Determination of Pesticide Residues in Commonly Consumed Vegetables

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Background information

Pesticides

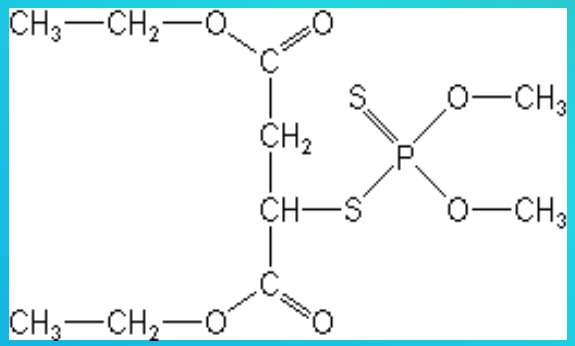
- used extensively on vegetables to obtain a high yield (Raheja[12])

- not used recommended dosage → **accumulation** in the environment (Howard *et al*., [6])
- Irrational & continual use on vegetable →

Organophosphates (OP) and Carbamates

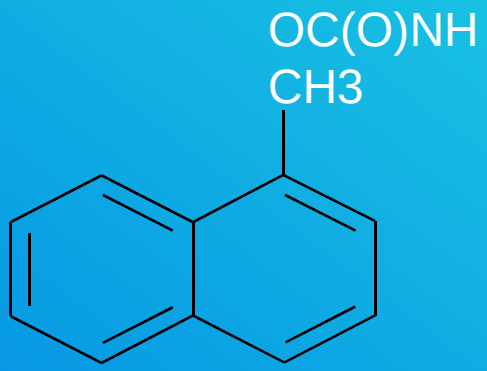
OP

X^1 or X^2 = O or S
Y = methyl or ethyl
R = miscellaneous groups



Malathion

Carbamates



Carbryl

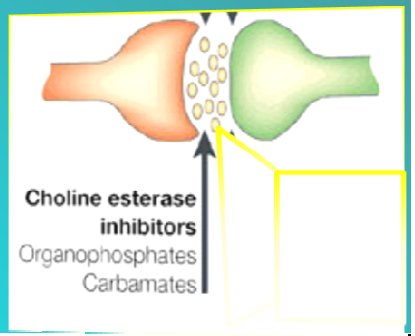
Synthetic Organophosphorus Pesticides (OPs)

- most widely used pesticides
- unacceptable levels of environmental residues in many countries worldwide
- not persistent, cause broad area pollution from continued use in agriculture and public health (DebMandal *et al.*, [3])

Carbamates

- less toxic

Toxic action of OPs and carbamate



▼acetylcholinesterase

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accumulation of ACh

↓

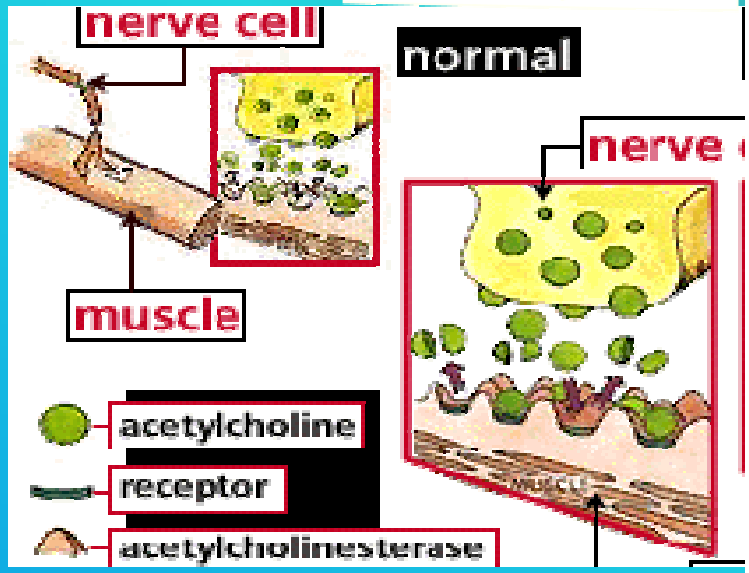
Generalized
cholinergic action

↓

rapid, uncontrolled twitching of voluntary muscles

↓

paralysis, respiratory failure and death



Health problems associated with chronic pesticide toxicity (long-term low doses exposure)

- cancers,
- congenital malformations,
- neurological disorders,
- infertility,
- blood dyscrasias,
- immunological disorders,
- liver and kidney damage,
- skin alterations
- worsening of existing health conditions

(Sesline and Jackson[14], Jobling *et al.* [7],)

Facts of previous studies

- currently used pesticides in Myanmar were mainly OPs (Mya-Thwin and Thet Thet-Mar[10])
- irrational use of OPs in vegetable agriculture (Steve Butkus and Myint Su[10])
  - revealed that residual OPs and carbamate pesticides in vegetables should be undertaken
  - delivering of safe food to local people in study area

Analytical methods

- Gas chromatographic and high performance liquid chromatographic techniques
  - expensive, time consuming
  - advantage -measuring the amount of pesticides to compare the result with Maximum residue levels
- Test kit
  - highly sensitive, very easy to use and can provide necessary residue information fastly and reliable results at low price (Zweig, G[17])

Table-1: Efficiencies of testing GT kit (Thoophom G[15])

Detection limit	**as Trichlorfon = 0.05 mg/kg** **Value of inhibition 50%**	
Efficiencies of kit	Sensitivity	92.3%
	Specificity	85.1%
	Accuracy	87.1%
	Positive predictive value	70.6%
	Negative predictive value	96.6%

Objectives

General Objective

- To detect OPs and carbamate pesticide residues in vegetables by colorimetric test kit (GT-test kit)

Specific Objectives

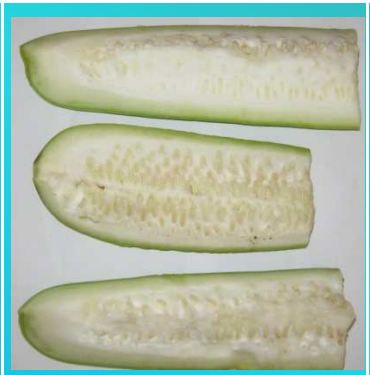
- To carry out sixty-four kinds of vegetables collection from Ahaya Thuka Market in Nay Pyi Taw in hot season
- To detect OPs and carbamate pesticide residues in sixty-four kinds of vegetables by GT-test kit

Materials and Methods

Collection of vegetable samples and analysis

- Sixty-four kinds of vegetables purchased from Ahaya Thuka Market in Nay Pyi Taw in hot season, 2013
- Biochemical Research Unit, DMR (CM)

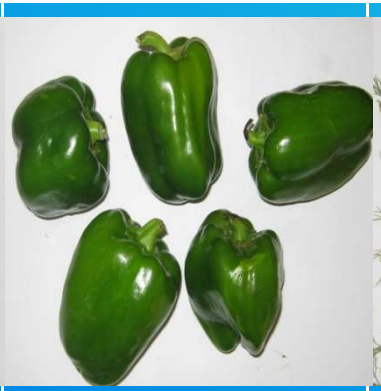
				
Bitter gourd	Gyu-myit	Mustard	Spinach	Mint
				
Bottle gourd shoot	Pumpkin shoot	Morinda leave	Chinese cabbage	Phat-pal

				
Asiatic pennywort	Pumpkin	Ash Pumpkin	Bottle gourd	Cauliflower
				
Broccoli	Cabbage	Celery cabbage	Apple green eggplant	Green goddess eggplant

				
Chinese eggplant	Hawaiian Eggplant	Thai eggplant	Pea eggplant	Tomato
				
Chayote	Cucumber	Ribbed luffa	Okra	Maize

				
Babycorn	Radish	Carrot	Kohlrabi	Potato
				
Taro	Long bean	Pe-pazun	Pe-zaung-ya	French bean

				
Green bean	Bean sprout	Chinese Kale	Green mustard	Water cress
				
Roselle	Chinbaung-khar	Lettuce	Za-yit	Chayote shoot

				
Pe-ywet	Gway-dauk	Garlic	Onion	Spring onion
				
Chili	Sweet pepper	Sameik	Coriander	Parsley

			
Shan nan-nan	Pyindaw-thein	Pinzein	Tong-ho

Detection on pesticide residues using GT test kit

GT Accessories box

- Plastic holder basket/all equipment/1
- Modified warm water tray /1
- Plastic dropper /12
- Aquarium air pump with evaporated kit/1
- Themometer/1
- Plastic bottle /5
- Test tube /18
- Glass dropper /5
- Rack /1
- Testing handbook/1

GT test kit (Pack 1)

- Solvent-1 (45ml)/1
- Solvent-2 (13ml)/1
- GT-1 (5.5ml)/1
- GT-2 (25 Tests)/1
- GT-2.1 (25 Tests)/1
- GT-3 (12 Tests)/1
- GT-3.1 (12 Tests)/1
- GT-4 (5.5ml)/1
- GT-5 .5ml/1

Extraction and Detection for pesticide analysis

Finely Chopped &

Poured 5g

Added 5ml solvent 1 , shook well & left for **15 mins**

pipetted 1cc of sample extract & + 1 ml of solvent 2 into a test tube, placed the tube into an Eva. basin Heated solvent 1 L. layer

evaporated

Labelled and filled in 3 new test tubes :" Cut" tube 0.25 cc of solvent 2

"Control"tube: 0.25 cc of solvent 2

"Sample" tube: 0.25 cc of sample extract

Added 0.50cc of GT-1, left for **10 mins**

GT-2.1 +GT-2 = mixed solvent GT-2

GT-3.1 + GT-3 = mixed solvent GT-3

Added 0.375cc of “mixed solvent GT-2” into :" Cut" tube , Added 0.25cc of “mixed solvent GT-2” into "Control"tube and "Sample" tube and leave for **30mins**

Added 1cc of “mixed solvent GT-3” into each test tubes followed by 0.5cc of GT-4. Shake well , add 0.5cc of GT-5, shake well, compared and analyzed the colors with the reference table

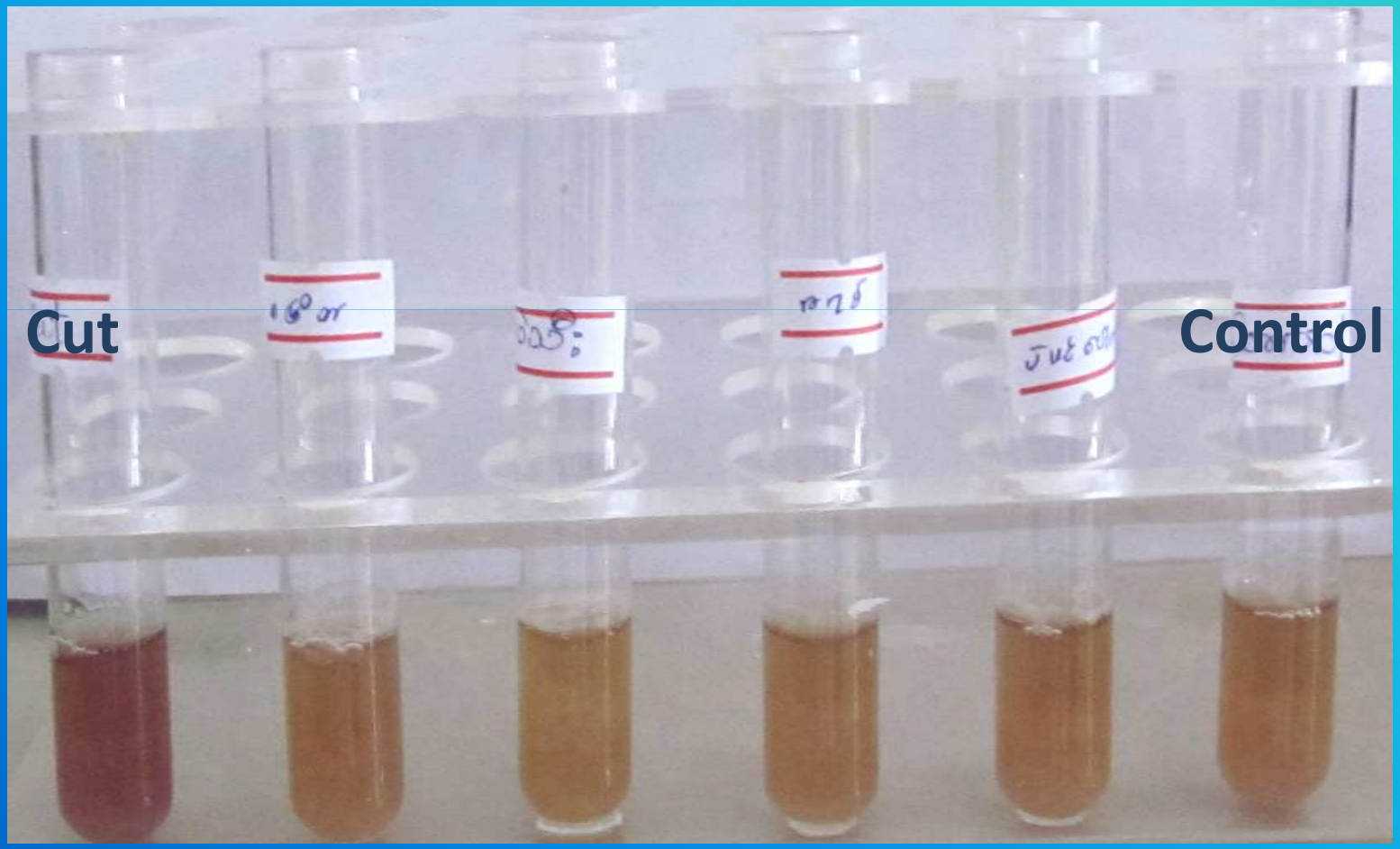
Result Evaluation: compare color in the tubes

Reading result table		
Color in sample tube(s)	Result	Color in sample tube(s)
Sample tube has less color than control tube.	1. Not Detect	Sample tube has less color than control tube.
Sample tube has greater color than control tube.	2. Detect but safe to be consumed	Sample tube has greater color than control tube.
Sample tube has greater color than critical tube.	3. Detect and not safe	Sample tube has greater color than critical tube.

Results

Testing remnant of pesticide residues by using GT test kit

Results of some vegetables showing no detection



Results of some vegetables showing no detection

color of 28veg. sample tubes ≤ control tube

↓

not detected in these vegetable samples

1. cauliflower
2. chayote
3. potato
4. carrot
5. coriander
6. lettuce
7. pe-pazun
8. babycorn
9. french bean
10. green goddess eggplant
11. Hawaiian egg plant
12. chinese kale
13. chinbaung-khar
14. pinzein
15. gway-dauk
16. pyindaw-thein
17. water cress
18. chayote shoot
19. pe-zaung-ya
20. okra
21. chinese egg plant
22. Thai egg plant
23. shan-nannan
24. sameik
25. za-yit
26. bean sprout
27. long bean
28. pe-yote

Results of some vegetables showing detection but safe

Results of some vegetables showing detection but safe for consumption

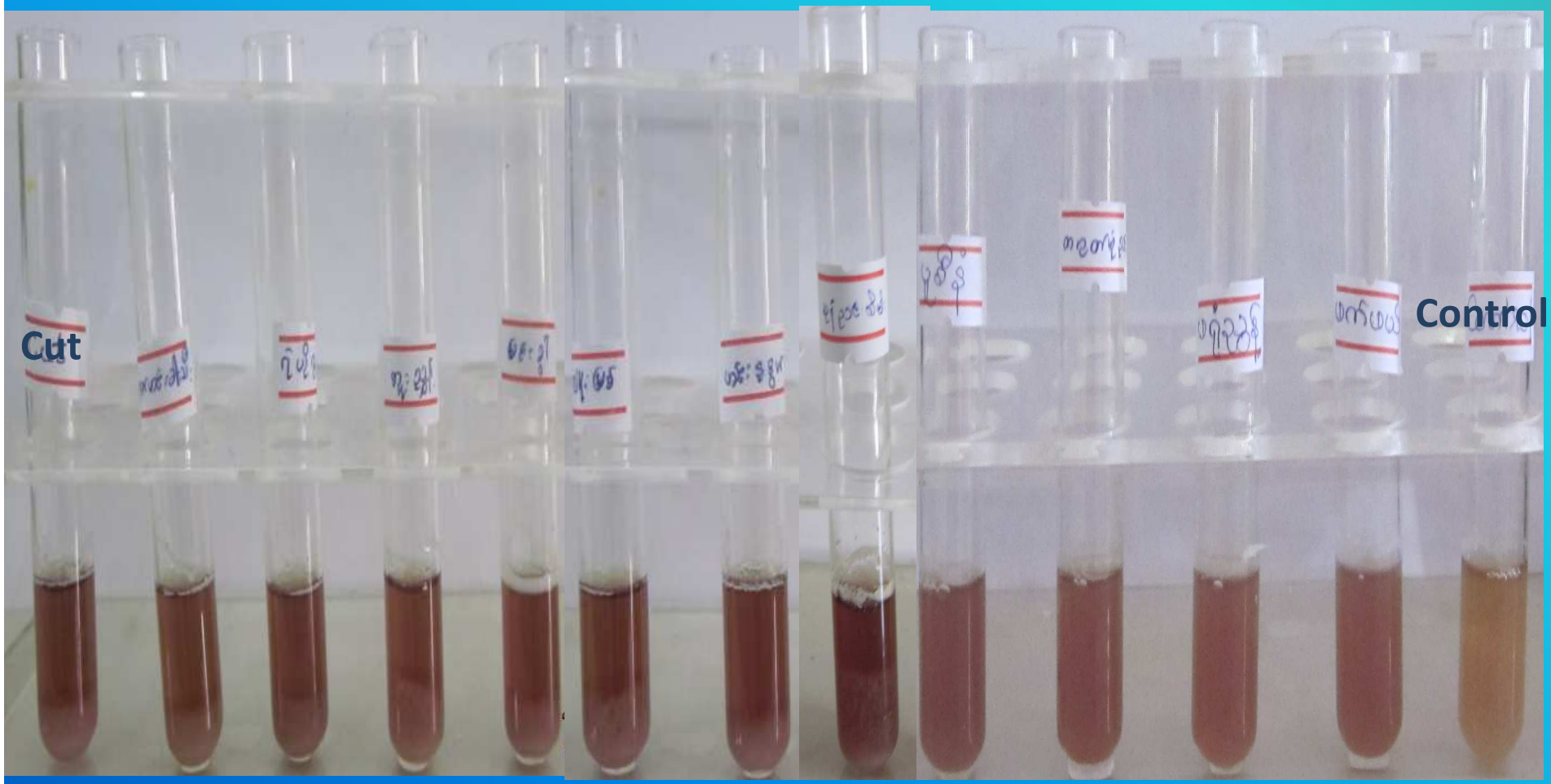
color of 25 veg. sample tubes > control tube but < cut tube

↓

detection of cholinesterase enzyme inhibition but safe for consumption

1. **pumpkin**
2. **bottle gourd**
3. **radish**
4. **tomato**
5. **cucumber**
6. **celery cabbage**
7. **garlic**
8. **onion**
9. **taro**
10. **sweet pepper**
11. **cabbage**
12. **parsley**
13. **green pea**
14. **spring onion**
15. **kohlrabi**
16. **chili**
17. **roselle**
18. **ribbed luffa**
19. **maize**
20. **broccoli**
21. **pea eggplant**
22. **tong-ho**
23. **mustard green**
24. **chinese eggplant**
25. **ash pumpkin**

Results of some vegetables showing detection and unsafe



Results of some vegetables showing detection and unsafe for consumption

color of 11 veg. sample tubes > control tube but = cut tube

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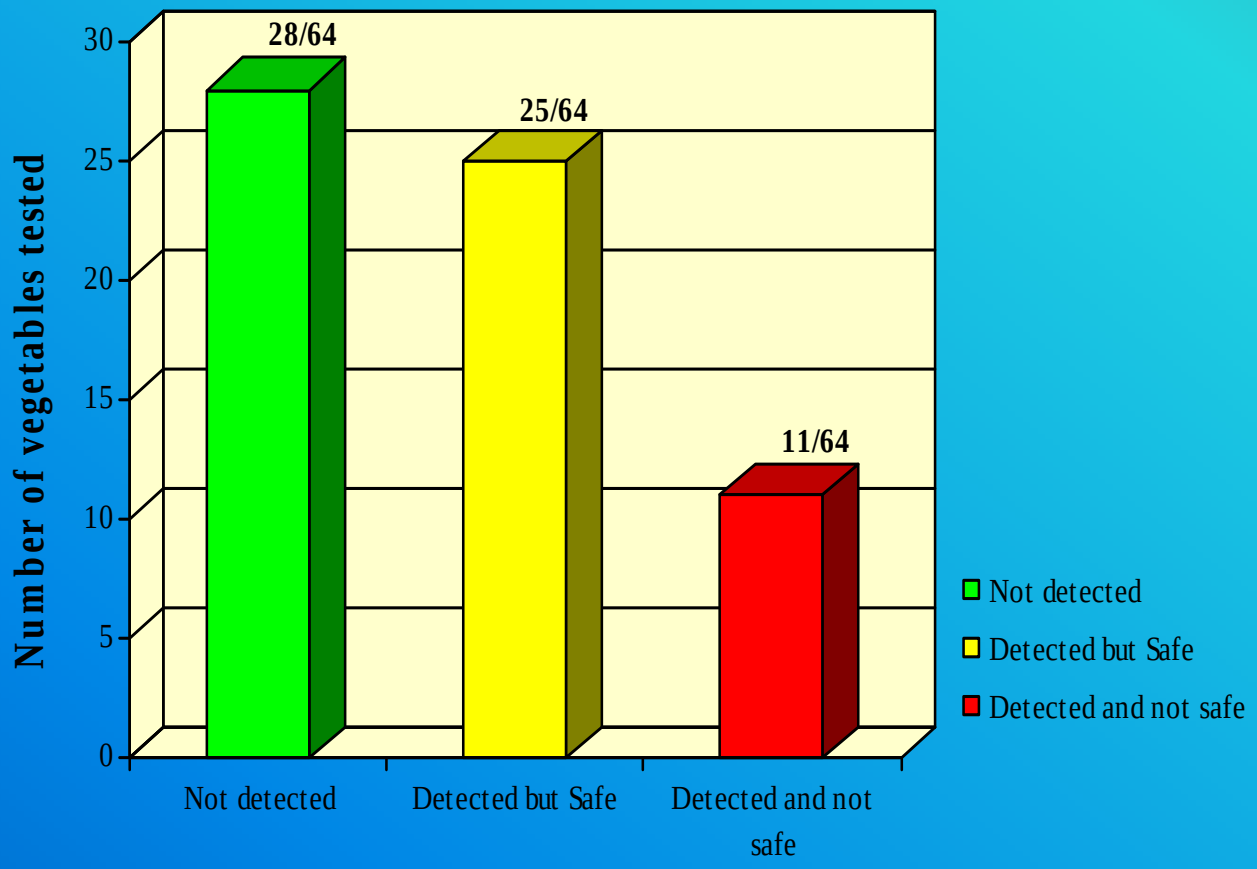
detected and unsafe for consumption

1. bitter gourd
2. morinda
3. asiatic pennywort
4. indian leek (gyu-myit)
5. spinach
6. mustard
7. mint
8. chinese cabbage
9. shoot of pumpkin
10. bottle gourd
11. phat-pal

Detection percentage results of vegetables for OPs and carbamate pesticide residues analysis

Sample	Not detected (0% inhibition)	Detected	
		Safe (< 50% inhibition)	Unsafe (≥ 50% inhibition)
Vegetables 64 samples	28 (43.75%)	25 (39.06%)	11 (17.19%)

Results of vegetables for OPs and carbamate pesticide residues analysis using column chart



Discussion and Conclusion

Assessing the purchasing vegetable

- 28 vegetable samples had no ▼ of cholinesterase enzyme **- not detected**
- 25 vegetable samples had < 50% ▼ - **safe for consumer & within in the acceptable safety level**
- l1vegetable samples - ≥ **50%** ▼ unsafe & not removed by washing out

Conclusion

- to increase public awareness of using unsafe vegetables contaminated with pesticide residues
- awareness of the farmers should be raised on safe and judicious use of pesticides
- could not provide specific name and quantity of organophosphate and carbamate

Recommendation

- further study should be survey to vegetables farm to know the specific names of pesticides
- pesticide analysis should be carried out by modern analytical techniques (high performance liquid chromatography and gas liquid chromatography)
- more extensive monitoring investigations covering all vegetables from different regions of Myanmar should be carried out to find the exact position of pesticide residues

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Thank You!