use		
	Knapsack	33	11.0
	Hand- held can	136	45.3
	Tractor	66	22
	Tractor	65	21.7
	Total	**300**	**100**

4.5 RQ5: Is there a relationship between farmer's monthly income and farmer's knowledge/work practices regarding pesticide use?

Pearson Correlation Correlations was employed to assess whether there was a relationship between monthly income and farmer's knowledge practices regarding pesticide use. From Table 11, there is a correlation between the two variables. Therefore, there is no significant (p = .178, >0.005) relationship between farmers' monthly income and their knowledge/work practices regarding pesticide use.

Table 11.
Correlations

		Monthlyincome	Knowledge
Monthlyincome	Pearson Correlation	1	-.078
	Sig. (2-tailed)		.178
	N	300	300
Knowledge	Pearson Correlation	-.078	1
	Sig. (2-tailed)	.178	
	N	300	300

4.6 RQ6: What is the relationship between practices with respect to pesticides used and symptoms experienced after exposure to pesticides?

Table 12 shows the standard regression model summary and Table 11 provides the Analysis of Variance (ANOVA) test of statistical significance of regression model. From the ANOVA (Table 11), F = 19.456 and p =.000 (< .05) suggests that the test was statistically significant. Therefore, linear relationship practices with respect to pesticides were used and symptoms experienced were after exposure to pesticides.

Table 12.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.250	3	6.083	19.456	.000[b]
	Residual	92.554	296	.313		
	Total	110.804	299			

a. Dependent Variable: Practice
b. Predictors: (Constant), Farmers return emptied pesticide containers to dealers,

Farmers feel comfortable wearing the protective clothing, The standard regression model summary (Table 12) indicates the value of the regression coefficient (R =.406). Moreover, the Adjusted R^2 = .156 shows that all the factors combine contributed 15.6% of the variances in the dependent factor

Table 13.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.406[a]	.165	.156	.559	.165	19.456	3	296	.000	1.549

a. Predictors: (Constant), Farmers return emptied pesticide containers to dealers, Farmers feel comfortable wearing the protective clothing, Farmers feel comfortable wearing the protective clothing
b. Dependent Variable: Practice

In Table 7, it is seen that apart from Factor 1 (Farmers feel comfortable wearing the protective clothing) which was not statistically significant (B = .037, t = .596; p = .551 > .05), Factor 2 (Farmers feel comfortable wearing the protective clothing) was statistically significant (B = .281, t = 4.574; p = .000 < .05) and Factor 3 (Farmers return emptied pesticide containers to dealers) was statistically significant (B = .268, t = 5.089; p = .000 < .05). Therefore, in general there is a positive relationship between practices with respect to pesticides used and symptoms experienced after exposure to pesticides.

Table 14.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.603	.183		14.198	.000	2.242	2.964					
	Farmers feel comfortable wearing the protective clothing	.012	.020	.037	.596	.551	-.027	.050	.161	.035	.032	.748	1.336
	Farmers feel comfortable wearing the protective clothing	.183	.040	.281	4.574	.000	.104	.261	.306	.257	.243	.750	1.333
	Farmers return emptied pesticide containers to dealers	.213	.043	.268	5.019	.000	.130	.297	.273	.280	.267	.993	1.007

a. Dependent Variable: Practice

CHAPTER V

CONCLUSION AND RECOMMENDATION

5.1 What are the farmer's knowledge, practice and health problems associated with pesticide use?

This study shows that pesticide affects the health of humans. It also indicates that the farmers have knowledge associated with the use of pesticide to health problems. Farmers re-spray the crops with surplus pesticide mixture they throw away surplus pesticide mixture on uncultivated land, wash and reuse emptied pesticide containers to store water then return emptied pesticide containers to dealers thereby reusing emptied pesticide containers to store pesticides. A high number of the farmers in West Tripoli bury or burn emptied pesticide containers and throw away emptied pesticide containers to rubbish dump and also hire trained sprayer to spray the farm. Farmers in West Libya wear protective clothes before spraying and while using the PPEs they feel comfortable wearing the protective clothing. Farmers in the region drink water while spraying, after each use of the PPEs farmers wash their protective clothing with personal clothes and all farmers bath with soap and water after pesticide application. This majorly shows that farmers practice with respect to pesticide use is high.

5.2 Does the level of education affect farmers' knowledge and practices associated with pesticide use?

There is no statistically significant difference between farmer's knowledge and practices associated with pesticide use, linear combination of education factors significantly relates to the perceived practice, and knowledge. Knowledge associated with pesticide use was not statistically significant and practices associated with pesticide use was also not statistically significant related to attitudes towards educational level. Therefore, level of education does not affect the farmers' knowledge and practices associated with pesticide use though as reported by Atreya, (2007) on distinction of gender in knowledge on pesticide use and practices and found out that female farmers had lower levels of education than male, making them less inclined to read and comprehend names on pesticides. According to the study of Remoundou, (2014) the result is similar to this study in which the researcher states that education was not found to impact farmers' practices since greater part of

farmers conceded getting data/training from the legislature and asserted reading label directions and warning but Dey (2010) states that the lack of education can lead to unsafe act by farmers and that farmers' education is the key in the increasing in knowledge in safety practices.

5.3 Does gender affects the awareness of pesticide use and handling?

Gender effect on awareness of pesticide use and handling indicates that both genders are aware of pesticide use and handling so there was no statistically significant difference between a male and female farmers' awareness of pesticide use and handling. Therefore, male and female gender do not affect the awareness about pesticide use and handling and it is similar to the study of Gupta, (2004) which shows that there is no difference between male and female awareness of pesticide usage and handling. However, by any international standard, both males and females had very low level of knowledge, but these are consistent with other studies done in developing countries (Recena et al., 2006; Yassin et al., 2002 and Salameh et al., 2004). This is due to the fact that the farmers in developing countries are illiterate.

5.4 What is the work practices regarding the use of protective measures and hygiene practices with the potential for exposure to pesticides?

The results of work practices regarding the use of protective measures and hygiene practices with the potential for exposure to pesticides indicates that farmers use gloves, face mask, respirator and boots. Moreover, the farmers keep their working clothe at home and the spraying methods used are knapsack, hand-held can, and tractor. Though the protective equipment used by Sosan and Akingbohungbe (2009) is overalls (safety cloth) as different from our present study still shows that the use of protective equipment while applying pesticide is crucial to avoid health effect and as concluded by Christos and Ilias, (2011). Great knowledge of farmers on pesticide use and practices, for example, transfer, storage and transportation will fundamentally reduce the routes in which pesticides influence human health and the environment.

5.5 Is there a relationship between farmer's monthly income and farmer's knowledge/work practices regarding pesticide use?

There is a relationship between monthly income and farmer's knowledge practices regarding pesticide use. Therefore, there is no significant relationship between farmer's monthly income and farmer's knowledge/work practices

regarding pesticide use. Similar to the study by Subashiny and Thiruchelvam (2008) incomes of farmers had showed no relationship with the knowledge level of pesticide management but contrary to the study of Suthep et al., (2016) monthly income was totally correlated with safe use of pesticides

5.6 What is the relationship between practices with respect to pesticides used and symptoms experienced after exposure to pesticides?

The study suggests that the test was statistically significant. Therefore, linear relationship practices with respect to pesticides used and symptoms experienced after exposure to pesticides.

The danger of exposure increase when farmers disregard safety directives on the correct utilization of pesticides, PPE utilization and using sanitary practices (Damalas et al., 2008). When farmers are exposed to pesticide in high concentration and dose it can cause several effects like negative health results and this can happen because exposure to pesticides vary as per the pesticide included and the methods of exposure, with the dermal course being the most extreme, particularly for sprayers or applicators, (MacFarlane et al., 2013). Gatto et al., (2014) found that outcomes from human examinations recommend that exposure to neurotoxic pesticides can initiate harm to the central auditory system and even more other health effect.

5.7 Recommendations

- Pesticide use in Libya should be monitored and only approved distributors should be allow to sell
- There should be special training on spraying and pesticides should only be sold to farm engineers who are expert in spraying of pesticides.
- There should be seminar and training on how to use PPEs while spraying pesticides and also how to use different sprayers.
- Every farmer in Libya should be enlightened and educated to understand the environmental and health effect of pesticides.
- There is should be an alternative to pesticide use
- For future it is recommended that symptoms of health effect of pesticides should be studied.
- Medical status of farmers should be ascertained monthly.
- There should be and enforcement of integrated pest management programs.

REFERENCES

Abstracts of the (2012). International Congress of the European Association of Poisons Centres and Clinical Toxicologists, 25 May–1 June 2012, London, UK, *Clinical Toxicology, 50*:4, 273-366, DOI: 10.3109/15563650.2012.669957

Ajayi, O. O. D. (2000). Pesticide Use Practices, Productivity and Farmers' Health : The Case of Cotton-Rice Systems in Cote d'Ivoire West Africa. *Pesticide Policy Project Publication Series, 3*, 1–172.

Suthep Silapanuntakul, Tanasri Srihabut & May Thet Khine (2016) Pesticides Use Practice and its Related Factors among Farmers in Pyin Oo Lwin Township, Myanmar. *International Journal of Health Sciences. 4*(1): 48-58

Subashiny Nagenthirarajah and S. Thiruchelvam (2008). Knowledge of Farmers about Pest Management Practices in Pambaimadu, Vavuniya District: An Ordered Probit Model Approach. *Sabaramuwa University Journal. 8*(1): 79-89

Andreatta, S. L. (1998). Agrochemical exposure and farm worker health in the Caribbean: a local/global perspective. *Human Organization, 57* (3), 350–358.

Arizona Agricultural Pesticide Applicator Training Manual (2000), College of Agriculture and Life Sciences, The University of Arizona, Tucson, Arizona, 85721. Full publication located at located at http://ag.arizona.edu/pubs/insects/az1149/

Atreya, K. (2007). Pesticide use knowledge and practices: A gender differences in Nepal. *Environmental Research, 104*(2), 305–311. http://doi.org/10.1016/j.envres.2007.01.001

Atreya, K., Sitaula, B. K., Johnsen, F. H., & Bajracharya, R. M. (2010). Continuing Issues in the Limitations of Pesticide Use in Developing Countries. *Journal of Agricultural and Environmental Ethics, 24*(1), 49–62.

Christos A. Damalas, and Ilias G. Eleftherohorinos. (2011). Review: Pesticide Exposure, Safety Issues, and Risk Assessment Indicators. *Int. J. Environ. Res. Public Health, 8*, 1402-1419; doi:10.3390/ijerph8051402

Dalvie Aqiel, M., Africa, A., & London, L. (2006). Disposal of unwanted pesticides in Stellenbosch, *South Africa. The Science of the Total Environment, 361*(1-3), 8–17. doi:10.1016/j.scitotenv.2005.09.049

Dalvie, M. A., Africa, A., London, L. (2006). Change in the quantity and acute toxicity of pesticides sold in South African crop sectors, 1994 - 1999. *Environment International, 35*(4), 683–687.

Dalvie, M. A., Africa, A., Solomons, A., London, L., Brouwer, D., & Kromhout, H. (2009). Pesticide exposure and blood endosulfan levels after first season spray amongst farm workers in the Western Cape, South Africa. *Journal of Environmental Science and Health, 44*, 271–277.

Damalas, C. a, Telidis, G. K., & Thanos, S. D. (2008). Assessing farmers‟ practices on disposal of pesticide waste after use. *The Science of the Total Environment, 390* (23), 341–5. http://doi.org/10.1016/j.scitotenv.2007.10.028

Devi, P. Indira (2009). Health Risk Perceptions, Awareness and Handling Behaviour of Pesticides by Farm Workers. *Agricultural Economics Research Review. 22*: 263-268

Dey Nepal,C., (2010). Use of Pesticides in vegetable farms and its impact on health of farmers and the environment. Environmental Science and technology.

Donkor, A., Bempah, C. K., Dubey, B. K., Attandoh, N., & Commission, E. (2015). R j c e s, 3(February), 1–9.

Dwayne Henry& Giuseppe Feola (2013). Pesticide-handling practices of smallholder coffee farmers in Eastern Jamaica. *Journal of Agriculture and Rural Development in the Tropics and Subtropics. 114*(1): 59–67. urn:nbn:de:hebis:34-2013030542613

Fianko, J. R. (2011). Agrochemicals and the Ghanaian Environment, a Review. Journal of Environmental Protection, 02(May), 221–230. http://doi.org/10.4236/jep.2011.23026

Francisco Sánchez-Bayo (2011).Impacts of Agricultural Pesticides on Terrestrial Ecosystems. Ecological Impacts of Toxic Chemicals. Chapter4: 63-87.

García-García, C. R., Parrón, T., Requena, M., Alarcón, R., Tsatsakis, A. M., & Hernández, A. F. (2015). Occupational pesticide exposure and adverse health effects at the clinical, hematological and biochemical level. Life Sciences. http://doi.org/10.1016/j.lfs.2015.10.013

Gatto M.P., Fioretti M., Fabrizi G., Gherardi M., Strafella E., Santarelli L., (2014) Effects of potential neurotoxic pesticides on hearing loss: A review. *NeuroToxicology 42* (2014) 24–32

Ghisari, M., Long, M., Tabbo, A., & Bonefeld-Jørgensen, E. C. (2015). Effects of currently used pesticides and their mixtures on the function of thyroid hormone and aryl hydrocarbon receptor in cell culture. *Toxicology and Applied Pharmacology*, *284*(3), 292–303. http://doi.org/10.1016/j.taap.2015.02.004

Gupta, P.K., 2004. Pesticide exposure-Indian scene. *Toxicology 198*, 83–90.

Hoppin, J. A., Valcin, Ã. M., Henneberger, P. K., Kullman, G. J., Umbach, D. M., London, S. J., Alavanja, M. C. R., et al. (2007). Pesticide Use and Chronic Bronchitis Among Farmers in the Agricultural Health Study. *American Journal of Industrial Medecine, 50*, 969–979.

Ian C. J. Perez, Chielo M. Gooc, Jilliane R. Cabili, Marlo J. P. Rico, Michelle S. Ebasan, Monaliza J. G. Zaragoza, Aileen F. S. Redondo, Ronaldo R. Orbita, Maria L. D. G. Lacuna (2015). Pesticide use among farmers in Mindanao, Southern Philippines. *Advances in Environmental Sciences-International Journal of the Bioflux Society*. *7*(1): 90-108

Khan M., Mahmood H.Z., Damalas C., (2012) Pesticide use and risk preception among farmers in the cotton belt of Punjab, Pakistan.

Limantol Andrew Manoba, Bruce Edward Keith, Bismark Atiayure Azabre and Bernd Lennartz (2016). Farmers' perception and adaptation practice to climate variability and change: a case study of the Vea catchment in Ghana. SpringerPlus 5:830 DOI 10.1186/s40064-016-2433-9

London, Leslie. (1992). Agrichemical hazards in the South African farming sector. *South African Medical Journal, 81*, 560–564.

London, Leslie. (2001). Pesticides and women agricultural workers in South Africa : A question of social justice. Women & Environments International Magazine, 32–33.

Lorenz, A. N., Prapamontol, T., Narksen, W., Srinual, N., Barr, D. B., & Riederer, A. M. (2012). Pilot study of pesticide knowledge, attitudes, and practices among pregnant women in northern Thailand. *International Journal of Environmental Research and Public Health, 9*(9), 3365–3383. http://doi.org/10.3390/ijerph9093365

Lotti, M. & Moretto, A (2005). Organophosphate-induced delayed polyneuropathy. *Toxicological Reviews, 24*(1), p. 37.

Lu, J. L. (2009). Comparison of pesticide exposure and physical examination, neurological assessment, and laboratory findings between full-time and part-time vegetable farmers in the Philippines. *Environmental Health and Preventive Medicine, 14*(6), 345–352. http://doi.org/10.1007/s12199-009-0105-x

Macfarlane, E., Carey, R., Keegel, T., El-Zaemay, S., & Fritschi, L. (2013). Dermal exposure associated with occupational end use of pesticides and the role of protective measures. *Safety and Health at Work, 4*(3), 136–141. http://doi.org/10.1016/j.shaw.2013.07.004

Mansingh, A., Robinson, D. & Dalip, K. M. (2003). Use, fate and ecotoxicity of pesticide in Jamaica and the Commonwealth Caribbean. In M. D. Taylor, S. J. Klaine, F. P. Carvalho, D. Barcelo, & J. Everaarts (Eds.), Pesticide residues in tropical coastal ecosystems. Distribution, fate and effects (pp. 425–463). Routledge, New York.

Mather, C. (1996). Towards sustainable agriculture in post-apartheid South Africa. *GeoJournal*, *39*(1), 41–49.

Mees, C., Esteban, N. & Seddon-Brown., S. (2003). Management of agro-chemicals for improved public and environmental health – A strategy for improved agro-chemical use and management for the wider Caribbean. Natural Resource System Program (NRSP); MRAG, London, UK. http://www.oas.org/dsd/Quimicos/Documents/Caribe/caribbean%20strategy%20dfid.pdf

Mekonnen, Y., & Agonafir, T. (2002). Pesticide sprayers' knowledge, attitude and practice of pesticide use on agricultural farms of Ethiopia. *Occupational Medicine, 52(*6), 311–315.

Mostafalou S., Mohammad A., (2013) Pesticides and human chronic diseases: Evidences, mechanisms, and perspectives. *Toxicology and Applied Pharmacology 268* (2013) 157–177

Muhammad Khan, Hafiz Zahid Mahmood, Christos A. Damalas (2015) Pesticide use and risk perceptions among farmers in the cotton belt of Punjab, *Pakistan Crop Protection 67*, 184-190

Naidoo, S, London, L., Rother, H., Burdorf, A., Naidoo, R. N., & Kromhout, H. (2010). Pesticide safety training and practices in women working in small-scale agriculture in South Africa. *Occupational and environmental medicine*, *67*(12), 823–828.

National Pesticide Information Center (USA) npic@ace.orst.edu

Ncube, N., Fogo, C., Bessler, P., Jolly, C. M. & Jolly, P. E. (2011). Factors associated with self-reported symptoms of acute pesticide poisoning among farmers in northwestern Jamaica. *Archives of Environmental & Occupational Health*, *66*, 65–74.

Neghab, M., Momenbella-Fard, M., Naziaghdam, R., Salahshour, N., Kazemi, M., & Alipour, H. (2014). The effects of exposure to pesticides on the fecundity status of farm workers resident in a rural region of Fars

province, southern Iran. *Asian Pacific Journal of Tropical Biomedicine*, *4*(4), 324–8. http://doi.org/10.12980/APJTB.4.2014C586

Ntow, W. J., Gijzen, H. J., Kelderman, P., & Drechsel, P. (2006). Farmer perceptions and pesticide use practices in vegetable production in Ghana. *Pest Management Science*, *62*(4), 356–65. http://doi.org/10.1002/ps.1178

Ntow, W. J., Tagoe, L. M., Drechsel, P., Kelderman, P., Nyarko, E., Gijzen, H. J., Gijzen, Æ. H. J. (2009). Occupational exposure to pesticides: blood cholinesterase activity in a farming community in Ghana. *Archives of Environmental Contamination and Toxicology*, *56*(3), 623–30. http://doi.org/10.1007/s00244-0079077-2

Oesterlund, A. H., Thomsen, J. F., Sekimpi, D. K., Maziina, J., Racheal, A., & Jørs, E. (2014). Pesticide knowledge, practice and attitude and how it affects the health of small-scale farmers in Uganda: a cross-sectional study. *African Health Sciences*, *14(*2), 420–33. http://doi.org/10.4314/ahs.v14i2.19

Open Anesthesia (2017). Organophosphate poisoning: diagnosis and treatment. International Anesthesia Research society. Accessed 24th November, 2017 and retrieved from https://www.openanesthesia.org/organophosphate_poisoning_diagnosis_and_treatment/

Rama, D. B., & Jaga, K. (1992). Pesticide exposure and cholinesterase levels among farm workers in the Republic of South Africa. *The Science of the total environment*, *122*(3), 315–9.

Recena, M.C.P., Caldas, E.D., Pires, D.X., Pontes, E.R.J.C., 2006. Pesticides exposure in Culturama, Brazil—knowledge, attitudes, and practices. *Environ. Res. 102* (2), 230–236.

Remoundou, K., Brennan, M., Hart, A., & Frewer, L. J. (2014). Pesticide Risk Perceptions, Knowledge, and Attitudes of Operators, Workers, and Residents: A Review of the Literature. Human and Ecological Risk Assessment, 7039(September 2015). http://doi.org/10.1080/10807039.2013.799405

Rother, H.-A. (2008). South African farm workers' interpretation of risk assessment data expressed as pictograms on pesticide labels. *Environmental Research, 108*(3), 419–27.

Rother, H.-A., & Jacobs, R. (2008). Pesticide Health Risks for South African Emerging Farmers: Surplus People Project (pp. 1–23).

Rother, H.-A., Hall, R., & London, L. (2008). Pesticide use among emerging farmers in South Africa: contributing factors and stakeholder perspectives. *Development Southern Africa, 25*(4), 399–424.

Salameh, P., Baldi, I., Brochard, P., & Abi Saleh, B. (2004). Pesticides in Lebanon: a knowledge, attitude, and practice study. *Environmental Research, 94*(1), 1–6.

Salameh, P.R., Baldi, I., Brochard, P., Abi Saleh, B., 2004. Pesticides in Lebanon: a knowledge, attitude, and practice study. *Environ. Res. 94,* 1–6.

Sam, K. G., Andrade, H. H., Pradhan, L., Pradhan, A., Sones, S. J., Rao, P. G. M., & Sudhakar, C. (2007). Effectiveness of an educational program to promote pesticide safety among pesticide handlers of South India. *International Archives of Occupational and Environmental Health, 81*(6), 787–795.

Schlosser, T. C. (1999). Local realities and structural constraints of agricultural health: pesticide poisoning of Jamaican small-holders. Master's thesis Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Singh B. and Gupta, M K. 2009. "Pattern of use of personal protective equipments and measures during application of pesticides by agricultural workers in a rural area of Ahmednagar district". *India, Indian J Occup & Env Med 13* (3): 127-130.

Sosan M.B., Akingbohungbe A.E., (2009) Occupational insecticide exposure and preception of safety measures among cacao farmers in Southwestern Nigeria. *Archives of environmental and Occupational health. 64*(3):185-93. doi: 10.1080/19338240903241077.

Starks, S. E., Hoppin, J. a, Kamel, F., Lynch, C. F., Jones, M. P., Alavanja, M. C., Sandler, D. P., et al. (2012). Peripheral nervous system function and organophosphate pesticide use among licensed pesticide applicators in the Agricultural Health Study. *Environmental health perspectives*, *120*(4), 515–20.

Thundiyil, J. G., Stober, J., Besbelli, N. & Pronczuk, J. (2008). Acute pesticide poisoning: a proposed classification tool. *Bulletin of the World Health Organization*, *86*, 205–209.

Wesseling, C., Aragón, A., Castillo, L., Corriols, M., Chaverri, F., De La Cruz, E., Keifer, M., Monge, P., Partanen, T. J., Ruepert, C. & Van Wendel De Joode, B. (2001). Hazardous pesticides in central America. *International Journal of Occupational and Environmental Health*, *7* (4), 287–294.

World Health Organization (2010). The WHO recommended classification of pesticides by hazard and guidelines to classification: 2009. WHO Library Cataloguing-in-Publication Data. Accessed 24th November, 2017 and retrieved from http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf/

Yassin, M.M., Abu Mourad, T.A., Safi, J.M., 2002. Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip. Occup. *Environ. Med. 59*, 387–394.

Zsuzsanna Jakab (2011). Presentation: "Designing the road to better health and well-being in Europe" at the 14th European Health Forum Gastein. http://www.euro.who.int/__data/assets/pdf_file/0003/152184/RD_Dastein_speech_wellbeing_07Oct.pdf

Zyoud, S.H.; Sawalha, A.F.; Sweileh, W.M.; Awang, R.; Al-Khalil, S.I.; Al-Jabi, S.W.; Bsharat, N.M. Knowledge and practices of pesticide use among farm workers in the West Bank, Palestine: Safety implications. Environ. Health Prev. Med. 2010, 15, 252–261.

Appendix I

Questionnaire

Dear respondents

The objective of the questionnaire is to collect information about *Farmers Knowledge, practices and health problems Associated with Pesticides use in West Tripoli, Libya.* The information you provide will be valuable for academic purpose of Near East University, Turkish Republic of north Cyprus TRNC. Therefore, your genuine, honest, and prompt response is a valuable input for the quality and successful completion of the research. The information you give is used only for academic purpose and will be kept confidential.

I. Demographic Data

i. Gender: ☐ Male ☐ Female

ii. Place of birth: …….

iii. Age: < 20 ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ 51 -60 ☐ >60

v. Level of Education

High school ☐ College ☐ University ☐

No education ☐

vii. What is your monthly income? (Dollars $)

Less than 500 ☐ 501-1,000 ☐ 1,001-2,000 ☐

2,001 and above ☐

II. Awareness about pesticide use and handling (Devi, 2009)

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1	Farmers read the labels on the package?					
2	Farmers seek help from others?					
3	Farmers follow the instructions given on the label?					
4	Farmers are aware of pesticide toxicity levels?					
5	The level of toxicity is understood by reading the sign on the label?					
6	Farmers take bath right after spraying?					
7	Farmers change clothes right after spraying?					
8	Farmers keep the pesticide bottle along with food items?					
9	Farmers store food items in pesticide bottle after use?					
10	Farmers wash the sprayer/bottle in the pond/canal/river/others?					
11	Do you determine the wind direction first and then spray?					
12	Farmers spray when it is windy?					
III. Knowledge on the effects of pesticides on Human health and the Environment (Akorfa Dzobo, 2016).						
13	Pesticide affects the health of humans?					
14	Pesticides affect the environment					
15	Pesticide have effect on fish and rivers?					
16	Pesticides can remain in the soil for a long time					

17. What are the pesticide(s) you use on your farm? .....

18. How do think pesticides enter your body? Skin ☐ Nose ☐ Mouth Eyes

19. Have you ever had any training on pesticide use? Yes ☐ No ☐

20. Who trained you? Pesticide Dealers □ Agric. Extension Officer□ □ NGO

IV. Practices with respect to pesticides use (Akorfa Dzobo, 2016).

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
21	Farmers re-spray the crops with surplus pesticide mixture					
22	Farmers throw away surplus pesticide mixture on uncultivated land					
23	Farmers wash and reuse emptied pesticide containers to store water					
24	Farmers return emptied pesticide containers to dealers					
25	Farmers reuse emptied pesticide containers to store pesticides					
26	Farmers bury or burn emptied pesticide containers					
27	Farmers throw away emptied pesticide containers to rubbish dump					
28	Farmers hire trained sprayer to spray the farm					
29	Farmers in West Libya wear protective clothes before spraying					
30	Farmers feel comfortable wearing the protective clothing					
31	Farmers in the region drink water while spraying					
32	Farmers wash their protective clothing with personal clothes					

33	All farmers bath with soap and water after pesticide application					
34	Farmers drink water while spraying					

35. What protective clothing do you wear? Gloves only □ Face Mask only □ respirator

Boots only □ Overall only □ All of the above □

36. Where do you keep your working clothes: Home □ Farmhouse □ Other

37. What spraying methods do you use? Knapsack □ Hand- held can □ □ Tractor □ Aerial

V. Symptoms experienced after exposure to pesticides (Akorfa Dzobo, 2016).

38. Which of the following symptoms do you experience after you are exposed to pesticides?

□ Red itchy eyes □ Nausea and vomiting □ Coughs □ Wheezing

□ Running nose □ Salivation □ Skin rash/itching Excessive

□ Sweating □ Headaches □ Sexual weakness Shortness of breath

39. When do you experience these symptoms?

Immediately after spraying □ within 24 hours □ After 48 □ hours

Moore than 3 days □

40. What do you do when you experience these symptoms?

Self-medication □ Report to the hospital □

Report to the Agric. Officer □ Other □