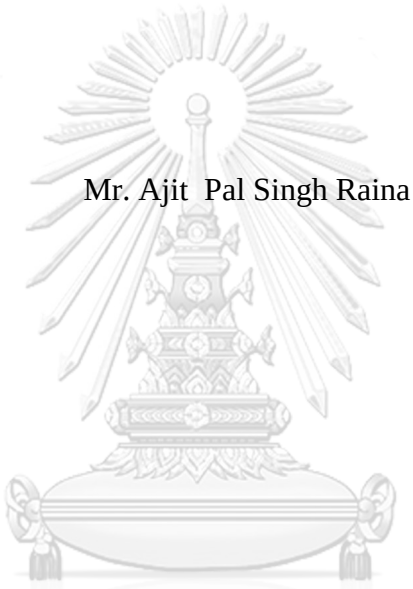
EFFECTIVENESS OF AN EDUCATIONAL PROGRAM TO PROMOTE THE SAF E USE OF PESTICIDE AMOUNG VEGETABLE FARMERS IN INDIA: A QUASI EXPE RIMENTAL STUDY

Mr. Ajit Pal Singh Raina



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.....Dean of the College of Public Health Sciences
(Professor Sathirakorn Pongpanich, Ph.D.)

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.....Examiner
(Associate Professor Wattasit Siriwong, Ph.D.)

.....External Examiner
(Nanta Auamkul, M.D.)

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…… Examiner
(Assoc. Prof. Wattasit Siriwong, Ph.D.)

…… Examiner
(Asst. Prof. Nutta Taneepanichskul, Ph.D)

…… External Examiner
(Nanta Auamkul, M.D, M.P.H)

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วัตถุประสงค์:1)เพื่อเป็นข้อมูลพื้นฐานเกี่ยวกับการใช้สารกำจัดศัตรูพืชและผลกระทบต่อสุขภาพต่อการใช้สารกำจัดศัตรูพืชในเกษตรกรปลูกผัก เมืองนิวเดลี 2) เพื่อเตรียมข้อมูลด้านความรู้ ทัศนคติ และการปฏิบัติตนเกี่ยวกับการใช้สารกำจัดศัตรูพืชในเกษตรกรปลูกผัก เมืองนิวเดลี 3) ออกแบบเครื่องมือในการศึกษาที่เรียบง่าย ราคาไม่แพง
สำหรับเกษตรกรผู้ปลูกผักซึ่งสามารถใช้ในการฝึกอบรมเกษตรกรเกี่ยวกับการใช้สารกำจัดศัตรูพืชได้อย่างปลอดภัย 4)
เพื่อประเมินการเปลี่ยนแปลงคะแนนความรู้
ทัศนคติและการปฏิบัติตนในการลดอาการสัมผัสสารกำจัดศัตรูพืชให้กับเกษตรกรและคนในครอบครัว

รูปแบบและวิธีการศึกษา : หลังจากพัฒนาเครื่องมือทางการศึกษาแบบง่ายๆ
มีการประเมินประสิทธิผลโดยการวัดคะแนนเฉลี่ยของความรู้ ทัศนคติ การปฏิบัติตน
และพฤติกรรมความปลอดภัยในบ้านของเกษตรกรปลูกผัก
มีการจัดเตรียมภาพที่เข้าใจง่ายและอธิบายแก่กลุ่มเกษตรกรปลูกผักที่เป็นกลุ่มทดลอง
ในขณะที่ไม่มีการให้ข้อมูลเพิ่มเติมใดๆกับกลุ่มควบคุม
มีการสัมภาษณ์แบบตัวต่อตัวโดยใช้แบบสอบถามที่มีโครงสร้างเพื่อการรวบรวมข้อมูลเชิงปริมาณเกี่ยวกับความรู้ ทัศนคติ
และแนวทางการใช้สารกำจัดศัตรูพืชของเกษตรกรกลุ่มปลูกผัก นอกจากนี้มีการตรวจสอบภายในบ้าน
เพื่อดูพฤติกรรมการใช้สารเคมีกำจัดศัตรูพืชในทั้งสองกลุ่ม การปรับปรุงความรู้ ทัศนคติ การปฏิบัติตน
และคะแนนการตรวจติดตามภายในบ้านในกลุ่มทดลองถูกนำมาเปรียบเทียบกับกลุ่มควบคุม ในเดือนที่ 1 และ 3
เพื่อแสดงให้เห็นประสิทธิผลของเครื่องมือการศึกษา

ผลการศึกษา: เกษตรกรปลูกผักที่ลงทะเบียนเข้าร่วมวิจัยจำนวนทั้งหมด 100 คน จาก 4 หมู่บ้าน พบว่ามีเพียง 90
คนที่สามารถเข้าร่วมในการวิจัยจนเสร็จสิ้นโครงการ โดยจำแนกได้ดังนี้ จำนวน 44 คนอยู่ในกลุ่มทดลอง และ 46 คนอยู่ในกลุ่มควบคุม
แม้ว่าจะไม่มีความแตกต่างทางด้านข้อมูลพื้นฐานของทั้งสองกลุ่ม แต่คะแนนความรู้พื้นฐานของทั้งสองกลุ่มค่อนข้างต่ำสุด
คะแนนรวม 26 คะแนน ผู้เข้าร่วมวิจัยให้คะแนนตอบคำถามที่ถูกต้องถึง 40% โดยเฉลี่ย
โดยจำแนกเป็นคะแนนทัศนคติและคะแนนการปฏิบัติซึ่งอยู่ระหว่าง 40-60% ของคะแนนซึ่งอยู่ในระดับพื้นฐาน
สำหรับการตรวจติดตามในบ้านเกี่ยวกับการปฏิบัติตนที่ปลอดภัยเกี่ยวกับการใช้ยาฆ่าแมลงที่ถูกต้องในทั้งสองกลุ่ม พบว่ามีค่าเฉลี่ย
66% เครื่องมือทางการศึกษาแบบง่ายๆที่ใช้ในกลุ่มทดลองมีผลทำให้ ความรู้ ทัศนคติ
และการปฏิบัติตนมีการพัฒนาดีขึ้นอย่างมีนัยยะ จากการ ติดตามผลในครั้งที่ 1 และครั้งที่ 2
ซึ่งนำผลมาเปรียบเทียบกับคะแนนเฉลี่ยพื้นฐาน สำหรับคะแนนความรู้เพิ่มขึ้นจากคะแนนพื้นฐานโดยรวม 59.9%
คะแนนทัศนคติเพิ่มขึ้น 7.10% คะแนนการปฏิบัติมีประสิทธิภาพเพิ่มขึ้น 9.29% จากคะแนนพื้นฐานที่ติดตามผล 2 รอบ
เมื่อเปรียบเทียบกับกลุ่มควบคุม ซึ่งสอดคล้องกับการประเมิน พฤติกรรมด้านความปลอดภัยในบ้าน
พบว่ากลุ่มทดลองมีประสิทธิภาพเพิ่มขึ้น 30.69% จากคะแนนพื้นฐานที่ติดตามผล 2
รอบเปรียบเทียบกับกลุ่มควบคุมนอกเหนือไปจากประสิทธิภาพของเครื่องมือการศึกษาช่วยที่ช่วยเพิ่มการปฏิบัติตนที่ปลอดภัยในการป้องกันการใช้สารกำจัดศัตรูพืชของเกษตรกรผู้ปลูกผักแล้ว
เครื่องมือดังกล่าวยังช่วยลดความชุกของอาการทางสุขภาพที่เกิดจากการสัมผัสสารกำจัดศัตรูพืชนั้นด้วย

การสรุปและอภิปรายผล: เครื่องมือการศึกษาแบบรูปภาพ เรียบง่าย และราคาไม่สูง
มีประสิทธิภาพเพียงพอที่จะให้ความรู้แก่เกษตรกรเกี่ยวกับการใช้สารกำจัดศัตรูพืชอย่างปลอดภัย
และเครื่องมือดังกล่าวยังมีผลกระทบระยะสั้นและระยะยาวต่อการปรับเปลี่ยน ความรู้ ทัศนคติ และ
พฤติกรรมการใช้สารกำจัดศัตรูพืชซึ่งสามารถช่วยลดผลกระทบต่อปัญหาสุขภาพของเกษตรกร
ผลสำเร็จของการวิจัยนี้ควรกระตุ้นให้บริษัทผู้ผลิตสารกำจัดศัตรูพืชดำเนินการใช้เครื่องมือทางการศึกษาที่มีราคาไม่สูงนี้
เพื่อส่งเสริมการใช้สารกำจัดศัตรูพืชอย่างปลอดภัยและลดอันตรายจากการประกอบอาชีพให้กับเกษตรกร

สาขาวิชา .....สาธารณสุขศาสตร์.....ลายมือชื่อนิสิต.....
ปีการศึกษา .....ที่ปรึกษาวิทยานิพนธ์หลัก.ลายมือชื่อ อ .....2561.....

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TITLE: EFFECTIVENESS OF AN EDUCATIONAL PROGRAM TO PROMOTE THE SAFE USE OF PESTICIDE AMONG VEGETABLE FARMERS IN INDIA: A QUASI EXPERIMENTAL STUDY.

Objectives: 1)To provide information on baseline use and Health impacts of pesticides. 2) To provide information on knowledge, attitude, and Practice for pesticide. 3) To design a self-explanatory and affordable educational tool for vegetable farmers which can be used to train farmers on safe use of pesticides and finally 4) To assess change in KAP score and reduction in pesticide exposure symptoms to farmers and their families.

Methods: After developing a simple educational tool, its effectiveness was assessed by measuring change in mean scores of knowledge, attitude, practice (KAP) and in-home pesticide safety behaviour in households of farmers. Pictorial and simple to understand educational tool was provided and explained to enrolled farmers in intervention villages only. A face to face interview based on a structured questionnaire was conducted to collect quantitative data on knowledge, attitude and pesticide use practices by the vegetable farmers. In-addition, in-home inspection as a component of pesticide use behaviours was carried out in both the study groups. Improvement in KAP and in-home inspection scores in intervention group was compared to control group at 1 and 3 months post intervention, to demonstrate effectiveness of educational tool.

Results: The study enrolled 100 study subjects from 4 villages, out of which a total of 90 subjects complete the study and were followed up to completion of study. 44 subjects completed study from intervention villages and 46 subjects completed all study follow up from control villages. Though there were no differences at baseline between study groups, however baseline knowledge score of study subjects was found to be lowest. Out of total knowledge questions, study participants gave correct response to 40%, on an average. This was followed by attitude and practice scores, which ranged between 40-60% of total score at baseline. For in-home assessment, we found an average of 66% correct safe pesticide practices being followed at home, which was similar in both intervention and control groups. The educational tool had effectively improved knowledge, attitude, and practice in the intervention group at follow-up 1 and follow-up 2 compare to mean score at baseline. For knowledge scores the educational tool had an overall effected increase of 59.9% from baseline score, for attitude the program had shown an increase of 7.10% from baseline score, for practice the program had effective increase of 9.29% from baseline score at follow-up 2 when compared with control group. Similarly, for in home assessment (behaviour) the intervention had an effective increase of 30.69% from baseline score at follow-up 2 when compare with control group.

In addition to effectiveness of the educational tool for increasing safe pesticide practice it also led to minimized pesticide exposure which decreased prevalence of health symptoms, in all five health symptoms categories assessed.

Conclusion and discussion: A simple, affordable and self-explanatory pictorial educational tool can be effective in not only providing knowledge to farmers on safe use of pesticides but also has short to long term impact on improving pesticide use attitude, and behaviour, which can help reduce health impact in the farming community. Successful outcome of this research should motivate pesticide manufacturers to undertake use of inexpensive educational tool to promote the safe use of pesticides and minimize occupational hazards to farmers.

Field of Study: Public Health Student's Signature ……

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CHAPTER I
INTRODUCTION

1.1 Background & Rationale

There has been a steep increase in dependence on chemical pesticides which is more common and prominent in developing countries, in recent years. Farmers in these countries often use outdated, inexpensive and more toxic to environment. Use of such persistent and toxic pesticide is mainly due to lack of legislature and within country control mechanisms for pesticide use, and also because of ignorance of farming community. This has led to widespread availability and hence use of pesticides by farming community, resulting in serious health problems not only to farmers and their families but also to environment. (Ecobichon 2001).

It is estimated that 1.5 million pesticides are being manufactured worldwide per year with a total pesticide market of worth $ 30 billion (Malik 1996). On annual production of pesticide, India is number second in terms of consumption after (Gupta 2004). India started its first pesticide production facility in mid of nineteen century and now is producing more than 85000 metric tons of pesticides per year. The institute of Central Insecticides Board and Registration Committee (CIBRC) has registered more than 145 varieties of pesticides so far (Arun 2005).

Pesticides has been associated with a large spectrum of morbidity and mortality, ranging from unintentional exposure, accidental consumption, to occupational exposure in industrial setting and farming. (The Health and Environmental Linkages Initiative, World Health Organization 2007). Out of above, occupational poisoning in farmers is the most common mainly due to ignorance and impractical guidance for use of pesticides to farmers. Most of the safety equipment advised do not work in humid and hot environment, especially in country like India. Moreover, safety instructions on pesticides containers are difficult to follow, often written in unfamiliar languages, which many farmers are unable to follow. Since there is no formal or informal advice is available to farmers on use of pesticides by either manufacturers or sellers, farmers and their family members run the highest risks of pesticide exposure as they directly come in contact with the pesticides during various process of its application like mixing,

spraying, storage and disposal. Pesticide residues are not only found on farmers, but also in their house hold as they usually carry residue back to their houses due to wrong practices on use of pesticides. Lack of resources and training programs for agricultural community by governments in developing countries, coupled with illiteracy in farming community, there is no way to ensure safe use of pesticides . Hence, pesticide poisoning is a problem among poor rural populations where men, women, and children all work and live in close proximity along with pets. (Mekonnen and Agonafer2002).

In past, there have been several studies and methods proposed to reduce pesticide exposure in farming communities. But all such methods have not been successful due to their expensive nature and unaffordability by governments and farmers. In 1985, the UN Food and Agricultural Organization (FAO) initiated a voluntary code of conduct, but a lack of adequate government resources in the developing world makes this code in-effective and thousands of deaths continue even today. Though WHO tried to limit the access to highly toxic pesticides, but this measure has failed in many parts of the world due to illegal trade practices. (Konradsen et al. 2003). Educating farmers with such measures that utilize local resources available in the area and tailored to local environment could be considered as one of the best methods to curb the indiscriminate and harmful use of pesticides (Ngowi2003).

Knowledge attitude and practice (KAP) questionnaires have been proven to provide insights and details about the pesticide use practices, pesticide exposure in many studies in past, and have been used to identify the lack of appropriate knowledge and shortage of inputs when dealing with pest problems (Conant 2005; Ellenhorn1997). It has been demonstrated successfully that a sustainable impact can be achieved if the awareness programs are initiated among agricultural population and in specially in areas which has reported high incidence of poisoning symptoms.

Current study have addressed following study gaps, which will definitely help marginalized population of vegetable farmers:

- What is current and prevalent use of pesticides by small-scale vegetable farmers in India and its health impacts?
- What are the existing knowledge, attitude, and Practice for pesticide use in vegetable farmers in India?
- What is the effectiveness of an educational interventions to promote pesticide safety among vegetable farmers and their families in India?

In our initial household contact, we will not only surveyed existing knowledge, attitude and practices of participating households, but also surveyed current and prevailing use of pesticides, vegetable crops being cultivated, various health concerns they have and what is the source of knowledge on various aspects of pesticides use. This will be done through an extended questionnaire (study questionnaire) during first visit for participating household to document trend of farming practices and pesticide use.

Hence, we planned to develop an inexpensive, pictorial and simple educational tool for farmers on pesticide use and then assessed its effectiveness to improve pesticide use practices, and thereby to reduce harmful health effects of pesticide exposure. Study outcome included measurement of pesticide-related KAP by standardized questionnaire, pesticide exposure-related symptom prevalence, and in-home assessment for placement of intervention materials, pesticide storage, and pesticide disposal practices. If found to be successful, this tool could act as an affordable intervention which could be adopted by pesticide manufacturers to educate poor and uneducated farming community of vegetable farmers. The advantage of an affordable tool could be translated into genuine benefit if it has successfully communicated critical and important information effectively, due to its inexpensive and self-explanatory nature.

1.2 Expected Benefits & Application

The farming community in developing country is usually poor and illiterate. Hence, they are neither able to comprehend complex pesticide training programs and literature, nor able to use recommended safety equipment, by manufacturers. The risk of exposure is highest in these farmers and their families, where ignorance and poverty magnifies their risk of exposure to pesticides (Eddleston and Phillips 2004). Knowledge gained through affordable and acceptable educational programs can directly affect the practice & behavior, and it is the easiest solution for prevention of pesticide poisoning through implementation of education program among the agricultural population. Through current study, we would like to reveal that an inexpensive and passive public education program can be successful in improving the knowledge, attitude and practice

of the pesticide handlers for long duration up to three months. Successful outcome of this research will escalate need for Pesticide manufacturers to undertake use of inexpensive educational tool in order to promote the safe use of pesticides and minimize occupational hazards.

1.3 Research Questions

1.3.1 What is baseline use of pesticides by small-scale vegetable farmers in Delhi and its health impacts.

1.3.2 What are baseline knowledge, attitude, and Practice for pesticide use in vegetable farmers in Delhi?

1.3.3 Whether an affordable and self-explanatory tool could be developed which can provide education to marginalized population of framers in India, like vegetable farmers.

1.3.4 What is the effectiveness of an educational intervention tool to promote pesticide safety among vegetable farmers and their families in Delhi?

1.4 Research Objectives

1.3.5 To provide information on baseline use of pesticide and Health impacts of pesticides in vegetable farmers in Delhi.

1.3.6 To provide information on knowledge, attitude, and Practice for pesticide use in vegetable farmers in Delhi.

1.3.7 To design an educational tool for vegetable farmers and train farmers on safe use of pesticides

1.3.8 To assess change in KAP score and reduction in pesticide exposure symptoms to farmers and their families.

1.5 Research Hypothesis

1.3.9 The health education tool will increase knowledge on safe use of pesticide as measured by increase in Knowledge score in intervention group.

1.3.10 The health education tool will increase attitude on safe use of pesticide as measured by increase in attitude score in intervention group.

1.3.11 The health education tool will increase safe behaviors in pesticide use as measured by practice scores and in-home assessment of safe behavior.

1.3.12 The health education tool will decrease prevalence of pesticide poisoning symptoms measured by detailed health outcome questionnaire and compared with control group.

1.6 Study Variables

The present study will measure change in Knowledge, Attitude, Practice and in-home safety behavior assessment at 1 and 3 months after educational intervention, and reduction in signs and symptoms of pesticide exposure as dependent variable in study population. The baseline knowledge, attitude and practice on pesticide will be used as intermediate variable as these variables will also be analyzed and presented as dependent variable for socioeconomic and demographic factors.

1.7 Study Area

The study area is located near the NCR (National Capital Region) of Delhi along the belt of river Yamuna, which crosses Delhi state. There are agricultural fields on both sides of the river mainly used for vegetable farming by small time farmers. Map below has indicated the study area in red balloon which is close Yamuna river on outskirts of Delhi.

Figure 1.1: Map of Study area.

The study was conducted at four identified villages as stated below. There were two villages, namely Ibrahimpur Majra and Gopalpur Khadana for enrolment of intervention group.

Ibrahimpur Majra is a large village located in Baraut Tehsil of Baghpat district, Uttar Pradesh with total 441 families residing. The village has population of 2839 of which 1560 are males while 1279 are females as per Population Census 2011. In Ibrahimpur Majra village population of children with age 0-6 is 426 which makes up 15.01 % of total population of village. Average Sex Ratio of Ibrahimpur Majra village is 820 which is lower than Uttar Pradesh state average of 912. Child Sex Ratio for the Ibrahimpur Majra as per census is 797, lower than Uttar Pradesh average of 902. In 2011, literacy rate of Ibrahimpur Majra village was 72.81 % compared to 67.68 % of Uttar Pradesh. In Ibrahimpur Majra Male literacy stands at 83.60 % while female literacy rate was 59.72 %.

Gopalpur Khadana is a medium size village located in Baraut Tehsil of Baghpat district, Uttar Pradesh with total 145 families residing. The Gopalpur Khadana village has population of 873 of which 506 are males while 367 are females as per Population Census 2011. In Gopalpur Khadana village population of children with age 0-6 is 108 which makes up 12.37 % of total population of village. Average Sex Ratio of Gopalpur

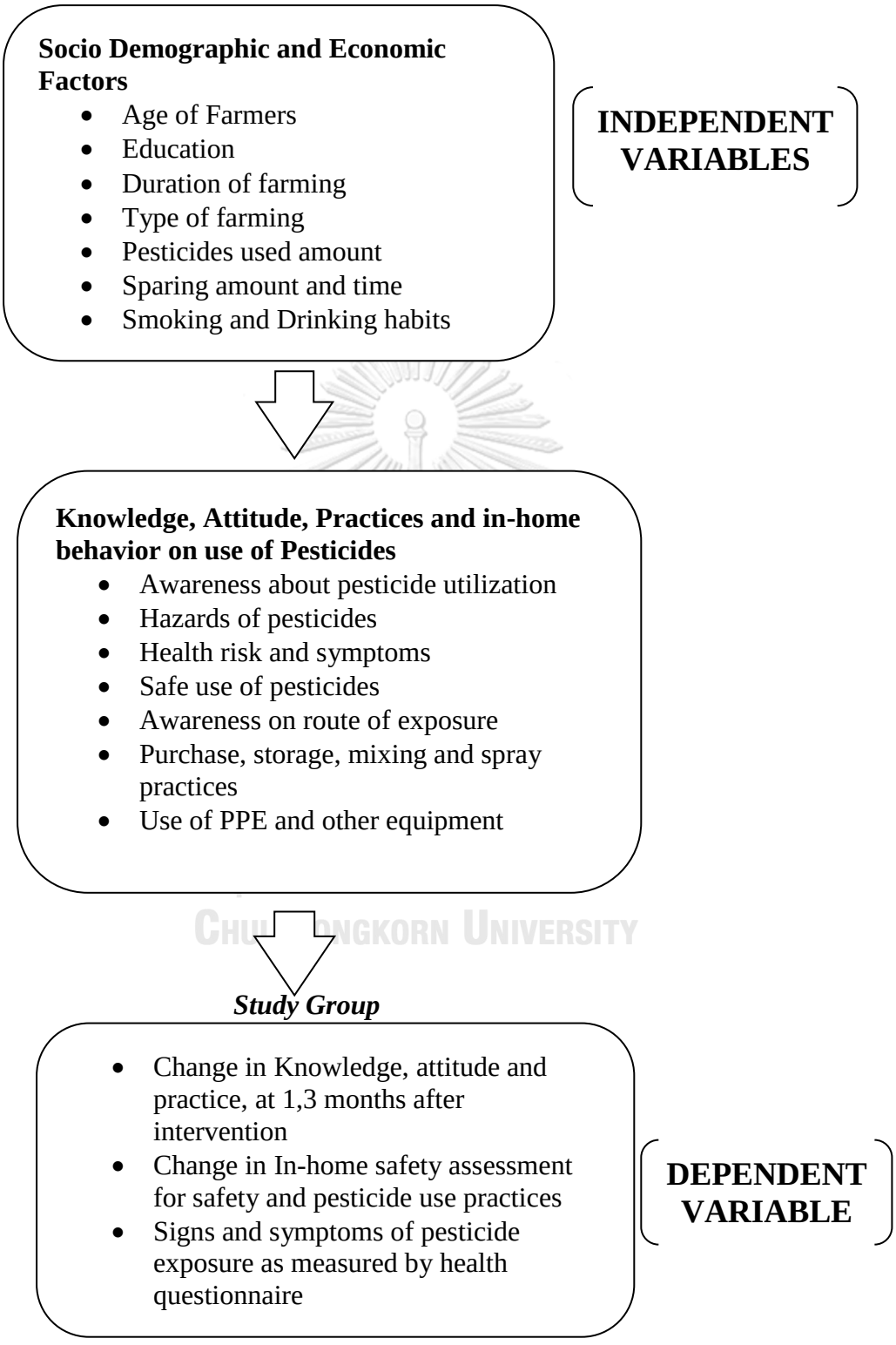
Khadana village is 725 which is lower than Uttar Pradesh state average of 912. Child Sex Ratio for the Gopalpur Khadana as per census is 800, lower than Uttar Pradesh average of 902. Gopalpur Khadana village has higher literacy rate compared to Uttar Pradesh. In 2011, literacy rate of Gopalpur Khadana village was 72.81 % compared to 67.68 % of Uttar Pradesh. In Gopalpur Khadana Male literacy stands at 85.20 % while female literacy rate was 55.49 %.

Similarly, we enrolled study participants from 2 villages for control group, as stated below. Both the villages are located north of interventional villages and are similar in demographics.

Puthri is a large village located in Farrukhabad Tehsil of Farrukhabad district, Uttar Pradesh with total 622 families residing. The Puthri village has population of 4256 of which 2309 are males while 1947 are females as per Population Census 2011. In Puthri village population of children with age 0-6 is 670 which makes up 15.74 % of total population of village. Average Sex Ratio of Puthri village is 843 which is lower than Uttar Pradesh state average of 912. Child Sex Ratio for the Puthri as per census is 745, lower than Uttar Pradesh average of 902. Puthri village has higher literacy rate compared to Uttar Pradesh. In 2011, literacy rate of Puthri village was 69.77 % compared to 67.68 % of Uttar Pradesh. In Puthri Male literacy stands at 77.51 % while female literacy rate was 60.81 %.

Barawad is a large village located in Baraut Tehsil of Baghpat district, Uttar Pradesh with total 641 families residing. The Barawad village has population of 3766 of which 2078 are males while 1688 are females as per Population Census 2011.In Barawad village population of children with age 0-6 is 568 which makes up 15.08 % of total population of village. Average Sex Ratio of Barawad village is 812 which is lower than Uttar Pradesh state average of 912. Child Sex Ratio for the Barawad as per census is 690, lower than Uttar Pradesh average of 902. Barawad village has higher literacy rate compared to Uttar Pradesh. In 2011, literacy rate of Barawad village was 75.55 % compared to 67.68 % of Uttar Pradesh. In Barawad Male literacy stands at 87.72 % while female literacy rate was 60.99 %.

1.8 Conceptual framework



An initial survey was done with 10-15 households in totally different area from study population to initially understand existence of such a problem/ gap in farming population and with consultation of health and farming practices experts to develop and evaluate a simple and usable tool in vegetable farmers to begin with. This initial survey indicated huge gap in knowledge on safe pesticide management and also high pesticide exposure mobility due to inadequate procedures of mixing, storage and use of pesticides by farmers. This prompted us to develop an educational intervention, which is not only simple to understand, but also easy & cost effective to use under given circumstances.

The study's goal is to improve the knowledge, attitude and practices of the vegetable farmers regarding safe use of pesticides. This affordable and self-explanatory educational tool is aimed to install safe behaviors regarding pesticide use and make them aware on health issues due to exposure to pesticides through first home visit. During the second and third home visit after one and three months, we measured impact of intervention though study questionnaire and in-home assessment. We would provide spontaneous but continuous information from the educational tool regarding pesticide safety, though the entire duration of study. This intervention will be influenced by a person's perception of a threat due to susceptibility of pesticide hazards; and existing gap in knowledge for improving pesticide safety. The intervention provided to two main factors, namely cue to action factors and reinforcing factors as they educational tool were placed on areas of house which is frequently visited by farmers and other family members. Cue to action comprised of pictorial information about pesticide safety and possible health hazards during first home visits and reinforcing factors being visual information via educational tool in the household every day. Study will provide the way to understand and predict how the vegetable farmers behave in relation to educational program and whether there is any health impact observed.

1.9 Operational Definition

1. **Pesticides:** A chemical, such, insecticide or soil treatment that improves the production of crops by making crop infestation free (FAO 1988).

2. **Farmer:** A person who operates or manages a farm or a person who obtains the right to collect and retain a tax, rent (Longman, 1999). In this study, a farmer is a

person who works as a vegetable farm and who has lived in the study area for at least one year.

3. Health care provider, worker: Clinical and other staff, including those in primary care, who have regular, clinical contact with patients (Health Protection Agency, 2010). In this study this included Primary Care Unit health care workers or physician at study area.

4. Research assistant: A person who assists the project supervisor in gathering information for a research project (Longman, 1999).

5. Knowledge: The information and understanding gained through learning or experience (Longman, 1999). This study focused on farmers' knowledge concerning pesticide use safety and hazards in study area.

6. Attitude or Belief The opinions and feelings that someone usually has about a particular thing, idea, or person (Longman, 1999). This study refers to vegetable farmers' attitude concerning pesticide use safety and hazards in study area.

7. Behavior: Regular activity that someone does in order to improve a skill or ability (Longman, 1999).Human behavior results from attitude, social norms, personality, and the expected outcome of a particular person (Suvan, 1983). Practice or behavior evaluations require great observation, both in the process and the action outcome. The equipment used in observation is a checklist, which is one of the standards for recording observational information (Suvan, 1983).

8. Perceived severity: An individual's assessment of the seriousness of occupational pesticide use hazards, and their potential consequences (Glanz et al., 2002).

9. Perceived benefits: An individual's assessment of the positive consequences of adopting occupational agrochemical safety behaviors (Glanz et al., 2002)

10. Educational Program: An affordable, self-explanatory educational tool in the form of wall poster/ calendar which is developed using pictures explaining various hazards of pesticide use and safe practices for vegetable farmers.

11. Effects of pesticide poisoning: Acute and persistent health effects that may arise after an acute poisoning, while in other situations may be associated with chronic, low-level or subacute pesticide exposure over time. (Abdollahi et al 2012) Abdollahi M, Karami-Mohajeri S. A comprehensive review on experimental and clinical fndings

in intermediate syndrome caused by organophosphate poisoning. Toxicol Appl Pharmacol. Feb 1 2012;258(3):309-314.

CHAPTER II
LITERATURE REVIEW

In this study, the supported theories and specific concepts including: Health Belief Model (HBM); Visual aid education model, and Knowledge/ Attitude/ Practice (KAP) are presented as below.

2.1 Health Belief Model

The Health Belief Model is a psychological concept developed by Rosenstock (1974) for studying and promoting the uptake of services offered by social psychologists. The model was furthered developed by Becker and his colleagues in the 1970s and 1980s. Subsequent amendments to the model were made as late as 1988, to accommodate evolving evidence generated within the health community about the role that knowledge and perceptions play in personal responsibility (Glanz et al., 2002). Originally, the model was designed to predict behavioral response to the treatment received by acutely or chronically ill patients, but in more recent years the model has been used to predict more general health behaviors (Rosenstock, 1974).

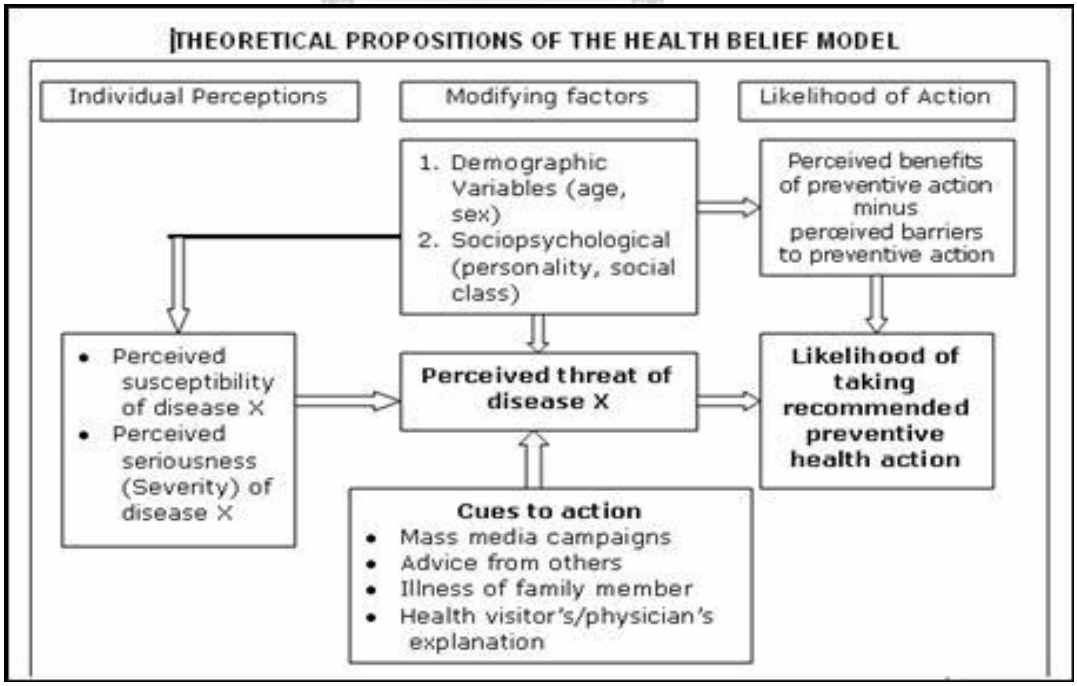


Figure 2.1: Diagram of Health Belief Model (Modified from Glanz et al., 2002)

The original Health Belief Model, constructed by Rosenstock (1974), was based on four constructs of the core beliefs of individuals based on their perceptions including: perceived susceptibility, severity, barriers, and benefits.

Constructs of mediating factors were later added to connect the various types of perceptions with the predicted health behavior: demographic variables (age, gender, ethnicity, occupation); socio-psychological variables (social economic status, personality, coping strategies); perceived efficacy (an individual's self-assessment of ability to successfully adopt the desired behavior); cues to action (external influences promoting the desired behavior, may include information provided or sought, reminders by powerful others, persuasive communications, and personal experiences); health motivation (whether an individual is driven to stick to a given health goal); perceived control (a measure of level of self-efficacy); and perceived threat (whether the danger imposed by not undertaking a certain health action recommended is great). The prediction of the model is the likelihood of the individual concerned to undertake recommended health action, such as preventive and curative health actions. In our study we have relied on this model to reinforce safe use of pesticides with our educational program and visual-aid educational tool.

2.2 Visual aid education

This is a model where a visual aid or picture which highlights the main ideas and variables in a process or a system are used to educate the population. There are various models of visual aid which include words or diagrams intended to give an understanding of the variables associated with learning, which is especially as measured by scores on standardized tests of basic skills. The main models used for the purpose and studies for this research are by Carroll (1963), Proctor (1984), Cruickshank (1985), Gage and Berliner (1992) and Huitt (1995).

Two major questions are addressed in educational psychology: (1) "What is the most convenient way to educate a population with diverse and low educational background" (a criterion-referenced evaluation question) and (2) "What is the retention factor for such an education" (a norm-referenced evaluation question.) Unfortunately,

the possible answers to these questions are enormous. Oftentimes research findings and theories of teaching and learning seem to contradict one another.

Gage & Berliner (1992) state that the use of models as learning aides have two primary benefits. First, models provide "accurate and useful representations of knowledge that is needed when solving problems in some particular domain". Second, a model makes the process of understanding a domain of knowledge easier because it is a visual expression of the topic. Gage and Berliner found that students who study models before a lecture may recall as much as 57% more on questions concerning conceptual information than students who receive instruction without the advantage of seeing and discussing models. Alesandrini (1981) came to similar conclusions when he studied different pictorial-verbal strategies for learning. Research on the effectiveness of pictorial learning strategies indicates that learning is improved when pictures supplement verbal materials, when learners draw their own pictures while studying, and when learners are asked to generate mental pictures while reading or studying.

National Training Coordinating Council (NTCC) and AARP/Legal Counsel for the Elderly in 1994 developed guidelines for training and educating adults, who not only have formal education in past, but also have varying degree of experience and understanding skills. Our educational tool in current is designed using recommendations from this council which address following aspects of adult learning:

- Create a comfortable learning environment.
- Emphasize the training's applicability to address their issues, concerns, needs, or interests
- Give practical examples or practice activities that will help them apply the new information.
- Relate training to their needs.

The council recommends that material presented to adults must be intended for direct and immediate application in order to keep their interest. Since adults have a low tolerance for sitting and listening, it is recommended that education tool timing should be kept at minimum and after making a major point, ask participants to think how it could relate to their situation. (National Training Coordinating Council 1994).

Educational program in our study is using above theory of visual aid in adult education and pictures used in the tool are self-explanatory, to initiate questioning from the recipients

2.3 Knowledge, Attitude and Practice Theory

The following areas of theories and researches had been studied for this research.

- **a.** Knowledge, Attitude and Practice Theory
- **b.** General Pesticide Safety
- **c.** Related Researches

2.3.1 Knowledge, Attitude and Practice Theory

Knowledge has many definitions such as:

Chawal Parattakul (Pithakthape Pujoy, 1999) said that Knowledge is facts and details of stories and of the actions that one has been told and thought from generation to generation while Uthumporn Longuthai (Pithakthape Pujoy, 1999) has definite "abilities to gain insight, analyze and synthesize different ideas and facts".

The Lesson Webster Dictionary 1997 states that knowledge is a facts understanding, truth and structure divided from researching. And is information about a person or place derived from observation, experience, and report. To have a clear understanding of such facts would take time.

Prapapen Suwan (1983) said "knowledge is a basic message understanding of which learners recall from what they have seen and heard". This stage of understanding is knowledge of definition, meaning, fact, theory, structure and problem solving.

Sucha Jan-Aim (Pithakthape Pujoy, 1999) referred to knowledge as message decoding process which occurs in between stimulating and responding:

Stimulus ⟶ Perception ⟶ Response

Booncherd Pinyoananpong (Pithakthape Pujoy, 1999) said that knowledge is an ability to recall general and/or specific events accurately. It depends on how a person

decodes a particular event. An ability to understand is the very basic cognitive skill to decode, to memorize and to make use of a message.

The Webster Dictionary (Pithakthape Pujoy, 1999) states that knowledge is: the state of knowing and understanding about a subject clearly and accurately, awareness gain through observation and self-study, skill gained through experience, familiarity, information collection, and realization of facts.

In conclusion, knowledge is information, standard and structure learned from others' experience and stored for recall, comprehension, application, analysis, synthesis and evaluation. It is abilities to interpret and to summarize a message as well as to foresee its response.

2.3.2 Attitude and Belief Theory

Attitude definitions

Kamolrat Larsuwan (Pithakthape Pujoy, 1999) summarized that an attitude is physically and mentally willingness in response to a stimulus by confronting or avoiding it. There are 2 types: (I) positive or good attitude is one's willingness to confront a stimulus or a situation because of his satisfaction and (II) negative or bad attitude is willingness to avoid a stimulus or a situation because of his dissatisfaction.

Teppanom Maungman et al. (Pithakthape Pujoy, 1999) said that an attitude is a mental state of readiness exciting an influence upon an individual's response to all. It is a determining factor whether a person likes or dislikes someone or something.

Prapapen Suwan (1983) said that attitudes involve the categorization of a stimulus along an evaluative dimension, based on affective, cognitive, and psycho-motor components.

Sometimes behavior is controlled by attitudes and sometimes not. Attitude may encourage self-improvement and help the person to understand the world as explained by the diagram below:

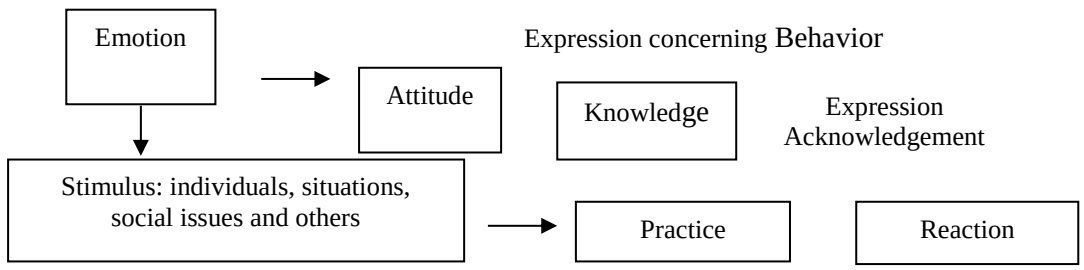


Figure 2.2: Elements of practice.

An Attitudes form **s**pecific experiences: People are exposed to stimuli; they learn through reinforcement; and this personal experience determines the person's attitude.

Communication: An individual may unintentionally acquire information and feelings by the process of communication. This generally occurs among family members where the atmosphere is informal.

Model: Attitude can also be learned through imitation.

Institutional factors have a major impact on an individual's attitudes: family school, temple and organization.

Benefits of Attitudes

(i) Help to understand the world around by categorization

(ii) Encourage self-esteem by avoiding thinking about negative self-perceptions or avoiding situations that would bring them to the fore

(iii) Help to conform to group behaviors in order to gain social acceptance

Malinee (Pithakthape Pujoy, 1999) pointed out the benefits of attitudes as follows:

To expect others' behavior: attitudes consist of all the person's emotions toward the object, especially positive and negative evaluations, as well as the thoughts the person has about particular object, including facts, knowledge and attitude. Attitudes are likely to predict how the person tends to act regarding the object.

To create social harmony: in some social situations people perceive one person or group as having the legitimate authority to influence our attitudes and behavior. Obedience to legitimate authority is often the price people pay for social harmony.

To seek for problem-solving measure: there should be social rules upon which the social members agree. When someone deviates from the rules, the person may be reminded of his obligations via punishment.

To be reasonable: relations between attitudes and behavior can go either way. Attitudes may control behavior, and behavior sometimes controls attitudes.

Prapapen Suwan (1983) has proposed Likert Model, named after Rensis Likert. This model is to build attitude statements, grading ranges in degree from negative to positive score as follows:

Choices	Positive Score	Negative Score
Absolutely agree	4 or 5	0 or1
Agree	3 or 4	1 or 2
Not sure	2 or 3	2 or 3
Disagree	1 or 2	3 or 4
Absolutely disagree	0 or 1	4 or 5

2.3.3 Practice Theory

Definitions of Practice

Prapapen Suwan (1983) has defined practice as all human's visible and invisible activities: cardiovascular system, muscular system, walking, speaking, eating, sensation, enjoyment, satisfaction etc. Psychologists hold the same attitude that there is always an objective, a reason, a stimulus or a motivation behind the activity done.

Practice is a part of behavior which could be observed. Practice is an action or a reaction to stimulus. Sometimes it could be clearly observed; other times measuring tools are needed (Anek Srisang, 1976). Likewise, Prapapen Suwan and Sawing Suwan (Pithakthape Pujoy, 1999) pointed out that effective practice is related to 5 steps of body's working system:

(i) Imitation: To choose an interesting model

(ii) Manipulation: To follow an interesting style

(iii) Precision: To decide what is the appropriate style to follow

(iv) Articulation: To continuously carry out the appropriate style

(v) Naturalization: To automatically behave as the style has become a part of the self

Reasons for Practice

Anchalee Singhasut (Pithakthape Pujoy, 1999) has mentioned the reasons for practice as below:

(i) Physical needs

(ii) Appropriate Stimuli

(iii) Emotions or feelings

(iv) Knowledge, an understanding and expectation of the outcome

(v) Motivations i.e. need for success

Practice Change

Practice may alter with respect to an individual's self-development; it is settled during periods of life and undergone transformation during the others.

Anchalee Singhasut (Pithakthape Pujoy, 1999) has classified practice change into 3 patterns.

(i) Obedience of authority; social rules, laws and regulations

(ii) Imitation others; a teacher, a parent or a superstar

(iii) Acceptance; People alter their behavior because a change supports their private attitude.

Factors Influencing Health Practice

Sukhothai-thammatirat Open University (cited in Pithakthape Pujoy, 1999) defined factors influencing health practice' as follows:

- Psychological factors i.e. maturity, needs, interests, motivations, skills etc. These may well influence knowledge and attitudes. Similarly, individuals differ in the levels in maturity would have different knowledge, attitudes and health practice.
- Social and cultural factors; family, social group, social status, culture etc. Differences in cultures would lead to differences in health practice. Some communities, a mother is not allowed to have meat for a while after giving birth. Some villagers prefer well water to boiled water because the former is tastier.
- Economic factors: The poor tend to possess knowledge and hold attitudes inappropriate for health practice. Most Thais live in upcountry with low income will have a very high chance of acquiring improper health practice, and therefore tend to become ill easily.

- Educational factors: The higher level of education people pursue more likely to obtain knowledge and beliefs appropriate for health practice than lowers.
- Political factors: Laws and regulations passed by the legislature may possibly have an effect on citizens' knowledge, attitudes and health practice.

Prapapen Suwan (1983) has summarized the relationship between knowledge, attitudes and practice as follows:

Knowledge and personal experience shape and influence attitudes. Besides cognitive, attitudes are founded on affective and behavioral components. Attitudes exemplify overall evaluations toward attitude objects. Also, an attitude contains some tendency to behave in connection with the attitude object. Relations between attitudes and behavior can go either way. Attitudes may control behavior, and behavior sometimes controls attitudes. In addition, behavior is sometimes controlled by attitudes and other times by norm, habit or expectation of a particular outcome. Individuals' health practice is complicated because each decision making involves motivations, attitudes as well as the current balance of incentives.

2.4 Related Researches

Sunil Mittal et al (2013) conducted a study on environmental and health impacts of pesticides in farming community. The study highlighted a sharp increase in many pesticide-related diseases, such as mental retardation and reproductive disorders in addition to acute neuromuscular and respiratory symptoms. The most affected individuals are the agricultural workers who are directly exposed to pesticides. The Malwa region of Punjab consumes nearly 75% of the total pesticides used in Punjab. The high use of pesticides, along with environmental and social factors, is responsible for the high concentration of pesticide residues in the food chain of this region. Moreover, many banned and restricted pesticides are still in use in this region, warranting strict periodical health checkups and other interventions.

K R Dey et al (2013) carried out in the three districts of Barak valley (Cachar, Karimganj and Hailakandi) Assam, India to ascertain the variety of pesticides that are

used in the agriculture sector and their probable impact on the health of farmers. The study revealed that the farmers often use pesticides ranging from high to extremely hazardous categories like Organochlorides, Organophosphates and Carbamates. Various signs and symptoms of diseases/ physiological disorders were observed; and the relative risk (RR) was also observed to be high. Lack of adoption of adequate protective measures were noticed to have increased the declining state of the health of farmers in the region. Need to correctly educate farmers was also felt by the researchers

Bonani Mazumder (2011) studied effects of use of pesticides in vegetable farming community in Assam, India and found rampant use of pesticides for increasing yield and also improving the quality of vegetables. However, in the long run they are causing great damage to their health and the environment too. These people suffer from various chronic diseases like indigestion, gastric problems, weakness and also low mental development. All these can be some way related to the indiscriminate use of pesticides. Another interesting thing is that they hardly go to the doctor for these 'petty symptoms', thinking that they will get cured naturally. The study emphasized the need we should start thinking about these poor farmers and help them out which could be in form of training and education specially in area of correct storing, using and disposing the used pesticides cans.

Buppha Raksanam et al (2012) have develop an effective educational and behavior change model, which was tested in field setting. The model was intended to improve farmers' health and prevent them from hazards of pesticide exposures. The model was also intended to evaluate its effectiveness on how much improvement it can render in terms of Knowledge and behavior change in farming community. Researches selected rice farmers from Thai community, who were randomly allocated to intervention and control group. All study participants were educated by multiple home visits as well as involvement of family participation in educational activities regarding pesticide safety. It was noted that chemical exposure to farmers is mainly due ignorance to safety practices and use of faulty equipment. The educational intervention program was found to improve on all areas of pesticide knowledge, attitude and practices, up to six months. Study findings demonstrate that a multi-approach model for improving

agrochemical safety behaviors can lead to sustainable prevention of agrochemical hazards for farmers.

Pinyupa et al. (2009) found that there is a gap in pesticide knowledge and use in farmers in Thailand who own small land for cultivation. The pesticide use practices among small-scale farmers in Thailand need improvement which could be done using an 'Educational' interventions which is targeted to promote safety during all phases of pesticide handling. The study also emphasized that there is a need to update public policies which will encourage farmers to change their pest management techniques and processes.

Farahat (2009) studied knowledge and practices of farmer's family on pesticide safety in Menoufia governorate, Egypt. Study evaluated two kind of interventions in various age groups of farming community members via lecture or videotape. It was found that improvement in knowledge was significantly more in group which was given visual intervention. The study also found that young age and higher education are positively correlated to ability to recall information or improve safety practices. Knowledge and practice scores after training of younger and more educated participants were significantly higher than older, less educated participants. Knowledge and practice performance of the videotape group was better than the lecture group and in both groups the improvement of knowledge scores after training was significantly higher than that of practice scores

Matthews (2009) studied pesticide safety practices, attitudes and behaviors of small-scale farmers using a questionnaire in 26 countries. Researcher surveyed large number of users in each country(~ 250 per country) on use of various safety practices, and tried to expose extent in gaps on safety practices along with knowledge attitudes and behaviors towards pesticide use. Study found that though large majority of responders were aware of need of PPE and other methods, they did not use it regularly. They also found gap in use of PPE which correlated with their attitude to the risk of poisoning and also to the lack of availability or cost of suitable personal protective equipment (PPE). The study found that overall majority of farmers had a working knowledge of the requirements for safe use of pesticides. The study also found some gaps in disposal practices and recommended adequate training for identified gaps.

Julie Samples et al. (2009) evaluated South American farm workers' in US who are involved in use of pesticides in agriculture farms. The study compared behaviours and practices of South American workers with local workers and found significant difference in both knowledge and attitudes between them. These differences were mainly due to language and other socioeconomic barriers, which resulted in differential training for them. It is recommended that educational material for pesticide safe use should be provided in local language which could be easily comprehended by farmers with low education. Employing training methods which are in indigenous languages is more acceptable to the community and organizational leaders, and may remove some of the linguistic and cultural barriers to occupational safety training.

Kishore et al (2008) studied health impact of pesticide exposure on vegetable farmers in India. Study also evaluated Effectiveness of an educational program which promote pesticide safety among pesticide handlers in community of farmers. They found that very few intervention have been conducted to reduce pesticide exposure and poisoning in Indian setting and most studies were small field of protective equipment, conducted in 20-30 farmers. In their study they enrolled two villages, one in control and another in intervention and evaluated impact of educational intervention on knowledge, attitude and practices of farmers on safe use of pesticides. Study used help of structured questionnaire for the purpose. Researchers found significant impact of educational program up to one month after intervention. They suggested to have continued way for educating farmers on effects of pesticide and promote awareness for safe use of pesticides.

Matthews (2008) identified the need for farmers to make them aware of hazards associated with pesticide use. They suggested that large proportion of farmers in their study area are not aware of the need for personal protection and the simple steps which could be used for avoiding unnecessary exposure. The barriers for not using PPE is mainly associated with cost incurred and also due to low attitude towards health associated risks. Though there was an overall low score on attitude on pesticides awareness on health hazards, the study reported very low health related problems from the study area. Study found that most pesticide users had a basic working knowledge for safe use and a high proportion of them were able to achieve this as indicated by the

low numbers of incidents affecting their health. Key areas of knowledge gap identified in this study was lack of awareness on disposal methods after use of pesticides which could be improved by training which will include the provision of secure stores & place for disposal of used containers.

Wutthichai (2006) showed that a community participatory learning program on pesticide use and management is beneficial among farmers in Sukhothai province of Thailand. Researchers employed Health Belief Model along with educational program and revealed that after the intervention was implemented, the experimental group had significantly higher mean scores of knowledge, attitude, and practice than that before receiving the program ($p<0.001$). On the contrary the mean scores of the control group were unchanged ($p>0.05$) between pre-test and post-test evaluations.

Surasak and Peeungjun (2005) found that there were 3 major occupational health and safety problems among farmers in Pathumthani, Thailand: symptoms from pesticide exposure (65% of respondents), musculoskeletal problems during various process (16.6%–75.9%), and injuries during various process (1.1%–83.2%). This study showed that participation with farmers could create a real sustainable model to promote farmer's health and prevent them from occupational health hazards.

Poss and Pierce (2003) found that it is necessary to reduce possible health and environmental risks associated with pesticide use by documenting risk perceptions and developing ways to address them and need to improve educational interventions are essential for promoting safety during all phases of pesticide handling.

Arcury et al. (2002) examined the perceived pesticide safety risk and perceived pesticide safety control among farm-workers with a main focus on education. The authors indicated that they used this model as a frame-work to study farm worker's behaviors because it is simple and because of its parsimony. Receiving information about pesticide safety reduced perceived pesticide risk and increased perceived pesticide control. For pesticide safety education to be effective, it must address issues of farm-worker control in implanting workplace pesticide safety.

Yassin et al. (2002) studied knowledge, attitude, practice and health associated symptoms of pesticide use and exposure among 189 farmers in Egypt. They found that the farmers though have high knowledge on pesticides health risks (97.9%) but only

moderate level of signs and symptoms of pesticide exposure to farmers. Though most farmers were aware of the protective measures however very few use PPE and other recommended measures for pesticide safety. Study found that burning sensation in eyes/face was the commonest symptom (64.3%) in farmers, which occurred mainly during mixing and spraying of pesticides. The highest toxicity symptoms and signs were reported within one hour of spraying activity by the farmers.

2.5 General Chemical safety (Fenske et al., 2007)

Handling Practices

- Never smell, inhale, taste, or swallow the product.
- Know the physical and health hazards associated with the product from its MSDS.
- Wear chemical protective goggles and gloves when handling.
- Properly label all containers containing the tracer according to Occupational Safety and Health Administration hazard communication standards (CFR 1910.1200).
- Store chemicals in a tightly closed container in a cool, dark, and well-ventilated place.

First Aid Procedures (check the Material Safety Data Sheets (MSDS) for specific instructions for each product)

- Eye contact: If product gets into the eyes immediately flush with water for at least 15 minutes while holding eyelids open. Seek medical advice immediately at nearest health center.
- Skin contact: Flush skin with plenty of water. Get medical attention if irritation occurs.
- Inhalation: If inhalation of dust or vapors occurs, immediately go to an area with fresh air. Get immediate medical attention.
- Ingestion: If ingested, vomiting may occur naturally. Do not induce vomiting.

Get immediate medical attention.

Cleanup Methods

- Launder and wash clothing items (baseball caps, sweatshirt, etc.) with detergent.
- Wash off skin with soap and rinse thoroughly under running water. For certain fluorescent tracers, it may take a week for tracer to disappear completely from the skin. Note: It will only be visible under black light.
- Scrub all personal protective equipment (gloves, masks, boots, mixing equipment's etc.) with detergent and rinse thoroughly under running water. Usually pesticides traces is the easiest to remove when it is still wet.

2.6 Insecticides

According to the Food and drugs Administration, Ministry of Public Health (1995:19).

2.4.1 Insecticide is a chemical substance used for pest control and prevention.

2.4.2 Pests could be animals, plants and micro-organisms that annoy and/or harm vegetation, human and/or animal.

Advantages of Insecticide Practice

(i) High productive and on time

(ii) Ready to use

(iii) Easy to use

(iv) Worthy

Disadvantages of Insecticide Practice

(i) A residue builds up in individuals' body and contaminates the environment.

- Agriculturists who come into contact with insecticide could be poisoned.
- Consumers could become ill from taking contaminated food.
- The resistance of pests is developed.
- Ecosystem is out of balance.
- Microbes residing in the soil are damaged.

- Food chain is contaminated by toxic chemicals.

(ii) Excessive amounts or rates of application could cause damage to plants such as leaf burning.

(iii) Other biological problems may arise:

- Beneficial insects and animals are harmed.
- A pest epidemic may sweep through an area.
- Smell and taste of vegetation are altered.

Insecticides could be powder or liquid. When choosing insecticides, their bio-characteristics, active ingredients' effectiveness, and side-effects should be taken into consideration.

Main Types of Insecticides Are:

(i) Organochlorine compounds such as DDT, Dieldrin, Chlordane, Heptachlor, Methoxychlor etc. These are traditional chemicals. Their effects are strong and long-lasting, composed with total disregard for the environment, therefore they are mostly banned. At present, DDT is only allowed for malaria control only but illegally used in many agriculture insecticides.

(ii) Organophosphate compounds such as Malathion, Diazinon, Fenitrothion, Trichlorfon, Temephos (Abate) etc. Formerly, they were employed to control mosquitoes. Temephos, for instance, is still used for larva control. Because of their strong odor, these compounds have to be kept in sizeable space away from residential area. They are even more toxic than the first group but relatively easy to decay. After employing, agriculturists have to leave their plantation after used at least 1 week to avoid exposure to it.

(iii) Carbamate compounds such as Furadan, Carbarylbendiocarb Propoxur etc. They are widely used for insect control and applicable for a wide range of insects. The compounds are easy to decay and their remains are short-lived. The group is familiarly known for mosquito spray.

(iv) Pyrethroid compounds such as Permethrin, Deltamethrin, Lamda,

Cyhalothrin etc. They are synthesized chemicals which have a structure similar to that of Pyrethrin extracted from plants. The formers' residue however lasts longer and is less affected by the sun than the latter's. The compounds are available both in powder and oil. They are very much safe for humans.

Dangerous of Insecticides

Insecticides could be harmful to lives and property in 5 ways:

(i) Flammable

(ii) Toxic to human and animals

(iii) Dermal irritation

(iv) Evaporation to a toxic gas in humidity

(v) Contamination of the environment around the area of application

2.7 Toxicity caused by Pesticides

1. Contact with Poison (Wijit Boonyaho-tra, cited in Pujoy, 1999)

Most of the pesticides are poisonous to humans. Therefore a user or a person coming into contact with insecticides has an excellent probability of having a build-up of poison in the body. Individuals may get toxins via oral, inhalation as well as dermal.

a. Oral: This usually happens when an individual attempts to commit suicide because insecticides are known for their toxicity. Besides a crime, some cases are accident because an individual keeps toxic insecticides in a bottle of drinking water or a drug bottle. Some users carelessly dissolve insecticides by hand and do not wash the dirty hand before drinking water, taking food or even smoking. After oral contact, poison would pass through one's gastro-intestinal tract and osmosis to gastric wall, to intestine and eventually to blood circulation.

b. Inhalation: Some insecticides like Organophosphate compounds are easy to evaporate. Oftentimes agriculturists breathe in a toxic gas while spraying; the poison would then enter their lungs. Spraying without wearing a canister mask will inevitably lead to inhalation of insecticides. In addition, type of insecticides and demographic character of individuals are factors influencing the quantity of insecticide

intake. Likewise, working environment is important. Working in an insecticide storehouse would surely have a higher chance of inhaling than people working in an open-air area would. If their package is not sealed well, insecticides may spread all around the store. Good ventilation could reduce the chance of inhalation. Quantity of insecticides absorbed into one's lungs are influenced by these factors:

(i) Solubility: Insecticide having less ability to dissolve in water will absorb to pulmonary sac easier than the one which has much more dissolve.

(ii) Particle Size: Insecticide which is small particle can absorb to lung without leftover at nose, mouth and bronchus.

(iii) Respiratory Rate: Higher respiratory rate, higher absorbent rate to lung, e.g. the respiratory rate while working is higher than sleeping, this cause more absorption in the lung. Exceptional case, child has respiratory volume only 5 cubic meters a day while adult has 20, but compare insecticides per 1 kg. weight in child is higher than adult.

(iv) Volume of each breath: the more volume per breath, the more insecticides absorbent to lung.

c. Dermal Some insecticide can absorb into a human body via Dermal while dissolving it, spraying it or contact without flow insecticide. These cause insecticide absorb into a human body, may be a lot or a little depends on many factors:

(i) State of Dermal: if it is tear or cut, injured, it will be absorbed easily Solubility and Absorb via Dermal: if a substance can be dissolved in oil, it can be absorbed very well e.g. Chlorinated hydrocarbons

(ii) Particle Size: so small so easy to absorb

(iii) Temperature: Organophosphate can absorbed easily when the weather it is hot, so agriculturists should not take off clothes while doing spray under sunshine this can be absorbed via soft tissues such as testicles, armpit, ear tube, forehead, head's dermal

2. Pesticides Toxicity symptoms (Wijit Boonyaho-tra, cited in Pujoy,

1999)

Organophosphate and Carbamates Chemical are the most important to cause symptoms as they are widely used in farming. They can evaporate easily and works by stop Cholinesterase enzyme's working. This enzyme controls nervous system. Toxin's symptoms from Organophosphate and Carbamates are

a. Less severe symptoms: headache, ill, retching, feel dizzy**,** fatigue, dermal, eye, nose and throat irritation, diarrhea, sweat, have no appetite.

b. Moderate symptoms: vomit, abdominal spasticity, exhaust, diarrhea, facial, abdominal, arms and legs muscular twitching, fatigue, blurred vision, constricted iris, tachycardia**.**

c. Serious symptoms: have a spasm, respiratory system failure, be unconscious, cardiac arrest, some can die immediately**.**

Correct Insecticide Practice (Hynter, cited in Pujoy, 1999)

Individual Protection Equipment listed below can help reduce exposure to pesticides but are rarely used due to their cost and uneasiness in hot and humid climate.

(i) Helmet

(ii) Rubber gloves

(iii) Canister mask

(iv) Rubber boots

(v) Protective clothing

Liquid Pesticides

This is chemical which is dissolved in solvent or oil, high concentrated, have to dissolve with water before using, some are premixed. There are 3 different types of usage.

1. With lot of Water: dissolving water and pesticides more than 60 liters per acre. This type of pesticides are sprayed by mechanical sprayer e.g. shoulder slinging, back slinging or sprayer with water pressure engine. These sprayers will through big particles and become water drop on plantation, then flow to soil.

2. With less Water: use only 5 – 20 liters of water to dissolve pesticides and use back slinging sprayer. This method will get small regular particles on

the plantation and frequently used for vegetable farming. Using small amount of water we can reduce cost and help spray pesticides quickly. However, exposre to the sprayer is higher and hence more riskier approach to farmers and others who live in that area.

3. Without any water: use special sprayer which has spin plate nozzle or electric charge nozzle or motor sprayer which ULV nozzle to spray ready to use liquid pesticides. This method use only 300 – 1,500 ml. per acre, which can get very small particles to spread easily on the vegetation. So it should be sprayed under slow wind current not faster than 5 kilometers per hour.

Because of wrong and excess usage of pesticides, the pests, insects have developed chemical resistance and cause agriculturists have to pay heavy price for pests control. Hence, we should study how to use insecticide correctly and safe.

Use of insecticide in farms should only be done after confirmation on type of pests. One should know what kind of pests are infesting farm m before use insecticide. Farmers should know techniques to not only catch them but also be able to identify and check effectiveness of pesticide for that specific pest. If one is not sure, then he should consult agricultural officer e.g. provincial agricultural officer or district agricultural officer. After identification of pest, one should choose insecticide as using rampant pesticides not only cause loss of resources but will also cause unnecessary environmental pollution. Different type of pests are sensitive to different type of insecticides e.g.

- Piercing Sucking Insects e.g. bug, mealy bug, aphid etc. has slow movement. The suitable pesticides are systemic and contact pesticides, that has less residue toxicity such as Organophosphate and Carbamates.
- Rodent Insects, destroy timber and bark, root (radical) and live in soil. Choose contact pesticides, that has long residue toxicity, and sprayed as soil dressing. These types of insecticides are also called Chlorinated hydrocarbons.
- Stem or Cork Borer Insects are found in flowers, cotton or long term reaping fruits. They are sensitive to contact or systemic pesticides which has long residue toxicity such as Carbamates and some Organophosphate pesticides.

- For insects that lay eggs within the flesh of plants, one should use contact pesticides, but need to leave it for a long on vegetation before harvesting.

1. Use in appropriate dosage and method. There are many types of pesticides which has different benefit and usage. The best way to get most benefit is to read it's instructional first, this will tell how to use it correctly. Most powder has to dissolve in water or oil before spraying in field. Most systemic types of insecticides have to be spread on field (soil), and need to undergo fertilizer mixing before spreading. Some pesticides become more effective after mixing with another, but some cannot be mixed with others as it will neutralise individual benefits of insecticides for effective pest control. Mixing ratio is also important, as diluting too much will reduce the effect of insecticide and will cause resistance in pests. It is always advisable to consult an agriculture officer for confirmation on use of insecticides and mixing potentials of insecticides. This will save not only cost for farmers but will also stop development of resistance to various insecticides.

2. Appropriate timing. You should spray in the morning because there are dews on leaves which helps insecticide powder fix easily. At noon or under strong sunshine, systemic pesticides can be easily absorbed by skin dermal surface. This could result in exposure to insecticides leading to serious toxicity especially if the sprayer takes off his clothes while spraying and is using minimal PPE. Also, spraying in hot sunshine may lead to plant injury due to chemical and can becomes dry, droop and perish. Do not spraying while it rains because pesticides will be washout out from the vegetation and will enter soil quickly. It is also important to know insects cycle and get knowledge of pests' behaviours to identify correct time of spray. If we spray before its germination season, we will get more effective use of pesticises resulting in higher impact and reduction in use of pesticides.

3. steps of pesticides usage *(*Hynter, cited in Pujoy, 1999*)*

1. Before using any pesticides we need to read it's instructional or asks for explanation from seller to understand usage, its danger and follow them. Choose pesticides and identify its label correctly for hazard level depending on poisonous materials act. The identification can be by following signs and pictures on the container in addition to other

information on its package.

- Skull with cross sign and clear red or black “poisonous materials”
- Chemical and common name of activate substance and ingredients
- Producer’s name and address
- Quantity of poisonous compounds and others
- Manufacturing and expiry date
- Description/instruction, benefit, usage, keeping and warning
- Toxicity sign, what to do in case of exposure

2. While using
   - Do not dissolve pesticides by hand
   - Spray windward to protect pesticides absorb via dermal and inhalation
   - Wash, take a shower with soap and clean water in case you are dirty from pesticides
   - Do not smoke or take any food
   - Wash your hands, rinse your mouth before smoking or taking food every time
3. After using
   - Clean up pesticides package with soap
   - Do not wash/clean in or near a well
   - Keep pesticides in safe place with danger label, away from children and food
   - The sprayer must take off his clothes and wash with soap then take a shower
   - Put sign in sprayed area of field for 6 – 7 days
   - Leave the sprayed plants for a while, which depends on the type of pesticide used. This duration is normally not less than 7 – 15 days

3. First Aids (Hynter, cited in Pujoy, 1999*)*

In case there is an exposure to any pesticide, accidental, occupational or intentional , help the subject to stabilise with first aid before taking him to the hospital. The important knowledge in first aids is as follow:-

- If the subject has symptoms during spraying and cause of exposure is from

spread pesticides, take him away from the affected area.

- Pesticides spilled over his body (dermal), wash off the residual pesticide with running water. Do not use warm water or alcohol.
- If get pesticides is exposed via eyes, wash off with clean water continuously for 10 – 15 min.
- In case of pesticide swallowing, make him to vomit by reaching into his throat or drink salty water (ratio 1 glass of water: 1 tablespoon of sodium chloride). If subject has become unconscious, do not induce vomiting, and immediately take him to hospital along with package and label of pesticides.
- Before giving first aids, protect yourself from chemicals on his body. If you have helped him cleaning up pesticides make sure you yourself have not contacted pesticides.

2.8 Hazard Classification of Pesticides

Hazard classification of pesticides is done by toxicity symptoms and their severity. The toxicity level is measured by toxicity hazard level unit "LD50" which is amount of chemical that killed 50% of total experiment animals. LD50 is measured in mg of poison or chemical per kg. of experimental animal (mg/kg) (Bailey and Swift) e.g. taking 1 mg. of pesticide could kill 50% of experimental rats which average weight of 1 kg. This international measurement from the oral rat toxicity unit is LD50 which is 1 mg./kg. Compare to human who has average 50 kg and take 50 mg. of pesticides, its result is as same as rat.

Toxicity measurement of pesticides, the popular method both in agricultural toxicity and medical classification is acute toxicity measurement. This is to measure toxicity of chemical after experimental animals administered chemicals via 3 possible methods such as:

1) Acute oral LD50
2) Acute dermal LD50
3) Inhalation LD50

The popular method of pesticides' quantity test is to check blood cholinesterase because Organophosphate and Carbamates are cholinesterase enzyme's resistance. So level of cholinesterase in red blood cell and lymph can indicate toxicity's as following:-

1) Lower cholinesterase in lymph, normal in red blood cell means patient get a little exposure from pesticide. Let him stop working for a while then he will get better.

2) Normal cholinesterase in lymph, lower in red blood cell means patient is exposed to adequate poison from pesticide. Let him stop working and see the doctor.

3) Lower cholinesterase in lymph and red blood cell means patient get very high exposure to poison from pesticide and should immediately be taken to hospital

Table 2.1: Human blood cholinesterase

- Male	Normal cholinesterase in lymph	88-137	unit/ml.
	Normal cholinesterase in red blood cell	137-303	unit/ml.
- Female	Normal cholinesterase in lymph	81-125	unit/ml.
	Normal cholinesterase in red blood cell	167-302	unit/ml.

(WHO, cited in Sumethanurakkhagul et al., 1983)

2.9 Organophosphorus insecticides (Wijit , cited in Pujoy, 1999)

Organophosphorus insecticide are Parathion or Folidol, Fenitrothion, Gusathion, Malathion, Mevinphos, Diazinon, Pirimophos methyl and Disyston. There are many other different names of these insecticides, some has highly hazardous as indicated by skull with cross sign e.g. Parathion or Folidol and also like Malathion, which has low hazardous potency for warm blooded animal**.** Their advantage is high efficiency in pest control and less residue because of faster detoxication, so it is good for vegetables, fruits. This group of pesticides is sprayed for short duration due to its quick action. Some of the organophosphorus insecticides compounds are systemic insecticide. This means they will be absorbed into plant stem after spray and will have toxic effect to piercing sucking or rodent insects. The examples are Disyston, Fosdrin, Azodrin etc. This kind of systemic insecticide is good for rodent insects.

Phosphorous compounds or organic compound is an important compound in protoplasm of plant and are very important to support human and animals life because they are coenzymes for nucleic acid and nucleotides. Study of Phosphorous compound has started very early by Lassaigne experimented many kinds of phosphate which have Phosphorous compound, grouping P-N or P-C and has made synthetic Phosphate esters from natural compounds**.** During the Second World War, scientists, Saunders and Schrader found Phosphorous compound poisonous effects on humans and animals. Saunders synthetic poison that can destroy nervous system includes Diisopropylphos- phorofluoridate (DPF) and Schrader found pesticide compound in B.E. 2480. Schrader and team later synthesise systemic insecticide called Octamethylpyrophosphoramide (OMPA) and named Schradan.

Schrader has later developed an insecticide callede Parathion which is widely used in many insecticides. Malathion, Fenthion and Fenitrothion has since been produced in large amounts and used in many pesticides. Organophospate pesticide inhibits enzyme Cholinesterase that cause incomplete decay Acetylcholine which send impulse from nerve ending to muscle. This will lead to accumulation of Acetylcholine, which results in generating nerve impulse, muscular stimulation, paralysis and death in severe cases. In humans, Organophospate causes dementia, affect periphery sensory system, motor movement, behaviour and respiratory system which could lead to death due to respiratory obstruction. Acute toxicity symptoms start started from getting exposure within 12 hours (normally within 4 hours). Most common of the symptoms are pain and weakness in legs and forearms. Some get well in 2 – 3 weeks, some may result into emaciated muscles and partial paralysis. (Department of Agriculture, 1989). Exposure to these compounds can also cause CNS symptoms like giddiness, headache, perplexed state (confused), impatient, be alarmed (frightened) and anxious. In serious cases, one can also become unconscious and die. Death is usually due lack of oxygenation of neural tissue due to trachea contraction and respiratory muscular paralysis. Mild to moderate exposure usually get well within 2 – 3 days, but still feel tired, weak for weeks. (Singhasenee, 1986).

Medical Treatment

Caution, the one who helps patient should avoid direct contact with clothes or his vomit, wear rubber gloves while cleaning up poison from the victim who is exposed. Following are the fist aid and management stems for poisoning:

2.4.3 Clear airway with all obstruction and start oxygenation

2.4.4 Administer Atropine Sulphate which will prevent Acetyl Chlorine accumulation. Atropine should be re-administered shortly if symptoms bocome worse due to high Organophosphate poisoning. Atropine is good for counteracting muscarinic poisoning, but not for nicotinic poisoning (whose symptoms include weakness, spasm and respiratory obstruction.

Common names of Organophosphate Insecticides
Highly Hazardous
Monocrotophos Methyl parathion Ethyl parathion
Methamidophos Dicrotophos

Moderate Hazardous
Dichlorvos Triazophos Chlorpyrifos Dimethoate Diazinon Fenitrothion
Malathion

2.10 Carbamate insecticide (Wijit Boonyaho-tra, cited in Pujoy, 1999)

Carbamates are new compounds and are lightly hazardous to warm blooded animals. The most commonly used are Carbaryl or Sevin which has broad spectrum action. The advantage of Sevin is that it is less hazardous to human and warm blooded animals. Besides, it has less residual effect on vegetables, and environment. Its disadvantage is that it is highly hazardous to bees and fishes. Carbamate is good for house insects especially cockroaches.

Organophosphate and Carbamate are classified as contact poisons. They have same toxicity to nervous system as seen by organophosphate and carbamate molecule. These compounds get through insects, and bind cholinesterase enzyme at sensory nerve or neuromuscular synapse. This causes accumulation of acetylcoline at the end of nerve until it reaches toxic levels. Symptom of organophosphate and carbamate's toxin mainly seen in involuntary nervous system e.g. slow breathing, constricted iris, and sweating.

Carbamate insecticides are used for many kinds of pests e.g. piercing sucking insects, pests in soil and garden snail. Carbamate insecticides are very popular especially Cabaryl because of broad spectrum both plants and animals. Carbamate insecticides can absorb via dermal easily, so user should be careful from direct contact. Unless use of Carbamate insecticide for insects, it can be used for fungi, earthworm and weed flora.

Carbamates toxin are absorb via inhalation, oral and dermal then has chemical reaction in liver and excrete by liver and kidney later. Some Carbamates are formulated with methyl alcohol, so should think of methanol's poison too e.g gastric irritation, get danger to central nervous system and neurotic disease.

Common names of Carbamate insecticides

Highly Hazardous:

Aldicarb Oxamyl Carbofuran Methomyl

Formetanate hydrochloride

Moderate Hazardous

Promecarb

Methiocarb

Propoxur

Pirimicarb

Carbaryl

BPMC

Thiodicarb

Medical Treatment for pesticide poisoning

A caretaker should avoid direct contacts with clothes contaminated by poisonous chemicals and/or a patient's vomit. Besides, he should wear rubber gloves while washing the chemicals off the patient's skin and hair

Let the patient take easy breaths by taking all waste from his bronchus. Provide him oxygen before giving atropine in order to reduce risk from heart ischemia. Atropine sulphate is to be given via vein or muscle. Atropine will prevent the patient from muscarinic developed out of Acetyl accumulation at nerve ending.

Atropine is an effective drug to counteract muscular reaction, but ineffective to nicotinic action such as fatigue, muscular twitching, and respiratory obstruction.

2.11 Pesticides Inhibit Cholinesterase

Any pesticide that can bind, or inhibit, cholinesterase, making it unable to breakdown acetylcholine, is called a "cholinesterase inhibitor," or "anticholinesterase agent." The two main classes of cholinesterase inhibiting pesticides are the organophosphates (OPs) and the carbamates (CMs). Some newer chemicals, such as the chlorinated derivatives of nicotine can also affect the cholinesterase enzyme. Organophosphate insecticides include some of the most toxic pesticides. They can enter the human body through skin absorption, inhalation and ingestion. They can affect cholinesterase activity in both red blood cells and in blood plasma, and can act directly, or in combination with other enzymes, on cholinesterase in the body. The following list includes some of the most commonly used OPs:

- acephate
- Aspon
- azinphos-methyl
- carbofuran
- carbophenothion
- chlorfenvinphos
- chlorpyrifos
- coumaphos
- crotoxyphos
- crufomate
- demeton
- diazinon
- dichlorvos
- dicrotophos
- dimethoate
- dioxathion
- fenitrothion, fensulfothion, fenthion
- fonofos
- isofenfos
- malathion
- methamidophos
- methidathion
- methyl parathio
- mevinphos
- monocrotophos
- naled
- oxydemeton-methyl, parathion
- phorate
- phosalone
- phosmet
- phosphamidon)
- temephos

□ disulfoton	□ TEPP
□ EPN	□ terbufos
□ ethion	□ tetrachlorvinphos
□ ethoprop	□ trichlorfon

Carbamates, like organophosphates, vary widely in toxicity and work by inhibiting plasma cholinesterase. Some examples of carbamates are listed below:

- aldicarb
- bendiocarb
- bufencarb
- carbaryl
- carbofuran
- formetanate
- methiocarb
- methomyl
- oxamyl
- pinmicarb
- propoxur

A result of overexposure to cholinesterase inhibiting pesticides

Overexposure to organophosphate (OPs) and carbamate (CMs) insecticides can result in cholinesterase inhibition. These pesticides combine with acetylcholinesterase at nerve endings in the brain and nervous system, and with other types of cholinesterase found in the blood. This allows acetylcholine to build up, while protective levels of the cholinesterase enzyme decrease. The more cholinesterase levels decrease, the more likely symptoms of poisoning from cholinesterase inhibiting pesticides are to show. Signs and symptoms of cholinesterase inhibition from exposure to CMs or OPs include the following:

1. In mild cases (within 4 - 24 hours of contact): tiredness, weakness, dizziness, nausea and blurred vision;
2. In moderate cases (within 4 - 24 hours of contact): headache, sweating, tearing, drooling, vomiting, tunnel vision, and twitching;
3. In severe cases (after continued daily absorption): abdominal cramps,

urinating, diarrhea, muscular tremors, staggering gait, pinpoint pupils, hypotension (abnormally low blood pressure), slow heartbeat, breathing difficulty, and possibly death, if not promptly treated by a physician.

Unfortunately, some of the above symptoms can be confused with influenza (flu), heat prostration, alcohol intoxication, exhaustion, hypoglycemia (low blood sugar), asthma, gastroenteritis, pneumonia, and brain hemorrhage. This can cause problems if the symptoms of lowered cholinesterase levels are either ignored or misdiagnosed as something more or less harmful than they really are.

The types and severity of cholinesterase inhibition symptoms depend on:

(a) The toxicity of the pesticide.

(b) The amount of pesticide involved in the exposure.

(c) The route of exposure.

(d) The duration of exposure.

Although the signs of cholinesterase inhibition are similar for both carbamate and organophosphate poisoning, blood cholinesterase returns to safe levels much more quickly after exposure to CMs than after OP exposure. Depending on the degree of exposure, cholinesterase levels may return to pre-exposure levels after a period ranging from several hours to several days for carbamate exposure, and from a few days to several weeks for organophosphates.

When symptoms of decreased cholinesterase levels first appear, it is impossible to tell whether a poisoning will be mild or severe. In many instances, when the skin is contaminated, symptoms can quickly go from mild to severe even though the area is washed. Certain chemicals can continue to be absorbed through the skin in spite of cleaning efforts.

If someone experiences any of these symptoms, especially a combination of four or more of these symptoms during pesticide handling or through other sources of exposure, they should immediately remove themselves from possible further exposure. Work should not be started again until first aid or medical attention is given and the work area has been decontaminated. Work practices, possible sources of exposure, and protective precautions should also be carefully examined.

The victim of poisoning should be transported to the nearest hospital or poison center at the first sign(s) of poisoning. Atropine and pralidoxime (2-PAM, Protopam) chloride may be given by the physician for organophosphate poisoning; atropine is the only antidote needed to treat cholinesterase inhibition resulting from carbamate exposur**e.**

List of common pesticides which are used in vegetable farming community is listed below. This information is gathered from pesticides sellers, shops and sales agent who are working in the study area.

Insecticides used in Vegetable farming:

Acetamaprid 20% SP

Chloropyriphos 20% SC

Cartap hydrochloride 50% SP

Imidacloprid 17.8% SL

Thiamethoxam 25% WG

Trizophos 40% EC

Carbofuran 3% CG

Diafenthivron 50% WP

Emamectin Benzoiats 5% SG

Chlorophyriphos + cypermethin 4% EC

Profenophos 40% + cypermethin 4% EC

Dultamethrin 1% + Triazophos 35% EC

Flubendiamide

Corozen

PGR used in vegetable farming:

Gibberellic Acid

Triacontanol

Sea weed extract

Zinc

Fungicides in vegetable farming

Carbendazim 125 + Mancozeb 63% WP

Sulphur 80% WDG

Thiophanate Methyl 70% WP

Mancozeb 75% WP

Carbendazim 50% WP

Herbicides used in vegetable farming

Pendimethlin 38.7%

Others

Streptomycin sulphate + tetracycline hydrochloride

CHAPTER III
RESEARCH METHODOLOGY

This chapter explains the method and tools used in this research. The various sections will explain the design, duration, population and methods used for selection of research participants. This section will also cover the data collection and analysis methods including the expected benefits of the research. The research procedure is divided into three phases: preparatory phase, implementation phase and evaluation phase. This chapter focused on the following topics:

3.1 Research design
3.2 Study area and study period
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3.1 Research Design

The study design was quasi-experimental study research design. The effectiveness of the intervention educational tool was monitored by the changes of mean scores of knowledge, attitude, practice and an assessment of the home's pesticide safety behavior in household of vegetable farmers. This study was conducted in farming community in outskirts of Delhi, from October 2016 to January 2017. National capital region of Delhi being a big market for vegetable farmers, the agriculture practices around Delhi are mainly vegetables, who have been using the pesticides irrespective of infestation in the crops. Vegetable farming is considered cash cow for such marginalized farmers, who earn money quickly, within 2-3 months due to short span of crop cycle. Hence Delhi Capital Region is chosen as representative of vegetable

farming community as there is a high mix of farmers who have migrated to the region from all over northern India.

Study population was divided into 2 similar groups, the intervention and control groups, drawn from 2 areas.

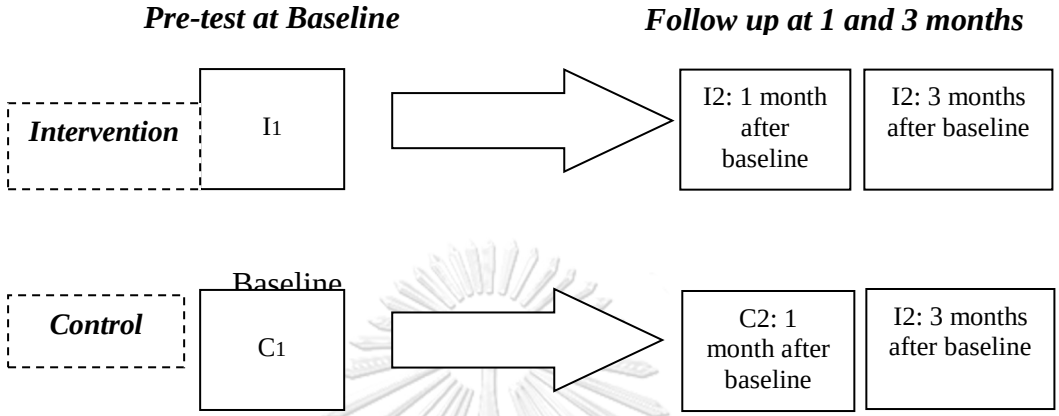


Figure 3.1: Diagram of study design

I1: Farmers in intervention group; C1: Farmers in control group

Procedure and study plan: Study activities are divided into two phases. Preparatory Phase, where an educational tool was prepared with help of three opinion leaders and experts in the field of pesticide use. The tool was prepared using pictures depicting and capturing following information:

- Pesticide utilization and pesticide problems
  - Classification and hazards of pesticides; Health risk (both acute and chronic illnesses); Route of exposure
- Safe use of pesticide
  - Procurement and Preparation; Spray; Storage; Accidental exposures
- Safe disposal practices
  - Correct disposal practices; Do and Don't's for users

The pictures selected for the tool were given to a sketch artist, who drew it as a single sheet of pictorial information sheet. This information sheet was converted into a day-calendar which provided other important information along with pesticide related information. The educational tool also contained important phone numbers of helpline and other emergency services in case of accidental exposure. The tool also carried a picture of a locally worshiped God, so that farmer will not get rid of it for un-necessary

reasons. After preparation, this tool was tested for external validity with three experts, independent of tool preparation. Using guidance and experience of experts in India, an affordable and self-explanatory pictorial poster was finalized as intervention in study, during month of Jan-Feb 2016. Consultation were taken with my thesis advisor Prof Robert S Chapman, along with below mentioned experts:

- Dr Manish Pant: Public Health Expert at UNDP office Delhi
- Dr Manoj Karwa: An expert in field of toxicity and pesticide poisoning
- Dr Saurabh Arora: Expert in Food safety

An educational is commercially printed as wall calendar so that it could be made useful for the household. Poster is prepared in 2 different sizes and posted on household walls depending on area available and visual aesthetics. Pictures of Educational Tool is provided in Appendix 8.

3.2 Study Area and study period

The study area is located in the NCR (National Capital Region) of Delhi along the belt of river Yamuna, which crosses Delhi state. There are agricultural fields on both sides of the river mainly used for vegetable farming by small time farmers. Vegetable farmers living in this community are often not aware of pesticide. They do not completely understand the hazards of pesticide exposure during its use, and especially in their work places and homes where it is usually stored and disposed. In addition, there is quite low understanding on potential adverse effects of pesticide use on their families' health. Furthermore, these communities are very poor and belong to low socioeconomic of farmers, who either work as laborer on other's land or a small land of their own.

These vegetable farmers from four villages of Baghpat district were identified as intervention and control group using the purposive sampling method, and selected based on similarity of their cultivated land and their year-round growing season. We have selected four villages for the purpose of study. Two of the villages, namely Ibrahim Majra and Gopalpur Khadana, which are adjacent to each other were selected as interventional villages. These two villages are separated from each other by 3 kilometers. Other two villages, namely Puthri and Barawad, which are in north of

interventional villages, were selected as control villages. The control and interventional villages are separated approximately 18 kilometers, with no common social and healthcare providing institutions. All four study villages are similar community in Baghpat district of India with a population range from 400-600 per village with similar agriculture practices. Baghpat is situated on the Yamuna basin near plenty of canals and is agriculturally known for various plantations. Health risk problems associated with pesticide exposure, especially pesticide, exposure were found in this area. Our study village were chosen for intervention and control group by using the purposive sampling according to the similarity of cultivated land and be the area with all year round growing the crop.

Within each study village we have selected 50 farmers each, by randomly picking household numbers through a computer-generated list. Initially our intention was to evenly distribute study population in all four selected villages, but due to contamination of population in our first intervention village, we only enrolled 5 farmers from first intervention village and remaining 39 from second intervention village. However in the control villages, the distribution of study population was similar.

3.3 Sample Size and Sampling

Study population

The study populations is the vegetable farmers who had been working at farm and risk to occupational pesticide exposure hazards in villages of district Faridabad, India.

Study Subjects

The study participants are the head of households, who had been working at farm in study village for at least 2 year.

The inclusion criteria are as follows;

- Participants who were willing to participate in the study.
- Farmers who are living in selected village/ community and use pesticides for at least three year.
- Who is involved in all major activities with respect to pesticide use in farms
- Farmers who have no communication problems

The exclusion criteria presented as follows;

- Participants who wanted to leave from the study

Sample size calculation

Sample size calculation in quasi-experimental study

According to the key concept of educational tool effectiveness, small sample size is more effective than that another big size, hence study villages were selected by using the proportional sampling.

In order to detect a true difference between study and control groups, the sample size of study and control groups were performed as follow;

$$n/group = \frac{2\boldsymbol{\sigma}^2 (Z\alpha + Z\beta)^2}{\boldsymbol{\delta}^2}$$

Where, difference in population means **(δ)**

Type I error probability **(α)**

Power = 80%

In an earlier study done in India, Kishore et al (2008) found average baseline KAP score of 30.88 +/- 10.33 which improved after education significantly ($P < 0.001$) at first follow-up to 45.03 +/- 9.16 and at second follow-up 42.9 +/- 9.54. Using information from above study, we arrived at following sample size:

$$n/group = \frac{10.33^2 (1.960+0.842)^2 \times 2}{12.02^2}$$

$$= 16 \text{ cases/group}$$

Though our primary endpoint for research is to evaluate change in KAP score between the control and intervention group, however we would like to power the study population so that we can significantly demonstrate change in practice score. To power the study for statistically identifying a true difference in practice score, which is most critical for effectiveness of an educational tool, we will need 40 subjects per study arm. Anticipating a dropout of 20% over 3 months, we planned to enroll 100 subjects in the study, with 50 each in intervention and control group.

Sampling technique

The subjects in both intervention and control groups were selected to be the representative of household by using a sampling technique as follows: Specific participants were selected by random selection within village.

Process 1: Sampling of District and villages: Purposive based on background information and after discussion with Key Opinion Leaders (KOLs) from health practice and farming experts in agriculture universities in the country.

Process 2: Sampling of households

A total of 100 house hold were selected from selected villages by using random sampling from the listed households. The total sample size were selected by using the proportional sampling according to the village size.

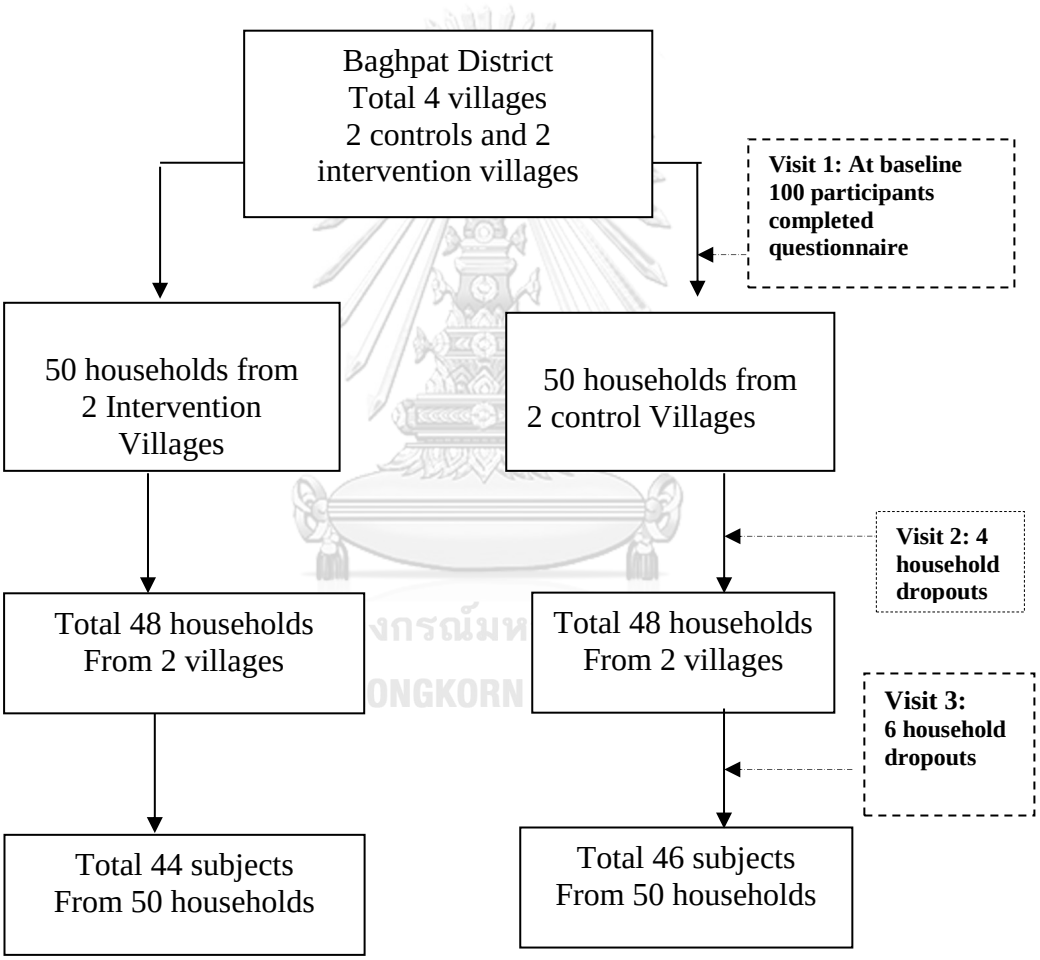
Process 3: Sampling of subjects

The subjects in both intervention and control groups were selected to be the representative of household, with one farmer per one household selected. Head of the family, who is involved in all decision makings process with respect of use of pesticides was selected as responder for the study questionnaire. It was encouraged if all available family members attend the interaction with researcher, especially older children. Farahat (2009) found that involving children improved knowledge and practices of farmer's in Egypt. Involving young children who may be better educated than their parents, may bring required behavior changes due to their involvement and better awareness on health issues. However, we did not want to analyze the effect of presence and number of other household members in KAP improvement in this study as we anticipate high variability between the family as well as between study visits. Hence, we did not capture information on other household members presence during the interview.

We intended to enroll 100 participants (50 in intervention and 50 in control arm) from 4 selected villages. A detailed sequential list of households is prepared for 2 interventions and 2 control villages. From this list of households, we randomly re-listed them and prepared randomized list of 50 houses per village. We enrolled intervention arm participants first followed by enrollment of farmers in control arm. We initiated enrolling farmers from top of the randomization list and asked head of

household for their consent and availability. Subjects who gave consent and confirmed availability for the duration of study were enrolled. Once we completed enrollment of 50 heads of households in intervention group, we followed the same process for control arm.

Out of 100 consenting household at first visit, we saw a dropout of 4 housed holds at first follow up visit and only 90 participants completed their second follow up, which occurred after 3 months from baseline visit.



3.4 Procedure and study plan

The study aims to develop strategies to reduce the risk of pesticide exposure to vegetable farming community and other stakeholders at selected districts of India. The study consists of 3 stages;

Preparatory phase

During this phase an educational tool was designed with support from all stakeholders, who are involved in promotion of safe pesticide use. Researcher interacted with Health Officer, institutes who work in pesticide regulations, local health authorities, selected farming families from outside the study area, pesticide sellers and NGO were interviewed to draw brief sketch of existing problem and design a cost effective educational tool. During this stage of interaction with the stakeholders, emphasis was made to find out issue of pesticide safety and current method/ source of information form farming community. Researcher and the stakeholders designed format of educational tool assessing the needs/feasibility among the stakeholders. An educational tool developed in this phase using simple pictures and text was tested for internal and external validity by using similar population in different village/community of province.

Implementation phase

The process of educational tool intervention was divided into 3 steps including: the baseline assessment; followed by two visits at 1 month and 3 months after baseline.

Process of approaching the study subjects

We approached all study villages through their village leader and health worker. Each selected village has homogenous farming household ranging from 60-120 households and finally four were selected for study. Study participants were randomly selected within each village and screened based on inclusion criterion defined earlier. We started from southern most point of village and stop enrolling as soon as we attain a sample of 25 confirmed households per visit. One we have selected household and participant for study, researcher made appointment with household heads to schedule first home visit, when maximum number of family members are available.

Step 1 Baseline assessment

During the first home visit, which may take 30 minutes, researcher read and explain the consent for study and obtain the participant's signature to be the study participant and allow researcher home assessment for safe pesticide use behavior c. A baseline questionnaire for KAP and health outcome assessment was administered. The "In Home Pesticide Safety Assessment" was administered after visual inspection of

various household areas. This assessment included inspection on wide range of practices relating to home safety.

Researcher educated the consenting subjects in intervention group using the educational tool, and answered any issues and concerns related to pesticide safety and management practices. Participants in intervention group households also received individual guidance from researcher for assistance with safer storage of pesticides, and discussions of improved hygienic practices, such as those associated with post-application wash-up and separate laundering of contaminate clothing, as indicated in the tool. Stress was given on pesticide storage areas adjacent to housing, improper disposal of pesticide containers near children play areas, and storage of soiled work clothes in living areas. At the end of the first assessment, "Educational Tool" was be placed in a prominent position. Participants also received additional copies of health education tool to stick on at appropriate places. Control group participants in study followed same study methodology for all research visits at baseline, one month and 3 months after first visit. However, control subjects were not given any educational tool, neither any information verbally by the researcher to increase knowledge on pesticide use and management. At the end of study, researcher made a final visit to all control group household and distribute education tool along with information on safe management of pesticides.

Since farmers often had difficulty getting time off from their work, so the schedule for the interaction was usually held during non-work hours in late evenings.

Follow up visit at 1, 3 months after baseline

The second and third home assessment involved the observation and administration of questionnaire to assess farmer's knowledge, attitude and behavior changes towards their ability to reduce the risk of pesticide exposures within their home, which will be conducted at 1, 3 months post baseline assessment. The researcher administered post-test to study participants during these follow up home assessment, discussed pesticide safety and other health related issues that had arisen. Researcher also provided additional printed materials as necessary to intervention group only. The follow up visits for questionnaire took approximately half an hour. In addition, research team also conducted a visual observation of the home for any changes the subject might

have made, based on the recommendations suggested to improve home safety during the baseline assessment in intervention group. This information was noted on the in-home assessment form.

3.5 Measurement tools and Pre Testing for Reliability

Content validity and reliability of all questionnaire was verified by 3 specialists and experts on environmental health, community health, behaviour and social sciences. Then, questionnaire was revised after getting the recommendations from the experts. In addition, a pilot project was carried out in different community by using 30 purposive sampling subjects before going to the final process of data collection. We used draft questionnaire which was approved by thesis advisors and 3 experts after checking its content validity. Then, the questionnaire was adjusted in according to comments and suggestions and reliability tested on 30 vegetable farmers in Faridabad district, which has similar farming community but is in different state of India Pilot testing showed the reliability with Cronbach's alpha value of 0.81. The questionnaire was verified concerning reliability using coefficient alpha of Cronbach, for both negative and positive direction questions.

The final and verified research instruments included knowledge on pesticide use, health attitude on pesticide use, pesticide use practices, within home's pesticide safety assessment and health outcome questionnaire. The measurement tools were separated in 6 sections including;

1. Interview form to survey general data which included socio-demographic information: age, education, marital status, religious, occupation, income, years have you used pesticides, years working in farming and medical history.
2. Health outcome questionnaire on various signs and symptoms suggesting any poisoning due to excessive pesticide exposure, along with import medical history.
3. Questionnaire of knowledge on occupational pesticide safety, which the contents of questionnaire included: knowledge and understanding before,

meanwhile, after handling pesticide; proper storage of pesticide; and environment and agrochemical effects

4. Questionnaire of health belief or attitude on pesticide safety. The contents of questionnaire will include: perception toward susceptibility, severity, benefits of pesticide safety and barriers to improving pesticide safety
5. Questionnaire on practice regarding on pesticide safety. The contents of questionnaire related an environmental, health and protective behavior issues
6. In home pesticide safety assessment involved the identification of pesticide safety behaviors in and around their home

The effectiveness of the intervention program was monitored by the changes of mean scores of knowledge, attitude, practice and assessment of the home's pesticide safety behavior. In additions, health status questions on various symptoms which are common due to pesticide exposure was asked via structured questionnaire.

Section 1 knowledge on pesticide safety

The knowledge on pesticide use questionnaire consisted of basic knowledge of pesticide safety behaviors. The examples of the questions are: How are you exposed from pesticide s especially pesticides? What is the dangerous of pesticide especially pesticides? What are the most important points to consider when choosing agrochemicals? What should you do, if the nozzle is clogged while you are spraying pesticide especially pesticide? How should you have the method to get rid of pesticide containers?

All of 27 questions will be 4 or 2 multiple-choice answers scored as follow;

Correct answer obtaining	1	score
Incorrect answer obtaining	0	score
Missing answer obtaining	0	score

Scores of knowledge will be classified into 3 groups by using Bloom's Theory (Bloom et al., 1956). The scores were summed up. Then, they were classified by percentage, ≤ 60.00 % was low level, >60.00 % - 80.00 % moderate, and > 80.00 % high level as follow.

Score	Level
0-16	Low
16-21	Moderate
22 above	High

Section 2 Attitude on pesticides scores

The health attitude on pesticide use questionnaire included perceived benefits, exposure, severity and barriers to using pesticide. The questions were both positive and negative which were scored on a five-point Likert's scale, ranging from strongly agree, agree, uncertain, disagree, and strongly disagree. A draft of questionnaire is provided in annexure.

Strongly agree meant the farmers thought that the message is correspond with his feeling, opinion or attitude following his perception most. Agree meant the farmers thought that the message is correspond with his feeling, opinion or attitude following his perception. Neutral meant the farmers are uncertain with the message in that sentence which is corresponding against to his feeling, opinion or attitude with perception. Disagree meant the farmers thought the message opposes his feeling, opinion or attitude with perception. Strongly disagree meant the farmers thought the message opposes all of his feeling, opinion or attitude with perception. The farmers could choose one choice and the criterion of the measurement present as follow:

	Positive statements	**Negative statements**
Strongly agree	5 scores	1 score
Agree	4 scores	2 scores
Neutral	3 scores	3 scores
Disagree	2 scores	4 scores
Strongly disagree	1 score	5 scores

Section 3 Practice on pesticides scores

A scoring criteria and evaluation standard total score were classified and applied into three categories as follow (Seri, 1993):

Negative attitude: Score = 0.00-59.99% (0-82)

Neutral attitude: Score = 60.00-79.99% (83-108)

Positive attitude: Score = 80.00-100% (109 and above)

Following are the possible responses in behaviors, which were interpreted as follows:

- Always done**:** farmers perform the dangerous protection activities from pesticides every time when they work with pesticides;
- Often done**:** farmers almost perform the dangerous protection activities from pesticides when they work with pesticides or the time of doing activities are between 5-9 times from 10 times of using pesticides;
- Sometimes done: farmers sometimes perform the dangerous protection activities from pesticides when their work related pesticides or the time amount of doing activity are not over 4 from 10 times of for using pesticides;
- Never done**:** farmers never perform the dangerous activities related to pesticide exposure

All individual points were sum up for a total score, means and standard deviations were calculated. Scores of behavior regarding pesticide exposure were classified into 3 groups by using Bloom's Theory (Bloom et al., 1956). The scores were sum up. Then, they were classified by percentage, ≤ 60.00 % was low level, >60.00 % - 80.00 % moderate, and > 80.00 % high level. The farmers could choose one choice and the criterion of the measurement was as follow:

	Positive statements	**Negative statements**
Always done	4 scores	1 scores
Often done	3 scores	2 scores
Sometime done	2 scores	3 scores
Never done	1 score	4 scores

A scoring criteria and evaluation standard total score were classified and applied into three categories as follow (Seri, 1993):

Negative Practice: Score = 0.00-59.99% (0-64)

Neutral Practice: Score = 60.00-79.99% (65-86)

Positive Practice: Score = 80.00-100% (87 and above)

Section 4 In-home pesticide safety assessment scores

The home pesticide safety assessment involved the identification of pesticide safety behaviors in and around their home. The answers of 12 questions is "yes" or

“no”. The examples are: Leave pesticides in the bathroom; Leave pesticides in the kitchen room; Store pesticides in a safety and locked room; Provide hazardous trash and general trash;

The answers of each question were “yes” or “no”. The answers were scored as follow;

“Yes” answer	obtaining	1	score
“No” answer	obtaining	0	score
Missing answer	obtaining	0	score

A scoring criteria and evaluation standard total score were classified and applied into three categories as follow (Seri, 1993):

Negative Assessment: Score = 0.00-59.99% (0-7)
Neutral Assessment: Score = 60.00-79.99% (7-9)
Positive Assessment: Score = 80.00-100% (10 and above)

3.6 Data Collection

Quantitative data on knowledge, attitude and practices, including background data and general data of health outcome assessment, and in home practice was collected by face to face interview with questionnaires. Observation on environment of workplace and characteristic of work activities by observation formed an important component of data on pesticide risk behaviour.

3.7 Data analysis

Descriptive Statistic used to describe the data of the study population: frequencies, percentage, mean, frequency, percentage, and standard deviation were calculated for general information, knowledge, attitude, practices, pesticide related symptoms and in-home assessment outcome. Inferential Statistics was used to infer cause and effect, and to determine the degree to which the findings of a sample can be generalized to a larger population. In preliminary data analysis (before intervention in study population) baseline difference were tested and compared independent

variables-general characteristics, and dependent variables- knowledge, attitude, practice, insecticides related symptoms, and in-home assessment between intervention and control groups. Chi- square tests for categorical variables independent t-test was used in continuous data was used.

As mentioned above, study outcomes were measured at baseline and at 2 follow-up times in the control and intervention groups. The SPSS (V16; SPSS, Inc, Chicago, IL, USA) repeated measures analysis of variance routine was used to generate figures showing means of continuous outcomes, in each group at each measurement time.

For continuous outcomes (knowledge, attitude, practice scores and in-home assessment), the magnitude of the intervention effect is equal to:

(follow-up mean – baseline mean)intervention − (follow-up mean – baseline mean)control.

List of inferential statistics used:

1. Chi-square, *t*-test, and paired-*t* test was used to evaluate differences of characteristics between experimental and control groups and to evaluate changes of participant's knowledge, attitude, and practice.

2. Linear regression model was prepared to see the effect of demographic and other pesticide use variable on baseline knowledge, attitude and practices scores.

3. Repeat measure analysis was done for dependent variables and P-value of 95% confidence was 0.05 and analysis was performed for all dependent variables. The proposed study includes one baseline and 2 follow-up data collections. Some outcome variables are continuous, some are dichotomous. The primary goal of data analysis was to quantify and test statistical significance of the effect of the intervention on the outcomes at follow-up 1 and follow-up 2 (as compared to baseline). For continuous outcomes, linear mixed models will be constructed, which account for repeated measures and which enable evaluation of intervention effects at each follow-up time. For dichotomous outcomes, generalized linear models was constructed, with choice of distribution probably being binomial or poison, and choice of link function possibly being logit (which gives odds ratios), log (which gives relative risks), or identity (which

gives absolute differences). Models were not adjusted for independent variables which exhibit no differences between the control and intervention groups at baseline.

3.8 Ethical consideration

The study protocol was approved according to Chulalongkorn University guidelines for the protection of human subjects and waiver was provided by local ethics committee in India. Information collected was kept confidential by using numbers and codes. Furthermore, written informed consent was obtained from the farmer participants prior to conducting any study-related procedures

CHAPTER IV
RESERCH RESULTS

The research is a quasi-experiment design which examined the effectiveness of simple and affordable educational tool as educational program intervention to educate on safe use of pesticides among vegetable farmers in outskirts of Delhi, India. The vegetable farmers from four villages of Baghpat District were recruited as intervention and control group using the purposive sampling method. These villages were selected for the similarity of their cultivated land and their year-round growing season. We selected four villages for the purpose of study. Two of the villages, namely Ibrahim Majra and Gopalpur Khadana, which are adjacent to each other and are selected as interventional villages. These two villages are separated from each other by 3 kilometers. Other two villages, namely Puthri and Barawad, which are in north of interventional villages, as control group. The control and interventional villages are separated approximately 18 kilometers, with no common social and healthcare providing institutions. The intervention and control villages are also catered by different agriculture market from where they purchase various agriculture related products lime farming equipment's, seeds, pesticides and other materials. All four study villages have similar community demography with a population range from 400-600 persons per village, with similar agriculture practices. Baghpat District is situated on the Yamuna basin near plenty of canals and is agriculturally known for various plantations. Table below illustrated various attributes of study villages:

Table 4.1: Population demographics of study villages.

Demography of Study Villages		**Interventional Village**		**Control Village**	
		Ibrahim Majra	**Gopalpur Khadana**	**Puthri**	**Barawad**
1	Total families in Village	63	147	69	95
2	Total Population	428	898	425	540
3	Males in Village	227	457	227	280
4	Females in Village	201	441	198	260
5	Children 6-18 of age	72	155	71	84

The map of the study villages is depicted in the figure below, where the village area marked with red are depicting interventional villages and the one with blue colour are depicting control villages. As seen from the google map image, the study intervention area is separated by 18 kilometers from the study control area, so that we did not incur any contamination of intervention in the control group.

Figure 4.1: Google map image of study villages and distance bar for reference.

Study enrolled 96 study subjects from 4 villages, out of which a total of 90 subjects complete the study and were followed up to completion of study. 44 subjects completed study from intervention villages and 46 completed all study follow up, from control villages. Below is the details of study subjects enrolled from each village, who completed entire study duration. In the intervention group, we initially started with village Gopalpur Khadana and distributed study educational tool to first five enrolled participants. On our subsequent visit to village next day, we found that there was contamination of interventional tool and other families were made aware of research activity by previously enrolled families. Though the entire village is an intervention village, we stopped more requirement from this village and continued enrollment from second intervention village, making sure minimal contamination occur in neighboring household, which is bias assessment of educational tool effectiveness.

Table 4.2: Study subject's enrollment within study village.

	Village Name	Frequency	Percent	Cumulative percent
1	Ibrahim Majra	39	43.3	43.3
2	Gopalpur Khadana	5	5.6	48.9
3	Puthri	24	26.7	75.6

4	Barawad	22	24.4	100
TOTAL		90	100	

The effectiveness of the intervention program was assessed by using the standardized questionnaires and in-home inspection at baseline, at follow after 1 month and 3 months from baseline. The study results are presented in 4 parts: (1) general characteristics consisting of socio-demographic characteristics, pesticides work characteristic, duration of work, duration of pesticides practice, Knowledge, attitude, and practice for pesticides used and health status as measured by symptoms questionnaire on use of pesticides-related symptoms, (2) effectiveness of Educational Tool, as analyzed with both repeated-measures analysis of variance and multilevel models, and finally (3) relationship between knowledge, attitude and practice in pesticide use.

4.1 Data Analysis and Baseline Characteristics

Independent t-test for continuous data and chi-square test for categorical demographical data were conducted to test the difference in baseline characteristics between intervention group and control group study participants. We did not find any difference in baseline demographic and other independent variables in study population and hence did not adjust any characteristics) when assessing the effects of the intervention on knowledge, attitude, practice and in-home assessment behavior. In addition, the effect of intervention on health related symptoms is also presented as unadjusted analysis.

4.1.1. General characteristic, demography, farming characteristics and health status at baseline assessment (Independent variables)

For all demographic and other baseline data we used Independent t-test for continuous data and chi-square test for categorical data, which is presented in tables 4.3 to 4.5 below. All of the demographic characters were found to be similar in both control and intervention group and are discussed in detail in respective sections.

4.1.1.2 General characteristics, duration of exposure and pesticide use characteristic between the study group.

The mean age of subjects in intervention population is 40.92 years and in control population is 40.47 years. The independent T-test There is no statistical difference between the mean age of subjects in the study arms (p= .893). Similarly, we also evaluated other critical pesticide use parameters which could affect the baseline knowledge and other study parameters like behavior due to total years spend using pesticides and last contacted time with pesticides. We found no difference in the intervention population and control population in both 'years of using pesticide' and 'last contact date' for pesticide handling. An average year of pesticide use in intervention is 5.58 years whereas in control population is 6.43 years. There is no significant difference in both groups (p=0.104). In addition, we also found no difference in last contacted day by study participant. It is 4.51 days in intervention and 3.96 days in control population, indication very similar behavior between the two study populations with respect to use of pesticides.

Table 4.3: Age and years of exposure of pesticides between the study groups

Characteristics	**Total N=90**		**Intervention Gp (n=44)**		**Control Gp (n=46)**		**P value**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Age of Subjects	40.92	12.08	40.74	11.84	41.08	12.40	0.893
Years using Pesticide	5.58	4.61	6.43	5.01	4.86	4.16	0.104
Last contacted	4.51	7.75	5.17	5.69	3.96	3.77	0.227

Independent T-test

Chi-square test results are shown in table 4.4. For cell values which are less than count of 5, we used Fisher Exact test. All characteristics were similar in the control and intervention groups. Both intervention and control groups had similar education over grade 5. It had no significant difference in number of smokers both control and intervention group (p=0.409) and no statistical significant difference in average drinking (2 drinks per day) of alcoholic beverages (p=0.352). There were very few subjects who have reported to be suffering from any chronic disease. The prevalence of

any chronic disease seems less compared to existing prevalence of disease in country. This could be due to low attitude on health seeking ailments and lack of awareness among the community on chronic diseases like hypertension, diabetes or other diseases.

Table 4.4: Socio demographic and pesticide use characteristics between the study groups

Characteristics	**Total N=90**		**Intervention (n=44)**		**Control Gp (n=46)**		**P value**
	N	**%**	**N**	**%**	**N**	**%**	
Education 5th Grade above	67	74.4	32	72.7	35	76.0	.362
Smoking status	43	47.7	23	52.2	20	43.5	.409
More than 2 drinks/ day	10	11.1	5	11.4	5	10.9	.984
Having any chronic disease	1	1.1	1	2.2	0	0	.309
Grow crops for yourself	88	97.7	43	97.7	45	97.8	.636
5 Years or more insec. use	82	91.1	42	95.4	40	86.9	.710
All activities of pesticide	70	77.7	34	72.2	36	78.2	.454
Training on pesticide use	4	4.4	2	4.5	2	4.4	.388
Spray up to 6 times per crop	66	73.3	35	79.5	31	67.4	.468
Spray 200 ml or more	72	80	37	84.1	35	76.1	.320
Mix pesticide before use	87	96.6	42	95.5	45	97.8	.975
Spray 2 hours or more/ day	61	67.7	27	61.4	34	73.9	.241
Spray during morning hours	71	78.8	36	78.8	35	76.1	.380
Use as per label or advice	57	63.3	26	59.1	31	67.4	.290

Chi-square test, *Fisher Exact Test

About 97.7% of farmers in the intervention group are growing vegetable plans for themselves, with a similar number in control group. Out of all the farmers, 91.1 percent in intervention arm and 95.4 percent in the control arm have more than 5 years of pesticide use experience. There is no significant difference in the experience of pesticide use in both groups (p=.710). The amount of sprayer was also similar in both groups (p=0.468) as well as number of spray per corp. The intervention arm farmers reported 73.3 percent spraying more than 6 times per crop and intervention arm this percentage was 79.5, with no statistical difference between the two arms (p=.468).

Almost all farmers in intervention group and control groups had never been trained on pesticide handling and use practices in their life. There were only 2 farmers in each group who have taken some form of training for use of pesticides. In spite of lack of formal education on use of pesticides, 63.3 percent of farmers in intervention group and 67.4 percent in control group reported reading of labels or following some kind of advice when using pesticides. This practice for reading label and following advice was found to be similar in both study groups (p=.290).

Table 4.5: Vegetable farming characteristics and comparison between the study groups

	Total (N=90)		**Control (n=46)**		**Intervention (n=44)**		**p-value**
	N	%	N	%	N	%	
Cauliflower	87	96.6	43	93.4	44	100	.209
Spinach	57	63.3	27	58.6	30	68.1	.452
Radish	38	42.2	19	41.3	19	43.1	.984
Fenugreek	15	16.6	6	13.0	9	20.4	.755
Chilly	13	14.4	8	17.3	5	11.3	.564
Onion	8	8.8	5	10.8	3	6.1	.102
Bitter Gourd	7	7.7	2	4.34	5	11.3	.092
Shalgum	4	4.4	2	4.34	2	4.5	.784

Chi-square test, *Fisher Exact Test

Table 4.5 listed the type of vegetables grown by the farmers in both intervention and control group. The study population, both intervention and control have grown similar vegetables during the study period from Sept to Jan. Most (96.6%) of the framers are growing Cauliflower, followed by spinach which is grown by 63.3 % of farmers. Fenugreek, radish and chilly were also grown during the period. Less than 10% of farmers were also growing various other vegetable like onion, bitter gourd and Shalgum. We found no difference between the vegetables grown in both intervention and control study farms (p >.05).

4.1.2 Knowledge, attitude, practice and in-home assessment for pesticides use at baseline in both intervention and control subjects. (dependent variables)

One hundred farmers were given a 26 items questionnaire, at start of study, however only 90 farmers completed entire duration of study. There were ten participants were lost to follow up due to travelling other districts or other areas during the time of first and second follow up visit, due to unforeseen circumstances. There were four dropouts from the control group and six from the intervention group. Hence, we are only presenting data for 90 farmers at baseline, who completed all study follow up and were present during the entire duration of study period. Table 4.6 below illustrates vegetable farmer's knowledge for pesticide use and management at baseline. Each correct response was given score of 1 whereas incorrect answers received zero point. Minimum and maximum possible total scores = 0 and 26, respectively.

Using chi square statistics, we analysed, we calculated p value for farmers in the control group who got correct answers versus farmers in the intervention in every item of knowledge for pesticide use. We found lowest score in the questions related to identification and disposal of harmful pesticides and how to make sure that farmers are not being exposed to higher or lethal levels of pesticides. In addition, lowest amount of knowledge is found in area of hazards related to pesticide exposure. None of the participants in the study could answer correctly on disposal methods for pesticides package and all methods which could protect them from all forms of pesticide exposure (question 6-7). In addition, very few farmers could provide correct response to identify dangerous pesticides, instructions on use of pesticides, and pesticide exposure during use (question 8-10). Farmers also showed low knowledge (with correct response by 10-20% of subjects) pesticide exposure routes, their accumulation in body, health impacts, effect of weather and wind during spray and benefits of PPE during spray of pesticides (q1-2, q19-22). However, farmers displaced high knowledge in places to store, mixing methods and use of different utensil for purpose, as seen in questions 3, 13-14. We used Chi square to find the difference between the knowledge in intervention and control group and found no difference in correct responses in study population, both intervention and control, in all 26 questions.

Table 4.6: Frequency of correct answers of knowledge questions by study groups at baseline.

	Questions	N (%)		P-value
		Control (n=46)	Intervention (n=44)	
1	We can get pesticide exposure via	6	9	.356
2	We can get pesticide easiest exposure in which weather	6	6	.934
3	Who had possibility to get poisoning from pesticide	21	21	.844
4	Where should you keep pesticide	32	28	.551
5	Benefits of high quantity of pesticide, if used	9	7	.650
6	How should you dispose a pesticide package	0	0	NA
7	How should you protect yourself from pesticide	0	0	NA
8	Correct instruction source for pesticide use	2	3	.609
9	How do you identify extremely dangerous pesticide	3	3	.955
10	How to check for the pesticide exposure in your body	2	0	.162
11	Reason for choosing pesticides	19	21	.405
12	Pesticide amount estimated for use	21	20	.985
13	Method for mixing pesticides	30	30	.766
14	Use of hand protection for mixing	38	42	.109
15	Use of containers for mixing process	16	17	.705
16	Past exposure of have protective effect	11	12	.715
17	Use more types of pesticide while applying is riskier	21	24	.399
18	Use of Avil like drugs before and after mixing or applying can protect or reduce pesticide poisoning	42	39	.673
19	When should you spray pesticides	5	4	.779

	Questions	N (%)		P-value
20	How should you dress while spraying pesticides	9	10	.713
21	Where can the pesticides accumulate	7	13	.102
22	List health hazards of pesticide exposure	8	11	.377
23	You can clean pesticide containers and materials in the river and canals	35	30	.403
24	You should take a bath after working	46	44	NA
25	You can clean and reuse pesticide container	44	42	.964
26	Is drinking and smoking correct practice while spraying pesticide	46	44	NA

Independent T-test

Table 4.7 below tabulated correct answers for 27 attitude questions with 5 Likert scale (Positive-direction questions were scored from 5 points for "strongly agree" to 1 point for "strongly disagree", Negative-direction questions were scored from 1 point for "strongly agree" to 5 points for "strongly disagree", minimum and maximum possible total scores = 27 and 135, respectively. Lowest attitude among the study participants was found in farmers attitude towards choice of buying and spraying of pesticides. Farmers believe that an expensive pesticide has better quality (q1) and they should use them for every crop irrespective of infestation (q2). In addition, farmers have low attitude towards use of personal protective equipment's (PPE) and believe that PPE are uncomfortable, expensive and ineffective in protecting them from pesticide exposure (q16, 20, 24,25 and 27).

We found the highest attitude score for questions related to use of separate clothes and benefits of taking a bath after pesticide spray activity (q15,22). Farmers also have high attitude score for stopping spray activity during windy days (q13) and were aware that good health will not protect them against adverse health effects of pesticides exposure. In addition, farmers in both intervention and control group believe that new generation improved and herbal pesticides are more effective and do less harm to farmers with respect to health symptoms (q 18,11 and 3). We compared attitude score between intervention group and control group of farmers and found no difference in the

study population for response towards any attitude question, in intervention and control subjects p value above 0.05.

Table 4.7: Frequency of correct answers of attitude questions by study groups at baseline

Questions	Mean (SD)		P-value
	Control (n=46)	Intervention (n=44)	
1 The more expensive, the better quality the pesticide is.	2.21(.72)	2.25(.71)	.940
2 It is necessary to use pesticide every time you grow crops.	2.04(.63)	2.27(.62)	.194
3 A pesticide of good quality is not harmful to humans	3.43(.68)	3.5(.65)	.401
4 Spraying tank can be washed in a river/canal without any harm to other animals.	3.82(.56)	3.81(.58)	.897
5 Pesticide will only affect to pest	3.10(1.03)	3.20(1.02)	.540
6 You are strong enough that can protect yourself from harmful effects of pesticide	2.17(.48)	2.20(.55)	.548
7 You should spray windward (in direction of wind) while spraying.	3.53(.83)	3.56(.81)	.792
8 All agriculturists should have a medical check-up for pesticide effects	3.86(.40)	3.88(.32)	.612
9 Smoking while spraying has nothing to do with the pesticide left over in the body.	3.30(.86)	3.02(.84)	.372
10 You can smoke, drink water or eat food while mixing or applying pesticides.	4.00(.42)	3.93(.39)	.601
11 Herbal pesticide usage is complicated and useless	3.28(.54)	3.22(.52)	.437
12 Although you have good health, you would have pesticide poisoning after you exposed to pesticide.	4.00(.21)	3.97(.26)	.346
13You must stop spraying immediately if it is windy.	4.21(.69)	4.20(.59)	.407

Questions	Mean (SD)		P-value
14 While mixing or spraying pesticide in less amount, it is not necessary to wear PPE	3.04(.91)	2.90(.85)	.288
15 After applying pesticide only change your clothes is enough not necessary to take a bath or wash hand	4.36(.79)	4.25(.99)	.375
16 Pesticide poisoning can be prevented and reduced by PPE	3.69(.46)	3.47(.62)	.286
17 Long use of pesticide make you resistant and you do not have any symptom now	3.13(.68)	3.00(.68)	.444
18 New chemical pesticides do not harmed to your health	3.36(.57)	3.22(.56)	.276
19 Mixing more pesticides together can reduce time of spray and health effected	2.34(.60)	2.38(.65)	.532
20 Using pesticides with PPE is not comfortable to work	2.09(.36)	2.06(.32)	.496
21Even though PPE is expensive it's necessary and worthwhile	3.75(.48)	3.78(.51)	.697
22Take a bath immediately after applied pesticide can reduce effected from pesticides	4.43(.84)	4.52(.75)	.263
23 Separate washing of clothes from others is difficult/ not practical	2.13(.55)	2.04(.29)	.276
24 Providing a full option of personal protective equipment(such as hat, gloves, boots, mask) is hard for you, as these are uncomfortable to use	2.20(.59)	2.23(.63)	.596
25 When having mild symptoms it will disappear itself and it is not necessary to see a doctor	2.36(.65)	2.36(.64)	.968
26 Pesticides can cause cancers	3.11(.53)	3.26(.57)	.110
27 Buying a full option of personal protective equipment (such as hat, gloves, boots, mask) is hard for you, as these will not be used	2.20(.59)	2.26(.68)	.271

Independent T-test

Table 4.8 below list correct answers in practice in pesticides use questions with 4-point Likert scale (Positive-direction questions were scored from 4 points for "every time" to 1 point for "never", Negative-direction questions were scored from 1 point for "every time" to 4 points for "never", minimum and maximum possible total scores 27 and 108, respectively. Lowest practice score was reported on use of PPE (27) and for storage & disposal of pesticides containers (q16,14). Due to lack of proper knowledge on pesticides container disposal, we saw low scores in this category of questions. Study participants responded adequately to score on practice which is performed before and during spraying of pesticides. In addition, low practice scores were reported for reading labels of pesticide containers (q1) and following instructions for mixing them (q23).

Farmers reported adequate practice scores for activities of mixing of pesticides for spraying, spraying in directions of wind, eating and drinking habits during spraying (q4-13). However baseline comparison of practice scores between intervention and control group, we found no statistical difference between the intervention and control group practice score, which is also presented in table as p values of independent t-test comparison.

Table 4.8: Frequency of correct answers of practice questions by study groups at baseline

Questions	Mean (SD)		P-value
	Control (n=46)	Intervention (n=44)	
1. Carefully read pesticide use instructions before use and also strictly follow the instructions	2.86(.93)	2.84(.77)	.336
2. Buy pesticide following a neighbor's advice	3.32(.84)	3.38(.86)	.821
3.Use expired pesticides	3.95(.29)	3.93(.33)	.470
4. You dissolve pesticide at home before going to spray in the field	3.91(.41)	3.90(.42)	.929
5.Leave food near/in the spraying area	3.97(.14)	3.97(.15)	.950
6. Open pesticide container using your mouth	3.93(.44)	3.86(.62)	.214

Questions	Mean (SD)		P-value
7. Blow or suck the nozzle using your mouth	3.91(.46)	3.90(.47)	.938
8. Mix or stir pesticides with hand	3.63(.79)	3.68(.77)	.601
9. Continue working even if you get wounded during the spraying of pesticide	3.00(.55)	2.9(.52)	.775
10. Spray pesticide during strong winds	3.76(.67)	3.81(.62)	.442
11. Spray pesticide in the same direction as the wind	2.63(.87)	2.59(.89)	.818
12. Drink some water during working with pesticides	3.41(.80)	3.34(.88)	.514
13. Eat some food during work with pesticides	3.86(.34)	3.93(.25)	.409
14. Burn or landfill the expired or left over pesticides	2.84(.96)	2.95(.77)	.090
15. Leave empty or expired containers in the river or canal	3.17(1.12)	3.18(1.06)	.681
16. Leave empty or expired containers in normal trash	2.23(.67)	2.29(.73)	.450
17.Wash pesticide equipment's, and pesticide containers in the pond or canal	3.65(.73)	3.79(.55)	.302
18.Take a bath immediately after finishing work related to pesticide use	4.58(5.96)	4.65(6.09)	.951
19. Separate pesticide contaminated clothes from others to clean	3.15(.51)	3.18(.54)	.626
20. Store pesticides in a locked area	2.95(.46)	2.93(.54)	.304
21. You use a spoon to measure pesticide when dissolve it.	2.65(.70)	2.54(.79)	.319
22. You use higher concentration of pesticide than that specified on the label	3.43(.71)	3.27(.81)	598
23. You dissolve many kinds of pesticide together when mixing	2.00(.21)	2.02(.26)	.346

Questions	Mean (SD)		P-value
24. You smell pesticide in its container, just to confirm before use	3.73(.61)	3.59(.69)	.125
25. You wash the clothes you wear for spraying together with other clothes.	3.84(.55)	3.84(.55	.911
26. You keep the left-over pesticide in your kitchen	3.84(.36)	3.75(.43)	.201
27. You wear full 'PPE' when applied pesticides	1.04(.29)	1.04(.30)	.950

Independent T-test

In-home inspection by physically checking items and behavior on safe use of pesticides was conducted by researcher at baseline. Safe conduct and behaviors of pesticide management at home were presented in table 4.9 below, where correct conduct was given a score of 1 and wrong conduct or inspection would get a score of zero. There were 12 items which were inspected as surrogate of correct conduct for safe use and management of pesticides at home. In-home assessment low score was seen for no lock on the places where pesticides are stored (q4) and no separate thrash or disposal place for used pesticide containers (q5). Very few farmers had handy information on nearby hospital and emergency contact numbers in case of acute poisoning due to pesticide exposure (q6). We found high score regarding storage of pesticide at home and their separate area of storage away from bathing and kitchen area (q 1-3,5,6,9). The pesticides were also away from pets of household (q12). However, baseline comparison of in-home inspection score between the intervention and control populations, we found no statistical difference between the intervention and control group practice score, which is also presented in table a p values of independent t-test comparison.

Table 4.9: Frequency of correct in-home assessment by study groups at baseline

	Questions	N (%)		p-value
		Control (n=46)	Intervention (n=44)	
1	Pesticides in the bath room close to shower cream, mouthwash, detergents, etc.	46	44	NA

	Questions	N (%)		p-value
		Control (n=46)	Intervention (n=44)	
2	Pesticides in the kitchen close to dishwashing liquid, sauce, fish sauce and other condiments.	46	44	NA
3	Storage area for pesticides, such as a closet or storage room, hard to reach for children.	46	44	NA
4	Safe and locked room of pesticides	9	10	.713
5	Pesticides in a storage area with other material	35	35	.693
6	Store pesticides in closed room	44	42	.964
7	Shirt and trousers stained with pesticides with your family's clothes.	36	33	.715
8	Same washing area for stained clothes with pesticides along with family's clothes.	19	12	.161
9	Separate pesticide trash	32	28	.551
10	Throw out pesticide containers in general trash	5	3	.796
11	Details of hospitals, health centers, and toxicological centers (for emergency pesticide hazards) available	6	9	.346
12	Pesticide in nearby to pet or other animals	46	43	.304

Chi-square test, *Fisher Exact Test

In table 4.10, summarized the comparison of the Knowledge, attitude, practice and in-home assessment score for any difference between the study groups, using independent t test for cumulative scores of each dependent variable at baseline. There was no difference in intervention and control population at baseline (p>.05)

Table 4.10: Total knowledge, attitude, practice and in-home assessment scores by study group at baseline

Total Score	Control (n=46)		Intervention (n=44)		p-value
	Mean	SD	Mean	SD	
Knowledge Score	9.9	1.9	10.3	2.5	.426
Attitude Score	85.2	4.0	84.7	3.7	.501

Practice Score	87.9	3.2	87.1	3.4	.594
In home assessment Score	8.0	1.0	7.8	.99	.398

Independent T-test

In table 4.10, we further divided baseline scores based on Bloom's Theory (Bloom et al., 1956). The scores were sum up and were classified by percentage, ≤ 60.00 % was low level, >60.00 % - 80.00 % moderate, and > 80.00 % high level. We found very few subjects with highly positive scores for all of the scores. There were only 1 subject with Knowledge score higher than 80% and 2 participants had above 80% score for in-home assessment. Knowledge. Most of the study participants have positive scores for Attitude, Practice and in-home assessment, whereas 82 participants had low knowledge score.

Table 4.11: Total knowledge, attitude, practice and in-home assessment levels (low, average and high) at baseline

Parameter	Low		Moderate		High	
	n	%	n	%	n	%
Knowledge Score	82	91.1	7	7.7	1	1.2
Attitude Score	11	12.2	79	87.8	0	0
Practice Score	13	14.4	77	85.6	0	0
In home assessment Score	5	5.5	83	92.3	2	2.2

As apparent in table above, despite low knowledge score at baseline, farmers attitude and practice scores were positive indicating high potential for improvement in pesticide management, if adequate knowledge is imparted to the community.

4.1.3. Relationship between demographic, farming and pesticide use variables with Knowledge, attitude, practice and in-home assessment of pesticide use behaviour

We used maximum likelihood regression to evaluate the extent to which the continuous knowledge, attitude, practice and in-home assessment safe pesticide use behavior score to evaluate association with socio-demographic, farming and other

pesticide use independent variables at baseline. We constructed preliminary regression models containing covariates to further evaluate these associations. In assessing collinearity, interaction, and confounding, we included covariates that were associated with both the 'primary predictor' (e.g., education level, age, history of disease, years of farming and pesticide use and spray characteristics) and the 'outcome' (e.g., knowledge, attitude, practice and in-home behaviors), identified using parametric t-tests, chi-square tests, and Fisher's exact tests. Covariates with p values >0.5 associated with such condition indices were eliminated from the model to ensure stability of maximum likelihood estimates Covariates were assessed for confounding by comparing reduced models to the full model with all covariates. Participants with missing data for any model variable were excluded from the corresponding analyses. To determine the explanatory power of these models, we used likelihood ratio tests to compare each final model to a corresponding reduced model containing only the intercept. Table 4.12 to 4.15 below present only the 'predictors' that were significantly associated with 'outcomes' in each model ($p < 0.05$).

Table 4.12 Effect of demographic and other independent variable on baseline knowledge of vegetable farmers

Independent Variables	B	Std Err	Beta	t	Sig
Education status	1.539	.344	.818	4.473	.000

Linear regression model

We found only education status statistically associate with Knowledge score at baseline out of all socio demographic variables, considered as independent variables for analysis. However, for attitude and practice, we found that both scores are positively associated with amount of pesticides used in addition to education status of farmers. Other socio demographic variables like, age, smoking status, drinking status, history of disease, years of farming or pesticide use, time and hours of spray have no significant impact on baseline knowledge, attitude and practice scores.

Table 4.13 Effect of demographic and other independent variable on baseline Attitude of vegetable farmers

Independent Variables	B	Std Err	Beta	t	Sig
Education status	2.029	.654	.648	3.102	.003
how much you mix pest	.992	.344	.313	2.884	.005

Linear regression model

Table 4.14 Effect of demographic and other independent variable on baseline Practices of vegetable farmers

Independent Variables	B	Std Err	Beta	t	Sig
Education status	1.114	.580	.406	1.920	.050
how much you mix pest	1.114	.580	.406	1.920	.050

Linear regression model

Table 4.15 below list the independent variables which are significantly associated with in-home assessment score on safe pesticide behavior, at baseline. We found that years of pesticide use and total amount of pesticide sprayed is positively associated with in-home scores on safe pesticide use behavior.

Table 4.15 Effect of demographic and other independent variable on baseline In-home practice score of vegetable farmers

Independent Variables	B	Std Err	Beta	t	Sig
Age in years	.032	.012	.394	2.655	.010
Education status	.408	.171	.484	2.380	.020
years of pest use	.045	.022	.303	2.060	.043
how much pest sprayed in ml	.001	.001	.247	-2.333	.022
how much you mix pest	.299	.090	.350	3.312	.001

Linear regression model

4.2 Effectiveness of educational tool using repeated-measures analysis of variance and multilevel models for Knowledge, attitude, practice and in-home assessment for pesticide use.

Repeated-measures analysis of variance and multilevel models for Knowledge, attitude, practice and in-home assessment for pesticide use was performed and results

of intervention effect is presented in Figure 4.2 below. General Linear Model repeated-measures ANOVA was used to assess overall effect of intervention in knowledge of pesticides use. Possible knowledge score was 0 to 26 points. Overall effectiveness of educational tool has statistically significant effected on knowledge score at $p<0.001$ in repeated- measures analysis of variance (Wilks' Lambda from Multivariate test). We found an overall improvement of 23.8% in knowledge level due to intervention.

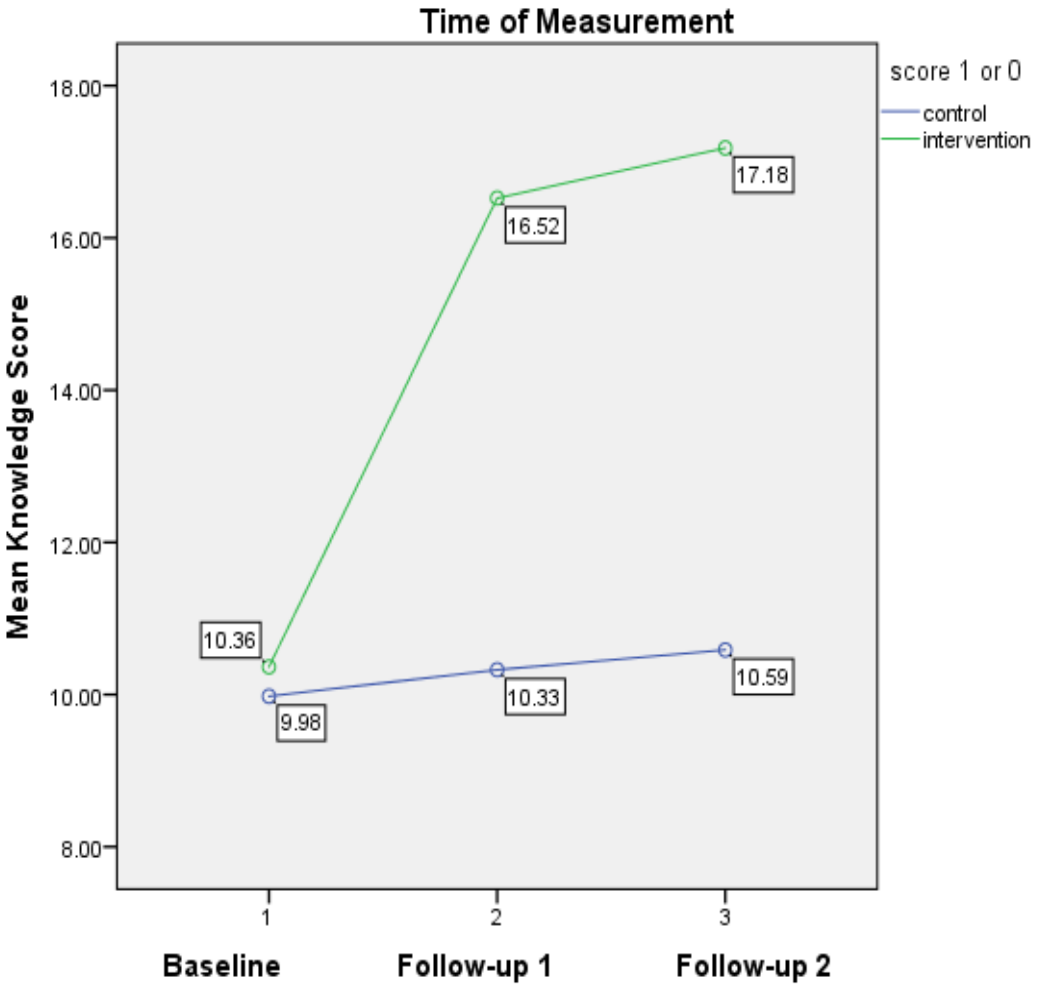


Figure 4.2: Mean knowledge score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted)

Overall effects of Educational tool was highly statistically significant effected attitude score at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects) see table 4.16.

Table 4.16 Overall test of intervention effects on knowledge score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted).

Knowledge score	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**p- value**
Sphericity Assumed	737.2	2	368.6	220.5	<0.001
Greenhouse-Geisser	737.2	1.632	451.7	220.5	<0.001
Huynh-Feldt	737.2	1.677	439.4	220.5	<0.001
Lower-bound	737.2	1.000	737.2	220.5	<0.001

Test of Within-Subjects Effects in General Linear Model repeated-measures ANOVA

Similarly, out of total attitude score of 0–135 points at baseline average attitude score in the control group (85.26 points) which was similar to attitude score in the intervention group (84.7 points), as shown in Fig 4.3. After subjects in the intervention group received the educational tool at follow-up 1 (one months after intervention) we found that average attitude score of farmers in the intervention group was rapidly increased to 90.73 points much higher than attitude score of subjects in the control group which was maintained (90.55) at follow up 2 (three months after intervention). However, there was no change in attitude score from baseline in farmers who were in control arm of study.

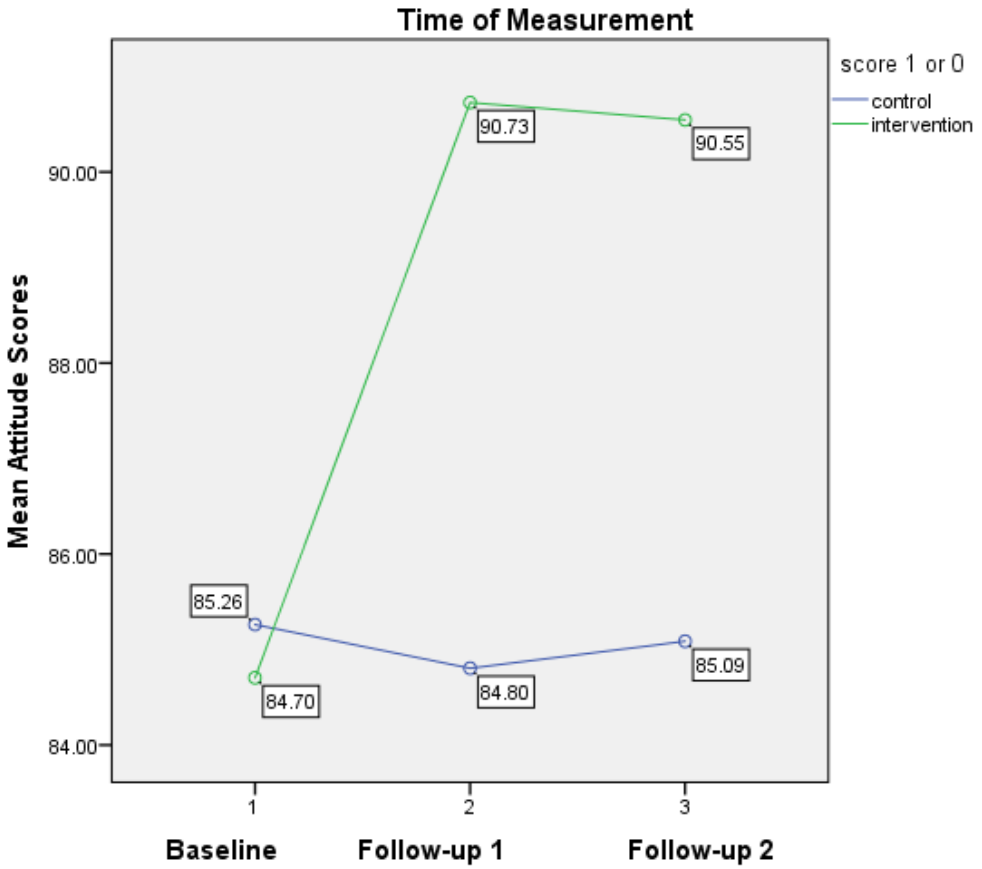


Figure 4.3: Mean attitude score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted)

Table 4.17: Overall test of intervention effects on attitude score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted).

Attitude score	Type III Sum of Squares	df	Mean Square	F	p- value
Sphericity Assumed	473.1	2	236.5	45.7	<0.001
Greenhouse-Geisser	473.1	1.632	362.2	45.7	<0.001
Huynh-Feldt	473.1	1.677	354.9	45.7	<0.001
Lower-bound	473.1	1.000	473.1	45.7	<0.001

Test of Within-Subjects Effects in General Linear Model repeated-measures ANOVA

Overall effects of Educational tool was highly statistically significant effected attitude score at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects) see table 4.18.

We also observed effectiveness of educational tool on not only improvement in practices score from baseline, but also in in-home safe pesticide behavior, as presented in figure 4.4 and 4.5 below. Out of total practice score of 0–108 points at baseline average practice score in the control group (87.96 points) was similar to practice score in the intervention group (87.14 points). After subjects in the intervention group received the educational tool, at follow-up 1 (one months after intervention) we found that average practice score of farmers in the intervention group was rapidly increased to 96.39 points much higher than attitude score of subjects in the control group which was maintained (87.28). At follow up 2 (three months after intervention), practice score in intervention group was maintained at 94.95 points, maintaining effect of educational tool even after 3 months in intervention group. However, there was no change in practice score from baseline in farmers who were in control arm of study.

Similarly, for in-home safe pesticide behavior Fig 4.5, we observed an increase from 7.82 points at baseline to 10.41 in intervention group which was a statistically significant increase compared to subjects in control group who showed no improvement in observed behaviour.

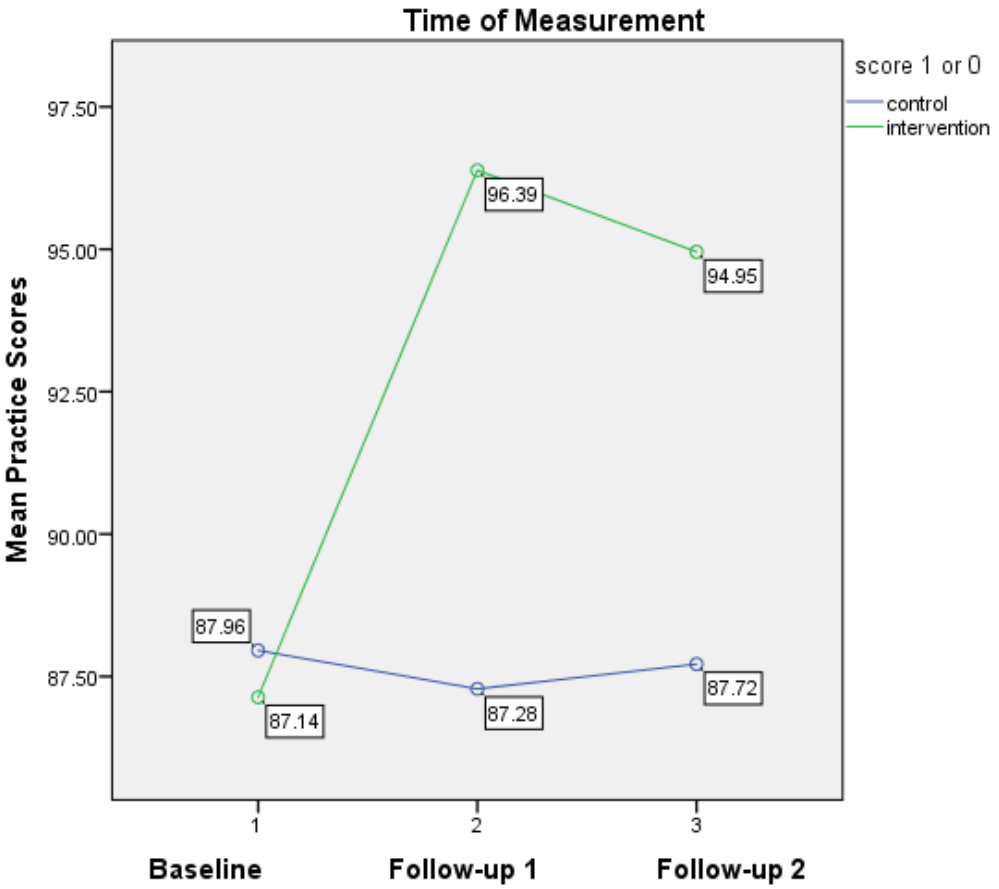


Figure 4.4: Mean practice score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted)

Overall effects of Educational tool was highly statistically significant effected practice score at p<0.001 in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects) see table 4.15.

Table 4.18: Overall test of intervention effects on practice score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted).

Practice score	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**p- value**
Sphericity Assumed	989.4	2	494.7	96.1	<0.001
Greenhouse-Geisser	989.4	1.632	506.7	96.1	<0.001

Huynh-Feldt	989.4	1.677	494.7	96.1	<0.001
Lower-bound	989.4	1.000	989.4	96.1	<0.001

Test of Within-Subjects Effects in General Linear Model repeated-measures ANOVA

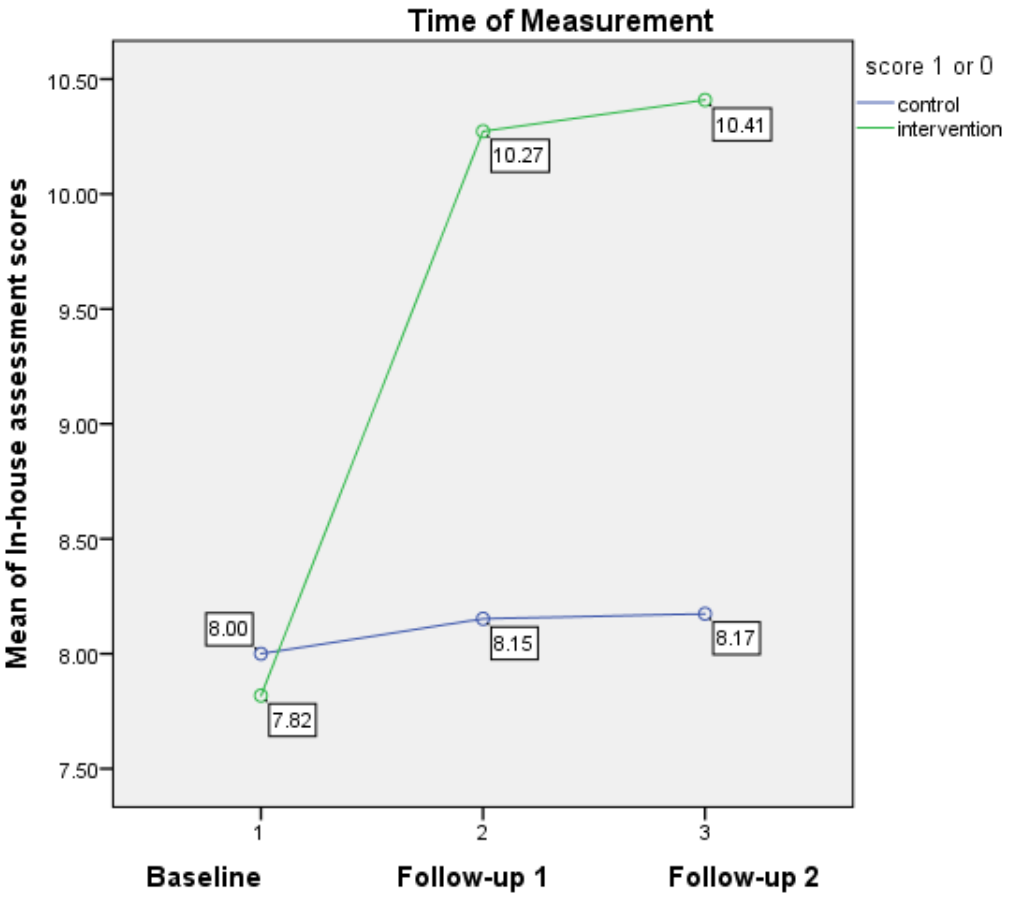


Figure 4.5: Mean in-house assessment score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted)

Table 4.19: Overall test of intervention effects on in-home assessment score in intervention and control groups at baseline, follow-up 1 and follow-up 2 (unadjusted).

In-home Assessment score	Type III Sum of Squares	df	Mean Square	F	p- value

Sphericity Assumed	989.4	2	494.7	96.1	<0.001
Greenhouse-Geisser	989.4	1.632	506.7	96.1	<0.001
Huynh-Feldt	989.4	1.677	494.7	96.1	<0.001
Lower-bound	989.4	1.000	989.4	96.1	<0.001

Test of Within-Subjects Effects in General Linear Model repeated-measures ANOVA

Overall effects of Educational tool was highly statistically significant effected in-home assessment score at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects) see table 4.19.

As indicated in table 4.20 below, we found positive change in scores due to intervention effects on knowledge, attitude, practice and in-home assessment score in intervention highly significant, compared to change in control group.

Table 4.20: Overall test of intervention effects on knowledge, attitude, practice and in-home assessment score in intervention and control groups at follow-up 1 and follow-up 2 (unadjusted).

Parameter	**Score at Follow up 1**	**Score at Follow up 2**	**Mean Square**	**F**	**p- value**
Knowledge	16.58	17.18	1.565	1.652	.202
Attitude	90.73	90.55	1.83	1.304	.257
Practice	96.39	94.95	4.34	.978	.325
In-home Assessment	10.27	10.41	4.94	.932	.227

Test of Within-Subjects Effects in General Linear Model repeated-measures ANOVA

4.2.1 Absolute and proportional intervention effects compare to baseline mean in knowledge, attitude, practice in insecticide use, and in-home assessment behavior, adjusted for baseline change in control group

The educational tool had effectively improved knowledge, attitude, and practice in the intervention group at follow-up 1 and follow-up 2 compare to mean score at baseline. For knowledge scores the program had an overall effected to increased 56% from baseline score at follow-up 1 and as increased 59.9% from baseline score at follow-up 2 when compare with control group, for attitude the program had effected to increased 7.66% from baseline score at follow-up 1 and increased 7.10% from baseline score at follow-up 2 when compare with control group, for practice the program had effected to increased 11.7% from baseline score at follow-up 1 and increased 9.29% from baseline score at follow-up 2 when compared with control group, and for in home assessment (safety behavior) the intervention had effected to increased 29.41% from baseline score at follow-up 1 and increased 30.69% from baseline score at follow-up 2 when compare with control group, as presented in table 4.21 below.

Table 4.21: Effects of intervention on knowledge, attitude, practice in insecticides use, and in home assessment behavior in the intervention and control groups at baseline, follow-up 1 and follow-up 2 (adjusted for baseline differences)

	Baseline				Follow-up1				Follow-up2				Intervention effects			
	Control (n = 46)		Intervention (n = 44)		Control (n = 46)		Intervention (n = 44)		Control (n = 46)		Intervention (n = 44)		Follow-up 1		Follow-up 2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Magnitude (95%CI)	P - value	Magnitude (95%CI)	P - value
Knowledge score	9.98	1.8	10.36	2.4	10.33	1.8	16.52	1.0	10.59	1.3	17.18	0.9	5.81 (3.71, 7.91)	<0.001	6.21 (4.01, 8.41)	<0.001
Attitude score	85.26	8.8	84.7	9.3	84.8	8.0	90.73	7.6	85.09	6.6	90.55	8.1	6.49 (2.6, 10.38)	<0.007	6.02 (1.12, 8.92)	<0.009
Total practice score	87.96	11.2	87.14	12.9	87.28	10.6	96.39	10.4	87.72	8.2	94.95	10	10.2 (6.4, 14)	0.006	8.1 (4.5, 11.7)	0.019
In home score	8.0	2.2	7.82	2.7	8.15	2.6	10.27	2.9	8.17	2.4	10.41	2.7	2.3 (0.8, 3.8)	0.021	2.42 (0.7, 4.1)	0.011

Mixed model, unadjusted

4.3 Prevalence of Pesticides Related Health Symptoms at Baseline (dependent variables)

A total of 22 pesticide use induced symptoms were considered as potentially related to pesticide exposure, mainly during the use of pesticides. This included mixing and preparation for spray, spray of pesticides and soon after pesticide spray. The questions were asked whether in past pesticide using/ spraying day(s), do the subjects suffer from any of the symptoms listed in health questionnaire. These symptoms were classified into 5 groups according to organ system: I) neuromuscular symptoms (10 symptoms): headache, twitching of muscles, numbness of tongue, blurred or dim vision, trembling, sweating, weakness, muscle cramps, staggering gait, dizziness, tremors, numbness in arms/legs, , II) Cardiorespiratory symptoms (7 symptoms): slow heart rate, chest pain, difficulty in breathing, runny nose, sore throat, cough, and wheezing, III) digestive symptoms (3 symptoms): stomach ache, diarrhea, and nausea or vomiting, IV) eyes irritation and V) skin itching. Symptoms were recorded when the subjects were preparing pesticides for spray and shortly after spraying. The study population did not show difference in any symptoms prevalence between both groups. Headache and sweating was reported by maximum number of participants, as symptom experience during use of pesticides. Table 4.21 listed all the symptoms which were reported at baseline by study population. There was no difference seen in the intervention and control group, for all pesticide related symptoms as indicated by p value of > .05 in chi square statistics.

Table 4.22: Pesticides related symptoms classified into organ system by study group at baseline (14 symptoms in neuromuscular system, 7 symptoms in respiratory system, 3 symptoms in digestive system, 4 symptoms in eyes system, and 2 symptoms in skin system).

	Symptoms and Health Status at Baseline (around the time of pesticide use)	N (%)		p-value
		Control (n=46)	Intervention (n=44)	
Neuromuscular Symptoms				
1	Headache	32	39	.067

	Symptoms and Health Status at Baseline (around the time of pesticide use)	N (%)		p-value
		Control (n=46)	Intervention (n=44)	
2	Muscle twitching	17	15	.776
3	Muscle Cramps	5	3	.500
3	Sweating	30	39	.084
4	Trembling	6	9	.346
5	Dizziness	13	9	.389
6	Weakness and lack of energy	25	20	.399
7	Staggering gait	4	4	.946
8	Limb numbness	3	3	.955
9	Numbness in tongue	1	1	.975
10	Blurred Vision	5	5	.941
Cardiorespiratory Symptoms				
11	Slow heart rate	2	2	.964
12	Chest pain	1	1	.975
13	Breathing Difficulty	4	6	.456
14	Runny Nose	6	9	.346
15	Wheezing in chest	2	2	.964
16	Sore throat	7	7	.928
17	Dry cough	10	15	.147
Any Digestive Symptom				
18	Stomachache	2	2	.779
19	Vomiting	8	8	.616
20	Diarrhea	4	7	.296
	EYE			
21	Eye irritation	9	4	.158
Any Skin Symptom:				
22	Itchiness	16	10	.207

Chi-square test, *Fisher Exact Test

4.4 Effectiveness of Educational Tool in Reduction of Health Symptoms

Generalized estimating equations for dichotomous dependent variables were conducted to assess the effects of educational tool reduction in health symptoms by reducing pesticide exposure using correct practices and higher knowledge. In order to assess magnitude of intervention effect, we merger organ class symptoms together, and presented decrease in symptoms for following categories:

i) Neuromuscular symptoms (10 symptoms): headache, twitching of muscles, numbness of tongue, blurred or dim vision, trembling, sweating, weakness, muscle cramps, staggering gait, dizziness, tremors, numbness in arms/legs.

ii) Cardiorespiratory symptoms (7 symptoms): slow heart rate, chest pain, difficulty in breathing, runny nose, sore throat, cough, and wheezing

iii) Digestive symptoms (3 symptoms): stomach ache, diarrhea, and nausea or vomiting

iv) eyes irritation and

v) skin itching.

Only unadjusted analysis of prevalence of pesticide related symptoms is presented as we did not see any difference at baseline between intervention and control group, for any of the individual symptoms.

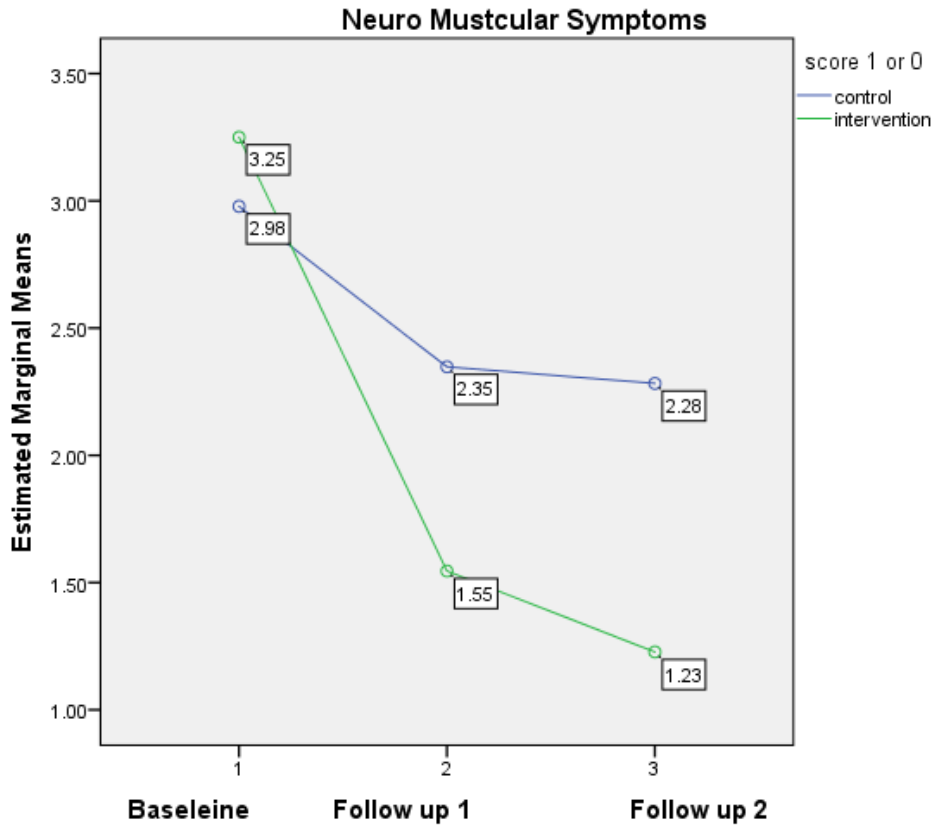


Figure 4.6: Effectiveness of educational tool in reduction of Neuromuscular symptoms shortly after the use of pesticides

The intervention group had prevalence of neuromuscular symptom slightly higher than the control, which was not significantly different though. However, at one moth of follow up there was a highly significant reduction in Neuromuscular symptom from 3.25 at baseline to 1.55, which continued to decline at 3 months follow up to 1.23, as indicated in figure 4.6.

Table 4.23: Test for significance on reduction in Neuromuscular symptoms after use of pesticide, in intervention and control arm.

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Neuromuscular Symptoms	.645	38.154	2	.00	.738	.756	.500

Mauchly's Test of Sphericity

As indicated in table 4.22 above, we found positive change in scores due to intervention effects on neuromuscular symptoms reduction in intervention highly significant, compared to change in control group. Overall effects of educational tool has statistically significant effected in reduction of neuromuscular symptoms, at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects).

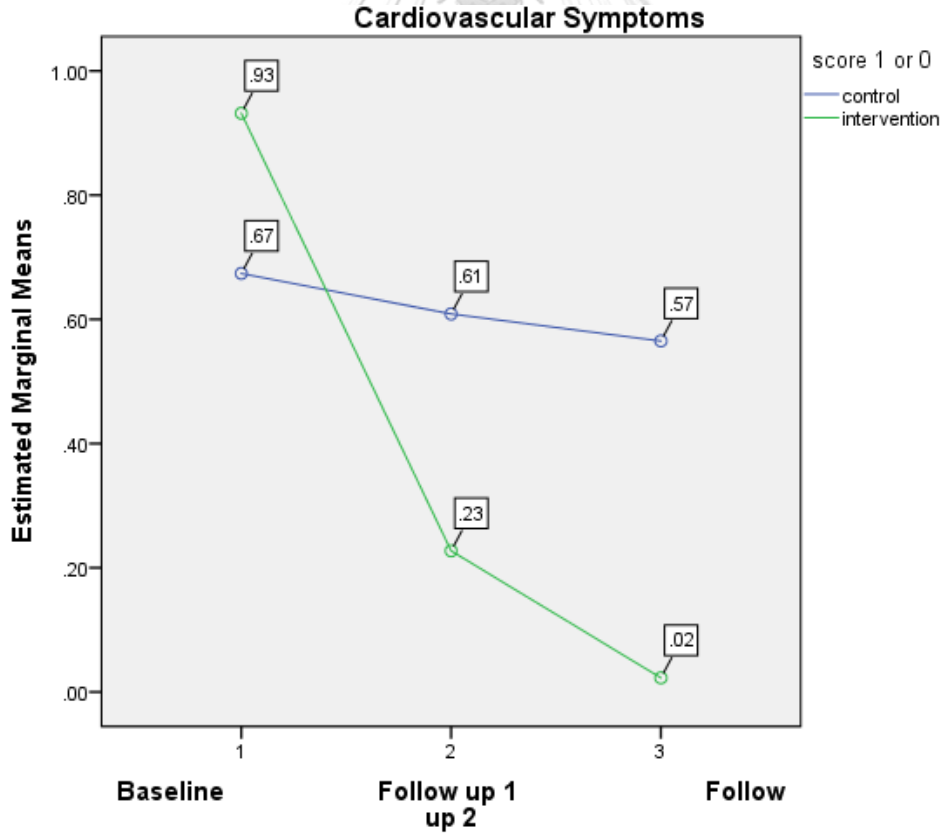


Figure 4.7: Effectiveness of educational tool in reduction of Cardiorespiratory symptoms shortly after the use of pesticides

The intervention group had prevalence of cardiorespiratory symptom slightly higher than the control, which was not significantly different though. However, at one moth of follow up there was a highly significant reduction in cardiorespiratory symptom from 0.93 at baseline to 0.23, which continued to decline at 3 months follow up to 0.02, as indicated in figure 4.7.

Table 4.24: Test for significance on reduction in Cardiorespiratory symptoms after use of pesticide, in intervention and control arm.

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Cardiorespiratory Symptoms	.441	71.203	2	.000	.641	.654	.500

Mauchly's Test of Sphericity

As indicated in table 4.23 above, we found positive change in scores due to intervention effects on cardiorespiratory symptoms reduction in intervention highly significant, compared to change in control group**.** Overall effects of educational tool has statistically significant effected in reduction of cardiorespiratory symptoms, at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects).

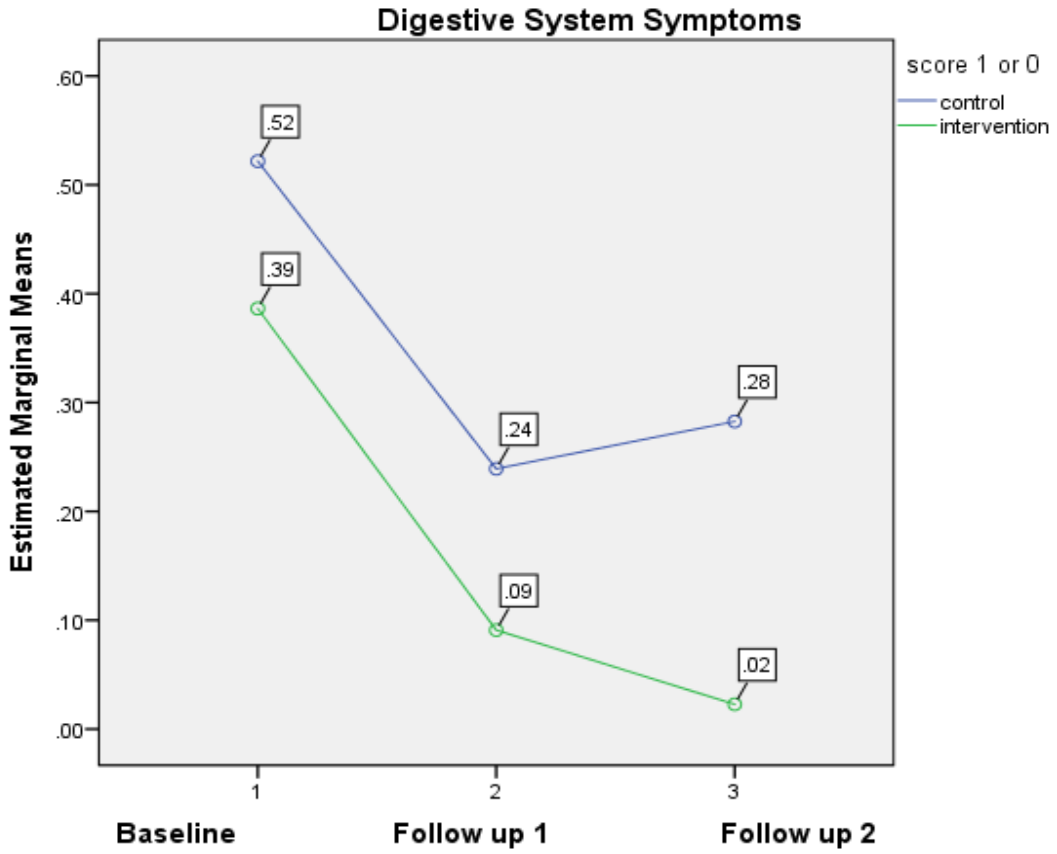


Figure 4.8: Effectiveness of educational tool in reduction of Digestive system symptoms shortly after the use of pesticides

The intervention group had prevalence of digestive symptom slightly lower than the control, which was not significantly different though. However, at one moth of follow up there was a reduction in digestive symptom from 0.39 at baseline to 0.09, which continued to decline at 3 months follow up to 0.02, as indicated in figure 4.8.

Table 4.25: Test for significance on reduction in Digestive symptoms after use of pesticide, in intervention and control arm**.**

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Digestive Symptoms	.112	190.120	2	.000	.530	.537	.500

Mauchly's Test of Sphericity

As indicated in table 4.24 above, we found positive change in scores due to intervention effects on digestive symptoms reduction in intervention highly significant, compared to change in control group**.** Overall effects of educational tool has statistically significant effected in reducing prevalence of digestive symptoms, at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects).

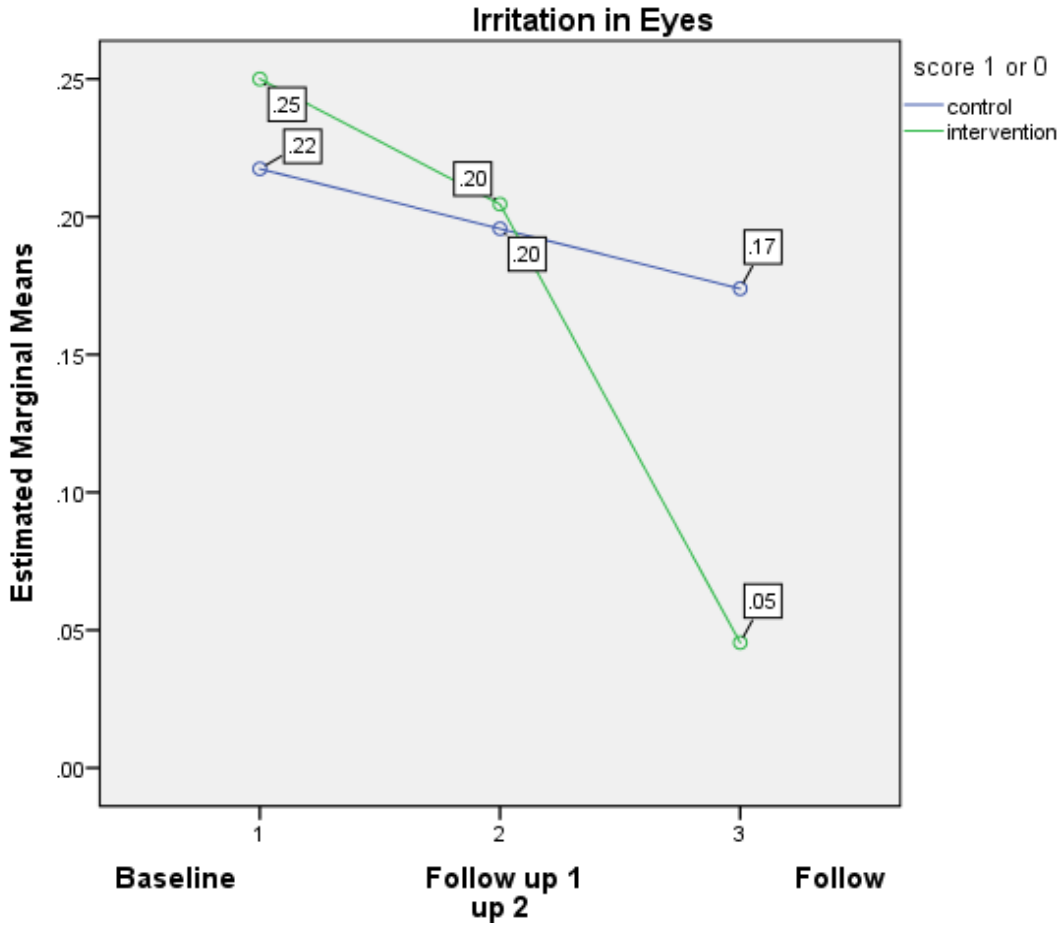


Figure 4.9: Effectiveness of educational tool in reduction of Eye symptoms shortly after the use of pesticides

The intervention group had prevalence of eye irritation symptom slightly higher than the control, which was not significantly different though. However, at one month of follow up there was a reduction in eye irritation symptom from 0.25 at baseline to 0.20, which continued to decline at 3 months follow up to 0.05, as indicated in figure 4.9.

Table 4.26: Test for significance on reduction in Eye symptoms after use of pesticide, in intervention and control arm.

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Eye Symptoms	.523	56.426	2	.000	.677	.692	.500

Mauchly's Test of Sphericity

As indicated in table 4.25 above, we found positive change in scores due to intervention effects on eye irritation symptoms reduction in intervention highly significant, compared to change in control group. Overall effects of educational tool has statistically significant effected in reducing prevalence of eye symptoms, at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects).

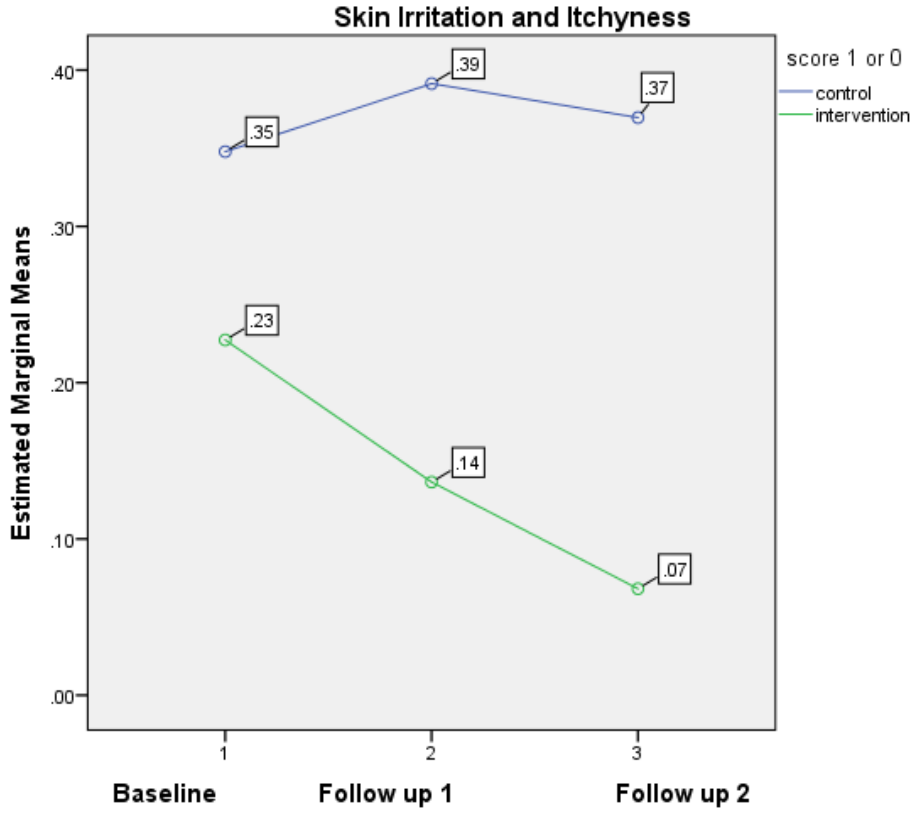


Figure 4.10: Effectiveness of educational tool in reduction of Skin symptoms shortly after the use of pesticides

The intervention group had prevalence of skin irritation and itchiness symptom slightly lower than the control, which was not significantly different though.

However, at one month of follow up there was a reduction in skin symptom reduced from 0.23 at baseline to 0.14, which continued to decline at 3 months follow up to 0.07, as indicated in figure 4.10.

Table 4.27: Test for significance on reduction in Skin symptoms after use of pesticide, in intervention and control arm.

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Skin Symptoms	.630	40.246	2	.000	.730	.747	.500

Mauchly's Test of Sphericity

As indicated in table 4.26 above, we found positive change in scores due to intervention effects on eye irritation symptoms reduction in intervention highly significant, compared to change in control group. Overall effects of educational tool has statistically significant effected in reducing prevalence of skin symptoms, at $p<0.001$ in General Linear Model repeated-measures ANOVA (Test of Within-Subjects Effects).

CHAPTER V
CONCLUSIONS, DISCUSSIONS AND RECOMMENDATIONS

The objective of present quasi-experimental study is to demonstrate the effectiveness of simple educational tool, in not only improving knowledge and attitude on safe management of pesticides but also bring a change in their safety practices which was measured by pre and post questionnaire scores for practice and in-home assessment of safe pesticide behavior. In past, there have been several studies and methods proposed to reduce pesticide exposure in farming communities. But all such methods have not been successful due to their expensive nature and non-availability to farmers, especially in rural settings. In 1985, the UN Food and Agricultural Organization (FAO) initiated a voluntary code of conduct, but lack of adequate government resources in the developing world has made this code ineffective and thousands of deaths continue even today. Though WHO tried to limit the access to highly toxic pesticides, but this measure has failed in many parts of the world due to illegal trade practices.

India ranks second in Asia in the annual pesticide consumption (Gupta 2004). The production in India started in 1958 with 5000 metric tons of pesticides. Currently there are approximately 145 pesticides registered for use and the production has increased to 85000 metric tons (Arun 2005). Occupational poisoning is common because pesticide user consider it impractical and expensive to use safety equipment in the humid tropic climate. Safety instructions on containers are difficult to follow, often written in unfamiliar languages and many farmers are illiterate. Chronic pesticide poisoning is largely a problem among poor rural populations where men, women, and children all work and live in close proximity to farms where pesticides are applied and stored (Mekonnen and Agonafir 2002). Educating farmers with such measures that utilize local resources available in the area and tailored to local environment needs could be considered as one of the best methods to curb the indiscriminate and harmful use of pesticides (Ngowi 2003). In the past, there have been multiple efforts to educate farmers, by developing various educational and behavior change model for the farming community (Raksanam B, 2012). These educational interventions like small books,

video tapes and recorded lecturers although were meant to educate farmers they seem to be too time consuming and effort oriented (Farahat, T.M, 2009). The challenge is not only to develop an affordable tool which could clearly identify hazards associated with pesticide use, but should also be self-explanatory which needs minimal explanation (Matthews, G.A., 2008). In addition, this education tool should also have some utility and must address local issues of farmers effectively addressing workplace pesticide safety (Arcury, T. A., 2009)

A simple pictorial educational tool, which is easy to read and understand, was developed during preparatory phase of study. The intention was to capture accurate and useful representations of knowledge gap in the form of pictures that is easy to comprehend when imparting knowledge on safe use of pesticides to farmers. This was intended to make the process of understanding easier because of its visual expression. Based on past research studies on the knowledge gaps among farmers for safe use of pesticides in similar farming communities (Matthews, G.A., 2008) and using guidance and experience of experts in India, an affordable and self-explanatory pictorial educational tool was prepared using help of professional sketch artist. Finally, an educational poster was printed in the form of a wall calendar so that it could also be made useful for the household throughout the year. Our main objective was to prepare an inexpensive, useful and self-intuitive educational tool which could be easily reproduced, if found successful

The effectiveness of educational interventions was assessed by pre-test, intervention and post-test questionnaire to head of family, from vegetable farming household of the study. This study was conducted in farming community in outskirts of Delhi, in vegetable farmers who were recruited as intervention and control group using purposive sampling method from villages which were similar in their cultivation and farming practices throughout the year. The research was divided into three phases: preparatory phase, implementation phase and post implementation evaluation phase. A face to face interview based on a structured questionnaire was performed to collect quantitative data on knowledge, attitude and pesticide use practices utilized by the vegetable farmers, along with health questionnaire on prevalence of symptoms. In-addition, scores were given on in-home inspection of environment and work activities as a component of pesticide risk behaviors by the

study team/researchers at the beginning of study. Changes in scores in intervention group was compared to control group at 1 and 3 months post intervention to demonstrate effectiveness of educational tool.

5.1 Summary of Research Findings

At baseline before the intervention program, the researcher had tested the difference between the intervention and control group for all independent variables (general characteristic, durations of work, duration of pesticides practice and health status) with cut off point for the difference inclusion at $p<0.1$ was appropriated than $p<0.05$ because our intention is to differentiated between both groups as much as possible for clarity confounding factors before we test the effects of the intervention program. None of the baseline variables were different at study start which could act as confounding factors in the study results and we believed that the study population was randomly distributed between the intervention and control group, at the beginning of study. The even distribution of population is also due to the fact that both intervention and control villages has similar population distribution, with same farming practices throughout the year. Due to close vicinity of these villages, we also found similar vegetable corps being cultivated by farmers in the community.

We found lowest score in the questions related to identification and disposal of harmful pesticides and how to make sure that farmers are not being exposed to higher or lethal levels of pesticides. In addition, low knowledge is found in area of hazards related to pesticide exposure. None of the participants in the study could answer correctly on disposal methods for used pesticides containers and all methods which could protect them from all forms of pesticide exposure and very few farmers could provide correct response to identify dangerous pesticides, instructions on use of pesticides, and pesticide exposure during use. Farmers also showed low knowledge on various pesticide exposure routes, their accumulation in body, health impacts, effect of weather and wind during spray and benefits of PPE during spray of pesticides. This low knowledge was also reflected when we further divided baseline scores based on Bloom's Theory (Bloom et al., 1956). The knowledge scores were sum up and were

classified by percentage, ≤ 60.00 % was low level, >60.00 % - 80.00 % moderate, and > 80.00 % high level. There were only 1 subject with Knowledge score higher than 80% and majority (> 90%) of farmers in low score category of < 60%. We also found that knowledge score also significantly influenced by education status of population where no socio demographic or farming practice variable has significant impact on knowledge. Farmers with higher level of education, showed higher score on knowledge. This shows that though knowledge on pesticide use is significantly associated with education, lack of specific knowledge on pesticide related issues is the main cause of low knowledge level. Above results highlights importance of imparting correct pesticide use knowledge, especially in area of pesticide disposal and storage.

We found adequate attitude score for majority of pesticide management areas except for low attitude among the study participants attitude towards choice of buying and spraying of pesticides. Farmers believe that an expensive pesticide has better quality and they should use them for every crop irrespective of infestation. This is mainly due to cash incentives of vegetable crops but also could be attitude that more use will not have higher impacts on their health. In addition, farmers have low attitude towards use of personal protective equipment's (PPE) and believe that PPE are uncomfortable, expensive and ineffective in protecting them from pesticide exposure.

Regarding practice and in-home pesticide behavior score, low practice score was reported on use of PPE and for storage & disposal of pesticides containers. Also, In-home assessment low score was seen for no lock on the places where pesticides are stored and no separate thrash or disposal place for used pesticide containers. This low practice and in-home assessment of behavior, is due to lack of correct knowledge on pesticides container storage and disposal methods. However, minimal use of PPE is due to lack of adequate attitude for its use. PPE is considered not only expensive and uncomfortable but also ineffective. Overall, we found attitude, practice and in-home assessment of behavior score to be adequate for majority of farmers when we further divided baseline scores based on Bloom's Theory (Bloom et al., 1956). Most of the study participants have positive scores for Attitude, Practice and in-home assessment, in-spite of majority of participants in low knowledge score category.

We analyzed overall effect of intervention in knowledge, attitude, practice and in-home assessment behavior. Overall effectiveness of educational tool was found

to have statistically significant effect on knowledge score (p<0.001) in repeated-measures analysis of variance (Wilks' Lambda from Multivariate test). We found an overall improvement of 23.8% in knowledge level due to intervention. Similarly, for attitude score at follow-up 1 (one month after the educational tool intervention) we found that average attitude score of farmers in the intervention group significantly higher which was further maintained at follow-up 2 (three months after the educational tool intervention). However, there was no change in attitude score from baseline in farmers in the control group of study. We also observed effectiveness of educational tool in not only "improvement in practices score" from baseline, but also in "in-home safe pesticide behavior, both at follow-up 1 and 2. However, there was no change in score from baseline in farmers in the control group of study.

The educational intervention used in the study had significant effect at 1 months and 3 months after administration, which not only improved safe use of pesticides in intervention population (increased knowledge, attitude and practice and in-home assessment behavior) but also led to reduced insecticides related symptoms when compared with the control. In addition to effectiveness of the educational tool for increasing safe pesticide practice it also led to minimized pesticide exposure which decreased prevalence of health symptoms, in all five health symptoms categories assessed. This finding was consistent with a randomized controlled study of Melissa J. Perry et al (2003) in Wisconsin dairy farmers which found that educational intervention can successfully pesticide induced health symptoms.

5.2 Conclusion

Educational interventions have been found to be beneficial in different ways. WHO has mentioned the importance of educating the public as well as agriculture and health-care workers about health risks. Education programs have been found to increase the farmers' realization of the serious health consequences associated with the irrational use of pesticides (Mancini et al. 2005) resulting in raise awareness of farmers on hazardous pesticide use and encourage them to use low toxic pesticides (Food and fertilizer technology center for the Asian and Pacific region 2004). Quick and simple to understand education can reduce the total number of pesticides used (Perry and

Layde 2003) and advocate reading the pesticide label before pesticide application (Prochaska 1998). This will create awareness among pesticide users on the potential hazard associated with indiscriminate use of pesticides (Mandel et al. 2000). Guidance and knowledge on proper waste disposal for pesticides (Eddleston et al. 2002) helps reduce inadvertent exposure.

A large number of similar studies have shown the usefulness of KAP questionnaires in highlighting the lack of knowledge, attitude and practice with respect to safe use of pesticides and the need for educational interventions. In a study carried out by (Ngowi 2003) in Tanzania, about half of the respondents used pesticides according to their own experience and most applied them as formulation mixtures. A study carried out by (Bury et al. 2005) showed that correct education led to more number of farmers following the ideal method of pesticide storage and storing it in separate rooms as compared to farmers in control group. Mekonnen and Agonafr (2002) recommended pesticide safety education to be given to the farmers to minimize the risk from pesticide application.

An important finding in a study carried out by (Salameh et al. 2004) was that the preventive measures taken were directly proportional to the knowledge, i.e., lower the knowledge, the lower were the preventive measures applied. Improvement in the knowledge by an educational intervention may lead to a direct improvement in practice, thus helping to minimize occupational exposure. In a study carried out in Brazil by Recena et al. (2006), educational intervention significantly improvement ($P < 0.001$) in the overall KAP score at the first and second KAP assessment as compared to the baseline. However, a significant decrease ($P < 0.001$) was also seen in the knowledge from the first to the second KAP assessment, which may be attributed to a decrease in retention of knowledge due to the time gap between the follow-ups. This finding is very important as it emphasizes the need to carry out continuous educational inputs for the agricultural workers on pesticide safety. Our strategy is to provide continues education on pesticide management using wall calendar took care of this issue and proved to be very effective as seen by maintain KAP scores at second baseline assessment.

In our current research, we significant usefulness of a self-intuitive educational tool, which could provide basic awareness on adverse health effects and impart knowledge on safe use of pesticides, in the form of a simple pictorial educational tool,

along with correct information on some of the prevalent wrong practices used for spraying, storage and destruction of pesticides at home by farmers. We developed a simple educational tool for the purpose and tested its effectiveness in small vegetable farming community in northern India. We found the tool to be highly effective in not only increasing knowledge, attitude and practice scores but also information being translated into change in behavior which is confirmed by in-home assessment of safe pesticide use behavior.

It is a well-known fact that in developing countries where users are often illiterate, ill-trained and lack appropriate protective devices, the risks of exposure are highly magnified (Eddleston and Phillips 2004). Knowledge gained can directly reflect the practice habits and it is the easiest solution for prevention of pesticide poisoning through implementation of simple education tool among the agricultural population. Pesticide manufacturers can undertake printing of such poster and educational tool in order to promote the safe use of pesticides and minimize occupational hazards and environmental contamination. This study revealed that education tool was successful in not only improving the knowledge, attitude and practice of the vegetable farmers but also reinforced positive practice and safe pesticide use behavior which resulted reduced prevalence of pesticide exposure and related health symptoms.

5.3 Limitations

5.1.1 As mentioned above, the intervention incorporated several components, including pictures, diagrams and other educational pictures. The study is not designed to identify testing of the specific contributions of these components to the overall effects of the intervention. This educational tool was designed specifically for small scale vegetable farming community. It would be desirable to address this topic in future research which could help design educational tool for different plantations and farming environment.

5.1.2 Self-reported symptoms asked in this study relied on farmers memory for their prevalence for 24 hours period of last pesticide use and not after use of pesticides in general. Since farmers were not documenting these symptoms assessed at baseline, they may report higher symptom prevalence. These self-report symptoms in this study

adapted from previous study and there may be some lack of accuracy for questionnaire on pesticide related symptoms, depending on local environment.

5.1.3 Personal protective equipment in this study was suboptimal in study population. Educational tool did no emphasized much on protective equipment use due to its cost, uneasiness in wearing, and other issues which were applicable for poor vegetable farmers.

5.1.4 A significant improvement ($P < 0.001$) in practice score at the second KAP assessment cannot be considered as a true improvement because the follow-up was conducted in 1 & 3 month's period. This period is so short that we were not able to observe the next crop cultivation cycle. Ideal assessment of the KAP score and effectiveness of educational tool would be possible by the direct observation of practice scores after the next cultivation/spraying season.

5.1.5 All the subjects of the subjects were males. However even though women may not be involved in agriculture directly, they are at an equal risk as they play supportive roles and are considered as less visible, but they are as much exposed subjects as any male member of society.

5.4 Recommendations

The intervention in this study was targeted specifically toward reducing insecticides exposure. Farmers in the study area and elsewhere use a wide variety of pesticides in addition to insecticides. It is quite conceivable that broader interventions, intended to reduce exposure to both insecticides and other pesticides, might be associated with larger benefits than were observed in this study. Such broader interventions should be implemented and evaluated in further research. Finally, the ultimate goal of pesticide-related agricultural interventions is to improve farmers' health and quality of life. Assessing such long-term goals was beyond the scope of the present study. Hopefully, it will be possible to conduct long-term research in the future, in which the effectiveness of interventions in achieving these goals can be assessed.

We found that a simple, affordable and self-explanatory pictorial educational tool can be effective in not only providing knowledge to farmers on safe use of

pesticides but also has short to long term impact on improving pesticide use behavior, which can help reduce health impact in the farming community**.** Through current study, we demonstrated that an inexpensive, self-explanatory and passive education tool can be successful in improving the knowledge, attitude and practice of the farmers for long duration of 3 months. Successful outcome of this research should motivate pesticide manufacturers to undertake use of inexpensive educational tool to promote the safe use of pesticides and minimize occupational hazards to farmers.

Appendix 1

List of Forms and Questionnaire (Example)

Interview forms

Introduction of the questionnaire

1. This questionnaire is created to:
   - 1.1 Study general information and health-related data of vegetable farmers in Faridabad, India
   - 1.2 Study working data of vegetable farming and practices in Faridabad Province
   - 1.3 Study knowledge in pesticide practice of vegetable farmers in Faridabad Province
   - 1.4 Study beliefs and attitude in pesticide practice of vegetable farmers in Faridabad Province
   - 1.5 Study pesticide practice of vegetable farmers in Faridabad Province

2. The questionnaire is divided into 6 parts as follows:
   - Part 1 General data (11 questions)
   - Part 2 Health Questionnaire
   - Part 3 Knowledge of pesticide use (22 questions)
   - Part 4 Attitudes on pesticide use (22 questions)
   - Part 5 Behaviors of pesticide use (20 questions)
   - Part 6 In-home pesticide safety assessment

3. All information obtained by means of this questionnaire will be kept confidential and used for the purpose of study only. You are requested to answer all questions as they apply to you.

Part 1 General Information of Vegetable Farmers

Explanation: Put / check √ in □ or fill in the blank for the following questions as they apply to you.

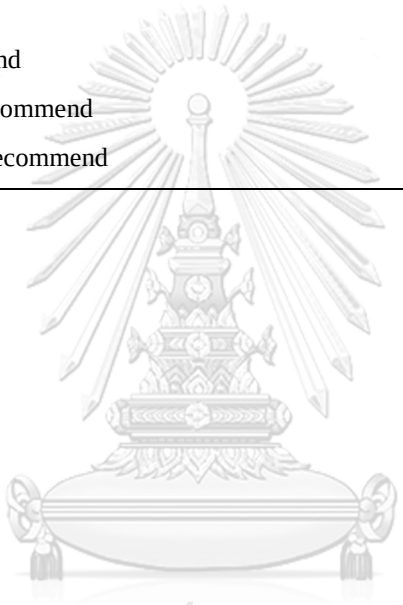
QUESTIONS	CODE	
Name: _____ Middle Name:_____Surname: _____ Address: _____ H.No ___ Village _____ _____District	□□□	NO
1 **Age ___ years old**	□□	AGE
2 **Gender** □ 1) Male □ 2) Female	□	SEX
3 **Education** (Check only one item.) □ 1) No formal education □ 2) Had education, but not above Grade 5 □ 3) Grade 5 or 8 □ 4) Grade 9 to 12 □ 5) Certificate/Diploma □ 6) Bachelor Degree and above	□ □ □ □ □	EDU1 EDU2 EDU3 EDU4 EDU5 EDU6
4 Have you ever smoked cigarettes? (Count both hand-rolled and store-bought cigarettes.) □ Yes □ No	□	SMOK1
5 If yes, about how old were you when you started smoking cigarettes?_____ years old	□□	SMOK2
6 If yes, do you smoke cigarettes at present? □ Yes □ No	□	SMOK3
7 If you have ever smoked cigarettes, but do not smoke at present, about how old were you when you stopped smoking? _____ years old	□□	SMOK4
8 If you have ever smoked cigarettes, about how many cigarettes have you smoked per day, on average? _____ cigarettes/day	□□	SMOK5

QUESTIONS	CODE	
9 During the past 12 months, how often did you drink any kind of alcoholic beverage (including beer, wine, and whiskey)? Check only one. □ 1) Less than one time per month (including never) □ 2)1-3 times per month □ 3) About one time per week □ 4) 2-4 times per week □ 5) Almost every day or every day	□	DRINK1
10 On days when you drank an alcoholic beverage, about how many drinks did you have, on average? (One drink is one beer, one glass of wine, or one shot of whiskey.) Check only one. □ 1) Did not drink at all □ 2) 1 or 2 drinks □ 3) 3 – 4 drinks □ 4) 5 drinks or more	□	DRINK2
14 **Have you ever been diagnosed by doctors in this:** (Can check more than 1) □ 1) None □ 2) Cancer □ 3) Heart disease □ 4) Diabetes □ 5) Hypertension □ 6) Asthma □ 7) Tuberculosis □ 8) Rheumatoid Arthritis □ 9) Skin diseases □ 10) others: _____	□ □ □ □ □ □ □ □ □ □	DIS1 DIS2 DIS3 DIS4 DIS5 DIS6 DIS7 DIS8 DIS9 DIS10
15 **Present working characteristic:** (Can check more than 1) □ 1) Cultivate crops by yourself □ 2) Hire other person(s) to cultivate crops □ 3) Both cultivate and Hire	□ □ □	CAL1 CAL2 CAL3

QUESTIONS	CODE	
16 **What vegetable crops do you grow?** 1. _____ 2. _____ 3. _____ 4. _____ 5. _____	□ □ □ □ □	OCC1 OCC2 OCC3 OCC4 OCC5 OCC6
16a **What are the time frame of crops** **1. Start month_____End Month_____** **2. Start month_____End Month_____** **3. Start month_____End Month_____** **4. Start month_____End Month_____** **5. Start month_____End Month_____**	□ □ □ □ □	CCC1 CCC2 CCC3 CCC4 CCC5 CCC6
17 **You have done agriculture for ___ years**	□□	LONG
18 **How do you have contact with pesticides:** (Can check more than 1) □ 1) Do not use pesticide □ 2) Sprayer □ 3) Mixer □ 4) Do not spray/ mix/scatter but do go into pesticide using area	□ □ □ □	RISK1 RISK2 RISK3 RISK4
19 **You have been using pesticide for ___ years**	□□	USE1
20 **Have you ever been trained in application of pesticides** □ Yes □ No	□	TRA1
21 **If yes, by who you got your training?** **1.** Government institute **2.** Pesticide supplier/ company representative **3.** Pesticide selling shop **4.** Other farmers/ family **5.** Any other_____	□	TRA2

QUESTIONS	CODE	
22 **Pesticides class that you usually used in your cultivate** (Can check more than 1) □ 1) insecticides □ 2) herbicides □ 3) fungicides □ 4) rodenticides □ 5) none	□ □ □ □ □	CLASS1 CLASS2 CLASS3 CLASS4 CLASS5
23 **How often do you use pesticide per crop**: Check only one □ 1) 1-3 times □ 2) 4-6 times □ 3) 7-9 times □ 4) 10-12 times □ 5) 13-15 times □ 6) more than 15 times	□	USE2
24 **How many ml. do you spray pesticide each time, on average?** Dissolve in water _____ ml. total	□□□□	MIX
25 **Form of pesticides that you used?** (can check more than one): □ 1) Powder □ 2) liquid □ 3) Others _____	□ □ □	TYPE1 TYPE2 TYPE3
26 **When do you usually spray pesticide?** (check only one): □ 1) Before 8am □ 2) 8am – 12pm □ 3) 12pm – 4pm □ 4) After 4pm	□	TIME

QUESTIONS	CODE	
27 **In one days, on average you spray pesticides about** (check only one): □ 1) None □ 2) less than 2 hours □ 3) 2 – 4 hours □ 4) More than 4 hours	□	HOUR
28 **The pesticides concentration that you mixed or applied was usually _____** (check only one): □ 1) None □ 2) As label recommend □ 3) Less than label recommend □ 4) More than label recommend	□	LABE



QUESTIONS	CODE	
29 **Have you ever been in this following situation while and/or after spraying pesticide:** (Can check more than 1)		
□ 1) Headache	□	HEAD1
- During using □ Yes □ No	□	HEAD2
- Shortly after used □ Yes □ No	□	HEAD3
- When not using □ Yes □ No	□	HEAD4
□ 2) Twitching muscle	□	TWIT1
- During using □ Yes □ No	□	TWIT2
- Shortly after used □ Yes □ No	□	TWIT3
- When not using □ Yes □ No	□	TWIT4
□ 3) Blurred or dim vision	□	DIM1
- During using □ Yes □ No	□	DIM2
- Shortly after used □ Yes □ No	□	DIM3
- When not using □ Yes □ No	□	DIM4
□ 4) Trembling	□	TREM1
- During using □ Yes □ No	□	TREM2
- Shortly after used □ Yes □ No	□	TREM3
- When not using □ Yes □ No	□	TREM4
□ 5) Been soaked with sweat	□	SOAK1
- During using □ Yes □ No	□	SOAK2
- Shortly after used □ Yes □ No	□	SOAK3
- When not using □ Yes □ No	□	SOAK4
□ 6) Weakness / lack of energy	□	WEAK1
- During using □ Yes □ No	□	WEAK2
- Shortly after used □ Yes □ No	□	WEAK3
- When not using □ Yes □ No	□	WEAK4
□ 7) Saliva comes down	□	SAL1
- During using □ Yes □ No	□	SAL2
- Shortly after used □ Yes □ No	□	SAL3
- When not using □ Yes □ No	□	SAL4

□ 8) Muscle cramps	□	MUS1
- During using □ Yes □ No		MUS2
- Shortly after used □ Yes □ No	□	MUS3
- When not using □ Yes □ No	□	MUS4
□ 9) Staggering gait		STAG1
- During using □ Yes □ No	□	STAG2
- Shortly after used □ Yes □ No	□	STAG3
- When not using □ Yes □ No		STAG4
□ 10) Dizziness	□	DIZ1
- During using □ Yes □ No		DIZ2
- Shortly after used □ Yes □ No	□	DIZ3
- When not using □ Yes □ No	□	DIZ4
□ 11) Urinating		URI1
- During using □ Yes □ No	□	URI2
- Shortly after used □ Yes □ No	□	URI3
- When not using □ Yes □ No		URI4
□ 12) Slow heart beat	□	HEART1
- During using □ Yes □ No		HEART2
- Shortly after used □ Yes □ No	□	HEART3
- When not using □ Yes □ No	□	HEART4
□ 13) Numbness in arms or legs		NUMB1
- During using □ Yes □ No	□	NUMB2~
- Shortly after used □ Yes □ No		NUMB3
- When not using □ Yes □ No	□	NUMB4
□ 14) Difficult breathing		BREA1
- During using □ Yes □ No	□	BREA2
- Shortly after used □ Yes □ No		BREA3
- When not using □ Yes □ No	□	BREA4
	□	
	□	
	□	
	□	
	□	

QUESTIONS	CODE	
□ 15) Runny nose	□	NOSE1
- During using □ Yes □ No	□	NOSE2
- Shortly after used □ Yes □ No	□	NOSE3
- When not using □ Yes □ No	□	NOSE4
□ 16) Wheezing	□	WHEZ1
- During using □ Yes □ No	□	WHEZ2
- Shortly after used □ Yes □ No	□	WHEZ3
- When not using □ Yes □ No	□	WHEZ4
□ 17) Dry/sore throat	□	THRO1
- During using □ Yes □ No	□	THRO2
- Shortly after used □ Yes □ No	□	THRO3
- When not using □ Yes □ No	□	THRO4
□ 18) Cough	□	COUG1
- During using □ Yes □ No	□	COUG2
- Shortly after used □ Yes □ No	□	COUG3
- When not using □ Yes □ No	□	COUG4
□ 19) Chest pain	□	CHES1
- During using □ Yes □ No	□	CHES2
- Shortly after used □ Yes □ No	□	CHES3
- When not using □ Yes □ No	□	CHES4
□ 20) Numbness of tongue	□	TONG1
- During using □ Yes □ No	□	TONG2
- Shortly after used □ Yes □ No	□	TONG3
- When not using □ Yes □ No	□	TONG4
□ 21) Feel nauseous or vomiting	□	VOM1
- During using □ Yes □ No	□	VOM2
- Shortly after used □ Yes □ No	□	VOM3
- When not using □ Yes □ No	□	VOM4
	□	
	□	

QUESTIONS	CODE	
□ 22) Diarrhea	□	DIAR1
- During using □ Yes □ No	□	DIAR2
- Shortly after used □ Yes □ No	□	DIAR3
- When not using □ Yes □ No	□	DIAR4
□ 23) Stomach ache	□	STOM1
- During using □ Yes □ No	□	STOM2
- Shortly after used □ Yes □ No	□	STOM3
- When not using □ Yes □ No	□	STOM4
□ 24) Itchy/scratchy eye, eye irritation, tear come down	□	EYE1
- During using □ Yes □ No	□	EYE2
- Shortly after used □ Yes □ No	□	EYE3
- When not using □ Yes □ No	□	EYE4
□ 25) Rash/itchy skin	□	RASH1
- During using □ Yes □ No	□	RASH2
- Shortly after used □ Yes □ No	□	RASH3
- When not using □ Yes □ No	□	RASH4
30 **The latest time you used or contacted pesticide was _____ days ago.**	□□	DAY
31 **Do you usually apply chemical fertilizer, herbicides in other cultivating crops?** □ Yes □ No	□	FER
32 **In your house have you used Mosquito Coils?** □ Yes □ No	□	MOS
33 **In your house you used Household Pesticide Spray?** □ Yes □ No	□	HOMSPRAY

Part 3 Knowledge in Pesticide Practice of Agriculturists

Explanation: Put / check √ in □ or fill in the blank for the following questions as they apply to you. Check only one choice in each question.

QUESTIONS	CODE	
1 We can get pesticide exposure via: □ 1) Oral □ 2) Dermal □ 3) Breathe □ 4) All are correct. □ 5) Don't know	□	KNO1
2 We can get pesticide easiest exposure in _____ weather □ 1) Humid □ 2) Hot climate □ 3) Cold □ 4) Fine weather □ 5) Variable climate	□	KNO2
3 Who had opportunity to get the poison from pesticide: □ 1) Animals; birds, cows, etc. □ 2) Infant □ 3) farmers who apply pesticides □ 4) people who eat fruits, vegetable □ 5) All are correct	□	KNO3
4 Where should you keep pesticide: □ 1) In specific and safe place □ 2) In a drug cabinet □ 3) In a basement □ 4) In a kitchen □ 5) Wherever that easy to see and access	□	KNO4
5 The more quantity of pesticide is used, □ 1) the more pests are killed □ 2) the more quantity user is exposed □ 3) the more productive the farm is □ 4) the more income agriculturists earn	□	KNO5

QUESTIONS	CODE	
6 How should you treat a pesticide package after finishing: □ 1) Burn □ 2) Leave in the field □ 3) Wash and reuse as a glass or dish □ 4) Bury somewhere far away from a river and/or canal □ 5) Sell for second-hand use	□	KNO6
7 How should you protect yourself from pesticide: □ 1) Cover mouth and nose with a thin cloth □ 2) Wear a face cover, a long-sleeve shirt and trousers □ 3) Wear a mask, long gloves, a long-sleeve shirt and trousers □ 4) Stay upwind of the spray □ 5) Just wear a mask	□	KNO7
8 What is the right instruction for pesticide practice: □ 1) Neighbor's advice □ 2) Direction on a label □ 3) Shopkeeper's advice □ 4) Up to individual experience and skill □ 5) Same technique for all brands	□	KNO8
9 How do you notice an extremely dangerous pesticide: □ 1) Strong odor □ 2) Dark color □ 3) A skull with an X sign □ 4) Not For Consumption sign guaranteed by the Food and Drug Administration □ 5) Expensive	□	KNO9
10 What is the best and easy way to check for the pesticide exposure in your body: □ 1) Brain checking □ 2) Blood examination □ 3) Stool examination □ 4) Clothes examination □ 4) EKG test	□	KNO10

QUESTIONS	CODE	
11 What is the most reason for choosing pesticides: □ 1) High efficiency □ 2) Long lasting effect □ 3) More concentration □ 4) safe for applier, consumer and environment □ 5) Low price	□	KNO11
12 Which is the right method to mix pesticide: □ 1) Pour pesticide for an amount estimated by sight □ 2) Stir pesticide by hand □ 3) Wear rubber gloves and stir pesticide using a stick □ 4) Pour pesticide into a container and shake well □ 5) Prefer high concentration	□	KNO12
13 Persons who have ever had pesticide poisoning will have immunization and will not have poisoning again. □ 1) Yes □ 2) No	□	KNO13
14 Use more types of pesticide while applying have more risky than one type. □ 1) Yes □ 2) No	□	KNO14
15 Take some drugs such Avil, Paracetamol before and after mixing or applying can protect or reduce pesticide poisoning. □ 1) Yes □ 2) No	□	KNO15
16 When should you spray pesticides □ 1) Calm winds □ (2) High winds □ (3) Sunny □ (4) Any time	□	KNO16

QUESTIONS	CODE	
17. How should you dress while spraying pesticides? □ (1) Do not wear personal protective equipment because of the hot weather □ (2) Do not use a mask because it is uncomfortable for breathing □ (3) Wear clothes and mask to protect your body □ (4) Wear shoes, clothes and mask to protect your body	□	KNO17
18 Where can the poison from a pesticides accumulate? □ (1) On the ground □ (2) In the river □ (3) On the ground and in the adjacent spray area □ (4) All of the above	□	KNO18
19 What is/are the hazards of pesticide exposure? □ (1) Headache and dizziness □ (2) Abdominal pain and vomiting □ (3) Dry throat and cough □ (4) Redness of eye □ (5) All of the above	□	KNO19
20 Which of the following is a correct practice of pesticide use? □ (1) Clean pesticide containers and materials in the river and canals □ (2) Immediately take a bath after working □ (3) Clean and reuse pesticide containers in the kitchen □ (4) All of the above	□	KNO20

QUESTIONS	CODE	
21 Which of the following is a correct practice while spraying pesticide □ (1) Eating food □ (2) Drinking alcohol □ (3) smoking cigarette/ bidi □ (4) None of the above	□	KNO21

Part 4 Belief & Attitude in Pesticide Use

Explanation: Put / check √ in □ for the following questions as they apply to you. Check only one choice for each question.

QUESTIONS	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	CODE	
1 The more expensive, the better quality the pesticide is.						□	ATT1
2 It is necessary to use pesticide every time you grow crops.						□	ATT2
3 A pesticide consisting of many compounds is of good quality.						□	ATT3
4 Spraying tank can be washed in a river/canal without any harm to other animals.						□	ATT4
5 Pesticide will only affect to pest						□	ATT5
6 Your are strong enough that can protect yourself from harmful effects of pesticide						□	ATT6
7 You should spray windward while spraying.						□	ATT7
8 All agriculturists should have a medical check-up for pesticide left over at least once a year.						□	ATT8
9 Smoking while spraying has nothing to do with the pesticide left over in the body.						□	ATT9
10 You can smoke, drink water or eat food while mixing or applying pesticides.						□	ATT10
11 Herbal pesticide usage is complicated and useless						□	ATT11
12 Although you have good health, you would have pesticide poisoning after you exposed to pesticide.						□	ATT12
13You must stop spraying immediately if it is windy.						□	ATT13

QUESTIONS	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	CODE	
14 While mixing or spraying pesticide in a few times or few amount, it is not necessary to wear PPE						□	ATT14
15 After applying pesticide only change your clothes is enough not necessary to take a bath						□	ATT15
16 Pesticide poisoning can be prevented and reduced						□	ATT16
17 Long use of pppesticide make you resistant and you do not have any symptom now						□	ATT17
18 New chemical pesticides donot harmed to your health						□	ATT18
19 Mixed more pesticides together can reduce time of spray and health effected						□	ATT19
20While using pesticides with PPE is not comfortable to works						□	ATT20
21Even though PPE is expensive it's necessary and worthwhile						□	ATT21
22Take a bath immediately after applied pesticide can reduce effected from pesticides						□	ATT22
23 Separate washing of clothes from others is difficult/ not practical						□	ATT23
24 Providing a full option of personal protective equipment(such as hat, gloves, boots, mask) is hard for you, as these are uncomfortable to use						□	ATT24
25 When having mild symptoms it will disappear itself not necessary to see a doctor						□	ATT25
26 Pesticides can cause cancers						□	ATT26

QUESTIONS	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree	CODE	
27 Buying a full option of personal protective equipment (such as hat, gloves, boots, mask) is hard for you, as these will not be used						□	ATT27

Part 5 Practice in Pesticide use

Explanation: Put / check √ in □ for the following questions as they apply to you. Check only one choice for **Behaviors**	**Always done**	**Often done**	**Sometime done**	**Rarely done**	**Code**
1. Carefully read pesticide use instructions before use and also strictly follow the instructions					PRA1
2. Buy pesticide following a neighbor's advice					PRA2
3.Use of expired pesticides					PRA3
4. You dissolve pesticide at home before going to spray in the field					PRA4
5.Leave food near/in the spraying area					PRA5
6. Open pesticide container using your mouth					PRA6
7. Blow or suck the nozzle using your mouth					PRA7
8. Mix or stir pesticides with stick or safety equipment					PRA8
9. Stop working immediately when you get wounded during the spraying of pesticide					PRA9
10. Spray pesticide during strong winds					PRA10
11. Spray pesticide in the same direction as the wind					PRA11
12. Drink some water during working with pesticides					PRA12
13. Eat some food during work with pesticides					PRA13
14. Burn or landfill the expired or left over pesticides in the safety area					PRA14
15. Leave empty or expired containers in the river or canal					PRA15
16. Leave empty or expired containers in normal trash					PRA16
17.Wash pesticide equipment's, and pesticide containers in the river or canal					PRA17
18.Take a bath immediately after finishing work related to pesticide use					PRA18
19. Separate pesticide contaminated clothes from others to clean					PRA19
20. Store pesticides in a locked area					PRA20

Behaviors	**Always done**	**Often done**	**Sometime done**	**Rarely done**	**Code**
21. You use a spoon to measure pesticide when dissolve it.					RA21
22. You use higher concentration of pesticide than that specified on the label					PRA22
23. You dissolve many kinds of pesticide together when mixing					PRA23
24. You smell pesticide in its container, just to prove it.					PRA24
25. You wash the clothes you wear for spraying together with other clothes.					PRA25
26. You keep the left-over pesticide in your kitchen					PRA 26
27. You wear full PPE when applied pesticides					PRA27

Part 6: In-home pesticide safety assessment

Instruction: Please tick (/) in the brackets. You select only one answer in each item

Statement	Yes	No	Code
Leave pesticides in the bath room close to shower cream, mouthwash, detergents, etc.			INH1
Leave pesticides in the kitchen close to dishwashing liquid, sauce, fish sauce and other condiments.			INH2
Provide a storage area for pesticides, such as a closet or storage room, hard to reach for children.			INH3
Provide a safety and locked room of pesticides			INH4
Store pesticides in a storage area			INH5
Store pesticides in a safe and locked room			INH6
Leave your shirt and trousers stained with pesticides with your family's clothes.			INH7
Separate for washing your shirt and trousers stained with pesticides from your family's clothes.			INH8
Provide hazardous trash and general trash.			INH9
Throw out pesticide containers in general trash			INH10
Provide the call numbers of hospitals, health centers, and toxicological centers (in case of emergency from pesticide hazards)			INH11
Easy to get emergency call numbers in your home (in case of an emergency from pesticide hazards)			INH12

Thank you for your kind attention

Appendix 2

Questionnaire in Local language

स्पष्टीकरण: नीचे दिए गए सवालों के लिए □ में √ का निशान लगाएँ/चेक करें या रिक्त स्थान को भरें।

सवाल
नाम: _____ बीच का नाम: _____ उपनाम: _____ पता: _____ मकान नं. : _____ गाँव: _____ _____ जिला
1 **उम्र** _____ **साल**
2 **लिंग** □ 1) पुरुष □ 2) महिला
3 **शिक्षा** (केवल एक पर निशान लगाएँ।) □ 1) कोई औपचारिक शिक्षा नहीं; □ 2) शिक्षित, लेकिन 5वीं ग्रेड से अधिक नहीं; □ 3) 5वीं या 8वीं ग्रेड □ 4) 9वीं से 12वीं ग्रेड; □ 5) सर्टिफिकेट/डिप्लोमा; □ 6) बैचलर डिग्री एवं उससे ऊपर
4 क्या आपने कभी सिगरेट पी है? (हाथ से रोल करी या बाज़ार से खरीदी गई सिगरेटों को भी गिनें) □ हाँ □ नहीं
5 अगर हाँ, आपने लगभग कितने साल की उम्र में सिगरेट पीना शुरू किया था? _____ साल
6 अगर हाँ, तो क्या आप अभी भी सिगरेट पीते हैं? □ हाँ □ नहीं
7 अगर आप कभी सिगरेट पीते थे, लेकिन अब नहीं पीते, तो किस उम्र में आपने सिगरेट पीना छोड़ा था? _____ साल की उम्र में
8 अगर आप कभी सिगरेट पीते थे, तो हर दिन आप लगभग कितनी सिगरेट पीते थे _____, औसतन _____ सिगरेट/दिन
9 पिछले 12 महीनों के दौरान, आपने कितनी बार किसी तरह की शराब पी है (बीयर, वाईन एवं व्हस्की सहित)? केवल एक पर निशान लगाएँ। □ 1) हर महीने एक बार से कम (कभी नहीं पीना सहित); □ 2) हर महीने में 1-3 बार □ 3) करीब एक बार हर हफ्ते; □ 4) 2-4 बार प्रति सप्ताह; □ 5) लगभग हर दिन या हर दिन

सवाल
10 जिन दिनों में भी आप शराब पीते हैं, औसतन कितनी ड्रिंक आप लेते हैं? (एक ड्रिंक यानी एक बियर, एक ग्लास वाइन, या व्हस्की का एक शॉट) □ 1) बिल्कुल नहीं पी; □ 2) 1 या दो ड्रिंक्स; □ 3) 3-4 ड्रिंक्स; □ 4) 5 ड्रिंक्स या अधिक
14 क्या आपको कभी इन रोगों के लिए डॉक्टर से जाँच कराई गई है: (1 से ज्यादा पर निशान लगा सकते हैं) □ 1) कोई नहीं; □ 2) कैंसर; □ 3) हृदय रोग; □ 4) मधुमेह; □ 5) उच्च रक्तचाप; □ 6) अस्थमा; □ 7) तपेदिक; □ 8) गठिया; □ 9) चर्म रोग; □ 10) अन्य: _____
15 वर्तमान कार्य के तरीके: (1 से ज्यादा पर निशान लगा सकते हैं) □ 1) आप खुद फसल उगाते हैं; □ 2) खेती के लिए व्यक्ति (यों) को काम पर रखते हैं; □ 3) खेती भी करते हैं और भाड़े पर मज़दूर भी रखते हैं
16 किस तरह की सब्जियाँ आप उगाते हैं? और किस समय उगाते हैं **1. _____ महीने से शुरू _____ महीने में अंत _____** **2. _____ महीने से शुरू _____ महीने में अंत _____** **3. _____ महीने से शुरू _____ महीने में अंत _____** **4. _____ महीने से शुरू _____ महीने में अंत _____** **5. _____ महीने से शुरू _____ महीने में अंत _____**
17 आपने कितने सालों तक खेती की है _____ साल
18 किसी कीटनाशक का आपने किस प्रकार उपयोग किया है: (1 से ज्यादा पर निशान लगा सकते हैं) □ 1) कीटनाशक का इस्तेमाल नहीं करते; □ 2) सिर्फ स्प्रे करते हैं; □ 3) मिश्रित; □ 4) सभी तरह की कीटनाशक गतिविधियाँ
19 आप _____ सालों से कीटनाशक का इस्तेमाल करते आ रहे हैं
20 क्या आपने कीटनाशक इस्तेमाल करने का कभी प्रशिक्षण लिया है □ हाँ □ नहीं
21 अगर हाँ, तो आपने कहाँ से प्रशिक्षण लिया है? सरकारी संस्थान; कीटनाशक आपूर्तिकर्ता/कंपनी प्रतिनिधि; कीटनाशक बेचने वाली दुकान; दूसरे किसान/परिवार; कोई अन्य _____
22 किस तरह के कीटनाशक का उपयोग सामान्यतः आप अपनी फसल के लिए करते हैं (1 से ज्यादा पर निशान लगा सकते हैं) □ 1) कीटनाशक; □ 2) घास-फूस खत्म करने वाले; □ 3) फंगस खत्म करने वाले; □ 4) चूहे, गिलहरी आदि को मारने वाले; □ 5) नहीं जानते
23 प्रत्येक फसल के लिए आप कितनी बार कीटनाशक का इस्तेमाल करते हैं: □ 1) 1-3 बार; □ 2) 4-6 बार; □ 3) 7-9 बार; □ 4) 10-12 बार; □ 5) 13-15 बार; □ 6) 15 बार से अधिक

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24 हर बार औसतन कितने मिली. कीटनाशक का छिड़काव आप करते हैं? पानी में घुलनशील _____ मिली कुल
25 किस तरह के कीटनाशक का इस्तेमाल आपने किया है? (एक से ज्यादा को निशान लगा सकते हैं): □ 1) पाउडर; □ 2) तरल (लिक्विड); □ 3) अन्य _____
26 आप सामान्यतः कब कीटनाशक का छिड़काव करते हैं? (केवल एक को ही निशान लगाएँ): □ 1) सुबह 8 बजे से पहले; □ 2) सुबह 8 बजे से दोपहर 12 बजे के बीच; □ 3) 12 बजे से शाम 4 बजे के बीच; □ 4) 4 बजे के बाद
27 हर दिन तकरीबन कितनी देर आप तक कीटनाशक का छिड़काव करते हैं (केवल एक को ही निशान लगाएँ): □ 1) कोई नहीं; □ 2) 2 घंटों से कम; □ 3) 2-4 घंटों तक; □ 4) 4 घंटों से ज्यादा
28 सामान्यतः आप किस तरह के कीटनाशक सकेंद्रण को मिलाते हैं या इस्तेमाल करते हैं _____ (केवल एक को ही निशान लगाएँ): □ 1) लेबल के अनुसार; □ 2) लेबल में बताए गए से कम; □ 3) लेबल में बताए गए से ज्यादा; □ लेबल के निर्देशों का पालन नहीं करते

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29 क्या आपको कीटनाशक के छिड़काव के समय या उसके बाद निम्न परिस्थितियों का सामना करना पड़ा है: (1 से ज्यादा पर निशान लगा सकते हैं) □ 1) सिर दर्द - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 2) माँसपेशियों में खिँचाव - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 3) धुंधला दिखाई देना या रोशनी में कमी - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 4) सिहरन - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 5) पसीने से भींगना - उपयोग के समय □ हाँ □ नहीं - उपयोग के तुरंत बाद □ हाँ □ नहीं - जब उपयोग न कर रहे हों □ हाँ □ नहीं □ 6) कमज़ोरी/ताकत की कमी - उपयोग के समय □ हाँ □ नहीं - उपयोग के तुरंत बाद □ हाँ □ नहीं - जब उपयोग न कर रहे हों □ हाँ □ नहीं □ 7) लार टपकना - उपयोग के समय □ हाँ □ नहीं - उपयोग के तुरंत बाद □ हाँ □ नहीं - जब उपयोग नहीं कर रहे हों □ हाँ □ नहीं	□ 8) माँसपेशियों में ऐंठन - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 9) चाल में लड़खड़ाहट - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 10) चक्कर आना - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 11) पेशाब आना - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 12) धड़कन धीमी होना - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 13) बाहों या पैरों में सुन्न होना - उपयोग के समय □ हाँ □ नहीं - उपयोग के तुरंत बाद □ हाँ □ नहीं - जब उपयोग न कर रहे हों □ हाँ □ नहीं □ 14) साँस लेने में तकलीफ - उपयोग के समय □ हाँ □ नहीं - उपयोग के तुरंत बाद □ हाँ □ नहीं - जब उपयोग न कर रहे हों □ हाँ □ नहीं

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□ 15) नाक बहना - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 16) घरघराहट - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 17) गला सूखना/खराब होना - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 18) खाँसी - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 19) सीने में दर्द - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 20) जीभ में अकड़न - उपयोग के समय □ हाँ □ नहीं - उपयोग के तुरंत बाद □ हाँ □ नहीं - जब उपयोग न कर रहे हों □ हाँ □ नहीं	□ 21) उल्टी आना या जी मचलना - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 22) डायरिया (दस्त) - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 23) पेट दर्द - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं □ 24) आँखों में खुजली/खरोंच होना, आँखों में जलन, आँसू निकलते हुए - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं नहीं □ 25) दानेदार/खुजाती त्वचा - इस्तेमाल के समय □ हाँ □ नहीं - इस्तेमाल के तुरंत बाद □ हाँ □ नहीं - जब इस्तेमाल न कर रहे हों □ हाँ □ नहीं नहीं
30 हाल में आप _____ दिनों के पहले कीटनाशक के संपर्क में आए थे।	
31 क्या आप अन्य खेती के फसलों में सामान्यतः रासायनिक उर्वरक, खर-पतवारनाशकों का इस्तेमाल करते हैं? □ हाँ □ नहीं	
32 क्या अपने घर में आपने मच्छर मारने वाले कॉइल का इस्तेमाल किया है? □ हाँ □ नहीं	
33 क्या अपने घर में आपने घरेलू उपयोगी कीटनाशक का छिड़काव किया है? □ हाँ □ नहीं	

भाग 2 कृषकों में कीटनाशक अभ्यास संबंधी जानकारी (केवल एक को ही निशान लगाएँ):

1 हमें कीटनाशक का खतरा इनके ज़रिए हो सकता है: □ 1) मौखिक; □ 2) त्वचा से; □ 3) साँस से; □ 4) सभी सही हैं; □ 5) नहीं जानते
2 हमें कीटनाशक खतरा किस मौसम में आसानी से हो सकता है □ 1) नम; □ 2) गर्म मौसम; □ 3) ठंड; □ 4) अच्छा मौसम; □ 5) बदलता मौसम
3 कीटनाशक से किसमें ज़हर फैलने के संभावना है: □ 1) जानवरों; पक्षियों, गायों, आदि; □ 2) नवजात शिशुओं; □ 3) कीटनाशक डालने वाले किसानों; □ 4) फल, सब्जियाँ खाने वाले लोगों; □ 5) सभी सही हैं
4 कीटनाशक को कहाँ रखना चाहिए: □ 1) एक तय और सुरक्षित जगह पर; □ 2) दवाइयों के एक कैबिनेट में; □ 3) एक बेसमेंट में; □ 4) एक रसोईघर में; □ 5) जहाँ उसे आसानी से देखा और उस तक पहुँचा जा सके
5 कीटनाशकों की अधिक मात्रा का उपयोग करने से, □ 1) और ज्यादा कीट मरते हैं; □ 2) इस्तेमाल करने वाले पर ज्यादा असर पड़ता है; □ 3) खेत और ज्यादा उपजाऊ होता है; □ 4) कृषकों की और अधिक कमाई होती है
6 इस्तेमाल के बाद एक कीटनाशक के डिब्बे का क्या करना चाहिए: □ 1) जलाना; □ 2) खेत में छोड़ना; □ 3) धोकर गिलास या बर्तन की तरह पुनः इस्तेमाल; □ 4) नदी और/या नहर से बहुत देर कहीं ज़मीन में गाड़ना; □ 5) दूसरी बार इस्तेमाल के लिए बेचना
7 अपने आपको कीटनाशक से कैसे बचाना चाहिए: □ 1) एक पतले कपड़े से मुँह और नाक ढकें; □ 2) एक फेस कवर, लंबी बाज़ू वाली कमीज़ और ट्राउज़र्स पहनें; □ 3) एक मास्क, लंबे दस्ताने, एक लंबी बाज़ू वाली कमीज़ और ट्राउज़र्स पहनें; □ 4) छिड़काव की हवा की दिशा में खड़े हों;
8 कीटनाशक के इस्तेमाल करने की सही जानकारी कहाँ से मिलती है: □ 1) पड़ोसी की सलाह; □ 2) एक लेबल पर लिखे निर्देश; □ 3) दुकानदार की सलाह; □ 4) एक व्यक्ति के अनुभव और कौशल से

9 आप एक बेहद खतरनाक कीटनाशक की पहचान कैसे करते हैं: □ 1) तेज़ गंध; □ 2) गाढ़ा रंग; □ 3) एक खोपड़ी पर एक X निशान; □ 4) "उपभोग के लिए नहीं" के निशान; □ 5) कीमती
10 आपके शरीर पर कीटनाशक प्रभाव की जाँच का सबसे अच्छा और आसान तरीका क्या है: □ 1) नर्वस सिस्टम की जाँच; □ 2) खून की जाँच; □ 3) मल की जाँच; □ 4) कपड़ों की जाँच; □ 5) दिल की जाँच
11 कीटनाशकों को चुनने का सबसे सामान्य कारण क्या है: □ 1) उच्च दक्षता; □ 2) लंबे समय तक असर; □ 3) ज्यादा गाढ़ापन □ 4) इस्तेमाल करने वाले, ग्राहक और वातावरण के लिए सुरक्षित; □ 5) कम कीमत
12 कीटनाशकों को मिलाने का सही तरीका क्या है: (हाँ / नहीं) 1) दृष्टि द्वारा एक अनुमान से कुछ मात्रा में कीटनाशक डालें; □ 1) हाँ □ 2) नहीं 2) कीटनाशक को हाथ से हिलाएँ □ 1) हाँ □ 2) नहीं 3) रबड़ के दस्ताने पहनें और एक डंडी से कीटनाशक को हिलाएँ □ 1) हाँ □ 2) नहीं 4) कीटनाशक को एक बड़े बर्तन में डालें और अच्छे तरह हिला लें □ 1) हाँ □ 2) नहीं
13 जिन व्यक्तियों को कभी कीटनाशक विषाक्तता हो गई हो, उन्हें बचाव मिलेगा और फिर से ज़हर नहीं फैलेगा: □ 1) हाँ □ 2) नहीं
14 छिड़काव के समय एक प्रकार के कीटनाशक का प्रयोग अधिक कीटनाशकों के प्रयोग से ज्यादा खतरनाक होता है: □ 1) हाँ □ 2) नहीं
15 कीटनाशक मिलाने या छिड़कने से पहले और बाद में, एविल, पैरासिटेमॉल जैसी दवाइयाँ खाना कीटनाशक के ज़हर से सुरक्षा दे सकता है और उसके असर को कम कर सकता है: □ 1) हाँ □2) नहीं
16 कीटनाशकों का छिड़काव कब करना चाहिए □ 1) हल्की हवाओं; □ (2) तेज़ हवाओं; □ (3) सूर्य में; □ (4) किसी भी समय

17 कीटनाशकों को छिड़कते समय आपको कैसी पोशाक पहननी चाहिए?

□ (1) गर्म मौसम के कारण निजी सुरक्षा उपकरण न पहनें

□ (2) एक मास्क का इस्तेमाल न करें क्योंकि इससे साँस लेने में असुविधा होती है

□ (3) अपने शरीर की सुरक्षा के लिए कपड़े और मास्क पहनें

□ (4) अपने शरीर की सुरक्षा के लिए जूते, कपड़े और मास्क पहनें

18 एक कीटनाशक का ज़हर कहाँ इकट्ठा हो सकता है?

□ (1) ज़मीन पर; □ (2) नदी में

□ (3) ज़मीन पर और छिड़काव की गई जगह के आसपास; □ (4) ऊपर के सभी

19 कीटनाशक का संक्रमण होने से शरीर पर क्या असर होता है/होते हैं?

□ (1) सिरदर्द और चक्कर आना; □ (2) पेट में दर्द और उल्टी

□ (3) गला सूखना और खाँसी; □ (4) आँखें लाल होना; □ (5) ऊपर के सभी

20 इनमें से कौन-सा कीटनाशक के इस्तेमाल का एक सही तरीका है?

(1) कीटनाशक के डिब्बों और सामग्रियों को नदी और नहर में साफ करना (हाँ/नहीं)

(2) काम करने के तुरंत बाद नहाना (हाँ/नहीं)

(3) कीटनाशक बर्तनों को साफ़ करके रसोई में फिर इस्तेमाल करना (हाँ/नहीं)

21 कीटनाशक छिड़कते समय इनमें से कौन सा एक सही अभ्यास है?

(1) भोजन करना □ 1) हाँ □ 2) नहीं

(2) शराब पीना □ 1) हाँ □ 2) नहीं

(3) सिगरेट/बीड़ी पीना □ 1) हाँ □ 2) नहीं

(4) ऊपर में से कोई नही □ 1) हाँ □ 2) नहीं

पार्ट 3 कीटनाशक के इस्तेमाल में विश्वास और दृष्टिकोण (केवल एक पर निशान लगाएँ)

सवाल	पूरी तरह असहमत	असहमत	अनिश्चित	सहमत	पूरी तरह सहमत
1 अधिक कीमत वाला कीटनाशक ज्यादा गुणवत्ता का होता है।					
2 हर बार फसल उगाते समय कीटनाशक का इस्तेमाल करना ज़रूरी है।					
3 उच्च गुणवत्ता वाला कीटनाशक मनुष्यों के लिए हानिकारक नहीं होता।					
4 छिड़काव वाले टैंक को नदी या नहर में धोया जा सकता है और इससे जानवरों को कोई नुकसान नहीं होता।					
5 कीटनाशक केवल कीटों पर प्रभाव डालता है।					
6 आप इतने मज़बूत तो हैं कि कीटनाशकों से होने वाले हानिकारक प्रभावों से अपनी सुरक्षा कर सकते हैं।					
7 आपको छिड़काव करते समय हवा की दिशा में रहना चाहिए।					
8 कीटनाशक के प्रभावों के लिए सभी किसानों की चिकित्सकीय जाँच करवानी चाहिए।					
9 छिड़काव के समय धुम्रपान करने से शरीर पर बचे हुए कीटनाशक का कोई प्रभाव नहीं पड़ता।					
10 कीटनाशकों को मिलाते समय या छिड़कते समय आप धुम्रपान कर सकते हैं, खाना खा सकते हैं या पानी पी सकते हैं।					
11 हर्बल कीटनाशक का इस्तेमाल कठिन और बेकार है।					
12 हालाँकि आपका स्वास्थ्य अच्छा है, तो भी कीटनाशक का इस्तेमाल करते समय आप कीटनाशक के ज़हर से प्रभावित हो सकते हैं।					
13 जब हवा चल रही हो, तो आपको तुरंत छिड़काव रोक देना चाहिए।					
14 थोड़ी मात्रा में कीटनाशक को मिलाते समय या छिड़काव करते समय पीपीई पहनना ज़रूरी नहीं है।					

सवाल	पूरी तरह असहमत	असहमत	अनिश्चित	सहमत	पूरी तरह सहमत
15 कीटनाशक का इस्तेमाल करने के बाद केवल कपड़े बदलना ही काफी है, नहाने या हाथ धोने की ज़रूरत नहीं होती					
16 पीपीई के द्वारा कीटनाशक के ज़हर से सुरक्षा मिल सकती है या इसे कम किया जा सकता है।					
17 लंबे समय तक कीटनाशक के इस्तेमाल ने आपको प्रभावशून्य बना दिया है और अब आपको इसका कोई लक्षण नहीं है।					
18 नए रासायनिक कीटनाशक आपके स्वास्थ्य के लिए हानिकारक नहीं हैं।					
19 एक साथ अधिक कीटनाशकों को मिलाने से आपके छिड़काव के समय और स्वास्थ्य पर पड़ने वाले प्रभाव में कमी आती है।					
20 पीपीई पहनकर कीटनाशक का इस्तेमाल करना काम के लिए आरामदायक नहीं है।					
21 हालाँकि, पीपीई महंगा होता है लेकिन फिर भी यह आवश्यक और बहुमूल्य है।					
22 कीटनाशक के इस्तेमाल के तुरंत बाद नहाने से कीटनाशक का प्रभाव कम हो जाता है।					
23 दूसरे कपड़ों से कीटनाशक के इस्तेमाल के समय पहनने वाले कपड़े को धोना मुश्किल है और यह व्यावहारिक नहीं है।					
24 व्यक्तिगत सुरक्षा उपकरण (जैसे कि, हैट, ग्लव्स, जूते, मास्क आदि) का विकल्प आपके लिए मुश्किल है क्योंकि इनका उपयोग करना आरामादायक नहीं होता।					
25 जब हल्का लक्षण दिखाई दे तो यह थोड़े समय के बाद अपने आप ठीक हो जाता है और डॉक्टर के पास जाने की ज़रूरत नहीं होती।					
26 कीटनाशक से कैंसर होता है।					
27 व्यक्तिगत सुरक्षा उपकरण (जैसे कि, हैट, ग्लव्स, जूते, मास्क आदि) खरीदना आपके लिए मुश्किल है, क्योंकि इसका उपयोग नहीं किया जाएगा।					

भाग 4 कीटनाशक इस्तेमाल का अभ्यास

स्पष्टीकरण: नीचे दिए गए सवालों के लिए अपने अनुसार □ में √ का निशान लगाएँ/चेक करें।

हर सवाल के लिए एक ही जवाब चुनकर चेक करें।

व्यवहार	हमेशा करते हैं	अक्सर करते हैं	कभी-कभी करते हैं	बहुत कम करते हैं
1. कीटनाशक के इस्तेमाल से पहले इससे जुड़े निर्देश ध्यानपूर्वक पढ़ते और पूरी तरह पालन करते हैं।				
2. पड़ोसी की सलाह पर कीटनाशक खरीदते हैं।				
3. एक्सपायर हो चुके कीटनाशक का इस्तेमाल करते हैं।				
4. खेत में छिड़काव करने से पहले घर में कीटनाशक मिलाते हैं।				
5. छिड़काव की जगह पर या उसके पास खाना छोड़ते हैं।				
6. कीटनाशक का डिब्बे को अपने मुँह से खोलते है।				
7. डिब्बे की टोंटी को अपने मुँह में डालकर हवा छोड़ते या अंदर खींचते हैं।				
8. कीटनाशकों को अपने हाथों से मिलाते या हिलाते हैं।				
9. कीटनाशक के छिड़काव के दौरान चोट लगने पर भी काम करते रहते हैं।				
10. तेज हवा चलने पर कीटनाशक का छिड़काव करते हैं।				
11. हवा की दिशा में ही कीटनाशक का छिड़काव करते हैं।				
12. कीटनाशकों का इस्तेमाल करने के दौरान पानी पीते हैं।				
13. कीटनाशकों के इस्तेमाल के दौरान कुछ खाना खाते हैं।				
14. एक्सपायर हो चुके या बचे हुए कीटनाशकों को जला देते हैं या ज़मीन में भर देते हैं।				

व्यवहार	हमेशा करते हैं	अक्सर करते हैं	कभी-कभी करते हैं	बहुत कम करते हैं
15. खाली और एक्सपायर हो चुके डिब्बे को नदी या नहर में बहा देते हैं।				
16. खाली और एक्सपायर हो चुके डिब्बों को आम कचरे के डब्बे में फेंक देते हैं।				
17. कीटनाशकों के उपकरणों और डिब्बों को तालाब या नहर में धोते हैं।				
18. कीटनाशकों से जुड़े काम खत्म करने के तुरंत बाद नहाते हैं।				
19. कीटनाशक से दूषित हुए कपड़ों को सफाई के लिए अन्य कपड़ों से अलग रखते हैं।				
20. कीटनाशकों को एक बंद जगह पर रखते हैं।				
21. आप कीटनाशक घोलते वक्त मापने के लिए एक चम्मच का इस्तेमाल करते हैं।				
22. लेबल पर जितना लिखा हुआ है आप उससे ज्यादा गाढ़ा कीटनाशक इस्तेमाल करते हैं।				
23. आप मिलाते समय कई तरह के कीटनाशक एक साथ घोलते हैं।				
24. आप इस्तेमाल से पहले केवल पक्का करने के लिए कीटनाशक को डिब्बे में सूंघते हैं।				
25. आप कीटनाशक छिड़कते वक्त पहने गए कपड़ों को दूसरे कपड़ों के साथ ही धोते हैं।				
26. आप बचा हुआ कीटनाशक अपनी रसोई में रखते हैं।				
27. आप कीटनाशक का इस्तेमाल करते हुए पूरे 'पीपीई' पहनते हैं।				

पार्ट 6: घर के अंदर सुरक्षित कीटनाशक उपाय

निर्देश: कृपया ब्रैकेटों में (/) निशान लगाएँ। आप प्रत्येक आइटम के लिए सिर्फ एक जवाब चुनें।

कथन	हाँ	नहीं
1. कीटनाशकों को शौचालय में शॉवर क्रीम, माउथवॉश, डिटर्जेंट आदि के पास रखना है।		
2. कीटनाशकों को रसोई घर में बर्तन धोने वाला लिक्विड, सॉस, मछली सॉस या अन्य मसालों के पास रखना है।		
3. कीटनाशकों को वहाँ स्टोर करना है, जैसे कि, एक अलमारी या स्टोरेज रूम, जोकि बच्चों की पहुँच से दूर हो।		
4. कीटनाशकों का सुरक्षित और तालाबंद कमरा है।		
5. कीटनाशकों को अन्य सामानों के साथ स्टोरेज क्षेत्र में रखा है।		
6. कीटनाशकों को खुले कमरे में रखें।		
7. कीटनाशक लगे हुए शर्ट और पैंट को परिवार के अन्य लोगों के कपड़ों के साथ रखा जाता है।		
8. कीटनाशक के धब्बे वाले कपड़े को उसी जगह धोते हैं, जहां परिवार के अन्य लोगों के कपड़े धुलते हैं।		
9. कीटनाशक को अलग कूड़ेदान में फेंकते हैं।		
10. कीटनाशक के कंटेनरों को सामान्य कूड़ेदान में फेंकते हैं।		
11. अस्पतालों, स्वास्थ्य केंद्रों एवं टॉक्सिकोलॉजिकल केंद्रों के कॉल नंबर हमारे पास हैं (किसी समय कीटनाशक के खतरों से आपात स्थिति में)		
12. कीटनाशक को पालतू या अन्य जानवारों के पास रखते हैं।		

आपके ध्यान देने के लिए धन्यवाद

Appendix 3

Informed Consent Form

Address
Date

Code number of participant ……
I who have signed here below agree to participate in this research project

Title "Effectiveness of an educational program to promote pesticide safety among vegetable farmers in Delhi, India: A quasi experimental study"

Principle researcher's name; Ajit pal Singh Raina

Contact address: College of Health Sciences. Chulalongkorn University
10th floor, Building 3, Phayathai Road Wangmai Pathumwan Bangkok 10330 Thailand.

Telephone: (office) 0-2218-8152-3; (mobile) 0894893990

I have (read or been informed) about rationale and objective(s) of the project, what I will be engaged with in details, risk/harm and benefit of this project. The researcher has explained to me and I clearly understand with satisfaction.

I willingly agree to participate in this project and consent the researcher to visit my house at least three times during the study period. If found to be eligible for enrollment in study, I will have to correctly answer the questionnaire to best of my knowledge and allow researcher to visit my house and field areas for verification of study related activities.

The investigators/ study researcher have explained the purpose, procedures, risks and benefits of participating in this study, and my rights as participants, and the confidential handling of the information and records to me. After the end of the project all personal data, if any, will be destroyed. I have fully understood all information provided to me and understand that I may withdraw from the study at any time without showing any cause. I understand that my name and/or identity will not be used in the analyses of data and in sharing the results with others. Based on above, I am voluntarily giving my consent to enroll in this research study.

Researcher has guaranteed that procedure(s) acted upon me would be exactly the same as indicated in the information. Any of my personal information will be kept confidential. Results of the study will be reported as total picture. Any of personal information which could be able to identify me will not appear in the report.

If I am not treated as indicated in the information sheet, I can report to the Research Ethics Review Committee for Research Involving Human Research

Participants, Health Sciences Group, Chulalongkorn University (RECCU). Jamjuree 1 Bldg., 2nd Fl., 254 Phyathai Rd., Patumwan district, Bangkok 10330, Thailand, Tel./Fax. 0-2218-3202 E-mail: eccu@chula.ac.th. I also have received a copy of information sheet and informed consent form

Sign ……..……
(……..……)
Researcher

Sign ……..……
(……..……)
Participant

Sign ……..……
(……..……)
Witness

Appendix 4

Patient/ Participant Information Sheet

Title "Effectiveness of an educational program to promote pesticide safety among vegetable farmers in Delhi, India: A quasi experimental study"

Principle researcher's name; Ajit pal Singh Raina

Contact address: College of Health Sciences. Chulalongkorn University
10th floor, Building 3, Phayathai Road Wangmai Pathumwan Bangkok 10330 Thailand.

Telephone: (office) 0-2218-8152-3; (mobile) 0894893990

Home address: H No M41, Malviya Nagar, New Delhi, India.

Telephone (home) +919971316999.
Cell phone: 0894893990; E-mail: ajitsingh146@hotmail.com

You are being invited to take part in a research project. Before you decide to participate it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and do not hesitate to ask if anything is unclear or if you would like more information.

This research project involves determination of knowledge, attitudes and practices of participants on use of pesticides in their farms. This research will also develop an inexpensive, pictorial and simple educational tool on pesticide use and then assess its usefulness.

The study participants are the head of households, who had been working at farm in study village for at least 2 year. Participants who were willing to participate in the study, will be consented if they fulfill following criterion:

- Using pesticides for at least three year.
- Involved in all major activities with respect to pesticide use in farms
- Have no communication problems

The study will enroll 100 potential participants in two different area and will be followed for 3 months.

Each participant will be visited by researcher at least three times during the study at suitable hours. During the visit, researcher will ask participant to fill questionnaire and answer questions regarding his medical health and wellbeing. Researcher will also visit key areas in house and farm which are related to pesticide use, spray and storage.

The investigators/ study researcher will explain the purpose, procedures, risks and benefits of participating in this study, and my rights as participants, and the confidential handling of the information and records to me. After the end of the project all personal data, if any, will be destroyed.

Study researcher will provide the information to all participants. If potential participant is illiterate/can not write/can not speak native language, the researcher will ask and independent witness to translate consent to participant and counter sign the informed consent, after thumb impression of participant. The study will not enroll vulnerable group e.g. psychosis, prisoner, mental retarded, person under eighteen years old, pregnant woman, dementia, disabled, minority, drafted private, very sick person, refugee, etc.

If after screening potential participant is found to not meet inclusion criteria and in need of help/advice, researcher will ask second incharge of family to be enrolled in his/her place

Researcher will only ask history of medical symptoms and conditions and no medical records will be taken from the participant.

There are no potential risk to the participants during the study course. Each participant will be spending approximately 30 minutes with researcher during each interaction. A prior appointment with participant will be taken to avoid any economical, physical or social loss.

Through current study, we would like to reveal current knowledge gaps in farmers for pesticide use and show that an inexpensive and fairly passive education tool can be successful in not only improving the knowledge, attitude and practice of the pesticide handlers for long duration but also reduce risk of health hazards for family and community.

Participation to the study is voluntary and participant has the right to deny and/or withdraw from the study at any time, no need to give any reason, and there will be no bad impact upon that participant.

If you have any question or would like to obtain more information, the researcher can be reached at all time. If the researcher has new information regarding benefit on risk/harm, participants will be informed as soon as possible. After completion of study, all study participants will be educated from the study results and will be told use of educational tool.

Researcher has guaranteed that procedure(s) acted upon me would be exactly the same as indicated in the information. Any of my personal information will be kept confidential. Results of the study will be reported as total picture. Any of personal information which could be able to identify me will not appear in the report. If researcher does not perform upon participants as indicated in the information, the participants can report the incident to the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). Jamjuree 1 Bldg., 2nd Fl., 254 Phyathai Rd., Patumwan district, Bangkok 10330, Thailand, Tel./Fax. 0-2218-3202 E-mail: eccu@chula.ac.th.

Appendix 5

Work plan of every activity including time requesting for research Ethics Review

Activities	When
Problem identification from literature review and formulate proposal	March-June 2015
Write proposal	July-October 2015
Defend Proposal	November 2015
Preparatory Phase	Jan-March 2016
Ethical Approval	April-May 2016
Pilot Testing of Questionnaire	June 2016
Subject recruitment and data collection at baseline	July 2016
Data collection at 1 month follow up	October 2016
Data collection at 3 month follow up	January 2017
Data analysis and first publication	November 2017
Final second publication	January 2018

The budget for all activities of the study as follow
Cost of educational tool development (60,000 bath)
Cost for conducting questionnaires in participants
(50,000 baht)
Labor cost for collecting data (40,000 baht)
Cost for data entry and data analysis (10,000 baht)
Cost for testing or measuring tools (50,000 baht)
Labor Cost for expert and staff (10,000 baht)
Cost for analysis of samples (150,000 baht)
Total 370,000 baht

Appendix 6

Ethical Approval

AF 02-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University
Jamjuree 1 Building, 2nd Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand.
Tel/Fax: 0-2218-3202 E-mail: eccu@chula.ac.th

COA No. 173/2016

Certificate of Approval

Study Title No. 073.2/59 : EFFECTIVENESS OF AN EDUCATIONAL PROGRAM TO PROMOTE PESTICIDE SAFETY AMONG VEGETABLE FARMERS IN DELHI, INDIA: A QUASI EXPERIMENTAL STUDY

Principal Investigator : MR. AJIT PAL SINGH RAINA

Place of Proposed Study/Institution : College of Public Health Sciences, Chulalongkorn University

The Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University, Thailand, has approved constituted in accordance with the International Conference on Harmonization – Good Clinical Practice (ICH-GCP).

Signature: ..... Signature: .....
(Associate Professor Prida Tasanapradit, M.D.) (Assistant Professor Nuntaree Chaichanawongsaroj, Ph.D.)
Chairman Secretary

Date of Approval : 10 October 2016 Approval Expire date : 9 October 2017

The approval documents including

1) Research proposal
2) Patient/Participant Information Sheet and Informed Consent Form
3) Researcher
4) Questionnaire

Protocol No. 073.2/59
Date of Approval 10 OCT 2016
Approval Expire Date - 9 OCT 2017

The approved investigator must comply with the following conditions:

1. *The research/project activities must end on the approval expired date of the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (RECCU). In case the research/project is unable to complete within that date, the project extension can be applied one month prior to the RECCU approval expired date.*
2. *Strictly conduct the research/project activities as written in the proposal.*
3. *Using only the documents that bearing the RECCU's seal of approval with the subjects/volunteers (including subject information sheet, consent form, invitation letter for project/research participation (if available).*
4. *Report to the RECCU for any serious adverse events within 5 working days*
5. *Report to the RECCU for any change of the research/project activities prior to conduct the activities.*
6. *Final report (AF 03-12) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project. For thesis, abstract is required and report within 30 days after the completion of the research/project.*
7. *Annual progress report is needed for a two- year (or more) research/project and submit the progress report before the expire date of certificate. After the completion of the research/project processes as No. 6.*

WAIVER OF ETHICAL REVIEW OF HUMAN RESEARCH

PLOT NO. 46-A, SECTOR A, SANWER ROAD INDUSTRIAL AREA, INDORE (M.P), INDIA – 452015; EMAIL – BIOVARUN2@GMAIL.COM

Submitting to the Chair of the Human Subject Research Committee (HSRC) through the Office of Bio Vaccines

Request for Waiver

It is important to note that waiver of the requirement for ethical review is only permitted in very limited circumstances and such a waiver does not release researchers from any other applicable legal obligations such as violating a person's right to protect privacy, fulfilling copyright requirements etc.. If your study does not meet one of the following requirements, you will be required to apply for ethical approval.

Following represents the reason this research qualifies for a waiver from ethical review:

[ ] ~~This research is limited to the use of materials that are in the public domain and for which all applicable copyright, patent, or other legal requirements and approvals have been either fulfilled or received. Databases must be supplied to the researcher in a completely anonymous form (attach a description of the materials you will use, all required approvals or permissions to use these materials and describe your methods).~~

[ ] ~~This research involves a living individual in the public arena, or is about an artist, based exclusively on publicly available information, documents, records, works, performances, or archival materials (attach a brief description of this research, including the name of the individual who will be the object of the research, your methods, and the types of materials you will be using in the course of the research).~~

✓ This is a cross sectional study with behavioral interventions, performance review or testing within normal or minimal discomfort to participants (attached description of who will participate in the study, the context of the study, your methods, and copies of materials such as questionnaires etc.).

[ ] ~~This study involves observation of participants who are seeking public visibility such as speakers at public political demonstrations, public meeting etc (attach a description of the types of people involved, the context in which the research will be conducted and your methods).~~

Applicant Information

Principal Investigator:	**Ajit Pal Singh**
Mailing address:	M 41, Malviya Nagar, New Delhi, India 110017
E-mail address:	Ajitsingh146@hotmail.com; **Ajitpal.singh@hillemanlabs.org**
Phone number(s):	**9971316999**

Supervisor (if applicable)

Name of Supervisor:	**Dr R S Chapman**		
E-mail address:	**Rschap0421@gmail.com**	Phone:	**0894893990**

Project Information

Title of the Project:	EFFECTIVENESS OF AN EDUCATIONAL PROGRAM TO PROMOTE THE SAFE USE OF PESTICIDE AMONG VEGETABLE FARMERS IN INDIA: A QUASI EXPERIMENTAL STUDY

Have you applied for funding for this project? ☐ No ☐ Yes (if "Yes" complete the following):

Source(s) of funding:	Exact title of grant(s):
Chulalongkorn University	72 year Scholarship from CU

Document Submitted:

1	**Study Proposal**
2	**ICD/ICF**
3	**Study Questionnaire in Hindi and English**
4	**CV of Researcher**
5	**EC submission and correspondence to Chulalongkorn University**

Note: Investigators are NOT employees (research assistants etc.)
If investigators change, provide this information to the Chair, Human Subjects Research Committee.

Proposed Start Date:	**Q3 2017**

Research Project Approved/ Waived ☐No ☐Yes

Signatures

EC Secretary: ATTESTED Date: 28.10.2017

Dr Devesh Gupta, MBBS, MD

Appendix 7

Educational Tool

REFERENCES

VITA