

Effect of Pesticide on Human Health

Shama Chavan¹, Dr. Meena Mehta²

¹Assistant Professor, Food & Nutrition, Sion, Mumbai, Maharashtra, India
Email: s.chavanphd[at]gmail.com

²Rtd. Associate Professor, Borivali, Maharashtra, India
Email: mehtameenab[at]gmail.com

Abstract: *After World War II the demand for food increased to curb hunger and satisfy the need for food the use of pesticides was increased in the agro industry. The human exposure is more among those who handle these pesticides and who consume them. The harmful effect of pesticide residue is seen among pregnant ladies and infants and children.*

Keywords: Pesticides, health, fruits, vegetables

1. Introduction

A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest (epa.gov). Pests can be any organism that causes plant diseases. Agricultural pesticides are those chemicals which are used by farmers to prevent the attack of the pests on the growth and productivity of agricultural crops. It was after the World War II that the use of pesticides increased in the agro industry as it was the only way to curb hunger and increase the production of food crops to support the starving population. In India this use started after 1952. These chemical substances are either restricted or they are unclassified. The meaning of restriction is that it may cause harm to the environment or to the person coming in close contact with it. While unclassified refers to other substances present in it. Pesticides are the ones which are extensively used in agriculture all over the world. They are substances or combinations of substances which are either used in agriculture or are used for protection of the general public. Some of the common examples of pesticides could be insecticides, herbicides, fungicides including the plant regulators. The other important uses of these are in the maintenance of sports fields or public green spots in urban cities. More interestingly the less known uses of these pesticides are their presence in the manufacturing of shampoos or even they are used in the building of boat bottoms so that unwanted species of sea animals can be kept at bay. The human exposure to such chemical substances could be due to direct contact with the skin, or by accidental inhalation or ingestion. The outcome of this exposure strongly depends on the healthy status of the person exposed and the type of the pesticide used. Within a live body whether human or animal these chemicals may be metabolized, they may be stored or they can get accumulated in the body fat. There are numerous negative effects of pesticide exposure, it can be dermatological, or neurological or can affect any of the systems in our body. Mild to severe conditions may arise when exposed to these chemical substances (Nicolopoulos et al) (1). These substances not only affect the humans or wild life but can have a devastating effect on the environment as well. With modern techniques in agriculture there are various problems associated with society, economy and environment. This may cause environmental impact on the local population and

affect their livelihood. It is time now to change our strategies and understand that with increased production are we able to eradicate hunger or malnutrition from the world, are we able to give food to every individual but just increasing the use of pesticides.

Pesticides and Human Health

Pesticides are either biological or chemical substances which have been widely used in the agricultural industry since last 2-3 decades. Their prime role in agriculture is to either kill or keep the pests at bay. Individual health status, the duration of exposure along with the route of exposure and the type of pesticide are some of the factors that effect on the person who is exposed to pesticides. When the pesticides enter the body, they are either excreted, or remain in the body or they are accumulated in body fat. There are many health effects in which it may affect the skin, the GI tract, neurological disorders, carcinogenic growths, respiratory, reproductive and endocrine effects. Any accidental or intentional exposure can also be fatal in some severe cases (Nicolopoulos et al) (1). In the beginning of the 20th century as a result of commercial interest many tropical areas were taken under agricultural cultivation. These regions were used for mass production of many fruits like bananas. Over the years this region is suffering due to environmental deterioration and contamination by these chemical compounds in the form of Pesticides. The pesticides used in agricultural sectors have been associated with many health problems like sterility in women, cancer, and deformation of foetus, allergies and intoxication. In modern agro industry there is use of sensors along with enzymatic biosensors for detection of pesticides and their rapid analysis (Zamora-Sequeira et al, 2019)(2). Their extensive usage can lead to contamination of food, water, this can also cause potential harm to the environment if use is not controlled. They potentially harm the underground water along with natural waterways. Those species that come in close contact with contaminated water or food are infected and which can be toxic to humans as well. Most pesticides can exert toxicity by inhibiting the enzyme acetylcholinesterase (AChE). This enzyme is known to degrade acetylcholine which is a neurotransmitter found in the central nervous system. These AChE inhibitors interrupt the functioning of ganglia as well as sympathetic nerves which are controlled by AChE normally (Mladenović, M. et. al, 2018) (3).

Volume 10 Issue 10, October 2021

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

Pesticides are potentially hazardous to human health more when we come in direct contact with them. This means that the farming community is at a higher risk of exposure. A Cross sectional study was carried out in Tanzania on 90 farmers engaged in Horticultural practices, who were occupationally exposed to pesticides. Their blood samples were checked for Acetylcholinesterase (AChE) inhibition. This acts as a useful biomarker of pesticides exposure and indicates the level of poisoning. The study revealed that the exposed farmers had lower levels of AChE. The young members, women and older farmers, underweight, overweight and obese farmers had higher risk of this AChE inhibition. Increase in age, increased its inhibition, while more the exposure more were the symptoms reported. Around 70% of the exposed farmers self-reported that they had feeling of tiredness, fatigue more than the controls. This study shows why it is important to control the use of pesticides at farm level which can be achieved by monitoring and pesticides surveillance system to limit pesticide exposure among farmers who come in direct contact with these chemicals (Kapeleka, J. et al, 2019) (4). Various chemical compounds used in the form of pesticides act either as rodenticides, nematicides, fungicides or herbicides. These chemical compounds can be grouped into different chemical families like organochlorines, pyrethroids, carbamates, organophosphorous compounds etc.. As these compounds are extensively used in agriculture, industry, in urban areas to maintain green zones or even used for domestic purposes, these pesticides appear to be widely as environmental pollutants. Human beings are most likely to be exposed to these through the oral way by consumption of variety of foods or water which is contaminated by pesticides. In the near future this is going to be a major health concern as human food consumption is largely dependent on the environment. These can have an adverse effect on the nervous system, effects on endocrine receptors or enzyme inhibitors (Chedik, L. et al, 2017) (5). There are certain group of individuals who may be more vulnerable to pesticides than others. These may include infants, young children and pregnant ladies. The farm workers and also those who apply these substances are vulnerable to infection as they have greater exposure (Californian Pesticide reforms, 2017) (6). A study carried out in California among maternal residence areas during pregnancy and Full Scale Intelligence Quotient (FSIQ) of the child at 7 years of age. Among various pesticides 15 potential neurotoxic pesticides were studied. It was reported that maternal exposure to neurotoxic pesticides during pregnancy was associated with FSIQ deficit among 7 year aged children (Coker, E. et al, 2017) (7). A study carried out in Switzerland verified a quick, easy, cheap, efficient, rugged and safe (QuEChERS) method along with gas chromatography was developed for detection of pesticides in fruits and vegetables with high water content this type of methodology can also be used for those fruits and vegetables which are containing more pigment and dyes Tankiewicz M. (2019) (8). A study was conducted on 518 vegetables in a region in China using multi residue gas chromatography. They found 27 pesticides which were exceeding the MRL (minimum residue limit) of pesticides which were banned in the area. Among them the most commonly found pesticides were Malathion and Dimethoate. It should be noted that the use of pesticides and their controlled use should be

improved. A training program should be started for the farmers to improve the pesticide applications (Yu, Y., et al, 2017)(9). The direct exposure of pesticides among farmers have shown symptoms of kidney disorders mainly due to heat stress and dehydration caused due to long hours of working in sun (Valcke, M et al, 2017)(10). In a systematic review of 39 articles selected for analysis, to understand the take home pathway of pesticides among farmers and their families, they found that the level of exposure dependent on many factors like the season, behavior at home, age and gender. The take home path is a crucial way of residential exposure along with the indoor residential application or dietary intake (López-Gálvez, N., et al, 2019)(11). Human studies are working towards establishing a threshold level for symptoms, where no effects were seen after usage. These are reported to the US EPA for considering the standard setting (Oleskey C et al, 2004)(12). The report generated by USFDA in 2012 suggested that high proportion of common fruits and vegetables already had detectable amounts of pesticide residue levels above the normal standards, which when compared to other foods were high. This actually suggested that the consumption of fruits and vegetables form the major source of pesticide residue exposure in US (FDA, 2012) (13). The basic source of pesticides in diet is through the residues on vegetables and fruits. We still do not have the exact ways of measuring these residues on our fruits or vegetables; therefore the research in this area is limited. A study was carried out among 3,679 participants in whom either their urine sample or their serum samples were tested for the Pesticide Residue Burden Score (PRBS) of organophosphate and organochlorines pesticide scores. It was found that the PSRBS and the scores of the major two pesticides used were associated with pesticide biomarkers (Hu, Yet al, 2016) (14). An interesting study was carried out as an investigation for over a period of 25 years in orchards in England and Wales among the pregnant ladies who were residing 100m or 1000meters near the treated areas. It was observed that the ones residing within the 1000 meter area had a hazard quotient which was 5 to 16 times smaller than those living in 100 meter area. This was observed more during 2012 than 1987 obviously as the use of pesticide was increased by then (Wong, H. L., et al, 2017) (15). A survey was published on effects of active ingredients of pesticides and neuro developmental functions like behavior, neuropharmacology and neuropathology). Their effects observed were much higher than that which was reported to the US Environment Protection Agencies. A latest report conducted in December 2020 indicated that around 60% of deaths among farmers occur in India which counts to 6600 every year. It is high time that we realize the importance of human life and save them.

References

- [1] Nicolopoulou-Stamati P., Maipas S., Kotampasi C., Stamatis P., Hens L. 'Chemical Pesticides and Human Health: The Urgent Need for a New Concept in Agriculture'. *Front. Public Heal.* (2016);4: 231.
- [2] Zamora-Sequeira, R., Starbird-Pérez, R., Rojas-Carillo, O., & Vargas-Villalobos, S. (2019). 'What are the Main Sensor Methods for Quantifying Pesticides in Agricultural Activities? A Review' *Molecules* (Basel, Switzerland), 24(14), 2659.

- [3] Mladenović, M., Arsić, B. B., Stanković, N., Mihović, N., Ragno, R., Regan, A., Milićević, J. S., Trtić-Petrović, T. M., & Micić, R. (2018). 'The Targeted Pesticides as Acetylcholinesterase Inhibitors: Comprehensive Cross-Organism Molecular Modelling Studies Performed to Anticipate the Pharmacology of Harmfulness to Humans In Vitro', *Molecules*(Basel,Switzerland), 23(9),2192.
- [4] Kapeleka, J. A., Sauli, E., Sadik, O., & Ndakidemi, P. A. (2019). 'Biomonitoring of Acetylcholinesterase (AChE) Activity among Smallholder Horticultural Farmers Occupationally Exposed to Mixtures of Pesticides in Tanzania', *Journal of environmental and public health*, 3084501.
- [5] Chedik, L., Mias-Lucquin, D., Bruyere, A., & Fardel, O. (2017). 'In Silico Prediction for Intestinal Absorption and Brain Penetration of Chemical Pesticides in Humans'. *International journal of environmental research and public health*, 14(7), 708.
- [6] Californian Pesticide reforms, 2017.
- [7] Coker, E., Gunier, R., Bradman, A., Harley, K., Kogut, K., Molitor, J., & Eskenazi, B. (2017). 'Association between Pesticide Profiles Used on Agricultural Fields near Maternal Residences during Pregnancy and IQ at Age 7 Years'. *International journal of environmental research and public health*, 14(5), 506.
- [8] <https://www.downtoearth.org.in/news/health/pesticides-leading-cause-of-poisoning-in-india-study-77183>
- [9] Tankiewicz M. (2019). 'Determination of Selected Priority Pesticides in High Water Fruits and Vegetables by Modified QuEChERS and GC-ECD with GC-MS/MS Confirmation'. *Molecules* (Basel, Switzerland), 24(3), 417.
- [10] Yu, Y., Hu, S., Yang, Y., Zhao, X., Xue, J., Zhang, J., Gao, S., & Yang, A. (2017). 'Successive monitoring surveys of selected banned and restricted pesticide residues in vegetables from the northwest region of China from 2011 to 2013'. *BMC public health*, 18(1), 91.
- [11] Valcke, M., Levasseur, M. E., Soares da Silva, A., & Wesseling, C. (2017). "Pesticide exposures and chronic kidney disease of unknown etiology: an epidemiologic review". *Environmental health: a global access science source*, 16(1), 49.
- [12] López-Gálvez, N., Wagoner, R., Quirós-Alcalá, L., Ornelas Van Horne, Y., Furlong, M., Avila, E., & Beamer, P. (2019). 'Systematic Literature Review of the Take-Home Route of Pesticide Exposure via Biomonitoring and Environmental Monitoring'. *International journal of environmental research and public health*, 6(12), 2177.
- [13] Oleskey C, Fleischman A, Goldman L, Hirschhorn K, Landrigan PJ, Lappé M, Marshall MF, Needleman H, Rhodes R, McCally M,(2004), 'Pesticide testing in humans: ethics and public policy', *Jun*;112(8):914-9.
- [14] FDA. 'Pesticide Monitoring Program Fiscal Year 2012' Pesticide Report 2012.
- [15] Hu, Y., Chiu, Y. H., Hauser, R., Chavarro, J., & Sun, Q. (2016). 'Overall and class-specific scores of pesticide residues from fruits and vegetables as a tool to rank intake of pesticide residues in United States: A validation study'. *Environment International*, 92-93, 294-300.
- [16] Wong, H. L., Garthwaite, D. G., Ramwell, C. T., & Brown, C. D. (2017). 'How does exposure to pesticides vary in space and time for residents living near to treated orchards?'. *Environmental science and pollution research international*, 24(34), 26444-26461.