Optimization of food recipes for people of mental work and their lifestyle

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Abstract. The types of mental work include the work of programmers, operators, teachers, doctors, students, etc. People of intense mental labor, especially chess players, have an increased need for essential amino and fatty acids. A particularly important role is assigned to the chess game as a means of the student’s intellectual development, mental activity and cognitive mental abilities of a person - memory, attention, thinking, etc. The article describes a method for optimizing food formulations. The prescription principles for the design of food products based on pancakes with cheese and greens for people with increased mental stress have been optimized. The composition of raw materials and finished products is analyzed.

1. Introduction
An important task, under modern living conditions, is the optimization of food recipes. It seems to be especially important since global nutritional defects are characteristic of the present. A person also encounters nutritional defects in various emergency and extreme situations.

The work aims to optimize food recipes, using pancakes with cheese and herbs as an example, as well as the choice of an unloading program during operation.

2. Materials and methods
For optimize the recipes of a food object, the method of optimizing food recipes is used. The design of the second dish for people with increased mental stress is carried out, for example, the recipe ”Pancakes with cheese and herbs.” We also consider various programs for unloading during rest.

3. Results and its discussion
In addition to separate nutrition, a person needs physical activity. To pause and relax the muscles, you can use fitness activities in the day mode and other types of fitness activities, for example, a) outdoor games, b) sports minutes, c) project games [1]. At breaks at school, children can play table tennis, which can be installed on the floors. You can turn on the music in the offices every two hours so that people do not sit around the table, can get up and stretch themselves, repeating movements at the speaker. In elementary school, the teacher in the middle of each lesson conducts a small fun warm-up, which allows relieving stress not only physically, but also mentally. If possible, you need to get up and open the window. So you ventilate the room and enrich the blood with oxygen. Correctly sit if you work. Stretch well on the working chair. Feet should rest evenly on the floor.
If you are sitting at a computer, then you should be more attentive to yourself. The computer should be at arm’s length, at least. Ideally – 70 cm. Doctors advise sitting for no more than an hour, doing warm-ups or an exercise session for at least 15 minutes every hour. The more often you do it, the less tired be. Doctors also advise doing gymnastics for the eyes, which include frequent blinking, turning the eyes clockwise and counterclockwise, as well as drawing various shapes in the air. For those who have impaired vision, gymnastics should be done more intensively and thoroughly. Eye exercises at the computer must be performed when you are in a relaxed state. If after prolonged work you have pain in the back or neck, you should first do gymnastics for these areas. To allow your eyes to rest adequately, change your seat, remove your glasses or contact lenses if you wear them. When performing exercises, do not strain your eyes as if working on a computer. Look into the distance or just close your eyes. Also, you should breathe deeply, because, during work, the eye muscles actively absorb oxygen.

Here are some examples of exercises that can be done in the office:

1) For the broadest back muscles (“wings”). Grasp the countertop this way: thumbs on the countertop, other fingers clenched into a fist under it. The distance between the hands is slightly wider than the shoulders. Tighten the “wings”, simulating the pull of the table towards you.

2) For the pectoral muscles. Put your hands slightly bent at the elbows in front of you into the castle. Due to the tension of the pectoral muscles, press the palm on the palm.

3) For biceps. Hands clenched into fists – under the tabletop at a shoulder-width distance. Tighten your biceps by simulating an attempt to raise a table.

4) For triceps. Put your clenched fists on the table. Focusing on the tension of the triceps, push it.

5) For the deltoid muscles. Grab your fingers from below the edges of the chair seat. Due to the tension of these muscles, try to raise your arms to the sides.

6) For extensors of the back. Sitting on a chair with a straightened back, strain these muscles in the lumbar region, simulating the arching of the back.

7) For the muscles of the press. Putting his fists on the table, straining his shoulder girdle and triceps, by reducing the pressure, press on the table.

8) For the muscles of the legs. Straighten your legs, while their straightening may be limited to the table. Tighten them and simulate an attempt to raise the table due to this stress.

Perform the indicated isometric exercises in the office according to one approach, one after another without interruption. Focus on your feelings, and then you can do without a warm-up. A person paying enough attention to physical activity achieve better results than devoting himself all the time to work [2].

Daily sports nutrition should ensure the development of skeletal muscles, their performance and quick recovery after intense exertion; diets of such nutrition are based on the general principles of balanced nutrition. It is vital to pay special attention to observing the norms of consumption of irreplaceable facts and supplying the body with the required number of energy sources, respectively spending during exercise [3].

As a result of the design of the recipe, a product was obtained that meets the specified criteria. The results of the optimization of the composition “Pancakes with cheese and herbs” are within the acceptable standards for many indicators.

The student’s period of human life is characterized by a high level of mental stress, which makes particular demands on the optimization of the prescription composition of food products, which preserve lipotropic and anti-sclerotic properties. Among these components, hygienists especially highlight cottage cheese, cheeses, legumes, as well as fish products that contain methionine and other sulfur-containing amino acids.

Chess students, to stimulate redox processes in the body, especially need to cover the deficiency of water-fat-soluble vitamins – inositol, choline, folic acid, \( E, F, B_1, B_6, B_{12}, C, P, PP \). Vitamin deficiency and its hidden forms contribute to a decrease in mental performance.

Long-term enthusiasm for the chess game often leads to a sedentary lifestyle with daily energy costs (2400–2800 kcal), which requires limiting the intake of low molecular weight carbohydrates. However, this statement contradicts the recommendations to increase sugar and chocolate consumption with...
increased mental stress, which inevitably leads to weight gain, obesity and an increase in glycemic index. In particular, the glycemic index (GI) is responsible for changes in blood glucose levels when consuming carbohydrate foods. For people of mental labour, it is advisable to use foods with a low glycemic index.

Consider the option of designing a second dish for people with increased mental stress, for example, the recipe "Pancakes with cheese and herbs."

The traditional recipe for pancakes with cheese and herbs, which has an optimal balance indicator $K(X) = 79.939\%$, has the form, %: chickpea flour – 77.381; eggs – 0; salt – 1.816; grape seed oil – 20.803; Adyghe cheese – 0; parsley greens – 0; green onions – 0; dill – 0.

Scripts for optimizing the recipe for pancakes with cheese and herbs $MathCAD$ is shown in Tables 1–6.

- $k = 24$ – number of indicators
- $n - 5 = 8$ – number of products
- $j = 0 .. k - 1$ – loop by column-indicators
- $i = 0 .. n - 6$ – loop by line-products

Table of fractions (g / g) of protein, fat, etc. in each product and in the last 4 lines of the border (d) "bad-good" of their deficiency and overdose for 1/8 daily requirement:

|   | 0  | 1  | 2  | 3  | 4  |
|---|----|----|----|----|----|
| A=|    |    |    |    |    |
| 0 | 0  | 0  | "Protein" | "Fats" | "Carbohydrates" | "En.value" |
| 1 | "Amaranth flour" | 0.203 | 0.089 | 0.475 | 3.63$\cdot 10^{-3}$ |
| 2 | "Eggs" | 0.127 | 0.115 | 7$\cdot 10^{-3}$ | 1.57$\cdot 10^{-3}$ |
| 3 | "Salt" | 0 | 0 | 0 | 0 |
| 4 | "Coconut Oil" | 0 | 0.999 | 1$\cdot 10^{-3}$ | 8.991$\cdot 10^{-3}$ |
| 5 | "Adyghe cheese" | 0.198 | 0.198 | 1.5$\cdot 10^{-3}$ | 2.64$\cdot 10^{-3}$ |
| 6 | "Parsley(greens)" | 3.7$\cdot 10^{-3}$ | 4$\cdot 10^{-3}$ | 0.076 | 4.9$\cdot 10^{4}$ |
| 7 | "Green onion" | 1.3$\cdot 10^{-3}$ | 1$\cdot 10^{-3}$ | 0.032 | 2$\cdot 10^{4}$ |
| 8 | "Dill" | 0.025 | 5$\cdot 10^{-3}$ | 0.063 | 4$\cdot 10^{4}$ |
| 9 | "min" | 1.575$\cdot 10^{4}$ | 1.05$\cdot 10^{4}$ | 3.15$\cdot 10^{4}$ | 283.5 |
| 10 | "Optimum min" | 2.415$\cdot 10^{4}$ | 1.68$\cdot 10^{4}$ | 4.2$\cdot 10^{4}$ |

In this case, $KO (X) = 1$, $KGI (X) = 0.981$, $KS (X) = 81.458$. The total weight of pancakes with cheese and herbs are 70.47 g.

The obtained ratio of ingredients is not optimal from a technological point of view. Therefore, after selecting the ratio of ingredients, the following formulation was obtained,%: chickpea flour – 33.015; eggs – 2.27; salt – 1.162; grape seed oil – 1.651; Adyghe cheese – 41.269; parsley greens – 5.159; green onions – 10.317; dill – 5.159.
Table 2. Matrices of the chemical composition and standards of pancakes with cheese and herbs

|       | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|
| B1=   | 0.20 | 0.08 | 0.47 | 3.63 | 5.09 | 1.8* | 2.64 | 0    | 3.4* | 0    | 7.72 | 9.4* |
| B2=   | 9    | 5    | *    | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-4}\) | *    | 10\(^{-3}\) | | |
| B3=   | 0.12 | 0.11 | 7*10\(^{-3}\) | 1.57 | 1.4* | 5.5* | 1.2* | 1.76 | 1.34 | 1.56 | 1.92 | 2.5* |
| B4=   | 7    | 5    | *    | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) |
| AA    | 2    | 0    | 0    | 0    | 9*10\(^{-3}\) | 3.68 | 2.2* | 1.8* | 0.38 | 0.59 | 7.5* | 2.9* |
|       | 0    | 0.99 | 1*10\(^{-3}\) | 8.99 | *    | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) |
|       | 3    | 0    | *    | 10\(^{-3}\) | 3.68 | 2.2* | 1.8* | 0.38 | 0.59 | 7.5* | 2.9* | 10\(^{-3}\) |
|       | 4    | 0.19 | 1*10\(^{-3}\) | 0    | 2*10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) | 10\(^{-3}\) |
|       | 5    | 3.7* | 4*10\(^{-3}\) | 8*10\(^{-3}\) | 2.45 | 0    | 8.5* | 0    | 3.4* | 0    | 9.5* | 10\(^{-3}\) |
|       | 6    | 30   | 60   | 120  | 375  | 5    | 750  | 8    | 2.25* | 8    | 675  | 10\(^{-3}\) |
|       | 7    | 45   | 75   | 150  | 450  | 7    | 450  | 7    | 450  | 7    | 112.5 | 10\(^{-3}\) |
|       | 8    | 300  | 600  | 750  | 153.75 | 5    | 900  | 5    | 375  | 4    | 153.75 | 10\(^{-3}\) |
|       | 9    | 300  | 600  | 750  | 456.75 | 5    | 900  | 5    | 375  | 4    | 153.75 | 10\(^{-3}\) |
|       | 10   | 30   | 60   | 180  | 375  | 5    | 900  | 5    | 375  | 4    | 153.75 | 10\(^{-3}\) |
|       | 11   | 0.75 | 1.5  | 3    | 15   | 11   | 15   | 11   | 15   | 11   | 2.25  | 10\(^{-3}\) |
|       | 12   | 0.3  | 0.75 | 1.5  | 3    | 12   | 1.5  | 12   | 3    | 12   | 1.125 | 10\(^{-3}\) |
|       | 13   | 0.075 | 0.15 | 0.3  | 0.45 | 13   | 0.45 | 13   | 0.45 | 13   | 0.225 | 10\(^{-3}\) |
|       | 14   | 1.05 | 1.5  | 3    | 15   | 14   | 15   | 14   | 15   | 14   | 2.25  | 10\(^{-3}\) |
|       | 15   | 17.5 | 15   | 15   | 15   | 15   | 15   | 15   | 15   | 15   | 15   | 10\(^{-3}\) |
Table 3. Calculation formulas

1) The contents \( g \) of proteins, fats, etc in the mix (\( x \)-vector with the weight \( g \) each product in the mix)

\[
k_r(j, x) = \sum (AA_{i,j} \cdot x_i)
\]

2) The criterion of balance of the mixture, \( \% \), without the GI:

\[
f(x) = \sum_{j=0}^{k-2} \left( \frac{k_r(j, x)}{B_j} - 1 \right)^2
\]

\[
KS(x) = 100 \cdot \left(1 - \frac{f(x)}{B_{k-1}}\right) - \text{criteria for the balance of the mixture, \( \% \), without the GI}
\]

3) Glycemic index

\[
KGI(x) = 1 - \left[\sum_{i=1}^{k} \frac{AA_{i,k-1} \cdot AA_{i,k-2} \cdot x_i}{B_{k-1}} - 1\right]^2 - \text{GI criteria of the mixture, percentage}
\]

4) Organoleptics (criteria for the taste of the mixture, percentage)

\[
KO(x) = 1 - \exp\left[-0.055 \cdot x_0 + 64.204 \cdot x_1 - 126.587 \cdot x_2 + 0.032 \cdot x_3 + 4.675 \cdot x_4 + 0.991 \cdot x_5 - 10.152 \cdot x_6 + 7.680 \cdot x_7\right]^2
\]

5) Optimization of the weight composition of the product mix:

You must set an initial approximation for the weight (mg) of each product

\[
x = \begin{pmatrix}
28000 \\
2400 \\
1100 \\
1500 \\
40000 \\
5000 \\
10000 \\
5000
\end{pmatrix}
\]

Table 4. Weight restrictions for the ingredients of pancakes with cheese and herbs

| Restrictions on the weight (mg) of an individual product, due to the initial approximation |
|---|
| 28000 \( \leq \) \( x_0 \) \( \leq \) 32000 |
| 2200 \( \leq \) \( x_1 \) |
| 1400 \( \leq \) \( x_3 \) \( \leq \) 1600 |
| 5000 \( \leq \) \( x_5 \) |
| 10000 \( \leq \) \( x_6 \) |
| 5000 \( \leq \) \( x_7 \) |

In this case, the balance indicators \( KO(X) = 0.913 \), \( KGI(X) = 0.708 \), \( KS(X) = 0.689 \) and \( K(X) = 76.365 \).
Table 5. Indicators of optimized recipes for pancakes with cheese and herbs

\[
X = \begin{pmatrix}
3.2 \times 10^4 \\
4.399 \times 10^2 \\
971.353 \\
1.6 \times 10^3 \\
4 \times 10^4 \\
5 \times 10^3 \\
1 \times 10^4 \\
5 \times 10^3 \\
\end{pmatrix}
\]

- results of calculating the weight (mg) of each product in the mix

\[
\text{M}(X) = 9.897 \times 10^4 \quad \text{total weight (g) of the mixture;}
\]

\[
\text{K}(X) = 80.603 \quad \text{the terms of the balance of the mixture;}
\]

vector of shares % of each product:

\[
\frac{X_i}{\text{M}(X)} \cdot 100 =
\]

32.333
4.445
0.981
1.617
40.416
5.032
10.104
5.052

\[
C_j = kr(j, X); \quad CB_j = \frac{C_j}{B_j}; \quad CB_{min} = \frac{C_j}{B_{2j}}; \quad CB_{max} = \frac{C_j}{B_{3j}};
\]

\[
CB_k = KO(X); \quad CB_{min_k} = KO(X); \quad CB_{max_k} = KO(X);
\]

\[
CB_{k-1} = \frac{\sum_i (AA_{i,k-1} \cdot AA_{i,2} \cdot x_i)}{B_{k-1}};
\]

\[
CB_{min_{k-1}} = \frac{\sum_i (AA_{i,k-1} \cdot AA_{i,2} \cdot x_i)}{B_{2k-1}};
\]

\[
CB_{max_{k-1}} = \frac{\sum_i (AA_{i,k-1} \cdot AA_{i,2} \cdot x_i)}{B_{3k-1}};
\]

\[
CB_{1j} = \begin{cases} 
\frac{C_j}{B_{1j}} & \text{if } B_{1j} > 0 \\
1 & \text{otherwise}
\end{cases}
\]

\[
CB_{1k_{-1}} = \begin{cases} 
\frac{\sum_i (AA_{i,k-1} \cdot AA_{i,2} \cdot x_i)}{1} & \text{if } B_{1j} > 0 \\
1 & \text{otherwise}
\end{cases}
\]

\[
CB_{k_{-1}} = \frac{C_j}{B_{kj}};
\]

\[
CB_{4k_{-1}} = \frac{\sum_i (AA_{i,k-1} \cdot AA_{i,2} \cdot x_i)}{B_{4k-1}};
\]

\[
CB_{1k} = KO(X);
\]

\[
CB_{4k} = KO(X);
\]

\[
CB_k = 1;
\]

\[
CB_{k-1} = 0.523;
\]

\[
j = 0..k
\]
A graphical representation of the balance of the ingredients contained in the chemical composition of pancakes with cheese and herbs is shown in Figure 1.

Comparison of mixture indicators with reference (=1) values: CB-too much or not enough

![Figure 1. Comparison of pancakes with cheese and herbs with reference](image1)

In Figure 2, the reference is line 1 shown in bold; the degree of desirability is represented by indicators $B_{min_j}$, $CB_{max_j}$, $CB_{1j}$, $CB_{4j}$, straight line $CB_j$, shows a comparison with the middle of the interval of acceptable values of the content of the ingredient.

![Figure 2. Graphic representation of the balance of ingredients pancakes with cheese and herbs](image2)

Based on the analysis of the composition options, the formulation is selected the most balanced in terms of physicochemical and organoleptic properties.

As a result of the design of the recipe, a product was obtained that meets the specified criteria ($K(X) = 80.60\%$). The obtained results of optimizing the composition of "Pancakes with cheese and herbs" are within acceptable standards for many indicators. Indicators such as the content of calcium, sodium, chlorine, and organoleptic are as close as possible to the reference values.
The exceptions are indicators of protein, fat, carbohydrates, zinc, vitamins E, B_1, B_3 and glycemic index. The content of these substances can not be corrected using the selected ingredients. Therefore it is recommended to serve pancakes with cheese and herbs with drinks rich in carbohydrates and enriched with a complex of vitamins. The following publications devoted to this direction.

4. Conclusion
Thus, as a result of a study on the optimization of pancakes recipes with cheese and herbs, a product was obtained that meets the specified criteria ($K(X) = 80, 60\%$).

Conflict of interest
The author claims no conflict of interest.

References
[1] Eremenko V N, Tyupenkova T E, Pitkin V N, Sinko O V and Khamzina L N 2018 Increasing motivation for physical education among students Modern pedagogical education 3
[2] Pukhova O A 2006 Food and diet for office workers (Moscow: Veche Publishing house) 25-26
[3] 2016 Collection of the best scientific works of young scientists of the Kuban state technological University, awarded at competitions: 3 parts. Part 1 (Krasnodar: Kuban state technol. UN-T) 32
[4] Berezina N A, Artyomov A V and Chuyev B N 2016 Modeling of composition of multicomponent flour mixes with the set indicators of food adequacy NIU ITMO Scientific magazine. "Processes and Devices of Food Productions" 3
[5] Gorodetskaya A A, Bugayets N A and Tamova M Yu 2016 Development of actions for correction of feeding behavior of students of higher educational institutions News of higher education institutions. Food technology 2-3 108-110
[6] Kasyanov G I and Grinchenko V S 2016 Need for foodstuffs of people of intensive brainwork Science. Equipment. Technologies (polytechnical messenger) 3 121-129
[7] Harenko E N, Yudina S B, Yarichevskaya N N 2018 Technology of products of sports food (SPb.: Publishing house Lan)
[8] Shipulin V I, Kasyanov G I and Zotova L V 2017 Designing of the foodstuff enriched with fruit and nuts Bulletin of the North Caucasian federal university 61 (4) 51-62