

OUR EXPERIENCE OF APPLYING THE RESULTS OF
RESEARCH AND EVIDENCE-BASED MEDICINE
FOR IMPROVING THE AWARENESS, ACHIEVING
COMPLIANCE WITH SAFETY MEASURES AND
IMPLEMENTING RECOMMENDATIONS BY THE
POPULATION LIVING IN THE AREAS POLLUTED BY
ORGANOCHLORINE PESTICIDES.

*¹Institute of Medical Problems, South Branch of the National Academy of Sciences, Kyrgyz Republic,
Osh, Kyrgyzstan*

²Medicine Faculty of the Osh State University, Osh, Kyrgyzstan

³Osh Clinical Hospital, Osh, Kyrgyzstan

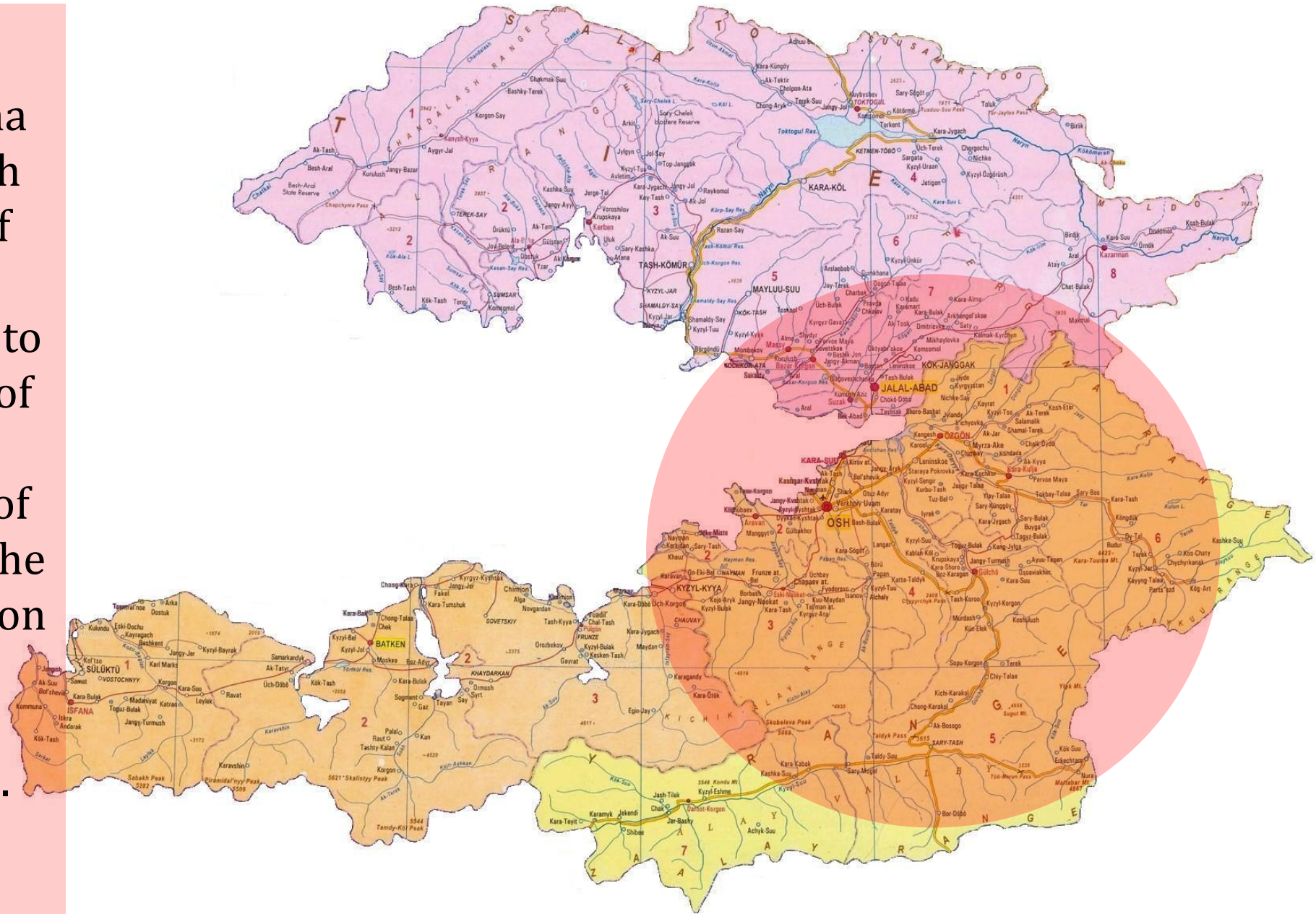
*Paizildaev, T.¹, Zhilova, L.¹, Toichuev, R.¹, Sakibaev,
K.², Toichueva, A.¹, Mamasharipov, K.³*

Introduction

- The problems of organochlorine pesticides (OCPs) in the south of Kyrgyzstan are caused by two pesticide burial grounds left since the Soviet era; they are located in the Suzak district of the Jalal-Abad region; 45 sites for agricultural aviation with the residues of pesticides stored there; 183 (storehouses where pesticides were previously stored; some territories, the so-called "plague zones", where OCPs were used to fight against fleas of marmots - carriers of the plague; fields where industrial crops of cotton and tobacco used to be grown and where DDT was used for pest control [1].



- There are about 1 Mha croplands in the south of Kyrgyzstan, 60% of which were used during the Soviet era to sow industrial crops of tobacco and cotton using large amounts of pesticides, where at the moment the population grows melons and other vegetables of more than 20 species.



Introduction

- Despite the fact that pesticides were used there 35 years ago, OCPs are still found in the environment [2] and will be found in the future, while getting into the body through food OCPs cause various pathologies [1,3,4,5,6,7] and also effect the quality of breast milk in lactating women [8,9,10], and food, reducing the content of vitamin C in vegetables and fruits, loss of taste [11].



Introduction

- Therefore, the problem of preserving the health of the population living near these places comes first, at the same time, one of the reasons for the ingestion of OCPs from the environment is the lack of knowledge and awareness of the population about the places where OCPs are found and their impact on human health.



Introduction

Measures taken to eliminate pesticide factors by raising awareness and implementing recommendations based on previously used methodologies did not give the desired result.



Introduction

- On the other hand, there are no specific antidotes against OCPs, therefore, in order to preserve the health of the population living near these areas, it became necessary to develop ways to raise awareness and implement evidence-based recommendations to the population.



Introduction

- And accordingly, the objective of the work was to raise the awareness, susceptibility and executive discipline of the population living near these places.



Introduction

- So to develop evidence-based methods, acceptable, simple recommendations with the elements of evidence-based medicine and evaluate their effectiveness.

In 2010, in the meat of dead rams the content of COPs was: HCCH α 0.013 \pm 0.001 mg/kg, Γ XCF γ 0.005 \pm 0.001 mg/kg, HCCH β <0.001 mg/kg; DDT 0.018 \pm 0.002 mg/kg; DDD 0.0036 \pm 0.0003 mg/kg, DDE 0.022 \pm 0.0002 mg/kg, totaling 0.0626 mg/kg.

Out of 32 poisoned people who consumed fried liver and meat of the same ram, the serum of three children showed DDT, DDE; α -HCG and β -HCG in all three did not exceed <0.005 mg/l.



Introduction

Local population cultivates
cotton, maize and has a rest on
these areas



Introduction



Introduction



New buildings near the airstrip



Materials and methods

- In studying the effects of OCPs on human body, type, concentration and the amount of detected types of pesticides in the body are of great importance, so it became necessary to determine the degree of environmental pollution with organochlorine pesticides and “it is advisable to use breast milk as a biomarker” [12], i.e. breast milk for determining the degree of environmental pollution is optimal and cheap, without any "damage" to the health of the examined women.
 - To raise the awareness and executive discipline of the population living in environmentally unfavorable places, Institute of Medical Problems (IMP), South Branch of the National Academy of Sciences of the Kyrgyz Republic formed a group of toxicologists, chemists, microbiologists, radiologists, ecologists, epidemiologists, and other clinical, laboratory and diagnostic specialists to develop acceptable, simple, easy to implement and scientifically based methods and recommendations with the elements of evidence-based medicine for the local population.
-



Materials and methods

- The group studied the effects of OCPs found in breast milk, blood, urine, feces, semen, hair, nails, tumor and "pathological" tissues, organs and in the environment and their effects in the examined women and their newborns and children. Simultaneous examinations were carried out by obstetricians, gynecologists, neonatologists, neuropathologists, cardiologists, endocrinologists, gastroenterologists, hepatologists, hematologists, nephrologists, therapists, dentists, infectious disease specialists, oncologists, immunologists, and other specialists. Previous deliveries of the examined women were analyzed, past and concomitant diseases were also taken into account, full description of the placenta-afterbirth was made, histological, chemical (including neutron activation and mass spectral analysis) and microbiological analyses were performed.



Materials and methods

- Children were also examined by neonatologists, neuropathologists, infectious disease specialists, as well as pediatric surgeons, orthopedists, since some, including neurological pathologies, manifested themselves later [13]. The data obtained were entered in a specially designed research map and Excel sheet. Laboratory specialists: toxicologists, chemists, microbiologists, radiologists collected human and environmental samples for laboratory research, environmental experts studied the presence of active factors, epidemiologists - the disease incidence of the population depending on pesticide "loads" and other environmental factors, clinical specialists carried out preventive examination of the population.



Materials and methods

- Prior to the start of the research, a number of meetings with the local population, activists, leaders of settlements, deputies of local rural administrations, specialists and members of NGOs was held to explain the goals, objectives and methods of the survey and the necessity of conducting research data. When clinical and laboratory results were obtained, a methodology for seminars, webinars, talks, lectures and preparation of handouts, manuals, etc. for the local population and other professionals was developed. Moreover, during epidemiological, clinical and laboratory studies, meetings with the population were carried out; we explained them how we could help them and what the population and local authorities could do.



Materials and methods

- The study was conducted in the southern cotton-growing regions of Kyrgyzstan, i.e. in the areas heavily polluted by pesticides used to control cotton, tobacco and plague vectors. The data of the preliminary assessment of soil and water pollution by OCPs in the south of Kyrgyzstan are given in [1], the results of earlier studies and other known data on cases of detection of OCPs in food and their concentrations are also collected there. As a control, the study involved women living in pesticide-free two mountain zones.
- To identify the places and degree of OCPs pollution, clinical and epidemiological studies were performed. We also analyzed OCPs concentrations in breast milk of lactating women.



Materials and methods

- Breast milk (BM) of 125 women, aged 18 to 45 years, with children from 6-10 days old, living in different zones, who currently do not have direct contact with pesticides, were subjected to examination. Depending on pesticide pollution, all the examined were divided into 5 groups and subgroups a) and b) depending on the source of OCPs. Group I included 20 women living in a conditionally pesticide free mountain zone in the Alai region. This zone (300 thousand hectares) is a conditionally pesticide free zone, because there were some plague foci (treated by pesticides) were registered in the past. The local population consume local food products of plant and animal origin.



Materials and methods

- Subgroup a) included 3 women living in the village of Bulolu, located near the former plague foci, where, DDT was used (until 1982) to treat marmot burrows against fleas as plague carriers. During all these years, domestic animals grazed and gave birth near these places. As a vegetable food, the population used their own garden. Subgroup b) included 17 women living far from the former plague foci at a distance of 4–7 km, where animals grazed 8–10 km from the former plague foci.
- Group II included 32 women living in pesticide free mountainous area in the Kara-Kulzha district. Of them, subgroup a) included 16 women who used local food products, and subgroup b) consisted of 16 women who consumed food from the central bazaar.



Materials and methods

- Group III includes 17 women living in the Aravan formerly cotton-growing region. The population grow cotton and are engaged in cultivation of vegetables, melons, legumes, fodder crops.
- Group IV included 24 women living in the cotton-growing zone, in the village of Burgandy, Nookan district, Jalal-Abad region. Of them, subgroup a) included 9 women living in the village of Uuru-Zhar, located 1–2 km from the unpaved agricultural airport, which functioned until 1985, then it was turned into an arable field, where cotton was grown until 1994, the population switched to cultivation of fruits, vegetables, gourds, fodder crops. In this area, the surface of the earth has slopes, i.e. the soil and OCPs are washed away by irrigation water and rainfalls. Subgroup b) included 24 women living in villages located at a distance of 4 to 6 km above the agro-airport.



Materials and methods

- Group V consisted of 32 women living in the cotton-growing zone of the same district in the rural community of Sakaldy, where until 1989 a stationary agro-airport and pesticide storehouses functioned. Currently, the agro-airport and pesticide storehouses (Fig. 1) are destroyed and abandoned. The terrain is flat, rainwater is deposited, irrigation water partially washes away the soil, including OCPs. Subgroup a) included 15 women living in a settlement located at a distance of 2–3 km from the agro-airport and near destroyed pesticide storehouses. Cotton and vegetables, fruits, fodder crops are grown here. Subgroup b) included 17 women living in the same rural community in the village of Arimzhan, located 5–6 km from the airport and pesticide storehouse.



Materials and methods

- Breast milk samples for microbiological and toxicological studies were collected according to the methodological recommendations of the Central Research Institute of Ecology of the Ministry of Health, MNIIEiM, TSOLIUV, Research Institute of Pediatrics and Pediatric Surgery [14]. For analysis, morning anterior (initial) and posterior (residual) portions of breast milk were collected from 125 lactating women, BM was collected in an amount of 10 ml in a sterile disposable tube with a lid, delivered to the toxicological laboratory in a container within 130 to 180 minutes.



Materials and methods

- Organochlorine pesticides in BM was detected in accordance with the methodological recommendation [15] on a gas chromatograph "Tsvet -800 M", (Dzerzhinsk, Russia, 1990, upgraded, with software). The presence of the following pesticides was determined: hexachlorocyclohexane (HCH) (α -, β -, γ -, δ -HCH isomers), dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and dichlorodiphenylethylene (DDE) isomers, aldrin, dieldrin, and heptachlor.
- Statistical processing of the obtained results was carried out using the methods of variation statistics recommended for biomedical research from the site (https://www.medcalc.org/calc/odds_ratio.php).



Results and discussion

- In this study, the following types of OCPs were found in BM of the examined women:
hexachlorocyclohexane isomers: α -HCH, γ -HCH, β -HCH, DDE. The highest percentage (100%) and degree of OCPs pollution was found in Group V subgroup a) – women living in the village Sakaldy, near the former agricultural airport, the smallest percentage in Group I subgroup b) far from the former plague foci - 5.88%, the concentration level was 0.0007 ± 0.00 mg/l in women who lived far away (at a distance of 6–7 km) from the former plague foci and consumed food grown in their garden and obtained from domestic animals grazing away from the former plague foci, i.e. away from the areas polluted by OCPs. Therefore, the data obtained indirectly indicate that, despite the fact that more than 30 years have passed, OCPs remained unchanged in the soil.



Results and discussion

- The highest concentration was found in Group I subgroup a) in women living near former plague foci in 2 women, the concentration was 0.29 ± 0.02 mg/l, but it was not reliable due to the small amount, while in Group V in subgroup a) in women living near the destroyed agro-airstrip and pesticide storehouses that functioned before 1989, the total concentration of OCPs was 0.044877 ± 0.012 mg/l, $P=0.01$. In some women, up to 4 types of OCPs were simultaneously detected in BM.



Results and discussion

- Among the mothers and children, the incidence rate was higher in women when 3-4 types of OCPs were detected in BM and concentrations over 0.03 revealed breast pathologies, menstrual irregularities, latent forms of toxic hepatitis, impaired intestinal biocenosis and other pathologies; when aldrin and heptachlor were detected, regardless of their concentration, the same pathologies with clinical manifestations were diagnosed. The disease incidence was higher in children than in mothers, it was manifested by pathologies of the gastrointestinal tract, jaundice-hepatitis, encephalopathies, malnutrition, immunodeficiency, congenital and other pathologies, impaired absorption of milk, repeated incidence associated with the intake of OCPs through the mother's breast milk was reported [12].



Results and discussion

- When conducting seminars, webinars, meetings, conversations and preparing calendars, booklets, handouts, we used the results of scientific research, data on pathologies diagnosed by medical specialists and laboratory tests. We also prepared recommendations for the local population, local authorities, agronomists, environmentalists, medical workers, members of different NGOs and activists.
- Nevertheless, based on the results of the study, the following recommendations can be made for the population living in the study area:
 - – prohibit farmers from growing fruits, vegetables, legumes, gourds, fodder crops, as well as grazing animals at a distance of 4-5 km from these objects in the places of former agro-airports and destroyed pesticide storehouses;



Results and discussion

- – state environmental protection agency and local agronomists are recommended to carry out soil remediation through winter-spring soil leaching, planting trees, which are then used by local residents only as building material;
- – for medical workers, the population living near the places of former agro-airports and pesticide storehouses to be classified as a risk group and for women to conduct BM examinations for OCPs, if they are found, to take appropriate preventive measures;
- - as regards scientific aspect, it is necessary to study the actions of OCPs in the human body that penetrate through the gastrointestinal tract, taking into account the nature of the diet and lifestyle of the local population, to search for funds based on local raw materials to eliminate OCPs from the gastrointestinal tract;



Results and discussion

- Also, during the seminars, we cited specific examples (for example, your and your child's illness is due to OCPs in your body, which came through cow's milk, meat and dairy, vegetables, melons, grains and legumes grown in pesticide polluted soils and waters - places of former pesticide storehouses, agro-airports, fields of former cotton and tobacco fields. Therefore, in order to maintain health, you should follow these recommendations, in these places and fields you have to plant trees for building materials, graze animals away from these places). Such meetings and seminars gave good results, the local population began to comply with our recommendations and demand that the authorities solve environmental problems.



Results and discussion

Outreach should begin with the most respected members of society, the «Aksakals". - older generations.



Results and discussion

Meeting of physicians
with women



Results and discussion

- Thus, in order to improve, raise the awareness and achieve compliance with safety measures and implementation of recommendations by the population living in places polluted by organochlorine pesticides, it is necessary to conduct a comprehensive study to determine the "degree of danger" for the pollution health. For this it is necessary to use breast milk as a biomarker and carry out a preventive examination of the population. When carrying out activities, use the data obtained from studies with specific examples, provide the local population the results of studies and recommendations so that they could demand from the local authorities the implementation of measures to eliminate OCPs pollution on the basis of the Stockholm Convention [16].



Results and discussion

- Scientifically based approach with the elements of evidence-based medicine will make it possible to raise the awareness of the population; their demand will also be justified, i.e. the population will demand from the authorities to withdraw the residues of obsolete pesticides and toxic substances, demand compensation for the “damage” caused to their health.
- To increase the effectiveness of ongoing seminars, meetings among the population and to raise the awareness and executive discipline, it is recommended to conduct a comprehensive study of the area, examine the local population by using our methods with the elements of evidence-based medicine.



References:

- 1. Toichuev R.M., Zhilova L.V., Makambaeva G.B., Payzildaev T.R., Pronk W., Bouwknegt M., & Weber R. (2018). Assessment and review of organochlorine pesticide pollution in Kyrgyzstan. *Environmental Science and Pollution Research*, 25 (32), 31836-31847. <https://doi.org/10.1007/s11356-017-0001-7>.
 - 2. Toichuev R.M., Toichueva A.U., Monitoring of organochlorine pesticides in breast milk of women in Kyrgyzstan. *Chemical Safety*, 2019, Vol.3, No. 2, pp. 94-109.
 - 3. Toichuev R.M., Zhilova L.V., Payzildaev T.R. et al. Organochlorine pesticides in placenta in Kyrgyzstan and the effect on pregnancy, childbirth, and newborn health // *Environmental Science and Pollution Research*. 2018. V. 25. No. 32. P. 31885.
 - 4. Malevich Yu.K., Simonova E.V. Organochlorine pesticides and their influence on the qualitative composition of breast milk of puerperas // *Belarusian Medical Journal*. 2003. No. 3. P. 86.
 - 5. Toguzbayeva K.K., Niyazbekova L.S., Seyduanova L.B. et al. Influence of ecological factor on the state of health of the rural population // *International Journal of Applied and Fundamental Research*. 2016. No. 4-2. P. 507.
 - 6. Karakushikova A.S., Toguzbayeva K.K., Myrzakhmetova Sh.K. Evaluation of the influence of the environmental factor on the state of health of the rural population // *Bulletin of KazNMU*. 2014. No. 3(3). P. 23.
 - 7. Tadevosyan N.S. Monitoring of individual organochlorine pesticides in the body of rural women in Armenia and indicators of the physical development of newborns and children of the first year of life // *Bulletin of KSMA named after I.K. Akhunbaev*. 2016. No. 5. P. 159.
 - 8. Hedley A.J., Hui L.L., Kypke K. et al. Residues of persistent organic pollutants (POPs) in human milk in Hong Kong // *Chemosphere*. 2010. V. 79. No. 3. P. 259.
 - 9. Madykova J.A. Contamination of cow's milk with organochlorine pesticides in the Osh Province, Kyrgyzstan // *Proceedings of 29th Annual Sci. Conf. International Society of Environmental Epidemiology (ISEE 2017)*. Sydney, Australia, 2017.
 - 10. Toichuev R.M. Adverse effects of pesticide deposit sites Ak-Chabyr and Tash-Baka located in Bazar-Korgon and Suzak districts of Zhalal-Abad region (Kyrgyz Republic) on the population health and biota // *Proceedings of the 11th HCH and Pesticides International forum*, 7-9 September 2011, Azerbaijan.
 - 11. Shtenberg A.I. Residual content of pesticides in food. M.: Medicine, 1973. P. 181.
 - 12. Toichueva A.U., Sakibaev K.Sh., Payzildaev T.R., Zhilova L.V., Toichuev R.M. Breast milk as a biological marker for determining the pollution of the environment with organochlorine pesticides in southern Kyrgyzstan. *Chemical Safety*. 2021. V. 5. No. 1. PP. 215-236.
 - 13. Toichuev R.M., Zhilova L.V., Toichueva A.U., Payzildaev T. R., Khametova M.Sh., Rakhmatillaev A. Organochlorine pesticides in the breast milk of urban women of Kyrgyzstan. *Chemical safety*. 2020. V.4. No. 1. PP. 197-215.
 - 14. Bacteriological control of breast milk. Method. rec. TsNIIE MZ, MNIIEiM, TSOLIUV, Research Institute of Pediatrics and Pediatric Surgery. M., 1984.
 - 15. Guidelines for selective gas chromatographic determination of organochlorine pesticides in biological media (urine, blood, adipose tissue) and breast milk. MU No. 3151-84. M., 1990.
 - 16. http://www.un.org/ru/documents/decl_conv/conventions/pdf/pollutants.pdf Stockholm. Convention on Persistent Organic Pollutants.
- ~~http://www.un.org/ru/documents/decl_conv/conventions/pdf/pollutants.pdf (accessed: 10/30/2019).~~