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Effects of Pesticides on Human Health

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1. Introduction

Pesticides are chemical and biological products which have been specifically developed to control pests, weeds and diseases particularly in the production of food. Pests, weed and diseases can all have devastating effects on the quantity and quality of crops grown for human consumption and without pesticides we could lose one third of world crops each year. There are several classes of pesticide including insecticides (control insect infestations), fungicides (control the spread of fungal diseases), herbicides (control the competing effects of weeds), molluscicides (control the destructive effects of slugs and snails) and rodenticides (control the activities of rats and mice).

Pesticides are sprayed onto food, especially fruits and vegetables, they secrete into soils and groundwater which can end up in drinking water, and pesticide spray can drift and pollute the air. Pesticides are found as common contaminants in soil, air, and water, and on non-target vegetation in our urban landscapes. Once there, they can harm plants and animals ranging from beneficial soil microorganisms and insects, non-target plants, fish, birds, and other wildlife. Animals may be poisoned by **pesticide residues** that remain on food after spraying, for example when wild animals enter sprayed fields or nearby areas shortly after spraying. Problems which have been identified as a result of mishandling and misuse of pesticides include: health hazard to applicators and workers in pesticide production plants; and residues in food and export crops.

Pesticides can enter the human body through inhalation of aerosols, dust and vapor that contain pesticides; through oral exposure by consuming food and water; and through dermal exposure by direct contact of pesticides with skin. Roughly 90 percent of pesticide intake is ingested with food; much of the remainder has its source in pesticide-contaminated air and water. Across the globe pesticides have been found in human blood, urine, breast milk, semen, adipose tissue, amniotic fluid, infant meconium and umbilical cord blood.

A small amount of some toxins has quick action and can kill within short period. And other toxins that are slower acting, may take a long time to cause harm to the human body. Children seem to be greatly susceptible to the toxic effects of pesticides. Researchers report the dangers of pesticides can start as early as fetal stages of life. What you also need to understand is that toxins from pesticides can remain in the body and build up in the liver. And, even at "safe" levels your reactions can be mild to severe. High levels of exposure can be fatal. How do you know if you're going to be ill? You don't; you just have to hope for the best. How will you be affected? Well, you don't really know how you body will react to the toxins until it happens. Several factors determine how your body will react including your level of exposure, the type of chemical you ingest, and your individual resistance to the chemicals.

2. Pesticide Residues

Any pesticide that remains in or on food or feed is called a residue. When a crop is treated with pesticide, a very small amount of pesticide, or indeed what it changes to in their plant (its ‘metabolites’ or ‘degradation product’), can remain in the crop until after it is harvested. This is known as the ‘residue’. Pesticide residue may be present in:

- Fresh or tinned fruit and vegetables, or
- Processed food and drink made from the crop (e.g. juice, bread or any other manufactured food or drink),
- Fresh or processed animal products (if the animals have been fed on crop treated with pesticide).
- Fish and aquatic organisms in pesticide contaminated water.

The level or amounts of residues present are expressed in milligrams of the chemical in a kilogram of crop/food/commodity (mg/kg). These are very small amounts. 1 mg/kg is the same as 1 part per million (ppm).

2.1. Organochlorine residues in fish from LakeVictoria, Kenya. Eighty-two samples of either nile perch fish fat or muscle were collected from the Kenyan region of Lake Victoria for detection of organochlorine residues. Nine organochlorine residues were detected in the following percentages: α-BHCIHCB-40%; P-BHC/HCB-40%; y-BHC/HCB/lindane-4%; aldrin-9%; dieldrin-1%; p, p'-DDE-73%; p, p'-DDD-9%; o, p'-DDT-170; and p, p'-DDT-11%. All levels of organochlorine residues were below the Maximum Residue Limit (MRL), apart from just one sample of fish fat which had 4.51 ppm of DDT above MRL (Mitema, 2009).

2.2.Analysis of environmental chemical residues in products of emerging aquaculture industry in Uganda. A study was conducted to analyse market-regulated heavy metals (lead, mercury and cadmium) and organochlorine pesticides in samples of 38 farmed fish comprising Nile tilapia (*Oreochromis niloticus*) (20 samples) and African catfish (*Clarias gariepinus*) (18 samples) from ten selected fish farms in Uganda.

- Lead was detected in all the 38 samples (maximum = 1.08 mg kg^{-1} (dry weight)),
- Mercury in 31 out of 38 samples (maximum= 0.35mg kg^{-1} (dry weight)),
- Cadmium in two samples (maximum = 0.03 mg kg^{-1} (dry weight)).
- Pesticides detected were: 4,4'-dichloro-diphenyl-trichloroethane (DDT) and endosulfan sulphate, which were found in one fish sample (both 0.002 mg kg^{-1} (wet weight)).

The levels of contaminants were below the US Food and Drug Administration (USFDA) action levels and European Union maximum residue limits (MRLs) (Bagumire, 2008).

2.3. Organochlorine pesticide residues in paddy fish in Malaysia and the associated health risk to farmers. Paddy fish (*Trichogaster pectoralis* Regan) were collected from five sampling locations in a major paddy-growing area of Malaysia and analysed for organochlorine residues. Pesticide residues found in the fish samples were aldrin/dieldrin, chlordane, HCH, and DDT. Maximum intake level for aldrin/dieldrin approached the acceptable daily intake as recommended by FAO/WHO. However, this study considered only fish. Rice also makes up a large portion of the diet. Published values for DDT in rice show a mean of 200 ng/g. Besides the rice, the farmer may also ingest residues in vegetables, poultry, and pork. The total daily intake of pesticide residues by the Malaysian paddy farmer may be considerably increased by consumption of other contaminated food. Hence, the sum of all these separate components could exceed the FAO/WHO ADI for some compounds. It is thus not surprising that the mean residue level of organochlorine insecticides in the sera of paddy-farmers (185 ng/g) was nearly twice that found in the general Malaysian population. All possible routes of exposure (i.e., in food, water, and direct) should be considered when assessing the potential health risk to the Malaysian paddy farmers (Donald *et al*, 1984).

2.4. Residual Toxicity of different insecticides to *Channa punctata* (Nga panaw). The author observed that Kitazin 48% EC remained toxic to the test fish only for 2.4 days. In contrast, DDT 25% EC was degraded very slowly and residual toxicity on fish was 45 days (Table 1). The residual toxicity periods for Lindane L- 20 and Endrin 19.5% EC were 34 days and 28 days respectively. DDT 25% EC, Lindane L-20 and Endrin 19.5% EC were persistent in the water owing to its resistance to biochemical degradation and had long term residual toxicity. Such pesticides will prolong the exposure period to fish and may also produce delayed mortality and fish may take up some of the pesticide residues into their body. They should be replaced with insecticides of short term residual toxicity: Kitazin 48% EC,Elsan 50% EC,Padan 50% EC, EPN 45% EC, Diazinon 40% EC, Sumithion 50% EC and Furadan 3-G. (Kyaw Myint Oo, 1991).

Table 1. Residual toxicity of 10 different insecticides to *Channa punctata (Nga panaw)* (Kyaw Myint Oo, 1991)

No	Insecticide	Residual toxicity (days)
1	Kitazin 48%EC	2.4
2	Elsan 50% EC	4.8
3	Padan 50% EC	5.6
4	EPN 45% EC	7.0
5	Diazinon 40% EC	8.8
6	Sumithion 50% EC	10.0
7	Furadan 3-G	11.6
8	Endrin 19.5% EC	28.0
9	Lindane L-20	34.0
10	DDT 25% EC	45.0

2.5. Residues in fruits and vegetables. Below is a table of 27 fruits and vegetables that were tested by the US. Environmental Working Group for pesticide residue (Table 2). The foods are ranked from worst to best (descending). The table will tell you what percentage of that particular fruit/vegetable had pesticides on it and average amount (in ppm) of all pesticides found on each fruit/vegetable. For example, peaches were the worst. 96.6% of peaches had pesticides on them. Average amount of all pesticides found was 1.134 ppm.

Table 2. Residue in fruits and vegetables (US. Environmental Working Group for Pesticide Residue, 2008)

Rank (Worst to best)	Commodity	Combined Score	% of sample tested with detectable pesticides	Average Amount (ppm) of all pesticides found
1	Peaches	100	96.6 %	1.134
2	Apples	96	93.6%	0.894
3	Pepper	86	81.5%	0.138
4	Strawberries	83	92.3%	0.799
5	Cherries	75	91.4%	0.290
6	Pears	65	86.2%	0.586
7	Potatoes	58	81.0%	1.655
8	Carrots	57	81.7%	0.046
9	Green beans	55	67.6%	0.199
10	Cucumbers	52	72.5%	0.057
11	Plums	46	74.0%	0.666
12	Oranges	46	85.1%	0.100
13	Grapes	46	60.5%	0.104
14	Cauliflower	39	84.6%	0.004
15	Mushrooms	37	60.2%	0.158
16	Lemon	31	55.6%	0.188
17	Grapefruit	31	62.9%	0.056
18	Tomatoes	30	46.9%	0.029
19	Sweet Potatoes	30	58.4%	0.198
20	Watermelons	25	38.5%	0.021
21	Papaya	21	23.5%	0.053
22	Cabbage	17	17.9%	0.121
23	Bananas	16	41.7%	0.029
24	Mango	9	7.1%	0.057
25	Pineapples	7	7.1%	0.057
26	Avocado	1	1.4%	0.001
27	Onions	1	0.2%	0.000

2.6. Residues of Cypermethrin and Methamidophos on cauliflower at various intervals after treatment. The residues of Cypermethrin and Methamidophos on cauliflower at different time intervals after treatment are shown in Table 3. The data showed that the dissipation rate of methamidophos was slower than that of cypermethrin. The residues of both insecticides were detected even on 15th day after treatment, indicating their prolong persistence nature in cauliflower (Table 3).

Table 3. Residues of Cypermethrin and Methamidophos on cauliflower at various intervals after treatment. (Barkat Ali Khan, 2003)

Days after Treatment	Cypermethrin Residues(mg/kg)	Metamidophos Residues(mg/kg)
0	3.74	4.41
1	1.04	2.55
3	0.73	1.62
5	0.35	1.12
7	0.17	0.83
10	0.10	0.68
15	0.07	0.52

2.7. Pesticide residues in organisms of Malaysian waters. Organochloride compounds were widely used in rapidly developing countries in South East Asia for agriculture, pest control and for public health purposes. From the study in the Straits of Melacca, pp'-DDE pollution in mussel (***Perna viridis***) tissue from six stations on Penang Island ranged from 3.7 to 17.4 ppb (dry weight basis) and the concentration of 1.2 to 38 ppb for DDT was also found in tissue of the same species (Table 4).It can be said that the level of persistent organic chemicals in the Malaysian waters are still at the acceptable level and comparable to the results in other Southeast Asia countries. Today, it is believed that the level of persistent organic chemicals in Malaysia and Southeast Asia water had been increased because of rapid population growth and urbanization.

Table 4. Pesticide residues in organisms of Malaysian waters. (Somchit, 2009)

No	Organism	Location	Concentration
1	***Perna viridis*** **(Mussel)**	**Penang Malaysia**	**3.7 – 17.4 ppb (dry weight basis) pp'-DDE** **1.2 – 38 ppb DDT**
2	***Anader granosa*** **(Blood Cockles)**	**Penang, Malaysia**	**0.21 ppb Lindane** **0.08ppb Aldrin** **0.15 ppb Endrin**

2.8. Levels of organochlorine pesticide residues in meat. Organochlorine pesticide residues (Lindane, Aldrin, Dieldrin, Endosulfan, and DDT) were found in beef samples from Buoho abattoirs in Ghana . Results in table 5 indicate that the highest concentration of DDT in beef fat from Buoho was 844.28 ug/kg. This is about two times higher than the WHO recommended maximum residue limit of 500 ug/kg.The average concentration of 6.01 ug/kg Dieldrin recoreded from beef fat is higher than the maximum level of 6.00 ug/kg recommended by WHO. DDT residues, like the other organochlorines, concentrate more in the fat than in the muscle or lean meat.

Table 5. Levels of pesticide residues in beef fat from Buoho (ug/kg) (Darco, 2007)

	Lindane	Aldrin	Endosulfan	Dieldrin	DDT
Mean	1.79	4.11	2.28	6.01	403.82
SD	0.38	8.19	1.74	5.14	276.88
Max.	2.11	24.32	6.53	15.37	844.28
Min.	1.24	0.56	0.40	2.21	37.60

2.9. Organochlorine Pesticides BHC and DDE in human blood in and around Madurai, India. Blood samples are taken from two groups of people, one that has direct exposure to pesticides (agriculturists & public health workers) the second group, which has indirect exposure to pesticides through food chain. The objective of the investigation was to analyze the blood of the patients with minimum health complaints and skin diseases for the residue of the organochlorine pesticides DDE and BHC using Gas Chromatography. High concentrations of BHC and DDE were noted both in the serum of agricultural and non-agricultural people. The pesticide residue concentration in serum ranges from 0.006 to 0.130 ppm for BHC and 0.002 to 0.033 ppm for DDE (Kallidass, 2006).

The earlier studies on the residues of these pesticides in milk and infant foods showed increased residue levels beyond applicable limit. From 2,205 samples of bovine milk 85% of the milk samples contained HCH isomers (alpha, beta, gamma or delta) above the tolerance limits. In the case of gamma-HCH, 28% of samples were above the tolerance limit of 0.01 mg/kg. In the case of DDT, 82% of the milk samples were contaminated, about 37% of these have above the tolerance limit of 0.05 mg/kg as set out under the Prevention of Food Adulteration Act on a whole milk basis. More over the increased level of the BHC in the non agriculturalists and agriculturalists irrespective of their exposure either direct or indirect shows that this pesticide residue are highly accumulated in their serum by the contamination of their food by this pesticide rather than their exposure. This may be the reason for the persistence of these pesticides residues in both groups' agriculturalists and non-agriculturalists taken for this study.

2.10. Organochlorine pesticide residues in human milk of a Hmong hill tribe living in Northern Thailand. In December 1998 whole breast milk samples from 25 Hmong mothers living in the village of Mae Sa Mai, 40 km north of Chiang Mai City, Northern Thailand, were collected and analysed for DDT, heptachlor, HCB and HCH residues. DDT was detected in all samples with a median and maximum level of 209 and 2012 ng of total DDT isomers per millilitre of milk, respectively. The median and highest percentages of p,p'-DDT were 23.2 and 44.7%. In 15 samples heptachlor was detected in the metabolized form of heptachlor-epoxide with a median value of 4.4 ng/ml.

The estimated daily intakes of DDT, heptachlor and heptachlor-epoxide by the infants exceeded up to 20 times the acceptable daily intakes as recommended by the FAO and WHO. The mean sum-DDT residues with 14.96 mg/kg milk fat, as well as the estimated daily intakes by the infants are one of the highest reported in the 1990s. The fact that the mother breast-feeds her first child and that she originally comes from a region where DDT is still in use as a vector control agent, as well as the former use of organochlorine pesticides (OCPs) in agriculture, seem to be the main factors for high DDT and other OCP residues in the mothers' milk (Steutz, 2001).

2.11. Evaluation of organochlorine pesticide residues in human serum from an urban and two rural populations in Portugal. Organochlorine pesticide residues were measured in human serum from an urban and two rural populations in Portugal, in an attempt to evaluate the contamination level of Portuguese population. Serum levels of 12 residues were determined using a validated methodology that included gas chromatography-electron-capture detection. The determination was made as an attempt to point out the differences of contamination between rural and urban populations; and among these, if it could be established a relation with sex and with age of individuals.

*p,p′*DDE, α-hexachlorocyclohexane (HCH), *p,p′*DDD, and β-HCH were the most frequently identified residues. *p,p′*DDE concentrations ranged from undetected to 390.5 μg/l in urban samples, and from undetected to 43.5 μg/l and to 171.2 μg/l in both rural samples. Maximum α-HCH concentration level was 114.4 μg/l in urban samples, 261.3 and 45.5 μg/l in both rural samples. Mean total DDT levels were always higher than mean total HCH levels. About *p,p′*DDE, in all three populations, the majority of the results above the limit of quantification were found among female sex. The analysis of different age groups showed that younger groups continue to reveal contamination. Comparing obtained results with others from Europe, Asia and America, it was observed that Portugal is between the highest levels of contamination (Susana, 2003).

3. Effects of pesticides on human health

The effects of pesticides on human health are more harmful based on the toxicity of the chemical and the length and magnitude of exposure. Farm workers and their families experience the greatest exposure to agricultural pesticides through direct contact with the chemicals. But every human contains a percentage of pesticides found in fat samples in their body**.** Children are most susceptible and sensitive to pesticides due to their small size and underdevelopment.

Fruits and vegetables are known to protect against heart disease and cancer. They are rich in vitamins, minerals, fiber, and health-promoting phytochemicals. However, many fruits and vegetables test positive for pesticide residues, with about one-third of them showing up with multiple residues. Fish are an important part of a healthy diet. Some fish caught in lakes, rivers, oceans and estuarines, however, may contain pesticide residues that could pose health risks if these fish are eaten in large amounts. Eating fish containing pesticide residues may cause birth defects, liver damage, cancer, and other serious health problems.

Researchers reveals that prolonged exposure to pesticide residues may increase the risk of various cancers and neurological problems (such as Parkinson's disease), and impair the immune system. Studies have proved that farmers are at a potentially high risk of developing leukemia, lymphomas, and cancers of organs like the prostate, stomach, skin and brain. Pesticides are linked to chronic health disorders and ailments. Exposure to pesticides can range from mild skin irritation to birth defects, cancers, blood and nerve disorders, hormone disruption, and even coma or death.

3.1. Asthma. Researchers found an association between asthma and use of pesticides by male farmers. Although this study involved adults, it raises concerns about children's exposures to pesticides used in the home or residues brought home on parents' clothes or equipment.

3.2. Birth Defects. The commonly used pesticide, chlorpyrifos caused severe birth defects in four children exposed in uteri. Chlorpyrifos is used widely as an agricultural chemical, but is also the most common pesticide used indoors to kill termites, fleas, roaches and in pest control strips. A study in Minnesota found significantly higher rates of birth defects in children born to pesticide applicators and in regions of the state where chlorophenoxy herbicides and fungicides are widely used.

In California, mothers living and working in agricultural areas with high pesticide use had a higher risk for giving birth to children with limb reduction defects. A study of pregnant women in Iowa and Michigan found that women exposed to multiple pesticides had an increased risk of giving birth to a child with cleft palate. Researchers found higher rates of numerous birth defects in children born to Norwegian farmers exposed to pesticides, including hormone effects like hypospadia and undescended testicles.

3.3. Neurological Effects. Pesticides can be potent neurotoxins. When people are exposed to neurotoxins they may feel dizzy, lightheaded, confused and may have reduced coordination and ability to think. These are the short-term effects, while long term exposure can result in reduced IQ and learning disability, associated with permanent brain damage. In spite of wide reporting of adverse symptoms, until recently, few studies could link permanent brain damage to such exposures. There is new evidence that prolonged exposure to pesticides in areas where they are used routinely may cause permanent brain damage to children who live in these areas.

Significant reductions in plasma cholinesterase are associated with a number of acute and subacute neurotoxic effects: muscle tremors, twitching and weakness, anorexia, nausea, vomiting, bronchospasm, excessive pupil contraction, blurred vision, headache, cognitive impairment, seizure, and coma.

An intermediate syndrome involving respiratory paralysis and failure may occur 1-5 days after exposure to some organophosphates. Irreversible weakness, ataxia (failure of muscle coordination), and paralysis may occur 2-5 weeks later. This delay is due to degeneration of myelin sheaths covering large nerve fibers. Acute clinical organophosphate and carbamate poisoning is likely to appear when cholinesterase activity is inhibited by 50% or more, and 30% inhibition has been proposed by WHO as a hazard level.

3.4. Cancers. The cumulative effects of widespread chronic low-level exposure to pesticides only partially is understood. However, mounting evidence suggests a strong correlation between pesticide exposure and the development of cancer in humans. Of the 80,000 pesticides and other chemicals in use today, 10 percent are recognized as carcinogens. Cancer-related deaths in the United States increased from 331,000 in 1970 to 521,000 in 1992, with as estimated 30,000 deaths attributed to chemical exposure. Farmers are prone to certain cancers, including stomach, prostate, and brain cancer, non-Hodgkin's lymphoma, and leukemia. The National Cancer Institute (NCI) has linked the common weed killer 2,4-D to non-Hodgkin's lymphoma in several studies.

Another NCI study found a link between breast cancer in women and elevated levels of DDE, a metabolite of the pesticide DDT, in their fat tissue. Women with the highest levels of exposure to DDT had four times the breast cancer risk of women with the least exposure. The link is not proven yet. Research also indicates that youngsters in homes where household and garden pesticides are used are seven times as likely to develop childhood leukemia.

A recent study of pesticides and childhood brain cancers has revealed a strong relationship between brain cancers and compounds used to kill fleas and ticks. The specific chemicals associated with children's brain cancers were pyrethrins and pyrethroids (which are synthetic pyrethrins, such as permethrin, tetramethrin, allethrin, resmethrin, and envalerate), and chlorpyrifos.

3.5. Hormone Disruption. While some substances cause physical birth defects, others can cause subtle hormonal effects on the developing fetus or affect a child's functional capacities. Hormone disruptors have been linked to many health problems including reproductive cancers. Pesticides like 2,4-D, lindane and atrazine, are known hormone-disrupters. Aside from increases in reproductive cancers, increasing rates of the following conditions are reported.

3.5.1. **Endometriosis**, a disease in which the uterine tissue grows outside the uterus, and a common cause of infertility was virtually unheard of twenty years ago. It now affects 5.5 million women in the U.S. and Canada, about 10-20% of women of childbearing age.

3.5.2. Hypospadias, a condition in which the urethra is near the base of the penis, not the end as it should be, has doubled in the last 10 years.

3.5.3. **Undescended testicles**, which is linked with later risk of testicular cancer, is increasing. Researchers reported a doubling in cases between 1962 and 1982 in England and Wales.

3.5.4. **Precocious puberty in girls** is now common. A study of 17,077 girls in the US found that the onset of puberty for white girls was 6-12 months earlier than expected and African-American girls experienced puberty 12-28 months earlier than whites.

3.5.5. Reduced sperm counts are documented. Between 1938 and 1990, sperm counts dropped 1.5% each year for American men and 3.1% per year for European men. There was no decrease in men from non-western countries. Low sperm count is a marker for testicular cancer.

3.5.6. Fertility Problems are becoming more common and now affect more than two million couples in the U.S.

4. Home food preparation to reduce exposure to pesticide residues on fresh fruits, vegetables, meats, poultry and fish

Consumers can take the following steps to reduce their potential exposure to pesticide residues in food. To reduce the amounts of pesticide residues in food, consumers can wash, peel, cook and dip their food; trim the fat from meat; and eat a variety of foods to avoid repeated exposures to a pesticide typically used on a given crop, however, many pesticides are systemic, which means they penetrate into the fruit and vegetable itself and cannot be washed off. Many pesticides are also by design created to be rain-proof. The following basic food preparation practices and habits can further reduce your exposure to pesticide residues on fresh fruits, vegetables, meats, poultry and fish.

4.1. Trim tops and remove the very outer portions of celery, lettuce, spinach and other leafy vegetables that may contain the bulk of pesticide residues.

4.2. Washing vegetable and fruit. Household washing procedures are normally carried out with running or standing water at moderate temperatures. You can wash using a very diluted solution of mild dishwashing detergent (1 tsp detergent per gallon, or 4 liters, water). For grapes, strawberries, green beans, and leafy vegetables, swirl the foods in a dilute solution of dish detergent and water at room temperature for 5 to 10 seconds, then rinse with slightly warm water. For the other fruits and vegetables, use a soft brush to scrub the food with the solution for about 5 to 10 seconds, then rinse again with slightly warm water. Carrot, cabbage and cauliflower, can be washed with 1 per cent tamarind solution. Other produce (acorn squash, apples, apricots, carrots, peaches, pears, potatoes, tomatoes) was scrubbed with a brush using a soapy solution of warm water, then rinsed.

4.3. Peel fruits with higher residue levels. Peeling fruits, especially peaches, pears and apples, will help remove residues. Be sure to keep the peelings out of the compost. The outer leaves of vegetables often contain residues of pesticides applied during the growing season. Therefore, peeling or trimming procedures reduce the residues levels in leafy vegetables. Peeling of root, tuber and bulb vegetables with a knife is common household practice. Many examples show that most of the residues concentration is located in or on the peel. Peeling may remove more than 50% of the pesticide residues present in the commodity. Thus, removal of the peel achieves almost complete removal of residues, so leaving little in the edible portions. This is especially important for fruits which are not eaten with their peels, such as bananas or citrus fruits.

Peeling or trimming of carrot reduced the residues of chlorfenvinphos, primiphos-methyl, quinalphos, triazophos . After application of thiometon on cucumbers, no reduction of residue levels could be detected in the peeled cucumbers. Peel and trim fruits like mango, citrus and kiwi and vegetables like gourds to reduce dirt, bacteria, and pesticides, if needed and likely to have high levels of pesticide residue.

4.4. Cooking. Several studies were reported on the dissipation of pesticides in crops during cooking. Residues of organophosphorus pesticides chlorfenvinphos, fenitrpothion, isoxathion, methidathion and prothiophos decreased during the cooking process corresponding to the boiling time. Cooking of endosulfan (Endoin 35 EC) spiked meat resulted in 58.33–64.59% reduction in α-endosulfan and 55.93–61.60% reduction in β-endosulfan. Among the cooking methods, pressure cooking was most effective in reducing both α- and β-endosulfan. **Don't microwave foods in plastic containers**. Chemicals from the plastic container can become absorbed by food during microwaving. Cover with waxed paper or paper towel instead of plastic wrap to keep food from spattering.

4.5. Dipping in chemical solution. Sodium chloride solution is largely used to decontaminate the pesticide residues from different fruits and vegetables. There are several studies to prove the efficacy of salt water washing to dislodge the pesticides from crops. In this process, sample of chopped fruits and vegetables is put in a beaker containing 5% sodium chloride solution. After 15 minutes the plant samples are gently rubbed by hand in salt solution and salt water is decanted.

Dipping of green chillies in 2% salt solution for 10 minute followed by water wash prove to be effective, facilitating the removal of 32.56 and 84.21% residues correspondingly at 0 and 5 days after spray of triazophos (700g a.i./ha). Following same technique it was also observed that 20.56 and 66.93% reduction correspondingly on 0 and 5 days after spraying of cypermethrin in chillies.

4.6. Trim the fat from meat, and fat and skin from poultry and fish. Animal products can contain synthetic hormones, antibiotics and organochlorine chemicals, such as dioxin, DDT and other pesticides, which concentrate in animal fat. The same chemicals that accumulate in animal fats are transferred to our own when we eat them. Then they linger there for years quietly causing damage. Trim all fats and skins and broil meats and fish so that the fats drain away. Avoid frying, which will lock in the contaminants.

5. The health benefits of eating organic food

We can help protect ourselves from a toxic environment by eating organic food. Fruit and vegetable certified as 'Organic' is your best assurance of pesticide-free status. Buying organic, in-season produce from your local market is the best assurance of pesticide-free produce. In the 21st century, a growing number of men and women from around the world are recognizing the benefits of organic food. These people are beginning to appreciate the health benefits that can be derived from organic food. Table 6 highlights differences between conventional and organic farming.

Table 6. Differences between conventional and organic farming

Conventional farmers	Organic farmers
Apply chemical fertilizers to promote plant growth.	Apply natural fertilizers, such as manure or compost, to feed soil and plants.
Spray insecticides to reduce pests and disease.	Use beneficial insects and birds, mating disruption or traps to reduce pests and disease.
Use chemical herbicides to manage weeds.	Rotate crops, till, hand weed or mulch to manage weeds.
Give animals antibiotics, growth hormones and medications to prevent disease and spur growth.	Give animals organic feed and allow them access to the outdoors. Use preventive measures — such as rotational grazing, a balanced diet and clean housing — to help minimize disease.

Conventional farming practices utilize an extensive array of different types of chemicals. For example, as a general rule in the cultivation of crops of all varieties, the typical farmer utilizes chemical insecticides, herbicides and fertilizers. Without fail, when these crops are harvested, those remains at least trace amounts of these various chemicals that were utilized during the planting and growing processes. When a consumer purchases and consumes these conventionally grown food items, the trace chemicals end up in a person's body. Over time, these insecticides, herbicides and fertilizers can accumulate in a person's body.

In organic farming, the farmers grow their crop entirely without synthetic pesticides and even without synthetic fertilizers**.** One of the most significant health benefits associated with eating organic food rests in the fact that these products are free from any potentially harmful chemicals. Organically grown food items are pure and completely wholesome. A number of recent research studies have also considered the benefits of eating organic food. Some of these research endeavors focused on the effects organic foods might have on lowering the incidence of certain diseases, including some types of cancer. It has been demonstrated that organically grown fruits and vegetables have significantly higher levels of antioxidants than do conventionally cultivated food products. Because organically grown fruits and vegetables are higher in antioxidants, these items have been demonstrated to work to reduce the risk of certain types of cancers.

Consumption of processed meat such as bacon, sausages and meat pies has been linked to cancer. By reducing your meat intake you will also be reducing toxic residues such as DDT, dioxin and PCBs which are found in meat fat, especially important for breastfeeding mothers. By eating organic meat, particularly pork, chicken and eggs you are reducing toxic residues, avoiding antibiotics and growth hormones given to the animals.

6. Conclusion

Because pesticides have many uses, we may be exposed to them in various ways, through food, water and air. Roughly 90 percent of pesticide intake is ingested with food; much of the remainder has its source in pesticide-contaminated air and water. Many of the pesticides found as residues in our food have serious long term effects including hormonal disruption, cancer, immune system suppression, nervous system damage, genetic damage and birth defects. Children are, as a rule, more vulnerable to toxins than are adults. So **we can help protect ourselves from a toxic environment by doing to reduce our exposure to pesticide residues in food.** We can minimize our exposure to pesticide residues by choosing our food and taking some simple steps to prepare them. To reduce the amounts of pesticide residues in food, consumers can wash, peel, cook and dip their food; trim the fat from meat, and fat and skin from poultry and fish. Eat a variety of foods to avoid repeated exposures to a pesticide typically used on a given crop. You may also choose organically grown fruits and vegetables. Organically grown fruits and vegetables have significantly higher levels of antioxidants than do conventionally cultivated food products. Organic foods might have on lowering the incidence of certain diseases, including some types of cancer.

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