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DETERMINING THE DAILY TOTAL ENERGY EXPENDITURE FOR THE HYGIENIC ASSESSMENT OF THE NUTRITIONAL STATUS OF WORKERS IN A TOBACCO PRODUCTION ENTERPRISE

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Abstract:

This study presents a hygienic assessment of the nutritional status of workers employed in a tobacco production enterprise by determining their daily total energy expenditure. A total of 369 workers participated, including 324 men and 45 women, divided into control and experimental groups. The control group consisted of administrative, medical, and security staff, while the experimental group included employees directly involved in tobacco processing and cigarette production. The basal metabolic rate (BMR) was calculated using the Mifflin–St Jeor equations in accordance with Sanitary Rules and Hygiene Standards No. 007-2020. Daily energy expenditure was determined following the methodology of Sanitary Regulations No. 0250-08, taking into account seasonal variations and 24-hour activity chronometry. Results showed that the experimental group had significantly higher energy expenditure compared to the control group. Men demonstrated higher energy requirements than women across all seasons. The findings emphasize the need for gender- and season-specific dietary planning to maintain optimal health and to mitigate the harmful effects of tobacco exposure. This research provides a scientific basis for developing preventive and hygienically balanced nutrition programs for industrial workers.

Keywords: Tobacco industry workers; daily energy expenditure; basal metabolic rate (BMR); Mifflin–St Jeor equation; hygienic assessment; nutritional status; energy balance; gender differences; seasonal variation; occupational health; preventive nutrition; sanitary standards No. 007-2020; sanitary rules No. 0250-08; Uzbekistan.

RELEVANCE. The hygienic assessment of the nutritional status of industrial workers, particularly those engaged in tobacco production, is of great significance for public health and occupational hygiene. Workers in tobacco manufacturing are exposed to specific physical, chemical, and psycho-emotional loads that influence their metabolism and energy expenditure. Evaluating daily energy costs and basal metabolic rates provides an essential basis for designing rational, hygienically balanced diets that meet the physiological demands of different worker categories. Considering gender and seasonal variations in energy consumption ensures more accurate planning of nutrient intake and helps prevent occupational fatigue, metabolic imbalance, and chronic diseases.

Furthermore, developing evidence-based dietary recommendations aligned with national sanitary norms — including Sanitary Standards and Rules No. 007-2020 and No. 0250-08 — contributes to strengthening workers' health, increasing labor productivity, and reducing the adverse health effects associated with tobacco exposure. This research thus serves as an important step in improving the nutritional hygiene of industrial workers and in developing localized preventive nutrition programs for enterprises in Uzbekistan.

PURPOSE OF THE RESEARCH:

The purpose of this study is to conduct a hygienic assessment of the nutritional status of workers employed in a tobacco production enterprise by determining their daily total energy expenditure and basal metabolic rate (BMR). The research aims to establish scientifically based recommendations for optimizing workers' nutrition according to their occupational energy demands, gender, and seasonal variations. This contributes to the development of preventive, hygienically balanced dietary programs that promote health preservation and reduce the negative effects of occupational factors in the tobacco industry.

OBJECT OF THE RESEARCH:

The object of the research is the contingent of workers at the tobacco production enterprise, consisting of both male and female employees engaged in different categories of work — including administrative, medical, technical, and production processes — whose daily

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energy expenditure and nutritional status were analyzed under varying working and environmental conditions.

RESULT

The total number of workers at the tobacco production enterprise was 369, of whom 324 were men and 45 were women.

To calculate the daily energy expenditure, the workers were conditionally divided into control and experimental groups.

The control group included administrative staff, security personnel, and medical workers.

The experimental group consisted of employees involved in tobacco processing, cigarette production, engineering, and other related jobs.

For conducting the research, the basal metabolic rate (BMR) was determined using the Mifflin–St Jeor equations and the methodology specified in Sanitary Rules, Regulations, and Hygiene Standards No. 007-2020.

In assessing the body's energy and basic nutrient requirements, the actual daily energy expenditure of an individual serves as a key criterion.

Table 1.
Anthropometric Indicators of Workers

№	Anthropometric Indicators	Control Group (n=144)		Experimental Group (n=223)	
		Men (n=125)	Women (n=19)	Men (n=199)	Women (n=24)
1	Body weight, kg	74,68±9,9	67,07±7,36**	73,43±10,74*	62,9±9,59**
2	Height, cm	173,54±5,6	164,43±5,7*	175±5,08**	167,66±5,77*
3	Age, years	42,29±7,27	42,52±8,08*	42,53±6,72*	42,04±8,2

* – Significance of differences between group indicators (* – r < 0.05; ** – r < 0.01; *** – r < 0.001); ^ – Significant differences between control and experimental groups (^ – r < 0.05; ^^ – r < 0.01; ^^^ – r < 0.001).

Insonni kunlik energiya sarfi kattaliklarini hisoblash uchun kun davomidagi barcha bosqichlar va faoliyat turlari uchun energiya qiymati (energetik ekvivalent) zarurdir.

To calculate a person's daily energy expenditure, it is necessary to determine the energy value (energy equivalent) for all stages and types of activities performed throughout the day. The main determining indicator of workers' daily energy expenditure is the quantitative and qualitative characterization of their specific activities during the day. In this regard, a complete chronometric analysis of the daily routine and the energetic equivalents adopted for various types of activity are of particular importance.

The workers of the tobacco production enterprise were evaluated in two groups: The control group consisted of 144 workers, including 125 men and 19 women. The experimental group included 223 workers, of whom 199 were men and 24 were women. The average values of body weight, height, and age were determined for each group.

According to the results: In the control group, the men's body weight averaged 74.68 ± 9.9 kg, height 173.54 ± 5.6 cm, and age 42.29 ± 7.27 years. The women's averages were 67.07 ± 7.36 kg, 164.43 ± 5.7 cm, and 42.52 ± 8.08 years.

In the experimental group, the men's averages were 73.43 ± 10.74 kg, 175 ± 5.08 cm, and 42.53 ± 6.72 years, while the women's averages were 62.9 ± 9.59 kg, 167.66 ± 5.77 cm, and 42.04 ± 8.2 years.

Based on these results, the basal metabolic rate (BMR) of the workers was calculated using the Mifflin–St Jeor predictive equations, and the hourly energy expenditure was determined.

According to Table 2: In the control group, men's BMR averaged 1624.97 kcal, with an hourly rate of 67.71 kcal/hour. Women's BMR averaged 1324.79 kcal, with an hourly rate of 55.2 kcal/hour. In the experimental group, men's BMR averaged 1620.4 kcal, with an hourly rate of 67.52 kcal/hour. Women's BMR averaged 1305.3 kcal, with an hourly rate of 54.39 kcal/hour.

The average daily energy expenditure of workers at the tobacco production enterprise was assessed according to the methodology specified in Sanitary Rules, Regulations, and Hygiene Standards No. 0250-08. During the winter, spring, summer, and autumn seasons, the 24-hour daily schedule of the workers — including both workplace activities and household movements — was recorded in detail.

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Table 2.
Results of the Daily Basal Metabolism of Workers at the Tobacco Production Enterprise

№	Indicator	Control Group (n=144)		Experimental Group (n=223)	
		Men (n=125)	Women (n=19)	Men (n=199)	Women (n=24)
1	Basal metabolism indicator, kcal	1624,97	1324,79	1620,4	1305,3
2	Basal metabolism per hour, kcal	67,71	55,2	67,52	54,39

According to the results:

In the summer–autumn period, the daily energy expenditure of male workers was 2457.26 kcal in the control group and 3087.55 kcal in the experimental group.

In the winter–spring period, the daily energy expenditure of male workers was 2493.08 kcal in the control group and 3060.68 kcal in the experimental group.

The daily energy expenditure of female workers was found to be 2003.26 kcal in the control group and 2487.15 kcal in the experimental group.

During the winter–spring season, the chronometric energy expenditure of female workers was 2032.46 kcal in the control group and 2465.5 kcal in the experimental group.

Overall, the total daily energy expenditure of male workers ranged from 2457.26 to 3087.55 kcal in the summer–autumn period, and from 2493.08 to 3060.68 kcal in the winter–spring period.

For female workers, these values ranged from 2003.26 to 2487.5 kcal in the summer–autumn period, and from 2032.46 to 2465.5 kcal in the winter–spring period.

When comparing the groups, it was found that the experimental group expended more energy during production processes than the control group.

Moreover, male workers consumed more energy compared to female workers.

Therefore, when developing dietary plans, it is essential to design specific seasonal local diets for men and women separately.

This approach will help strengthen workers' health and reduce the harmful effects of tobacco products by establishing a preventive, hygienically balanced nutrition program tailored to the working conditions.

CONCLUSIONS: The study showed that energy expenditure among tobacco industry workers varies by gender, job type, and season. Male workers had higher basal metabolic rates (1620–1625 kcal/day) and energy expenditure (2457–3087 kcal/day) compared to female workers (1305–1325 kcal/day; 2003–2487 kcal/day). The experimental group, directly engaged in tobacco processing, demonstrated significantly higher energy costs than the control group ($p < 0.05$). These findings highlight the need for gender- and season-specific dietary planning to maintain workers' health and productivity. Applying sanitary norms No. 007-2020 and No. 0250-08 ensures an effective framework for hygienic assessment and preventive nutrition in industrial settings.

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