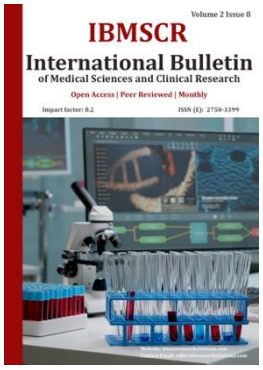

THE HYGIENIC ANALYSIS RESULTS OF THE NUTRITIONAL VALUE OF THE DIET CONSUMED BY WORKERS OF A TOBACCO PRODUCTS MANUFACTURING ENTERPRISE

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Annotation: The study presents the results of a hygienic assessment of the nutritional and energy value of the daily diet consumed by workers employed in a tobacco products manufacturing enterprise. The research aimed to determine seasonal variations in the intake of major nutrients—proteins, fats, and carbohydrates—and their compliance with physiological requirements and hygienic standards.

Keywords: Nutrition, Hygienic analysis, Tobacco industry workers, Dietary structure, Energy value, Seasonal variation

Research relevance: Occupational nutrition and hygienic assessment of dietary patterns among industrial workers have been recognized as an essential aspect of labor hygiene and public health. Numerous studies indicate that workers employed in hazardous production environments, including tobacco manufacturing, are exposed to multiple occupational risk factors such as nicotine vapor, tobacco dust, volatile organic compounds, and psychosocial stress. These factors significantly affect the metabolic rate, nutrient utilization, and overall health status of workers, thus necessitating an adequate and well-balanced diet to maintain physiological resilience and work capacity.

According to the World Health Organization (WHO, 2021) and FAO nutritional guidelines (2019), industrial workers' diets should ensure sufficient intake of energy, proteins, essential fatty acids, vitamins (especially A, C, and E), and minerals such as calcium, magnesium, and zinc. Research by Kuznetsova et al. (2018) and Belyaeva & Rakhimova (2020) demonstrated that workers in tobacco industries often exhibit deficiencies in antioxidant vitamins and trace elements, which may increase oxidative stress and susceptibility to respiratory and cardiovascular disorders.

Studies conducted in Russia, Uzbekistan, and other Central Asian countries (e.g., Tashkenbaeva, 2020; Mamatov, 2022) emphasized the hygienic importance of diet optimization for industrial workers. It was shown that an imbalance in macronutrients—particularly excessive carbohydrates and insufficient protein and unsaturated fats—leads to decreased immune resistance and faster fatigue during working hours. Moreover, insufficient intake of B-group vitamins, iron, and magnesium is associated with a decline in cognitive and neuromuscular performance.

Foreign investigations (e.g., Liu et al., 2019; Hernández & Ortiz, 2021) confirm that occupational exposure to nicotine and dust negatively affects appetite, digestive enzyme activity, and micronutrient absorption, leading to lower levels of vitamin C, folate, and iron in blood serum. Therefore, dietary correction through enriched and fortified foods, as well as periodic medical and nutritional monitoring, are recommended hygienic measures.

In Uzbekistan, comprehensive studies of the nutritional status of tobacco factory workers

remain limited. Preliminary assessments indicate that their daily rations often fail to meet physiological norms for protein and vitamins, especially during long working shifts. Hence, a systematic hygienic evaluation of the workers' diet is crucial for developing targeted recommendations aimed at improving occupational nutrition, preventing chronic fatigue, and reducing the risk of nutrition-related diseases.

In conclusion, the literature highlights that ensuring an optimal and balanced diet for tobacco industry workers is a key preventive measure within occupational health management. Regular hygienic monitoring of dietary quality, nutrient intake balance, and biochemical indicators should be an integral part of workplace health programs to maintain the efficiency, safety, and long-term well-being of employees engaged in tobacco manufacturing.

Research methods: In this study, the nutritional (nutrient) status of workers employed in a tobacco manufacturing enterprise was evaluated using hygienic, questionnaire-survey, and statistical methods. The hygienic method involved assessing the composition, energy value, and nutrient balance of workers' daily diets in accordance with sanitary-epidemiological standards. The questionnaire survey was conducted to determine the workers' dietary habits, food preferences, and awareness of healthy nutrition. Statistical methods were applied to process and analyze the obtained data, including the calculation of mean values, standard deviations, and correlation coefficients to identify significant relationships between nutritional indicators and working conditions.

Research Objective: The purpose of the study is to analyze the hygienic assessment results of the nutritional value of the diet consumed by workers of a tobacco products manufacturing enterprise in each season**.**

Research Results: The proportion of the main nutrients—proteins, fats, and carbohydrates—within the workers' diet was systematically analyzed across all seasons to determine seasonal variations in dietary balance.

A comparative evaluation of the nutritional and energy value of the daily average diet consumed by employees of the tobacco manufacturing enterprise was conducted in accordance with physiological requirements and established hygienic standards. The findings illustrating these relationships and seasonal fluctuations are summarized in Table 1.

During the winter season, the average protein content in the workers' diet amounted to 160.7 ± 15.6 g (123.9%), fats and oils to 161.5 ± 11 g (131.1%), and carbohydrates to 686.6 ± 11.3 g (110%). The calculated energy ratio of these nutrients was 1:1:4.3, indicating a relative predominance of carbohydrates in the dietary structure (see Table 1).

Table 1

The Amount of Main Nutrients in the Daily Diet of Workers of a Tobacco Products Manufacturing Enterprise During the Winter Season

№	Indicators	Standard, g	Result	%
1	Proteins, g	129,7	160,7±15,6**	123,9
2	Fats, g	123,2	161,5±11*	131,1
3	Carbohydrates, g	624,2	686,6±11,3***	110,0
4	Energy value	3414,8	4975,9±174,6	145,7
5	P:F:C ratio	1:1:4	1:1:4,3	

Note: – the differences between the group indicators of the given diet are statistically

significant (–r<0.05; **–r<0.01; **–r<0.001);

In the spring season, the workers' daily intake of proteins averaged 151.8 ± 8.4 g, showing a statistically significant difference ($p < 0.01$). The consumption of fats and oils reached 146.9 ± 10.5 g ($p < 0.05$), while carbohydrates were recorded at 638.1 ± 15.2 g ($p < 0.001$). The resulting energy value ratio was 1:1:4.2, reflecting a slightly more balanced nutrient distribution compared to the winter period (see Table 2).

Table 2

The Amount of Main Nutrients in the Daily Diet of Workers of a Tobacco Products Manufacturing Enterprise During the Spring Season

№	Indicators	Standard, g	Result	%
1	Proteins, g	129,7	151,8±8,4**	117
2	Fats, g	123,2	146,9±10,5*	119,2
3	Carbohydrates, g	624,2	638,1±15,2***	102,2
4	Energy value	3414,8	4604,8±160,8	134,8
5	P:F:C ratio	1:1:4	1:1:4,2	

Note: – the differences between the group indicators of the given diet are statistically significant (–r<0.05; **–r<0.01; **–r<0.001);

The distribution of the main nutrients during the summer season is summarized in Table 3.

Analysis of the workers' daily diet revealed that the average protein intake was 139.3 ± 7.6 g ($p < 0.001$), while the amount of fats and oils consumed was 139.8 ± 10.5 g ($p < 0.001$), and carbohydrates accounted for 626.3 ± 18.4 g ($p < 0.001$). The computed energy value ratio of these nutrients was 1:1:4.5, indicating a relative increase in carbohydrate contribution to the total caloric intake compared to previous seasons.

Table 3

The Amount of Main Nutrients in the Daily Diet of Workers of a Tobacco Products Manufacturing Enterprise During the Summer Season

№	Indicators	Standard, g	Result	%
1	Proteins, g	129,7	139,3±7,6***	107,4
2	Fats, g	123,2	139,8±10,5***	113,5
3	Carbohydrates, g	624,2	626,3±18,4***	100,3
4	Energy value	3414,8	4439,1±167,6	130,0
5	P:F:C ratio	1:1:4	1:1:4,5	

Note: – the differences between the group indicators of the given diet are statistically significant (–r<0.05; **–r<0.01; **–r<0.001);

During the autumn season, the daily diet of workers at the tobacco products manufacturing enterprise contained on average 143.9 ± 9.3 g of proteins ($p < 0.001$), 152.0 ± 11.3 g of fats and oils ($p < 0.001$), and 676.8 ± 13.6 g of carbohydrates ($p < 0.001$). The calculated energy ratio derived from these macronutrients was 1:1:4.7, indicating a noticeable predominance of carbohydrates in the dietary structure during this period (see Table 4).

Table 4

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The Amount of Main Nutrients in the Daily Diet of Workers of a Tobacco Products Manufacturing Enterprise During the Autumn Season

№	Indicators	Standard, g	Result	%
1	Proteins, g	129,7	143,9±9,3***	110,9
2	Fats, g	123,2	152,0±11,3**	123,4
3	Carbohydrates, g	624,2	676,8±13,6***	108,4
4	Energy value	3414,8	4778,5±158,8	139,9
5	P:F:C ratio	1:1:4	1:1,1:4,7	

Note: – the differences between the group indicators of the given diet are statistically significant (–r<0.05; **–r<0.01; **–r<0.001);

In the workers' daily diet, the protein content during the winter–spring and summer–autumn seasons ranged between 117.0–123.9% and 107.4–110.9%, respectively. The intake of fats and oils varied from 119.2–131.1% in the colder months to 113.5–123.4% in the warmer seasons, while carbohydrate consumption constituted 100.3–110.0% of the recommended levels.

The energy value ratio of these macronutrients was calculated to be 1:1:4.2 for the winter–spring period and 1:1:4.7 for the summer–autumn period. The observed increase in total energy value was primarily attributed to the excessive consumption of meat products and vegetable oils incorporated into the workers' diets.

Conclusion

The hygienic analysis of the nutritional value of diets consumed by workers at the tobacco products manufacturing enterprise revealed notable seasonal variations in the intake of macronutrients and total energy value.

Across all seasons, the intake of proteins and fats consistently exceeded the physiological standards, while carbohydrate consumption remained within or slightly above the recommended norms. The highest protein and fat intake was observed during the winter season, coinciding with an increased energy demand in colder months, whereas the lowest values were recorded in the summer season, when total food consumption tends to decrease.

The energy ratios (P:F:C) showed moderate fluctuations throughout the year—1:1:4.2 in the winter–spring period and 1:1:4.7 in the summer–autumn period—indicating a predominance of carbohydrates in the overall dietary structure. These patterns suggest that while the workers' diets provided sufficient caloric intake, there was a tendency toward excessive consumption of animal products and vegetable oils, leading to elevated energy values relative to physiological needs.

From a hygienic and preventive standpoint, it is recommended to optimize the dietary structure of workers by balancing macronutrient intake, particularly by moderating fat consumption and increasing the proportion of fresh vegetables, fruits, and complex carbohydrates in the menu. Such adjustments would contribute to maintaining metabolic balance and improving overall work performance and health outcomes throughout the year.

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