ГІГІЄНІЧНА ОЦІНКА РИЗИКУ НЕСПРИЯТЛИВОГО ВПЛИВУ ФУНГІЦИДІВ НА ЗДОРОВ'Я ЛЮДИНИ ПРИ СПОЖИВАННІ СІЛЬСЬКОГОСПОДАРСЬКОЇ ПРОДУКЦІЇ, ВИРОЩЕНОЇ З ЇХ ЗАСТОСУВАННЯМ

Вавріневич О.П., Антоненко А.М., Омельчук С.Т.

HYGIENIC ASSESSMENT OF FUNGYCIDES ON HUMAN HEALTH INFLUENCE RISK AFTER CONSUMPTION OF AGRICULTURAL PRODUCTS GROWED IN THEIR APPLICATION

VAVRINEVYCH O.P., ANTONENKO A.M., OMELCHUK S.T.
Hygiene and Ecology № 1 Department, Hygiene and Ecology Institute of O.O. Bogomolets National Medical University, Kyiv, Ukrane

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The main component of rational nutrition is the obligatory consumption of vegetables and fruits. According to WHO, for reliable protection of the human body from premature aging and the development of many diseases, it is necessary to have in daily ration at least 700-800 g of fruit and vegetables [1], since the connection between the type of nutrition and the prevalence of alimentary diseases and risk factors associated with them (obesity, diseases of the cardiovascular system, etc.) is proved [2-4].

It is known that the use of chemical plant protection products to combat various diseases is an integral part of the intensive technology of fruit, vegetable crops and vineyards growing, but the presence of its residual amounts in food products and raw materials may lead to violations in the health of consumers [5, 6].

After various crops spraying with pesticides, their containment is carried out on the plant surface using electrostatic and absorption forces [7]. Contamination of food products and agricultural raw materials with pesticides is determined by a number of factors, which are conventionally divided by Antonovich E.A., Sedokur L.K. into four main groups:

- ❑ the properties of a pesticide – the structure, physical and chemical properties;
- ❑ features of the cultivated culture (morphological, physiological and biochemical);
- ❑ conditions of pesticides application; 4) soil and climatic conditions [7].

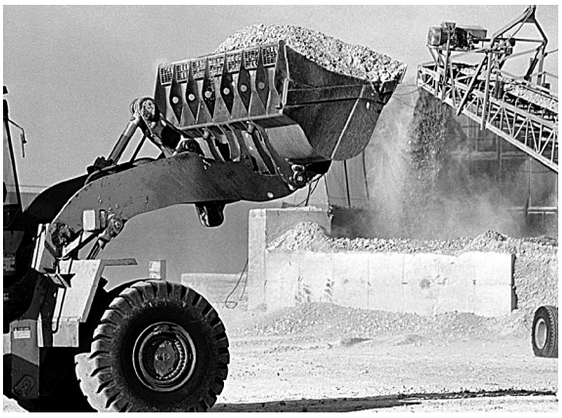
The abovementioned requires special control over the content of active substances of chemical plant protection products in vegetables, fruits, grapes and juices made from them, as well as risk assessment of such products usage.

Taking into account the above listed purpose the work was hygienic assessment of the risk of fungicides adverse effects on human health when consuming agricultural products grown in their application.

ГІГІЄНІЧНА ОЦІНКА РИЗИКУ НЕСПРИЯТЛИВОГО ВПЛИВУ ФУНГІЦИДІВ НА ЗДОРОВ'Я ЛЮДИНИ ПРИ СПОЖИВАННІ СІЛЬСЬКОГОСПОДАРСЬКОЇ ПРОДУКЦІЇ, ВИРОЩЕНОЇ З ЇХ ЗАСТОСУВАННЯМ
Вавріневич О.П., Антоненко А.М., Омельчук С.Т.
Інститут гігієни та екології Національного медичного університету ім. О.О. Богомольця, м. Київ, Україна

Основним компонентом раціонального харчування є обов'язкове споживання овочів та фруктів. Відомо, що застосування хімічних засобів захисту рослин для боротьби з різними захворюваннями є невід'ємною частиною інтенсивної технології вирощування плодових, овочевих культур та виноградників, проте наявність залишкових кількостей їх у харчових продуктах та сільськогосподарській сировині може призвести до порушень здоров'я споживачів.
Метою роботи *була гігієнічна оцінка ризику впливу фунгіцидів на здоров'я людини при споживанні сільськогосподарської продукції, вирощеної з застосуванням їх.*
Матеріали та методи. *Розраховані періоди напівруйнування (τ_{50}) речовини у рослинах. Для цього був використаний метод математичного моделювання. Для оцінки отриманих показників ми запропонували алгоритм комплексної оцінки можливого негативного впливу на організм людини пестицидів під час використання сільськогосподарської продукції, вирощеної з застосуванням їх.*
Результати і обговорення. *Результати розрахунків та порівняння отриманих величин показали, що значення можливого щоденного споживання пестицидів з продуктами були значно нижчими, ніж допустиме щоденне споживання пестицидів з продуктами для усіх досліджених овочевих культур.*
Висновки*. Встановлено, що величина ризику шкідливого впливу фунгіцидів під час споживання сільськогосподарської продукції, вирощеної з застосуванням їх, на 1-2 порядки нижче за допустимий і коливається від $1,2x10^{-2}$ до $2,6x10^{-1}$.*

Ключові слова: ризик, споживання, допустимий, сільськогосподарська продукція, можливий.



Materials and methods. We have studied the most promising representatives of fungicides chemical classes, which are widely used in Ukrainian and world agriculture [8-12]: triazoles (difenoconazole, penconazole, tebukonazole); strobilurines (pyraclostrobin, azoxystrobin, trifloxystrobin); cyanopyrrole (fludioxonil); ethylene-bisdithyocarbamates (methyram, mancozeb); anilides (benelaxyl-M, boscalid), aniline pyrimidines (cyprodinyl, pyrimethanil, valifenale); pyrazolecarboxamides (fluxaproxade, isopyrazam).

During the last 10 years at the Hygiene and Ecology Institute of Bogomolets National Medical University parameters of abovementioned fungicides stability in various crops were studied. In the course of field experiments in different soil-climatic regions of Ukraine: Polissya (Kyiv region), Forest-steppe (Vinnitsa, Kyiv, Poltava, Cherkasy regions) and Step (Odesa, Kherson regions), we determined the actual content of compounds in fruits of vegetables, pome and stone fruits, grapes and green mass of plants. For the study, samples of fruits and leaves were taken from the day of the last treatment and, after certain periods, 3-6 times during the growing season until the harvest. For comparison, before the beginning of crop processing, control samples of fruits and green mass of plants were taken. In control samples, active substances of different classes fungicides were not detected.

Determination of the content of active ingredients (a.i.) in fruits of vegetable, pome and stone fruits, grapes and green mass of plants was carried out using high-performance liquid (HPLC) and gas-liquid chromatography (GLC) methods.

In order to assess the behavior of the studied pesticides in the agrocenosis objects, the half-life periods (τ_{50}) of the substance in plants were calculated. For this purpose, a method of mathematical modeling that involves the estimated reproduction of the pesticides destruction processes on the basis of actual data was used, which allowed to predict their persistence.

In the classification of substances for stability in plants, the Ukrainian classification of pesticides according to the degree of Hazard State Standarts8.8.1.002-98 was used [13]. This classification foresees the division of substances according to stability in plants into 4 classes: 1 – highly stable (τ_{50} is more than 30 days), 2 – stable (15-30 days), 3 – moderately stable (5-14 days), 4 – not stable (less than 5 days).

To determine the potential risk to human health when using agricultural products containing residual amounts of fungicides, the maximum allowable level of content (MAL) and maximum residue level (MRL) of the substance in the cultures were used. These levels were justified during the state registration tests of formulations based on studied a.i.

In order to evaluate the obtained indices, we proposed the algorithm for a comprehensive assessment of the possible negative impact on human organism of pesticides in the use of agricultural products grown in their application. The algorithm takes into account the current in Ukraine approach of the actual dose of pesticide entering into the human body definition [14]. The algorithm is based on the establishment of a possible daily intake of pesticide with products (PDIPP) and a subsequent comparison with the allowable daily intake of pesticide with products (ADIPP), and consists of three steps (fig. 1).

On the first, using the results of field experiments concentration (C) of the studied fungicides in agricultural raw materials determination and the average daily consumption of the product (DCP), taking into account its physiological needs (K), the possible daily intake of pesticide with product (PDIPP) was calculated by the equation:

$$\mathbf{PDIPP = C_1 \times K_1 + C_2 \times K_2 + \ldots + C_n \times K_n\ (mg/day),}$$

where $C_{1,2, \ldots n}$ – content of pesticide in fruits of agricultural crops, mg/kg; $K_{1,2, \ldots n}$ – daily consumption of the product taking into account physiological needs, kg/day.

At the next stage, the allowable daily consumption of a pesticide (ADC) was established by the equation:

$$\mathbf{ADC = ADD \times M\ (mg/kg),}$$

where ADD – allowable daily dose of pesticide, mg/kg; M – average body weight of an adult (60 kg).

As well as the allowable daily intake of pesticide with products (ADIPP) by the equation:

$$\mathbf{ADIPP = ADC \times 0,7\ (mg/day)},$$

where ADC – allowable daily consumption, mg/day; 0,7 – coefficient, taking into account the maximum permissible consumption of a pesticide with food products (70%), % of the total, taking into account other ways of intake (20% with water and 10% with atmospheric air).

where M — body weight of an adult, 60 kg; ADD– allowable daily dose; 1,2, ... n — consumed food products; 0,7 – coefficient, taking into account the maximum permissible consumption of a pesticide with food products (70%),% of the total, taking into account other ways of intake (20% with water and 10 with atmospheric air).

After that, in the third stage, the values of PDIPP and ADIPP were correlated.

The risk was considered as acceptable if the resulting value (R) was ≤ 1.

Results and discussion. Therefore, at the first stage, we conducted a full-scale field researches on the studied fungicides content dynamics in various crops.

Study of the dynamics of triazole fungicides a. i. content in the fruits of crops and the green mass of plants in the field experiment showed that in the initial terms of the study their amount depended on the formulation application rate and the type of cultivated culture.

Comparison of several methods of vegetable crops processing in various agroclimatic zones showed that the content of strobilurines residual amounts in vegetables varies in the initial periods of observation, and it depends on the morphological properties of the culture (the formation of plants, the degree of leaves and buds growth) [6].

In the course of field studies, it was found that in all cases the initial amount of investigated compounds in the leaves and peduncles was higher than in the fruits of the studied cultures. A low concentration of compounds in fruits can be explained by their size at the time of formulations application.

The main amount of anilinopyrimidines active substances was found in the leaves on the day of treatment, followed by a decrease of 50% 5-6 days after exposure. The obtained results can be explained by the fact that the total surface area of leaves is much higher than that of fruits [7]. In subsequent study periods (after 20-25 days), the studied compounds content gradually decreased and in the green mass of plants their content was below the limit of quantitative determination of the method when harvesting.

It was also established that residual amounts of studied classes of fungicides in fruits and green mass of plants also depended on the type of processing.

It was established that in late terms of research after processing the contents of all studied a.i. in vegetables and fruits gradually decreased. When harvesting agricultural crops studied substanceswere not found. Study of all studied class of fungicides a.i. content in tomato, apple, grape, peach, pear, cherry, cherry juice from fruit after harvest was carried out. In juices the compounds studied were not detected.

In the next step, for all investigated compounds, the total amounts of each studied fungicide with all the food products, on which the formulation based on it could be used, were calculated (table 1).

Based on the principle of complex hygienic standardization, the values of ADC and ADIPPP were calculated (table 2).

Allowable daily consumptions of the studied substances were calculated (table 2). The obtained values ranged from 0,12 mg/day to 2,4 mg/day, taking into account the allowable daily dose (ADD), approved in Ukraine [14].

Proceeding from the principles of complex hygienic standardization, adopted in Ukraine, with food products in the human body can enter 70% of pesticide ADC. Thus, the calculated ADIPP (table 2) ranged from 0,084 μg/day to 1,68 μg/day.

Possible daily intake of pesticide with products was calculated based on the residual amounts of fungicides in the fruits of the studied crops, in the absence of their residues the limit of quantification of analytical methods usedwas used in calculations. PDIPP values were in the range from 0,008 μg/day to 0,077 μg day.

The results of calculations and comparison of variables showed that the values of PDIPPs were significantly lower than ADIPPs for all studied fruit and vegetable crops.

Figure 1

Steps of risk assessment of pesticides adverse effects on human health when consuming agricultural products grown in their application

I step — **Indices**

Content of pesticide in fruits of agricultural plants (C), mg/kg

Daily consumption of the product, taking into account its physiological needs (K), kg

Possible daily intake of pesticide with product (PDIPP)

$PDIPP = C_1 \times K_1 + C_2 \times K_2 + \ldots + C_n \times K_n$ (mg/day)

II step — **Allowable daily consumption of pesticide (ADC)**

ADC = ADD x M (mg/day)

Allowable daily intake of pesticide with products (ADIPP)

ADIPP = ADC x 0,7 (mg/day)

III step — **Assessment of pesticides adverse effect risk**

$$R = \frac{PDIPP}{ADIPP}$$

Risk is acceptable ≤ 1 | Risk is not acceptable > 1

where M — body weight of an adult, 60 kg; ADD– allowable daily dose; 1,2, ... n — consumed food products; 0,7 – coefficient, taking into account the maximum permissible consumption of a pesticide with food products (70%),% of the total, taking into account other ways of intake (20% with water and 10 with atmospheric air).

Conclusions

1. It has been shown that the maximum possible concentrations of the studied fungicides in food products are very low, and much lower than the allowable ones, which is related, first of all, to low application rates and indicates the relative safety for a person when using agricultural products, which could be contaminated with studied compounds in their application in the agro-industrial complex against diseases of agricultural crops.

2. It was established that the magnitude of the risk of harmful effects of fungicides in the consumption of agricultural products grown during their application were 1-2 orders of magnitude lower than the allowable ones and ranged from $1,2 \times 10^{-2}$ to $2,6 \times 10^{-1}$.

ЛІТЕРАТУРА

1. Глобальная стратегия ВОЗ в области рациона питания, физической активности и здоровья (Утверждена Всемирной Ассамблеей Здоровья. Резолюция 57.17 от 22.05.2004 г.). URL : *www.gnicpm.ru/UserFiles/Global_strategy_voz_diet.pdf*

2. Цимбаліста Н.В., Давиденко Н.В. Стан фактичного харчування населення та аліментарно обумовлена захворюваність. *Проблеми харчування.* 2008. № 1-2 (18). С. 32-35.
3. Rimm E.B., Ascherio A., Giovannucci E. et al. Vegetable, fruit, and cereal fiber intake and risk of coronary heart disease among men . *JAMA*. 1996. Vol. 275, № 6. P. 447-451.
4. Давиденко Н.В., Смирнова І.П., Горбась І.М., Кваша О.О. Харчування і артеріальна гіпертензія. *Укр. кардіол. журн.* 2004. № 5. С. 2-6.
5. Черных А.М. Угроза здоровью человека при использовании пестицидов. *Гигиена и санитария*. 2003. № 5. С. 25-29.
6. Safe use of pesticides. WHO Technical report series. Geneva : WHO, 1991. Vol. 813. 179 p.
7. Антонович Е.А., Седокур Л.К. Качество продуктов питания в условиях химизации сельского хозяйства. Справочник. К. : Урожай, 1990. 240 с.

Table 1

The estimated possible daily average intake of fungicides of the studied classes with food products into the human body

Product	Daily norm of the product consumption, g	Residual amounts in daily norm, mg							
		triazoles			strobilurines			ethylene-bis-dithyocarbamates	
		tebuko-nazole	penco-nazole	difeno-conazole	pyraclo-strobin	trifloxy-strobin	azoxy-strobin	methy-ram	manco-zeb
apple	125	0,00625	0,0025	0,00625	-	0,0025	-	0,00625	-
grape vine	200 (seasonal)	0,002	-	-	0,01	0,004	-	0,0100	0,0100
peach	70	-	0,0035	-	0,0105	-	-	-	-
plum	60	-	-	-	-	-	-	-	-
pear	80	-	-	0,0040	-	-	-	-	-
cherry	70	-	-	0,0028	0,007	-	-	-	-
merry	70	-	-	0,0028	0,007	-	-	-	-
apricot	60	-	-	-	0,009	-	-	-	-
cucumbers	50	-	0,0020	-	-	-	0,0005	-	-
potato	470	0,0235	-	0,0470	-	0,0094	0,047	0,0235	0,0235
tomatoes	120	0,0024	-	0,0120	0,012	0,0024	0,0012	0,006	0,006
carrot	50	0,0025	-	-	-	0,00125	-	-	-
cabbage	100	0,0200	-	-	-	0,002	0,01	-	-
onion	50	-	-	-	-	-	0,0025	0,0025	-
pea	50	-	-	-	-	-	0,01	-	-
Total	-	0,0567	0,008	0,0749	0,0555	0,02155	0,0712	0,04825	0,0395

Product	Daily norm of the product consumption, g	Residual amounts in daily norm, mg							
		cyanopyrrole	anilides		aniline pyrimidines			pyrazolecarboxamides	
		fludioxonil	benelaxyl-M	boscalid	cyprodi-nyl	valife-nale	pyrime-thanil	fluxapro-xad	isopyra-zam
apple	125	0,00625	-	-	0,0063	-	0,0125	0,044	0,006
grape vine	200 (seasonal)	-	0,020	-	-	0,02	0,02		
peach	70	0,007	-	0,0210	0,0035	-	-		
plum	60	0,006	-	-	0,0035	-	-		
pear	80	0,004	-	-	0,004	-	-	-	0,004
cherry	70	-	-	0,0175				0,007	-
merry	70	0,007	-	0,0175	0,0035	-	-	0,007	-
apricot	60	0,006	-	0,0210	0,0035	-	-		
cucumbers	50	0,002	-	-	0,005	-	-		
potato	470	-	0,0235	-	-	0,0235	-		
tomatoes	120	0,0048	0,012	-	0,012	0,012	0,006		
carrot	50	-	-	-					
cabbage	100	-	-	-					
onion	50	-	-	-					
pea	50	-	-	-					
Total	-	0,04305	0,0555	0,0770	0,0413	0,0555	0,0385	0,051	0,01

Note: – — preparations based on a.i. not used in this culture.

HYGIENIC ASSESSMENT OF FUNGICIDES' UNFAVOURABLE IMPACT ON HUMAN HEALTH AT THE CONSUMPTION OF AGRICULTURAL PRODUCTS GROWN WITH THEIR APPLICATION

Vavrinevych O.P., Antonenko A.M., Omelchuk S.T.
O.O. Bohomolets National Medical University, Kyiv, Ukraine

The main component of rational nutrition is an obligatory consumption of vegetables and fruits. It is known that the use of the plant protection chemical agents for the struggle with various diseases is an integral part of the intensive technology in fruit, vegetable crops and vineyards growing but the presence of their residual amounts in foodstuffs and agricultural raw materials may lead to disorders in consumers' health.
***Objective**. We performed a hygienic assessment of the risk of fungicides' impact on human health at the consumption of the agricultural products grown with their application.*
***Materials and methods.** We calculated the half-life periods (τ_{50}) of the substance in the plants with the help of the method of mathematical modeling. In order to evaluate the obtained indices, we proposed the algorithm for the complex assessment of possible negative impact of pesticides on human organism at the use of agricultural products grown with their application.*
***Results and discussion.** The results of calculations and comparison of the variables showed that the value of the possible daily intake of pesticide with the products was significantly smaller than allowable daily intake of pesticide with the products for all studied fruit and vegetable crops.*
***Conclusions**. The magnitude of the risk of the harmful impact of fungicides at the consumption of agricultural products, grown with their application, were 1-2 orders of magnitude smaller than the allowable one and ranged from $1,2x10^{-2}$ to $2,6x10^{-1}$.*
Keywords: Risk, consumption, allowable, possible, agricultural products.

8. EU – Pesticides database : Maximum Residue Levels. URL : *http://ec.europa.eu/food/plant/pesticides/max_residue_levels/index_en.htm.*
9. Positive List System for Agricultural Chemical Residues in Foods : Maximum Residue Limits (MRLs). List of Agricultural Chemicals in Foods. URL: *http://www.m5.ws001.squarestart.ne.jp/foundation/search.html*.
10. Health Canada : Maximum Residue Limits for Pesticides. URL : *http://pr-rp.hc-sc.gc.ca/mrl-lrm/index-eng.php.*
11. Codex Alimentarius : Codex Pesticides Residues in Food Online Database. URL : *http://www.fao.org/fao-who-codexalimentarius/standards/pestres/pesticides/en/.*
12. Перелік пестицидів і агрохімікатів, дозволених до використання в Україні. Офіційне видання. Київ : Юнівест Медіа, 2016. 1026 с.
13. Пестициди. Класифікація за ступенем небезпечності : ДСанПіН 8.8.1.002-98. *Збірник важливих офіційних матеріалів з санітарних і протиепідемічних питань.* Київ, 2000. Т. 9. Ч. 1. С. 249-266.
14. Методические указания по гигиенической оценке новых пестицидов : МУ № 4263-87. К. : М-во здравоохранения СССР, 1988. 210 с.

REFERENCES
1. Global Strategy on Diet, Physical Activity and Health (Resolution WHA 57.17 – 22.05.2004). URL : *http://www.gnicpm.ru/UserFiles/Global_strategy_voz_diet.pdf http://apps.who.int/gb/ebwha/pdf_files/WHA57/A57_R17-en.pdf .*
2. Tsymbalista N.V. and Davydenko N.V. *Problemy kharchuvannia*. 2008 ; № 1–2 (18) : 32-35 (in Ukrainian).
3. Rimm E.B., Ascherio A., Giovannucci E., Spiegelman D., Stampfer M.J. and Willett W.C. *JAMA.* 1996 ; 275 (6) : 447-451.
4. Davydenko N.V., Smyrnova I.P., Gorbas I.M. and Kvasha O.O. *Ukrainian Cardiology*

Table 2

Assessment of the risk of adverse effects of pesticides on human health when consuming agricultural products grown in their application

Fungicide class	Active ingredient	ADD, mg/kg	ADC, mg/day	ADIPP, vg|day	PDIPP, mg/day	R
Triazoles	tebukonazole	0,030	1,8	1,260	0,0567	$4,5x10^{-2}$
	penconazole	0,007	0,42	0,294	0,0080	$2,7x10^{-2}$
	difenoconazole	0,002	0,12	0,084	0,0749	$8,9x10^{-1}$
Strobilurines	pyraclostrobin	0,030	1,8	1,260	0,0555	$4,4x10^{-2}$
	trifloxystrobin	0,020	1,2	0,840	0,0216	$2,6x10^{-2}$
	azoxystrobin	0,030	1,8	1,260	0,0712	$5,7x10^{-2}$
Ethylene-bis-dithyocarbamates	methyram	0,020	1,2	0,840	0,0483	$5,8x10^{-2}$
	mancozeb	0,005	0,3	0,210	0,0395	$1,9x10^{-1}$
cyanopy-rrole	fludioxonil	0,015	0,9	0,630	0,0431	$6,8x10^{-2}$
anilides	benelaxyl-M	0,005	0,3	0,210	0,0555	$2,6x10^{-1}$
	boscalid	0,040	2,4	1,680	0,0770	$4,6x10^{-2}$
aniline pyrimidines	cyprodinyl	0,030	1,8	1,260	0,0413	$3,3x10^{-2}$
	valifenale	0,005	0,3	0,210	0,0555	$2,6x10^{-1}$
	pyrimethanil	0,020	1,2	0,840	0,0385	$4,6x10^{-2}$
pyrazolecarbox-amides	isopyrazam	0,010	0,6	0,420	0,0510	$1,2x10^{-1}$
	fluxaproxad	0,020	1,2	0,840	0,0100	$1,2x10^{-2}$

Notes: ADC – allowable daily consumption; PDIPP – possible daily intake of pesticide with products; ADIPP – allowable daily intake of pesticide with products; R – risk value.

Journal. 2004 ; 5 : 2-6 (in Ukrainian).
5. Chernykh A.M. *Gig. i san.* 2003 ; 5 : 25-29 (in Russian).
6. Safe Use of Pesticides. WHO Technical Report Series. Geneva : WHO, 1991 ; 813:179 p.
7. Antonovich Ye.A. and Sedokur L.K. Kachestvo produktov pitaniya v usloviyakh khimizatsii selskogo khoziaistva. Spravochnik [Quality of the Foodstuffs under Conditions of Agricultural Chemicalization]. Kiev : Urozhay; 1990 : 240 p. (in Russian).
8. EU – Pesticides database : Maximum Residue Levels. URL : *http://ec.europa.eu/food/plant/pesticides/max_residue_levels/index_en.htm.*
9. Positive List System for Agricultural Chemical Residues in Foods : Maximum Residue Limits (MRLs). List of Agricultural Chemicals in Foods. URL : *http://www.m5.ws001.squarestart.ne.jp/foundation/search.html.*
10. Health Canada : Maximum Residue Limits for Pesticides. URL : *http://pr-rp.hc-sc.gc.ca/mrl-lrm/index-eng.php.*
11. Codex Alimentarius : Codex Pesticides Residues in Food Online Database. URL : *http://www.fao.org/fao-who-codexalimentarius/standards/pestres/pesticides/en/.*
12. Perelik pestytsydiv I ahrokhemikativ, dozvolenykh do vykorystannia v Ukraini. Ofitsiine vydannia [List of Pesticides and Agrochemicals Allowed for Application in Ukraine. Official Edition]. Kyiv : Yunivest Media; 2016 : 1026 p. (in Ukrainian).
13. Pesrytsydy. Klasyfikatsiia za stupenem nebezpechnosti : DSanPiN 8.8.1.002-98 [Pesticides. Classification by Safety Degree : State Sanitary Rules and Norms 8.8.1.002-98]. In : *Zbirnyk vazhlyvykh ofitsiinykh materialiv z sanitarnykh I protyepidemichnykh pytan [Collection of the Important Official Materials on Sanitary and Anti-Epidemic Issues].* Kyiv ; 2000; 9 (P. 1) : 249-266 (in Ukrainian).
14. Metodicheskie ukazaniya po gigienicheskoi otsenke novykh pestitsidov : MU № 4263-87 [Methodical Directions on the Hygienic Assessment of New Pesticides : MD № 4263-87]. Kiev ; 1988 : 210 p. (in Russian).

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ANALYSIS OF THE DATA OF ULTRASOUND HEART EXAMINATION IN THE WORKERS OF LOCOMOTIVE CREWS DEPENDING ON THEIR SENIORITY

Tkachyshyna N.Yu.

АНАЛІЗ ДАНИХ УЛЬТРАЗВУКОВОГО ДОСЛІДЖЕННЯ СЕРЦЯ У ПРАЦІВНИКІВ ЛОКОМОТИВНИХ БРИГАД ЗАЛЕЖНО ВІД СТАЖУ РОБОТИ

ТКАЧИШИНА Н.Ю.
ПАТ «УЗ» філії «ЦОЗ» Київська клінічна лікарня на залізничному транспорті № 2

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Ключові слова: локомотивні бригади, умови праці, серцево-судинна система, ультразвукове дослідження серця.

Безпека перевезень на залізничному транспорті є першочерговим завданням медицини транспортної галузі. Тому вивчення стану здоров'я, попередження, рання діагностика і своєчасне лікування загальносоматичних захворювань у працівників локомотивних бригад (ПЛБ) завжди залишається актуальним завданням транспортної медицини [1]. Визначення патологічних процесів у ПЛБ на ранніх етапах призведе до запобігання виникненню нозологій, що несумісні з виконанням професійних обов'язків означеної категорії. Особливого значення набувають серцево-судинні захворювання

АНАЛИЗ ДАННЫХ УЛЬТРАЗВУКОВОГО ИССЛЕДОВАНИЯ СЕРДЦА У РАБОТНИКОВ ЛОКОМОТИВНЫХ БРИГАД В ЗАВИСИМОСТИ ОТ СТАЖА РАБОТЫ

Ткачишина Н.Ю.

ПАО «УЗ» филиала «ЦЗО» Киевская клиническая больница на железнодорожном транспорте № 2, г. Киев, Украина

Проведено ультразвуковое исследование сердца 398 работникам локомотивных бригад (РЛБ) и 116 инженерно-техническим работникам УЗ. ***Результаты исследования*** *показали, что у РЛБ имеют место такие изменения: дилатация аорты, ранняя диастолическая дисфункция миокарда, специфическая динамика геометрических изменений левого желудочка с приобретением им формы шара, что является особенностью его моделирования с уменьшением ударного объема на фоне увеличения частоты сердечних сокращений. Подобные изменения прогрессируют у РЛБ с увеличением стажа и способствуют ускоренному темпу старения при наличии вредных условий работы.*

Ключевые слова: локомотивные бригады, стаж работы, сердечно-сосудистая система, ультразвуковое исследование сердца.

ANALYSIS OF THE DATA OF ULTRASOUND HEART EXAMINATION IN THE WORKERS OF LOCOMOTIVE CREWS DEPENDING ON THEIR SENIORITY

Tkachyshyna N.Yu.

Kyiv Clinical Hospital at Railway Transport № 2, "HC" Branch, PC"UR"

We performed the ultrasound examination of the heart in 398 workers of locomotive crews (WLC) and 116 engineers and technicians of UR. ***The results*** *of the study showed that there were the following changes in the WLC: aorta dilatation, early diastolic dysfunction of myocardium, specific dynamics of geometric changes in the left ventricle with the acquisition of a ball shape that was a feature of its modelling with a decrease of the stroke volume in an increase of the heart rate. Similar changes progress in the WLC at the increase of the seniority and contribute to the accelerated rate of aging under harmful working conditions.*

Keywords: locomotive crews, seniority, cardiovascular system, ultrasound examination of the heart.