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# EVALUATION OF THE EFFECT OF SOME BIOLOGICAL PROPERTIES OF SPROUT JUICE OF YAKUT WHEAT VARIETIES ON WOMEN'S BODIES

The article presents a study on the effectiveness of the immunomodulatory and anti-inflammatory properties of juice from wheat sprouts growing in the extreme climatic conditions of the Far North. Based on clinical and immunological analyses of 27 volunteers from Sakha women aged 40 to 60 years who took vitgrass for 24 days in a volume of 20 ml, positive changes were obtained: there is a significant increase in lymphocytes and monocytes, which indicates the activation of immune mechanisms while maintaining homeostasis. In 29,6% of the participants, elevated ESR levels returned to normal after taking the juice, which shows the anti-inflammatory effect of witgrass. Restoration of leukocyte and granulocyte levels in 14.8% of participants with reduced levels indicates support for hematopoiesis and immunological balance. A moderate increase in IgA, IgM, and IgG antibodies after juice intake causes a strengthening of humoral immunity and the interaction of various parts of the defense system.

The results obtained are consistent with the literature data and open up opportunities for further study of the biological properties of juice from the sprouts of local wheat varieties growing in the extreme climatic conditions of Yakutia, its potential for use in complex therapy of immune disorders and for the development of effective natural remedies for the treatment and prevention of many diseases in the North.

**Keywords:** whitegrass, green shoots, wheat, chlorophyll, immunity, inflammation.

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**Introduction.** Ensuring the health of the population in the North, especially in Arctic and rural areas, becomes particularly important against the backdrop of a deteriorating environmental situation, poor nutrition, and a rise in disease incidence. It necessitates the search for effective natural methods and means to strengthen and restore the health of northerners. One such natural product that can replenish the body with vitamins, minerals, essential amino acids, and enzymes is young wheat sprouts, 10–12 cm long, grown using the hydroponic method [5]. The therapeutic effect of wheatgrass juice is due to its high content of chlorophyll (70%), carotene, vitamins (A, C, E, K, B vitamins), bioflavonoids, iron, mineral substances (calcium, potassium, sodium, zinc, copper, aluminum, and magnesium), sulfur, phosphorus, and 17 amino acids, 8 of which are essential (lysine, isoleucine, tryptophan, phenylalanine, and others). Its composition includes proteins - 7.5 g, fats - 1.3 g, carbohydrates - 41.4 g. [4].

The vitamin-mineral composition of juice from wheat sprouts is richer than that of whole grain, as during the sprouting of wheat, the content of vitamin E (tocopherol) increases by 50 times, vitamin B6 (pyridoxine) by 10 times, vitamins F and P by 3-4 times, protein compounds by 2-3 times, and fats by 4-5 times. The energy value is 198 kilocalories [9, 12].

Numerous studies of the therapeutic properties of this product have proven its immunomodulatory, antioxidant, anti-hypoxic, nephroprotective, anti-inflammatory, and anti-tumor effects [1].

In Yakutia, under conditions of extremely cold climate, the production of wheatgrass has started relatively recently, and the main feature of local production is the use of zoned wheat varieties «Tuymaada», «Prilenskaya-9», grown in the ecologically clean territory of the largest agricultural region of the republic.

The aim of the study is to assess the immunomodulatory and anti-inflammatory properties of juice from the sprouts of Yakut varieties of wheat.

**Materials and Methods.** The study voluntarily involved 27 women of Yakut nationality aged from 40 to 61 years, living in the city of Yakutsk.All participants in the study signed informed consent for the research after being briefly informed about the purpose and objectives of the study, approved by the Local Committee on Biomedical Ethics at the Federal State Budgetary Institution 'Yakutsk Scientific Center for Complex Medical Problems', Yakutsk (protocol No. 60 of April 10, 2024).

The work was conducted at the base of the YNC KMP. The study program included a survey on general health status; anthropometric examination - measuring height, body weight, waist and hip circumference, chest using scales and a tape measure; functional studies of the cardio-respiratory system: heart rate (bpm), systolic blood pressure (mmHg), diastolic blood pressure (mmHg), performing a general analysis of blood, determining IgA, IgG, IgM, and IL-6. Venous blood was taken in vacuum containers in the morning on an empty stomach before taking wheatgrass and after 24 days of taking wheatgrass (the course recommended by the manufacturer).

Statistical processing was carried out using the IBM SPSS Statistics 27 software package. The normality of the distribution of quantitative indicators was determined by the Kolmogorov-Smirnov test. Values are presented as median (Me) and quartiles (Q1; Q3). The significance of differences was assessed using the Mann-Whitney test. The probability of the null hypothesis being true was accepted at $p<0.05$. Correlation analysis was conducted using the Spearman method,

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where r is the correlation coefficient, and p is the significance of the result.

**Results and discussion.** The dynamics of the complete blood count indicators in the subjects before and after taking wheatgrass shows that the increase in lymphocytes by 17% (p=0.036), MID (monocytes, eosinophils, basophils) by 40% (p<0.001), as well as the decrease in ESR by 46% (p <0.002), indicate positive changes in immune status and a reduction in inflammation. All indicators remained within reference a value, which suggests the maintenance of homeostasis and the absence of negative effects [14].

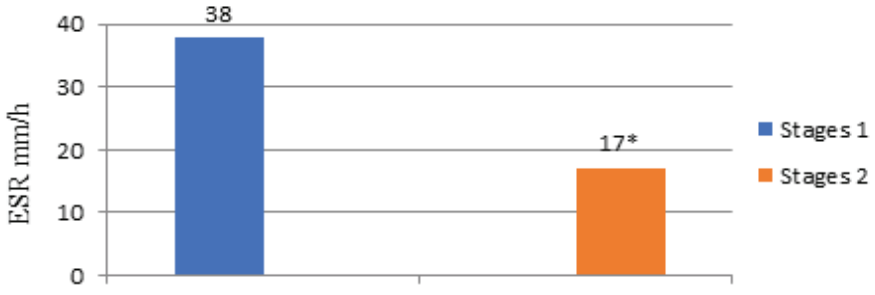
Positive changes in lymphocyte (p=0.036) and monocyte (p=0.001) counts upon juice consumption indicate activation of the cellular component of the immune system (Table 1). Furthermore, the activation of monocytic and eosinophilic lines in the second stage may suggest the activation of the body's adaptive defense mechanisms [2], which is consistent with the known immunomodulatory and anti-inflammatory effects of plant components rich in isoflavones, polysaccharides, and phytochemical compounds that promote the harmonization of the immune response [4,15,17].

ESR is a nonspecific marker of inflammation, and the observed twofold decrease in the median ESR value in our participants after taking vitgrass (p<0.002) also indicates the anti-inflammatory and immunostimulating properties of whitegrass [13,18]. Importantly, the initial inflammatory reactions are not exacerbated; on the contrary, they decrease, confirming the safety and potential effectiveness of using vitgrass in the treatment of inflammatory processes.

In 8 participants (29.6%), elevated ESR levels (23 - 54 mm/h) were identified prior to the intake of the juice while leukocyte levels remained stable, indicating the presence of hidden inflammatory processes or reactions in the body that are not accompanied by obvious signs of infection (Fig. 1).

After consuming the juice, the ESR values in the participants significantly improved and returned to normal, which once again demonstrates the anti-inflammatory and immunomodulatory effects of this herbal adaptogen. Such a separate analysis underscores the importance of a comprehensive assessment of the body's condition when using biologically active substances.

In 4 participants (14.8%), the median levels of leukocytes (3.45×10⁹/L) and granulocytes (1.65×10⁹/L) were below normal; however, after taking whitegrass, these levels significantly increased and returned to normal values (4.5×10⁹/L and 2.2×10⁹/L, respectively). At the same time, the levels of lymphocytes and ESR remained within the normal range. Indeed, the decrease in leukocytes and granulocytes may indicate temporary immune system disruptions possibly due to stress, nutrient deficiencies, and quality of life [16]. The absence of bright inflammatory signs or an acute infectious process with normal ESR aligns with the concept of 'hidden' or chronic infections or conditions related to a deficiency in the immune system's resources [11]. The recovery of leukocytes and granulocytes after taking whitegrass further indicates its potential role in supporting and restoring immune functions and highlights the possibility of integrating natural remedies into modern approaches to strengthening immunity, which is a promising and relevant area of science.




Improvement of ESR indicators in eight participants after consuming wheatgrass juice. 1- stage before the reception, 2- stage after taking.

Table 1

**Indicators of peripheral blood, antibodies, and IL-6 before and after taking wheatgrass**

| Показатель | Me (25%;75%) | | p |
|---|---|---|---|
| | 1 этап | 2 этап | |
| WBC, $10^9$/L | 5.60 (4.60; 6.10) | 5.60 (4.60; 6.50) | |
| Lymph#, $10^9$/L | 1.70 (1.40; 2.10) | 2.00 (1.60; 2.30) | 0.036 |
| Mid#, $10^9$/L | 0.50 (0.30; 0.50) | 0.70 (0.50; 0.90) | <0.001 |
| Gran#, $10^9$/L | 3.30 (2.50; 3.60) | 3.00 (2.10; 3.80) | |
| Lymph#, % | 32.80 (29.80; 29.40) | 35.70 (30.90; 49.00) | |
| Mid, % | 8.40 (6.70; 9.70) | 12.40 (10.50;13.10) | <0.001 |
| Gran, % | 57.80 (52.50;61.80) | 51.10 (46.30; 55.60) | 0.003 |
| RBC,$10^{12}$/L | 4.07 (3.66;4.21) | 3.90 (3.60; 4.11) | |
| HGB, g/L | 113.00 (105; 120) | 108.00 (99; 117) | |
| HCT, % | 35.40 (33.00; 38.00) | 35.60 (32.30; 37.50) | |
| MCV, fL | 92.10 (86.00;94.10) | 92 (86.90; 94.80) | |
| MCH, pg | 29.30 (27.60; 30.60) | 28.20 (27.30; 29.70) | |
| MCHC, g/L | 322.00 (320; 327) | 311.00 (305; 314) | <0.001 |
| RDW-CV, % | 13.90 (13.60; 14.60) | 14.60 (14.00; 15.20) | 0.04 |
| PLT, $10^9$/L | 212.00 (180; 254) | 213 (181; 257) | |
| MPV, fl | 9.10 (8.60; 10.40) | 9.70 (8.90; 10.40) | |
| PDW | 15.80 (15.50;16.00) | 15.90 (15.60; 16.20) | |
| PCT, % | 0.19 (0.18; 0.23) | 0.19 (0.17; 0.23) | |
| P-LCC, $10^9$/L | 66.00 (51.00; 74.00) | 69.00 (54.00; 81.00) | |
| P-LCR, % | 31.10 (26.00; 39.00) | 33.90 (27.20; 38.80) | |
| ESR, мм/h | 15.00 (10.00; 27.00) | 7.00 (4.00; 11.00) | 0.002 |
| IgA, 0,8-4,0 mg/ml | 4.60 (3.17; 6.32) | 4.90 (2.80; 7.09) | |
| IgM, 0,48-2,16 mg/ml | 2.66 (2.07; 4.32) | 2.41 (1.64; 3.79) | |
| IgG, 4,8-16 mg/ml | 8.30 (5.99; 13.22) | 7.54 (5.40; 10.48) | |
| Il-6, 6-10 pg/ml | 4.10 (3.86; 5.00) | 4.12 (3.84; 6.03) | |

Table 2

**Correlations of IgA, IgM, IgG, IL-6 with peripheral blood parameters. Spearman's Correlations**

| | | IgA 0,8-4,0 mg/ml | IgM 0,48-2,16 mg/ml | IgG 4,8-16,0 mg/ml | Il-6 up to 10 pg/ml | WBC, $10^9$/L | Mid#, $10^9$/L | Gran#, $10^9$/L | RDW-CV, % | RDW-SD, fL | P-LCR, % | MCV, fL | HGB, g/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IgA 0,8-4,0 mg/ml | Correlation coefficient | 1.000 | .269* | .181 | .542** | .352** | .332* | .332* | -.091 | -.210 | .355** | -.045 | .187 |
| | Significance (bilateral) | . | .049 | .191 | -.001 | .009 | .014 | .014 | .514 | .127 | .008 | .743 | .176 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| IgM 0,48-2,16 mg/ml | Correlation coefficient | .269* | 1.000 | -.071 | .036 | .081 | .012 | .052 | -.089 | -.367** | -.029 | -.281* | -.183 |
| | Significance (bilateral) | .049 | . | .612 | .795 | .561 | .934 | .710 | .520 | .007 | .834 | .039 | .185 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| IgG 4,8-16,0 mg/ml | Correlation coefficient | .181 | -.071 | 1.000 | .040 | .116 | .062 | .127 | .138 | .185 | -.207 | -.134 | -.090 |
| | Significance (bilateral) | .191 | .612 | . | .775 | .403 | .656 | .359 | .328 | .181 | .133 | .335 | .516 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| Il-6 up to 10 pg/ml | Correlation coefficient | .542** | .036 | .040 | 1.000 | .340* | .260 | .370** | -.134 | -.111 | .230 | .932 | .387** |
| | Significance (bilateral) | -.001 | .795 | .775 | . | .012 | .058 | .006 | .335 | .424 | .094 | .818 | .004 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| WBC, $10^9$/L | Correlation coefficient | .352** | .081 | .116 | .340* | 1.000 | .656** | .927** | -.207 | -.217 | .108 | -.106 | .151 |
| | Significance (bilateral) | .009 | .561 | .403 | .012 | . | -.001 | -.001 | .134 | .115 | .438 | .445 | .277 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| Mid#, $10^9$/L | Correlation coefficient | .332 | .012 | .082 | .260 | .656** | 1.000 | .466** | .111 | .128 | .171 | .043 | .094 |
| | Significance (bilateral) | .014 | .934 | .656 | .058 | -.001 | . | -.001 | .425 | .358 | .217 | .760 | .501 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| Gran#, $10^9$/L | Correlation coefficient | .332* | .052 | .127 | .370** | .927** | .466** | 1.000 | -..231 | -.271* | .083 | -.111 | .152 |
| | Significance (bilateral) | .014 | .710 | .359 | .006 | -.001 | -.001 | . | .094 | .047 | .549 | .423 | .272 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| RDW-CV, % | Correlation coefficient | -.091 | -.088 | .136 | -.134 | -.207 | .111 | -.231 | 1.000 | .491** | -.011 | -.388** | -.482** |
| | Significance (bilateral) | .514 | .520 | .326 | .335 | .134 | .425 | .094 | . | -.001 | 0.934 | .004 | -.001 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| RDW-SD, fL | Correlation coefficient | -.218 | -.364** | .185 | -.111 | -.217 | .128 | -.271* | .491** | 1.000 | -.087 | .327* | -.001 |
| | Significance (bilateral) | .127 | .007 | .101 | .424 | .115 | .358 | .047 | -.001 | . | .530 | .016 | .993 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| P-LCR, % | Correlation coefficient | .355** | -.029 | -.207 | .230 | .106 | .171 | .083 | -.011 | -.087 | 1.000 | -.141 | .076 |
| | Significance (bilateral) | .008 | .834 | .133 | .094 | .438 | .217 | .549 | .934 | .530 | . | .308 | .585 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| MCV, fL | Correlation coefficient | -.046 | -.281* | -.134 | .032 | -.106 | .043 | -.111 | -.388** | .327* | -.141 | 1.000 | .401** |
| | Significance (bilateral) | .743 | .039 | .335 | .818 | .445 | .760 | .423 | .004 | .016 | .308 | . | .003 |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| HGB, g/L | Correlation coefficient | .187 | -.183 | -.090 | .387** | .151 | .094 | .152 | -.482** | -.001 | .076 | .401** | 1.000 |
| | Significance (bilateral) | .176 | .185 | .516 | .004 | .277 | .501 | .272 | -.001 | .993 | .585 | .003 | . |
| | N | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |

* The correlation is significant at the 0.05 level (two –tailed). ** The correlation is significant at the 0.01 level (two-tailed)

Despite a slight decrease in the level of red blood cells (RBC) within the normal range and the maintenance of a low hematocrit (HCT) value, one can say that the function of erythropoiesis is preserved and there are no severely expressed anemias (Table 1). However, the decreased concentration of hemoglobin (Hb) and MCHC (hemoglobin in red blood cells) (p=0.035) indicates pathological features that are characteristic of hypochromic anemias, where the decrease in MCHC is mainly related to iron deficiency or disruptions in hemoglobin synthesis. At the same time, it is important to consider that a reduction in MCHC may also be due to a deficiency of nutrients necessary for hemoglobin synthesis, such as vitamin B12, folic acid, and trace elements, such as copper or zinc, whose deficiency disrupts the normal metabolism of erythrocytes [10]. Therefore, an extensive study with an assessment of nutritional status will be appropriate for accurately determining the cause of the changes.

Antibodies IgA, IgM, and IgG are different types of immune proteins and vary in structure, function, and timing of appearance during the immune response. The main function of IgA is to prevent the entry of pathogens through mucous membranes. IgM is the first immunoglobulin that appears in response to infection and indicates a recent infection. IgG are the main antibodies in the blood and tissues, providing long-term protection.

Our research showed that the levels of IgA and IgM antibodies in the subjects slightly exceeded the reference values both before and after the intake of wheatgrass (Table 1). At the same time, the content of IgA in the second phase increased slightly compared to IgM and IgG. According to some authors, in individuals living in Arctic conditions, elevated concentrations of IgM and IgA, 1.4–2.6 times higher, and the frequency of elevated concentrations, 2.4–8.8 times higher, are associated with an increase in the content of neutrophilic granulocytes and the cytokine interferon-gamma (IFN-γ), which in turn is aimed at ensuring the effectiveness of clearance of metabolic products under hypoxic conditions [7]. In other studies, this fact is associated with a decrease in adaptive potential, an increase in morbidity [8], or the peculiarities of the immunological reactivity of the indigenous Arctic population under harsh climatic conditions [6]. A slight excess of the upper limit of the norm of IgM may also be a response of the immune system to a recent infection that occurred in the spring. At the same time, the average IL-6 level in our study participants is slightly lowered and has not changed since the stage of the study (Table 1), which indicates the absence of obvious inflammatory reactions in the body, since Interleukin-6 is a cytokine, that is, a signaling molecule that plays an important role in regulating immune and inflammatory responses in the body. This aspect is important for understanding the features of the immune response in people living in harsh conditions, and requires further research to fully uncover the mechanisms of this phenomenon.

The correlation analysis showed a direct link between IL-6 and IgA as well as the content of HGB (Table 2), which further confirms the role of IL-6 as an important modulator of the immune response, especially in the regulation of IgA production - the main antibody of mucous membranes and its key role in the production of erythropoietin (EPO) - a hormone that stimulates the formation of red blood cells in the bone marrow.

Correlations of IgA, IgM, IgG, IL-6 with peripheral blood parameters.

Thus, the application of wheat grass from local varieties of wheat contributes to positive changes in the immune status of Sakha women. There is a significant increase in lymphocytes and monocytes, as well as a decrease in ESR, which indicates activation of immune mechanisms and reduction of inflammatory processes while maintaining homeostasis. An important aspect is the restoration of leukocyte levels among participants in the study with reduced levels, which indicates support for hematopoiesis and immunological balance. The analysis of IgA, IgM, and IgG antibodies shows a tendency for their moderate increase, indicating a strengthening of humoral immunity and the interaction of various components of the defense system. Despite the stable level of IL-6, its correlation with IgA confirms the significance of cytokines in regulating the immune response of mucous membranes. Overall, the results confirm the immunomodulatory and anti-inflammatory properties of wheatgrass from local wheat varieties on the female body, which is consistent with the literature.

**Conclusion.** The obtained results open up the possibility for further extensive study of the biological properties of wheatgrass juice, which grows in the extreme climatic conditions of Yakutia, with the aim of developing effective local natural remedies for the comprehensive therapy of immune disorders, prevention, and treatment of various diseases in the North.

*The authors declare that there are no conflicts of interest.*

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## DIAGNOSTIC AND TREATMENT METHODS

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# EXPERIENCE OF USING SENTINEL LYMPH NODE BIOPSY IN BREAST CANCER USING ICG FLUORESCENCE IN THE REPUBLIC OF SAKHA (YAKUTIA)

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Breast cancer is the leading cause of malignant neoplasms among women worldwide. Today, lymph node biopsy is one of the main diagnostic methods to assess the extent of the oncological process. The aim of the study has been to investigate the possibilities of conducting and evaluating the performance of diagnostic statistical methods of ICG fluorescence for sentinel lymph node biopsy in breast cancer in the Republic of Sakha (Yakutia). The study included 223 patients diagnosed with cT1-3N0M0, occurring in the period from 2022 to 2023. Surgical treatment for the mammary gland with sentinel lymph node biopsy using the ICG fluorescence method was performed in the Department of Breast Oncology and Skin Oncology of the State Autonomous Institution of the Republic of Sakha ( Yakutia) in the OOMZhIOK (Department of Breast Oncology and Skin Oncology) of the Yakut Republican Oncology Dispensary. As a result of the study, metastases in the lymph nodes were detected in 44 (19.73%) cases out of 223. It has been established that the use of the method of sentinel lymph node biopsy in breast cancer using ICG fluorescence of the gland allows for large-scale surgical treatment of the initial form of mammary gland cancer.

**Keywords:** sentinel lymph node biopsy, fluorescence lymphography, breast cancer, lymph node dissection , indocyanine green .

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**Introduction.** Currently, one of the leading sites of cancer among oncological diseases in women is the mammary gland (BC). According to GLOBOCAN, in recent years, the propensity index for the incidence of BC cancer has increased; in 2020, 2.3 million cases of BC cancer were registered worldwide, which is 11.7% of all cancer cases [11]. In Russia, BC in the female population ranks 1st among all malignant neoplasms, and its incidence is 22.1% [3]. This problem is relevant in the oncology service in the Republic of Sakha (Yakutia). It was registered that in the period from 2013 to 2022, high rates of BC indicators were observed in the population of Yakutia at the early stages ( I -II) of the disease in 72.7% of cases.

It has been proven that timely diagnosis of regional lymph node involvement is essential for determining the prognosis and selecting the optimal treatment strategy [1]. Today, the standard principle of surgical treatment of malignant neoplasms of various organs is the mandatory removal of all lymphatic collectors. Extended lymph node dissection in breast