LABOR PROTECTION

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Occupational morbidity and occupational injury in the food industry

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Introduction. The article considers the problems of occupational morbidity and occupational injuries in the food industry, including factors and causes that form working conditions that contribute to the occurrence of morbidity and accidents.

Problem Statement. The aim of the study is to analyze occupational morbidity and occupational injuries and their causes, as well as to propose corrective or preventive measures aimed at eliminating the causes of accidents, injuries, and the development of occupational diseases.

Theoretical Part. As initial information, the statistical reporting data of the Federal State Statistics Service and the materials of domestic and foreign literary sources are given.

Conclusions. The results of the work indicate the presence of occupational morbidity and occupational injuries among food workers and the need to introduce and implement a number of measures aimed at improving working conditions and improving safety.

Keywords: occupational morbidity, occupational injuries, food industry, hazardous and harmful factors, labor protection.

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Introduction. The tasks of labor protection and organization of safety of workers at enterprises of various fields of activity form the basis of the socio-economic well-being of the country, and are also the most important condition for the formation of the health of the nation. One of the leading branches of the national economy of the Russian Federation is the food industry, which employs about 1.5 million people.

Problem Statement. The objective of the study is to analyze occupational morbidity and occupational injuries and their causes, as well as to propose corrective or preventive measures aimed at eliminating the causes of accidents, injuries, and the development of occupational diseases.

Theoretical Part. Figure 1 shows data from the Federal State Statistics Service on the number of people employed in production with harmful and (or) dangerous working conditions in food production organizations from the beginning of 2018 to the end of 2020 [1].

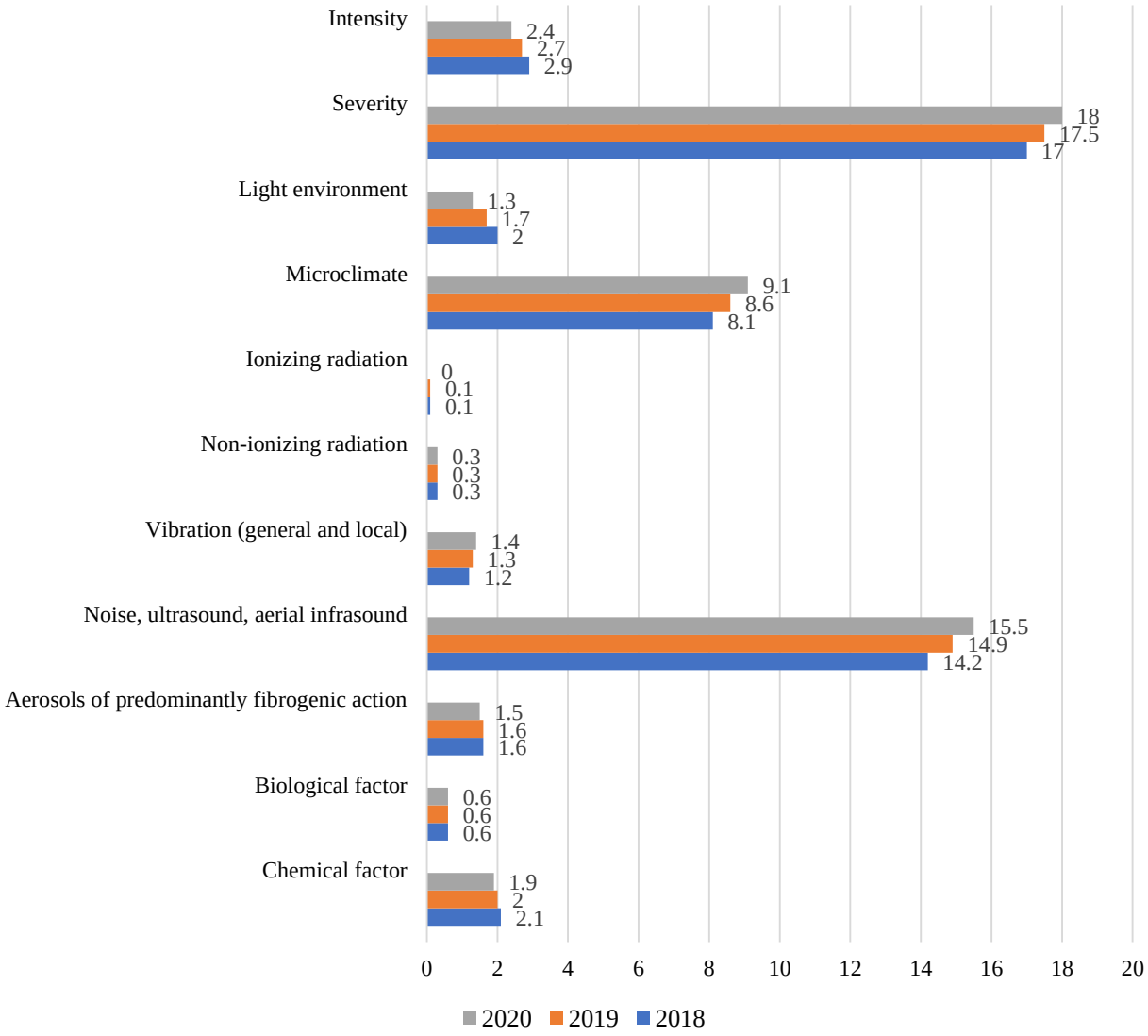

Fig. 1. The number of employees working in harmful and (or) dangerous working conditions at food industry enterprises, in % of the total number

The share of those employed in jobs with harmful and (or) dangerous working conditions is on average 35% per year of the total number of employees in the food industry, while each employee is counted once, regardless of the number of hazardous and harmful production factors affecting him. Thus, more than 1/3 of food industry workers perform their functions under the predominant influence of the heavy labor process, noise, and microclimate. At the same time, it should be noted that during the period under review, there was no decrease in the number of people working in such conditions.

Modern technologies in the food industry, the technical condition of enterprises, working conditions and organization of workplaces do not ensure compliance with sanitary and hygienic standards for a number of indicators: acoustic, microclimate, light environment, air of the working area, severity and intensity of work, etc. These factors contribute to the development of occupational and work-related diseases. Under the influence of the above factors and/or their combinations, a critical mass of toxic (harmful) substances accumulates in the human body and changes the physiological functions of organs and systems, leading to pathological conditions [2]. These include diseases caused by chemical and biological substances, diseases of the musculoskeletal system, peripheral vessels and heart, central nervous system, upper respiratory tract, etc.

According to the European statistics on occupational diseases, diseases of the musculoskeletal system (MSS) account for about 38% of all occupational diseases. In the food and beverage industry, there are many risk factors for the development of MSS diseases: work is characterized by long hours of static loads leaning forward (uncomfortable forced posture), repetitive and rapid movements of hands and wrists (stereotypical movements), prolonged and strong tension of hands and wrists, as well as carrying and lifting heavy objects [3-4].

The prevalence of MSS diseases among food industry workers reaches 67.5%, according to localization they are distributed as follows: 63% — in the lower limbs, 56-65.8% — in the lower back, 49% — in the neck and upper back, 62.3% — in the shoulder [5, 6].

In-depth nosological analysis indicates a significantly increased risk of carpal tunnel syndrome / median/ ulnar nervous disorders, myelopathy, spondylosis, displacement of the thoracic or lumbar intervertebral disc, peripheral enthesopathy, disorders of the synovial region, tendon and bursa, diseases of the extra-articular soft tissues of the back and extremities, as well as trigger finger and radial styloid tendovaginitis [7].

Soft tissue diseases, spondylosis and related disorders occupy a leading place in the ranking of MSS diseases in this group of workers, which is associated with the excessive use of muscles, rapid and repetitive movements, as well as prolonged static loads and uncomfortable forced posture [8, 9].

There is an increased risk of peripheral vascular diseases, including varicose veins of the lower limbs due to prolonged static load during the working day. The results of systematic observations indicate that those who work standing up for more than 3-4 hours a day have an increased risk of varicose veins development (2.5 times) compared to those who do not have such a load. At the same time, the prevalence of this disease or even the risk of acquiring it is higher in women than in men [10, 11].

The risk of developing vibration disease in food industry workers, which may be associated with exposure to local or general vibration, is not excluded. Manifestations: polyneuropathy of the upper limbs, including sensory and vegetative-trophic disorders, peripheral angiodistonic syndrome of the upper limbs (including Raynaud's syndrome), carpal tunnel syndrome (compression neuropathy of the median nerve), myofibrosis of the forearms and shoulder girdle, arthrosis and periarthrosis of the wrist and elbow joints, polyneuropathy of the extremities in combination with radiculopathy of the lumbosacral level, cerebral angiodistonic syndrome [12, 13].

One of the risk factors for food industry workers is exposure to dangerous sound levels. A number of studies have shown that the average sound level in the food industry can vary from 58 to 98 dBA, this affects the development of specific aural effects, manifested both in the form of slowly progressive hearing loss by the type of auditory nerve neuritis (cochlear neuritis), and with some extraaural effects, including headaches, high blood pressure, sleep loss, increased heart rate, pain in the heart, increased blood pressure, gastrointestinal dysfunction, decreased immunological reactivity, stress metabolic reaction [14, 15].

Infrasound sources in the food industry can be compressors, air conditioners, turbines, industrial fans and hoods, large-sized refrigeration equipment [16]. The biological action of infrasound (IS) is characterized mainly by extraaural effects. The mechanism of action of IS is associated with the effect on the mechano- and proprioceptors of the body, with resonant effects, direct propagation of elastic waves through organs and tissues. The critical organs are the vestibular analyzer, the central nervous and cardiovascular systems, and the respiratory organs. The clinical picture is dominated by asthenovegetative and vascular disorders that contribute to the formation of asthenic syndrome, hypertension, encephalopathy of the discirculatory type, etc. [17, 18].

Figure 2 shows the data reflecting the number of employees engaged in the production of food products with the established occupational disease.

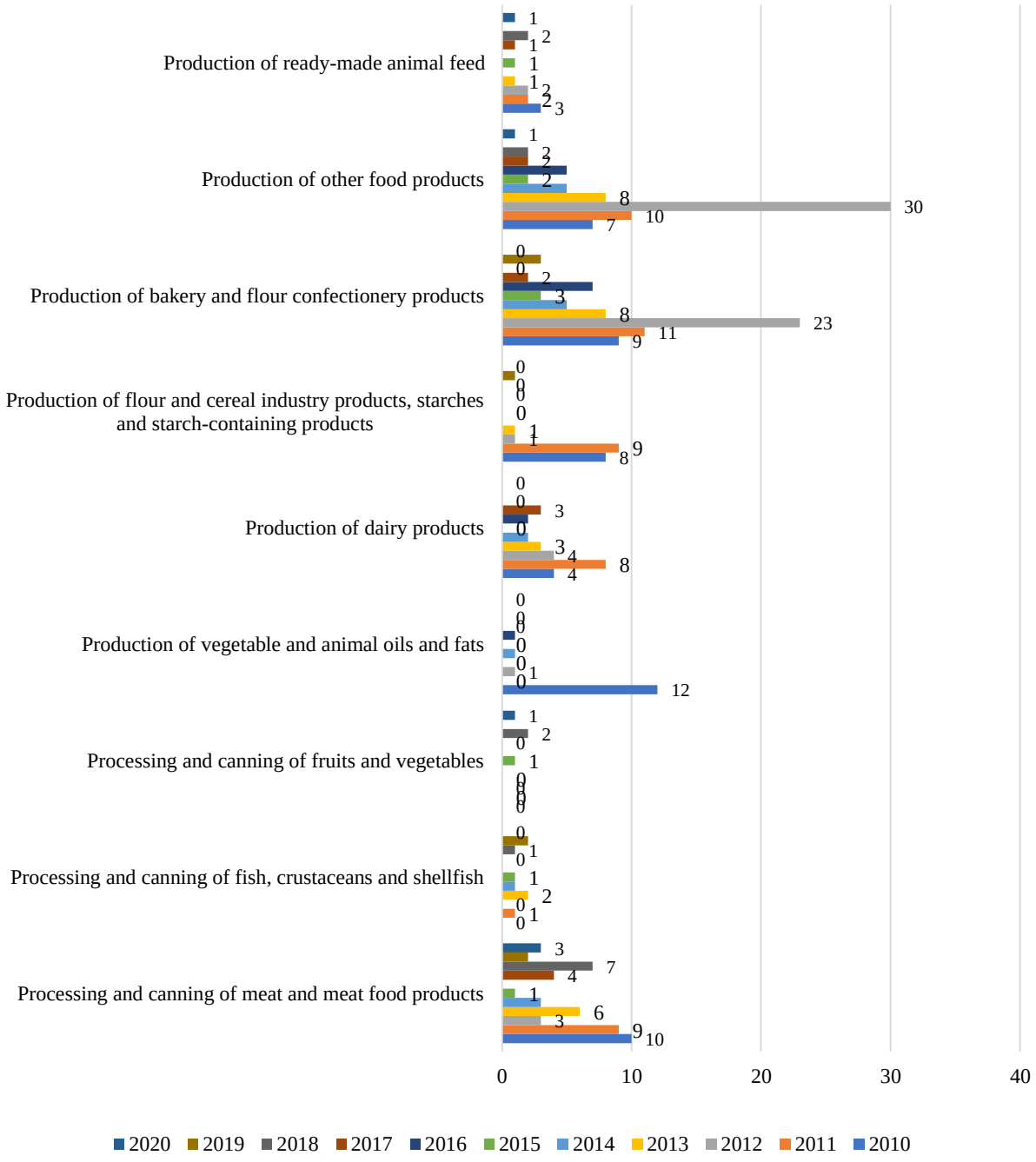

Fig. 2. The number of people employed in the production of food products with occupational diseases established in 2010-2020

The analysis of statistical data indicates the stabilization of the number of occupational diseases in the industry as a whole. However, these data generally reflect the officially confirmed cases, the actual rates are not taken into account, they occur due to late detection or no detection of occupational diseases during periods of medical examinations, but also because of the concealment of the occurrence of occupational diseases, etc.

In addition to occupational diseases, there are risks of traumatic situations and accidents, including fatal outcomes [19].

Tables 1, 2 contain data on occupational injuries in the food industry.

Table 1

Statistical data on victims in the food industry from 2010 to 2020

Type of activity	**The number of victims with disability for 1 working day or more and with a fatal outcome**										
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Processing and canning of meat and meat food products	684/11	567/8	505/15	450/9	360/5	303/4	309/8	363/13	308/8	327/8	273/8
Processing and canning of fish, crustaceans and shellfish	112/6	82/2	75/5	67/3	40/-	39/2	55/5	67/3	63/2	87/2	57/3
Processing and canning of fruits and vegetables	54/2	35/-	35/-	25/1	24/-	25/-	21/-	21/1	11/1	10/1	13/1
Production of vegetable and animal oils and fats	72/5	65/2	81/5	63/5	62/3	61/5	50/3	40/-	56/3	54/2	49/-
Production of dairy products	537/12	474/8	420/10	400/10	300/4	321/5	272/6	216/5	220/8	179/4	167/6
Production of flour and cereal industry products, starch and starch-containing products	220/6	187/1	168/11	112/4	96/6	82/4	61/4	63/1	61/5	67/-	46/2
Production of bakery and flour confectionery products	898/12	796/13	786/16	647/16	595/16	490/10	457/9	454/7	363/6	396/4	319/3
Production of other food products	528/8	468/9	461/9	380/10	349/10	228/6	269/6	268/5	216/8	239/8	210/9
Production of ready-made animal feed	103/2	66/2	64/2	55/3	52/1	47/2	38/7	44/1	34/-	31/-	23/2
TOTAL	3502/70	2994/49	2595/73	2199/61	1878/45	1656/38	1532/48	1536/36	1331/41	1390/29	1157/34

Table 2

Statistical data on the total number of employees and the number of victims in the food industry from 2010 to 2020

Indicator	**Period**										
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Average number of employees, people	1053666	1034207	876126	848335	832456	821365	825123	832900	805487	830396	802799
Number of victims, people	3502	2994	2595	2199	1878	1656	1532	1536	1331	1390	1157
Expenses for labor protection measures, thousand rubles	4530588,4	4783211,2	5033211,2	5546878,4	5881758,8	6932264,8	7064749,3	8071147,8	8195880,5	9273797,3	11368203,4

The data provided on injuries and the number of established occupational diseases indicate a downward trend in recent years. However, at the same time, there is a clear correlation between the reduction in the number of victims in the industry with a decrease in the average number of employees and an increase in the costs of labor protection measures. So, from 2010 to 2020, the number of employees decreased from 1,053,666 to 802,799 people, expenses aimed at improving working conditions increased from 4,530,588.4 thousand rubles to 11,368,203.4 thousand rubles. For example, the number of accidents fell from 3502 to 1,157, and the number of people with the established occupational diseases decreased from 53 to 6.

It should be noted that the violation of the procedure for providing statistical data, their untimely provision or the provision of unreliable data by enterprises occurs for a number of reasons. Firstly, the size of the insurance tariff for the enterprise, as well as the return of funds from the social insurance fund provided for the prevention of injuries at work, directly depend on the number of injuries and deaths. Secondly, the employers are afraid of penalties from the supervisory authorities, namely the State Labor Inspectorate. In case of a serious or fatal accident at an enterprise, an inspector of the State Labor Inspectorate is included in the investigation commission, who has the right to fine for violations detected or issue instructions for their elimination, and these actions are costly for owners. Thirdly, officials are afraid of fall under the criminal liability under Article 143 of the Criminal Code of the Russian Federation "Violation of labor protection requirements". Fourthly, the investigation of accidents requires time and financial costs, as well as the collection of a significant number of documents.

Statistical data, as well as the research by a number of authors, indicate that accidents occur at enterprises due to unsatisfactory organization of production and technological violations, weak control by management or those responsible for production and labor discipline, regular deviation from the rules and instructions of safety by employees, employers' evasion from the introduction of a labor protection management system and inclusion in the structure of labor protection and/or industrial safety services, and in the staffing table — specialists in labor protection, operation of obsolete morally and physically technological equipment or its use in a faulty condition, poor equipment of workplaces and their maintenance in improper order, absence or malfunction of blocking devices, fences of rotating and moving parts of equipment, absence or non-use of personal and collective protective equipment, erroneous actions of employees, their presence in a state of alcoholic, narcotic and other types of intoxication, etc. [16, 20-21].

All of the above reasons are common to the businesses in question. However, there are also specific causes of injuries at food industry enterprises related to the peculiarities of the technological process, the equipment used, etc. For example, at enterprises for processing and canning meat and meat food products, where the greatest number of accidents are found, the facts of injuries are caused by malfunction and wear of machines and mechanisms (such as

saws, meat grinders, cutters, lifts, tops, etc. d.), close contact of workers with dangerous production equipment or tools (for example, when working with knives), imperfection of technological equipment (for example, there are no devices on the machine for processing intestines that ensure the safety of loading and unloading, pressure monitoring and control devices are not installed on vacuum boilers, there are no locking systems on power grinders and crushers, fences are not installed at electric dehumidifiers, etc., there are no emergency switches on the line of primary processing of poultry, etc. non-compliance of the placement of technological equipment with the requirements of safety and ergonomics (for example, the distance between the work places of boners and meat trimmers is not observed, there are no devices for storing hand knives during the work of the operator of the machine for removing the skin from the fat, etc.), non-compliance with labor protection rules when working with technological equipment. The main types of injuries in the above cases are limb injuries, fractures, dislocations, burns, electric shocks [21].

In order to reduce the number of accidents, injuries and occupational diseases, as well as to bring working conditions in line with sanitary and hygienic standards, it is necessary to solve the following tasks on labor protection at food industry enterprises:

— to increase the effectiveness of occupational safety training and promotion of labor protection;

— to normalize sanitary and hygienic working conditions;

— to ensure the safety of production equipment, technological processes, buildings, structures, premises, and the territory of the enterprise;

— to carry out professional selection of employees from the point of view of suitability for work safety;

— to provide workers with individual and collective protection means;

— to carry out constant monitoring and introduce control over the compliance with the occupational health and safety regulations;

— to motivate employees to observe their own safety, etc.

To develop corrective or preventive measures and eliminate the causes of accidents, injuries, the development of occupational and work-related diseases, it is possible to use modern approaches to protecting the health of workers. These include:

— implementation of national standards of the "Risk Management" system;

— use of a causal relationship diagram of occupational injuries and occupational diseases Ishikawa;

— development of programs for accounting and analysis of working conditions at the whole enterprise and separately by workshops, sites, divisions;

— use of visual management methods based on the principles of lean manufacturing and workplace safety, methods of standardization of work and visualization, protection against unintentional errors, the method of universal maintenance of equipment;

— use of modern digital tools in the field of occupational safety, especially virtual and augmented reality technologies, serious games and gamified methods aimed at training employees in the field of occupational safety by immersion in the production environment, including with the increased danger conditions, emergency situations;

— creation and implementation of tracking devices that allow you to track and analyze the work of personnel and prevent emergencies (at the same time, both standard mobile gadgets and specially designed devices can be used as such devices);

— introduction of positioning devices related to the movement of machines, mechanisms, production equipment (for example, to prevent the number of accidents associated with the runover on staff, collision);

— development of organizational measures by introducing critically important rules, in case of non-compliance with which the violators are dismissed from work, etc.

Conclusions. The results of the analysis of statistical data on occupational morbidity and occupational injuries from 2010 to 2020 indicate a downward trend in the total number of cases of occupational morbidity and occupational injuries among food industry workers, which is primarily due to the decrease in the average number of employees in the

industry and the increase in the cost of occupational safety measures, rather than a general improvement in working conditions and the introduction of measures to improve safety. Thus, there is a need to introduce and implement a number of corrective or preventive measures at enterprises aimed at eliminating the causes of accidents, injuries, and the development of occupational diseases.

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Contribution of the authors:

V. Y. Kontareva — formulation of the basic concept, goals and objectives of the study, preparation of the text, formulation of the conclusions; S. N. Belik — analysis of the research results, revision of the text, correction of the conclusions.