

# Pesticide application in Armenia: Carcinogenic after-effects

Hmayak Avagyan, Derenik Dumanyan, Leon Karabashyan

National Institute of Health, Ministry of Health

49/4 Komitas Avenue, Yerevan, 375051, Republic of Armenia

Phone: +374 1 23 13 29, Email: havagyan@ipia.sci.am

Environment, environmental impact, environmental pollution and environmental hazards. This is the main chain one should follow in order to ensure such essential point of interest like Environmental and Human Health. Environmental threats to human health can be divided into "traditional hazards" associated with lack of development and "modern hazards" associated with unsustainable development. Modern hazards are related to development that lacks health-and-environment safeguards, and to unsustainable consumption of natural resources. They include: water pollution from polluted areas, industry and intense agriculture, and transboundary pollution. The number and quantities of chemicals used, both in developed and developing countries, are constantly increasing. Long-term exposures to agrochemicals (pesticides, herbicides, plant growth regulators, mineral fertilisers, etc) even at low levels can have long-term delayed consequences for the health status of the population, thus contributing to respiratory diseases, cancer, reproductive disorders, allergies, cardiovascular disease, etc.

The last decades of intense and frequently uncontrolled application of plant and crop protection chemicals in agriculture of the Republic of Armenia could not pass without the after-effects on human health. One of the medical consequences of prime importance for us is the cancer case. Our aim was to establish the relationship of pesticide intense application and cancer prevalence in the population of different regions in Armenia.

The total area of the Republic of Armenia is 28,400 km<sup>2</sup> with a population of 3.6 million (68% urban and 32% rural). Annually 0.2% of the population acquires cancer (Table 1). In the entire structure of oncology diseases, as to the absolute morbidity index, lung cancer and gastroenteric cancer rank first and second; the mortality index being significant: 84.2% and 74.4% (Table 2).

**Table 1. Quantitative indices of morbidity and mortality due to malignant tumours during 1994-1998.**

Index	Year	1994	1995	1996	1997	1998
	Morbidity (disease prevalence), NN of persons		4,515	4,705	4,757	4,709
Mortality (% of morbidity), NN of persons		2,893 (64.1)	3,206 (68.1)	3,406 (71.6)	3,504 (74.4)	2,385 (78.9)

**Table 2. Data on morbidity and mortality due to malignant tumours of different locations in 1997.**

Index	Tumour location								
	Lungs	Gastro- enteric	Mammal gland	Female genitalia	Urology	Blood & lymph	Skin	Larynx	Oral cavity
Morbidity, NN of persons	860	878	577	361	382	325	193	101	99
Mortality, NN (% of morbidity)	724 (84.2)	653 (74.4)	331 (57.4)	265 (73.4)	495 (130)	189 (58.2)	58 (30.5)	160 (158.4)	56 (56.6)

The economy collapse, extremely low level of living and housing conditions brought forth the abrupt worsening of sanitary, epidemiological and environmental situation. Simultaneous decline of the health care services level have brought forth the extreme decrease in medical and preventive measures intended at early detection and express-diagnostics of environment-related diseases, including cancer.

Cancers are responsible for about 25% of all deaths in the developed countries. In these countries, through surgical, radiological and drug treatment, it is estimated that perhaps 50% of cancers diagnosed are cured. Early diagnosis has contributed to this progress. Health status is directly dependent on a better environment and quality of life; yet, the relationship between health and the environment is unsatisfactory in practically every country. The social consequences of adverse environmental conditions are obvious. People who live in substandard sanitary conditions, without adequate water supply or waste disposal facilities, who fall ill as a result of eating unsafe food, or who are exposed to increasing concentrations of chemicals in the environment in which they live and work, cannot be expected to lead socially and economically productive lives.

In the recent years suitable and reliable methods of immune-enzyme tumour markers testing in blood serum are widely used in order to solve such problems. Tumour markers present themselves a group of factors detected in malignant and malignant growth associated cells. The diagnostic significance of tumour markers is high enough in combined co-testing; the procedure is rather convenient and suitable. It is of prime importance for the screening and early diagnostics. Tumour markers are irreplaceable in the monitoring of both the disease and the treatment process. It is urgent to mention that recurrence and metastasis spreading could be revealed with the use of tumour markers 6 months prior to the clinical manifestation of the disease.

During the last 3 years, efforts were done to implement the immunoenzyme methods of tumour markers testing into the practice of diagnostic services offered by the Clinical Diagnostics Department of the National Institute of Health, Republic of Armenia. Now we have achieved significant progress in this concern. This allowed us to reveal the oncology diseases at the early stage.

During 1997-1999, Enzyme Immune Assays method was applied in our Laboratory to perform more than 2,000 blood serum analyses. Samples were tested in order to reveal the content of tumour markers in patients directed from different oncology services. The following tumour markers (Syntron Bioresearch Inc., DRG International, Inc.) were used:

1. CA -19 - 9 (gastrointestinal cancer antigen)
2. CEA (carcinoembryonic gastrointestinal and colon antigen)
3. PSA (prostate-specific antigen).
4. CA - 125 (ovarian cancer antigen)
5. CA - 15-3 (breast cancer antigen)
6. NSE (neuron specific enolase) small cell lung cancer and neuroblastoma

For example, the increase of tumour markers CA-19-9 and CEA (used for screening of gastrointestinal diseases) was revealed in blood serum of 265 individuals tested. Out of this number 72 persons were the inhabitants of the regions with the intense agronomical use. The population of these regions makes approximately 15% of the entire population of the Republic of Armenia. It was revealed that the increased level of tumour markers CA-19-9 and CEA in this cohort of population is about 2 times higher, than the average level in the population of Armenia. In these agricultural regions, organochlorine and organophosphorus pesticides, mineral fertilisers and nitrites, both piled and newly brought, were used.

However, no significant increase was revealed in respect of the content of other tumour markers tested in the blood serum of the population from the rural regions with intense agrochemicals use.

Apparently, a number of pesticides are not considered to be direct carcinogens, but in the human body, due to the metabolism, carcinogenic metabolites are formed. There is also the combined effect of 2 and/or more pesticides as well. The carcinogenic effect itself is a result of joint combined action of pesticides or their metabolites. That is why, in our opinion, the determination of concrete pesticides in human blood samples is not useful.

Of course, one cannot exclude other factors of the environmental impact. But the statistical data available convince us to study the phenomenon in respect of pesticide application and disease relationship. The regions where the study was performed are far from the industrial sites. In Armenia during the last decade, the industrial enterprises were either non-functioning, or operating up to 10% of their capability (or not full time). Thus there was almost no influence of the industrial factors in practice.

Data obtained demonstrate that the long-term uncontrolled pesticide application brings forth the elevated incidence risk as to the cancer of gastrointestinal tract and pancreas. Further researches are required to reveal the dominating significance of this or that class of pesticides in concern of this carcinogenic effect. Prevention would also play a significant role: new hygienic standards on pesticide application (MACs, ADIs), elimination of tobacco smoking are of prime importance. Evidence indicates a casual relationship between composition of diet and cancer. Research on the relationship between diet and cancer must be given high priority as well.