Research Article

Contamination of Fruits and Vegetable through Pesticides and their Harmful Effect in India

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ABSTRACT

In the thirst of modernization and industrialization man has contributed pollution to the life and ecology of plants, animals and microbes. Increased demand for food and fiber has lead to the chemicalization of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizer and pesticides.In the existing study, an effort has been made to evaluate and determine residues of pesticides in vegetables, fruits and it shows an attempt to assess the health hazards faced by the consumers through possible ingestion of toxic chemicals contained in the fruits and vegetables.

Key words: Fruits, Health hazards, Liquid chromatography (LC)/Mass spectrometry (MS).

I. INTRODUCTION

Pesticides are substances utilized with the intent to deter or kill any kind of pest that poses a threat to vegetable. However, the pesticides that have this lethal quality towards insects, vermin, and plant diseases pose significant health risks towards humans as well. When disposed of improperly, they remain in the ecosystem, travelling through the food chain to humans.

As the health risks of pesticides have become more widely recognized, many countries have enacted strict regulations regarding pesticide use. However, in many developing countries quality control is irregular, disposal is unsafe, and hundreds of tons of obsolete pesticides lie in storage, posing a risk to the surrounding environment. Health risks associated with various pesticides include chemical burns, respiratory failure, pulmonary edema, bronchioconstriction, respiratory muscular paralysis, cardiac arrhythmias, epileptic seizures, headaches, nausea, skin rashes, fatigue, blindness, permanent psychological damage, and death.

The orga-nophosphate, organochlorine and related pesticides act by binding to the enzyme acetyl cholinesterase,disrupting nerve function, resulting in paralysis and may cause death[1].They may produce acute and chronic toxicity. The acute effects manifesting as miosis, urination, diarrhea, diaphoresis, lacrimation, excitation of CNS and salivation[2].The chronic exposure involves neurotoxic and behavioral effects[3].Pesticides can also interfere with drug metabolizing enzymes especially cytochrome P_{450} leading to drug interactions[4].About 27% of the pesticides being consumed in India are used on fruits and vegetables. Setting a balance between risk and methods to increase agricultural productivity is particularly important for developing countries[5].The monitoring of pesticide residues in food is now a days a priority objective in pesticide research in order to get extensive evaluation of food quality and to avoid possible risks to human health. To ensure the safety of the US food supply, the Environmental Protection Agency (EPA) sets a tolerance or maxi-mum residue limit (MRL), which is the amount of pesticide residue that may lawfully remain in each food commodity that has been treated with a pesticide[6].

The aims of this investigation were two fold: The analysis of the levels of pesticide residues in vegetables, fruits and pesticide residue contamination produce hazardous effect to human. Indirectly, the outcome will contribute to the achievement of risk reduction measured mainly in terms of pesticide residues in fruits and vegetable (both imported and grown domestically), and acute health hazard to the users.

II. METHOD AND MATERIAL

Study of pesticide residues in different fruits and vegetable

Table 1: Pesticide residues in Apple

Granny Smith Green Apple					
S/N	**Pesticide**	**Maximum residue limit (mg/kg)**	**No wash**	**Lukewarm water wash**	**Salted lukewarm water wash**
1	Pyraclostrobin	0.3	0.07	ND	ND
2	Dithiocarbamates	3	2.8	1.6	1.3
3	Dodine	5	3.8	2.7	2.4
4	Acetamiprid	0.1	0.03	ND	ND
5	Diphenylamine	5	6.9	5.9	3.7
6	Dithiocarbates	3	1.9	1.5	1.3
7	Imazalil	5	4.8	4.3	3.4
8	Phosmet	10	9.8	8.4	5.6
9	Pirimicarb	1	0.08	ND	ND
10	Chlorpyrifos	0.5	3.1	2.9	1.4
11	Captan	3	2.2	1.7	1.4
12	Dithiocarbates	3	2.9	2.7	2
13	Malathion	0.5	1.7	1	0.09
14	Thiacloprid	0.3	0.2	0.01	ND
15	Thiabendazole	10	44.4	34.7	29

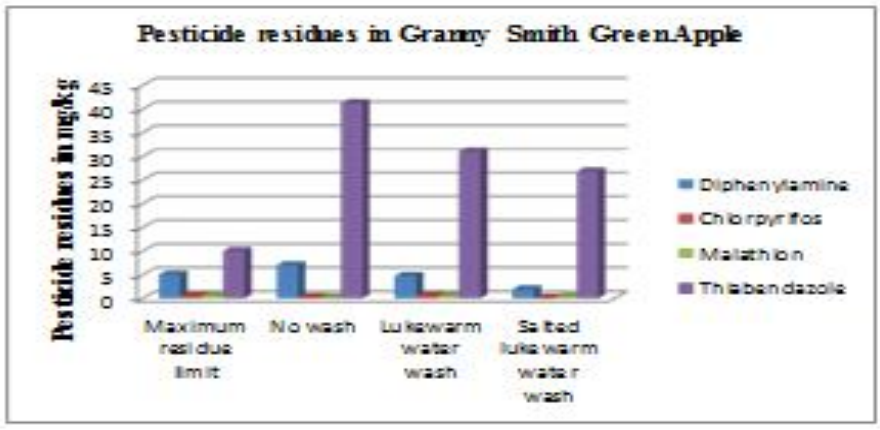


Table 2: Pesticide residues in Grape

Green grapes					
S/N	**Pesticide**	**Max residue limit (mg/kg)**	**No wash**	**Lukewarm water wash**	**Salted lukewarm water wash**
1	Imazalil	5	7.6	6.3	5.5
2	Thiabendazole	10	35.5	14.3	13.5
3	Phosmet	10	11.8	7.7	5.3
4	Decamethrin	0.05	0.01	ND	ND

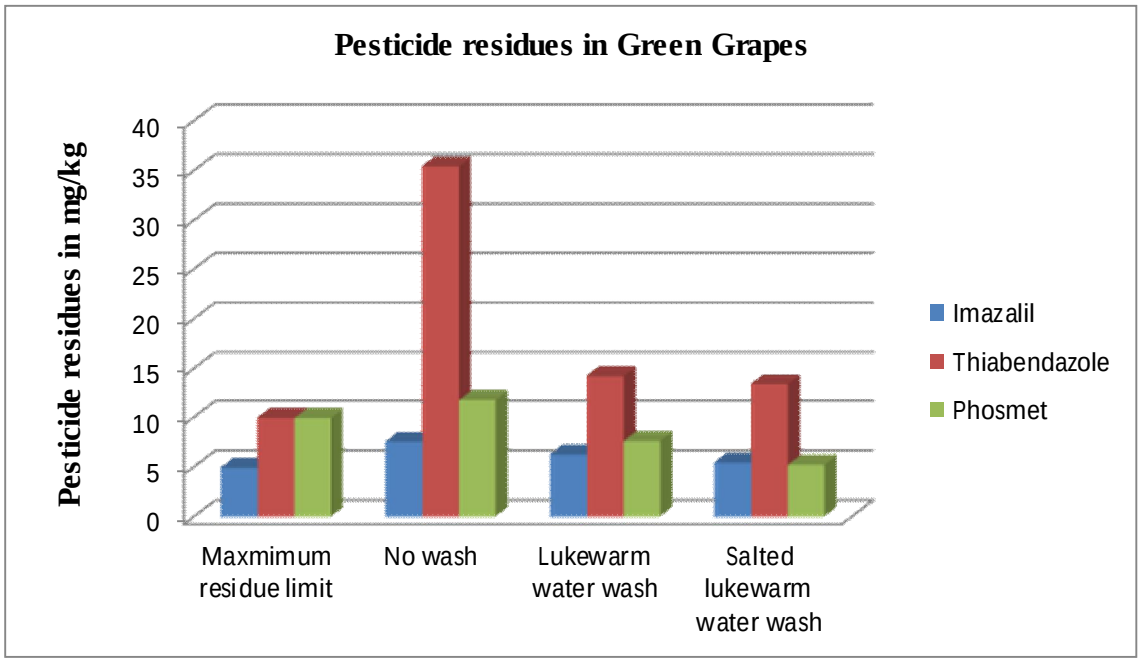


Table 3. Pesticide residues in Brinjal.

Brinjal					
S/N	Pesticide	Maximum residue limit (mg/kg)	No Wash	Lukewarm water wash	Salted lukewarm water wash
1	Diphenylamine	5	10.4	7.9	4.7
2	Imazalil	5	3.9	2.6	1.2
3	Phosmet	10	8	7.3	5.8
4	Chlorpyrifos	0.5	1.6	0.9	0.06
5	Thiabendazole	10	47.1	30.3	16.3
6	Chlorothalonil	0.1	0.7	0.3	ND
7	Endosulfan	2	3	2.7	1.2
8	Acephate	2	7.2	6.3	3

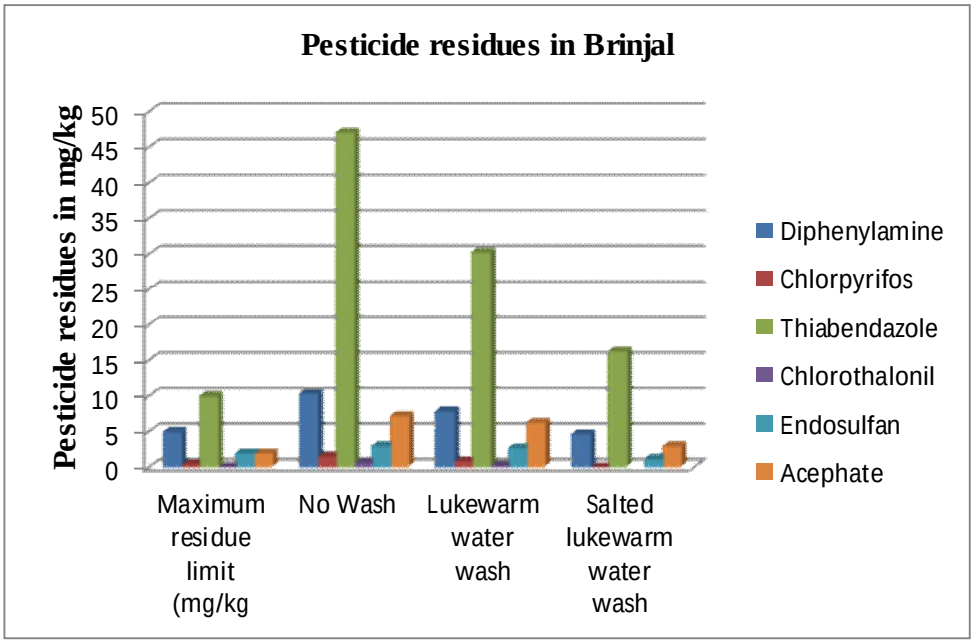


Table 4: Pesticide residues in Tomato

S/N	Pesticide	Maximum residue limit (mg/kg)	No Wash	Lukewarm water wash	Salted lukewarm water wash
1	Endosulphan	2	2.2	1.9	1.5
2	Thiabendazole	10	42.5	28.7	15.9
3	Phosmet	10	8.4	6.3	2.6
4	chloropyrifos	0.5	0.14	ND	ND

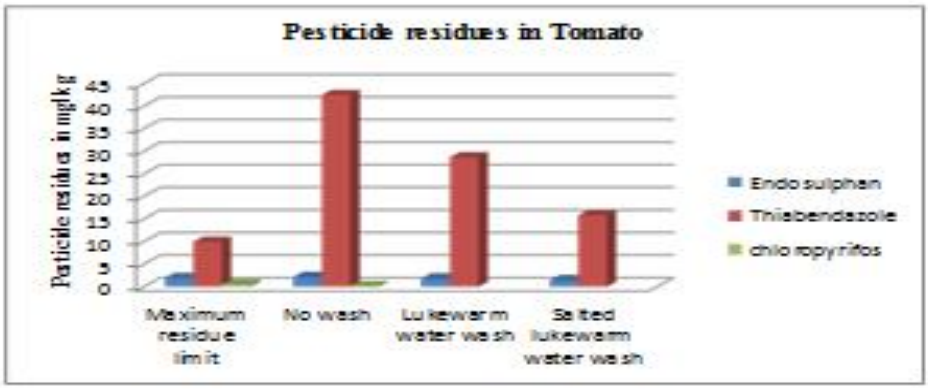
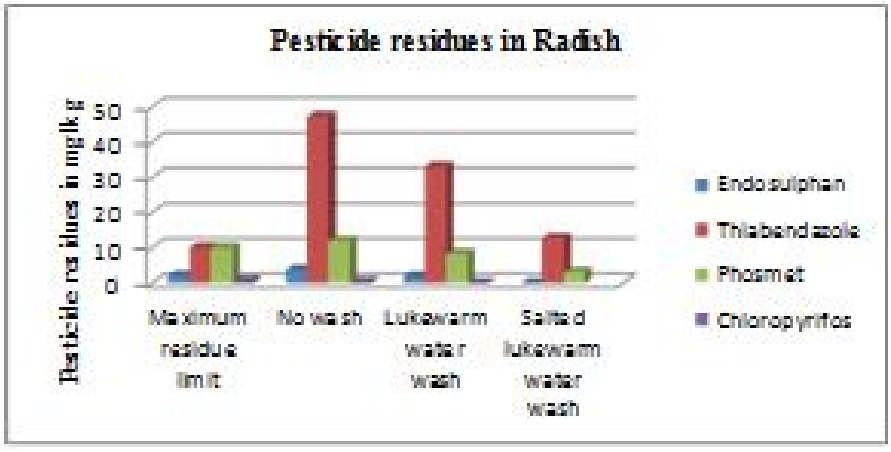


Table 5: Pesticide residues in Radish

S/N	Pesticide	Maximum residue limit (mg/kg)	No Wash	Lukewarm water wash	Salted lukewarm water wash
1	Endosulphan	2	3.7	1.8	0.025
2	Thiabendazole	10	47.3	33	12.8
3	Phosmet	10	12	8.4	3.1
4	Chloropyrifos	0.5	0.23	0.02	ND



The developed combination of the methods described above permitted the fast and easy qualitative screening of target pesticides in a 45 min LCMS/ MS run. Although the manual evaluation of the given chromatograms increased the analysis time by an additional 15 min per sample, very little time, cost and labour was spent on sample preparation. In

the case of dirty samples, some false indications were observed, but these were caught by the use of the MRM confirmatory and quantitative method for the more common pesticides. The construction of standard addition calibration was carried out with the same extract that was previously injected for screening the compounds. A large calibration database in different matrices was collected to show the consistency of the average calibration slope, which helped us check the accuracy of the calculated results from the method of standard additions[7,8,9].

III. Reasons for more pesticide residues in India

1. **Indiscrimate use of pesticides**
   The use of pesticides is comparatively more in certain crops while in some it is negligible. The farmers use pesticides more frequently and in increased doses than the recommended doses or procedures. It leads to the presence of high amount of residues in food commodities.

2. **Lack of education**
   Most of the farmers or labours working in the agricultural fields are either illiterate or having low formal education. They are not able to understand and read the instructions mentioned on pesticide containers or in the literature supplied with them. Their tendency is to use comparatively higher quantity of pesticides than recommended by the scientists/manufacturers. They ignore the required dilution factor and use much higher concentration of the pesticides. They are even not aware of the harmful effects of the pesticides and do not properly dispose the used containers of the pesticides.

3. **Lack of extension activities**
   In spite of Krishi Vigyan Kendra, Krishi Gyan Kendras and a network of extension workers of the Government/ NGO's, there is a lack or deficiency in proper extension activities in India. The farmers are not fully aware about how to use pesticides.

4. **For want of more production and profit**
   Most of the farmers have impression in their mind that spray/ use of more pesticide will lead to higher production. Therefore, the desire of more production and profit leads to indiscrimate use of pesticides in crops which ultimately enters in the food chain.
   To confirm above information a questionnaire was prepared and all 250 farmers were asked to respond. The responses were recorded in a tabular form, given below.

S/N	Questions Asked	Positive Response	Negative Response
1	Basic training	1%	99%
2	Mixture of pesticides used	98%	2%
3	Precaution followed	74	26
4	Pesticide poisoning	2%	98%
5	Chronic diseases	95%	5%
6	Pesticides kept in safe place	20%	80%
7	Gradual increase in pesticide use	100%	-

IV. STATUS OF PESTICIDE RESIDUES IN INDIA

The presence of pesticide residues have been detected in various fruits and vegetable. The levels of the pesticides are found much higher than expected level because of heavy contamination of environment. The perusal of literature in this regard reveals the studies directed towards when a large number of pesticides are present and their combined effect has not been measured; which of course will give very dangerous view. Various effects of pesticides in man are as under: carcinogenic effect[10,11], genotoxicity[12], immunotoxicity[13], dermatologic health effects[14], nervous system disorders[15].

V. RESULT

The overall residue levels of all pesticides tested showed significant improvement with values going down anywhere from 50 to 80% when compared against no wash readings. However, at this stage more washing will be required to bring the residue levels closer to MRL. On analyzing the collected data, we

know that majority of the farmers are illiterate and a small group are educated/ literate. It has also been found that 99% of the farmers are not at all trained and do not know the proper use of agro-chemicals, they simply use these by learning from their elders, which may not always be correct. Most of the farmers mix two or more pesticides and spray them in the field. This is a very harmful practice both for the farmer and the environment. It has also been noticed that most of the farmers suffer from general ill health and chronic diseases. These can be due to the side effects caused by the handling of these harmful chemicals. Moreover they hardly follow any precautions before and after spraying the chemicals in the field.

VI. CONCLUSION

In summary, the study reflected that, no produce can be consumed right after it is purchased from the market. It may be safe to pick produce and consume right away on smaller farms. The survey reports from the farmers indicated the following:

1. Farmers use IPM (Integrated Pest Management)
2. Pest management which relies on common sense and information about pests and pesticides in farm.
3. Used to lessen the pest damage with least harm to humans, plants, and their environment.
4. Big farmers use pesticides heavily, but with a gap of 10 to 14 days before each application.
5. Small farmers do not have the space or need to use heavy pesticides. Most produce can be eaten right after picking without washing.
6. However, large farmers, because of the size rely more heavily on pesticides.
7. Large farmers employ sophisticated cleaning mechanisms before the product is sold.

These are useful for generating hypotheses and suggesting future directions for observational studies.

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