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Developing a New Recipe for Producing Belgian Waffles with Peanut Butter

S.H. Gevorgyan, Z.H. Hoveyan, A.K. Solomonyan
Armenian National Agrarian University
Sargisgevorgyan17@yahoo.com, z.hoveyan@anau.am, solomonyan.2017@mail.ru

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ABSTRACT

The issues related to children obesity and those of supplying them with daily required nutrients and energy value are becoming exacerbated year after year. The current research has been conducted within the context of developing a new recipe of Belgian waffles with peanut butter instead of the traditional one. Considering the circumstance that the mentioned product is rich in proteins, fats and carbohydrates, as well as minerals, such as manganese and copper, the relevant technology for Belgian waffle has been worked out and developed. Besides, the prime cost and chemical indicators of the new product manufactured via the store-bought and homemade peanut butter has been identified.

Introduction

Keeping to healthy diet has always been a pressing issue both throughout the world and in the Republic of Armenia. The highest rate in the habit of having breakfast is recorded in European countries both among the adults and children. Whereas, the lowest indicators for children obesity are observed in Netherlands, which is mostly due to the policy adopted by the health care institutions of the country (Louise Dye, 2017). In the countries of Eastern Europe and in Armenia, the habit of having breakfast has not been properly developed yet.

High nutrient value butter and waffles produced therewith are considered as part of breakfast foods. The process of manufacturing Belgian waffles upon the use of peanut butter hasn't been studied enough yet.

The peanut butter is considered to be an exceptionally healthy food product. It is rich not only in protein, fat and fibers, but also in vitamins and mineral matters, which are vital for the children's growth and development, as well as for metabolic functions and immunity system. People using peanut and peanut products take in more nutrients per recommended dietary allowance (RDAs) than those who don't use them. On the whole, peanut users have a healthier diet than those whose food diet lacks peanut products (Barbara Millen, 2015).

Peanut butter, as a substitute of traditional butter, promotes the reduction of high fat amount in butter and supplements the food with vitamins (E, B_3, B_6) and minerals, such as manganese and copper. The latter support the health of bones, blood vessels and immunity system. A number

of investigations have indicated that the use of sufficient amount of copper can reduce the risks for heart disease development (www.webmd.com).

Application of peanut butter, as a substitute, is also relevant from the prospect of supplementing the food diet with another primary component - Mn (manganese). Manganese is an important element, which takes part in the synthesis and activation of multiple enzymes, as well as in the regulation of human glucose and lipid metabolism. Lack of manganese can cause demineralization in children and result in their underdevelopment (Longman and Xiaobo Yang, 2018).

Materials and methods

The current research aims to develop a new recipe for waffle production by applying peanut butter with the combination of 10 % carrot extract. Based on the abovementioned, comparative analysis has been conducted both in view of qualitative properties, as well as the prime cost and economic feasibility of the new product. To this end the following objectives have been set up:

- searching out plant-based components, which will enable to manufacture Belgian waffle by substituting animal-based butter product
- developing recipe for the new product range
- producing a new food product for breakfast supplemented with proteins, fats, carbohydrates and minerals
- estimating the prime cost and justifying the economic efficiency of the product.

The peanut butter and Belgian waffle have served as the study subjects. To produce 1 kg of the new food product, the entire portion of 5 %, 15 % and 25 % ordinary butter was substituted with respective rates of peanut butter. The Belgian waffle with 15 % peanut butter has been selected as an optimal variant. This choice is conditioned by the fact that when using 5 % peanut butter, insignificant changes have been observed, while when using the option of 25 %, deterioration in organoleptic indicators have been recorded. Whereas, in case of applying 15 % peanut butter it was possible to obtain the required favorable outcomes.

The trials have been implemented in 2 variants with 2 replications:

1. *Control sample:* Belgian waffle manufactured with the store-bought peanut butter

2. *Experimental sample*: Belgian waffle manufactured with homemade peanut butter.

The research has been implemented in consistent with the normative documents for waffles production. The content of protein mass has been determined according to the regulations set per GOST 26889-86 through Kjeldahl method, the oil mass- with extraction methods per point 8 of GOST 31902-2012 and the amount of minerals has been identified based on AOAC 974-27 and MV-01-008 methods.

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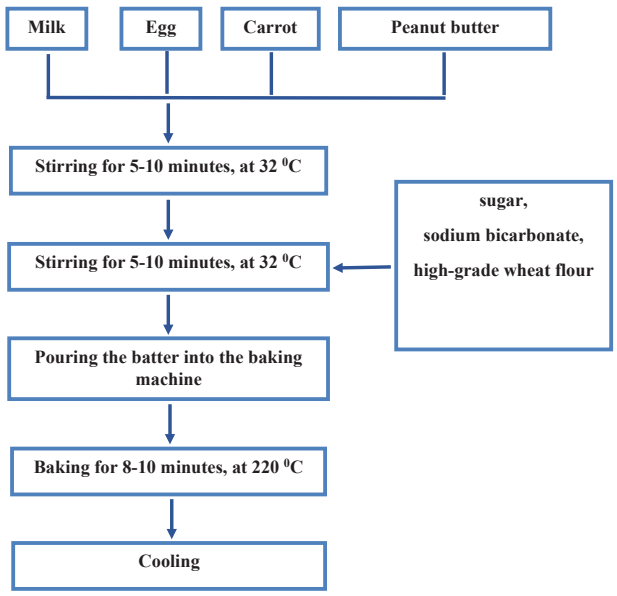
Results and discussions

The control (Belgian waffle manufactured with store-bought peanut butter) and experimental (Belgian waffle manufactured with the homemade peanut butter) samples have been subjected to investigations. The common technological methods have served as a base for the development of the new technological scheme (Koryachkina and Matveeva, 2011).

For the preparation of the first sample the following ingredients have been used: for 1 kg finished product, 600 g high-grade wheat flour, 90 g sugar, 600 ml milk, 6 eggs, 15 g soda, 150 g store-bought peanut butter and 100 g carrot was required, while for the preparation of the second sample all the ingredients stayed the same except for peanut butter, which was substituted by the homemade butter (Scheme).

The acidity degree and moisture content of the Belgian waffles prepared with store-bought and homemade peanut butters comply with the set standards (Table 1).

The protein content in the Belgian waffles produced with the use of store-bought peanut butter makes 12.3 % and the carbohydrates – 10.85 %. These indicators exceed those recorded in the Belgian waffles manufactured with homemade peanut butter by 0.35 % and 0.65 %, respectively. Anyhow, in contrast to the control sample, the fat amount in the experimental variant is higher by 1.15 % amounting to 12.75 % (Table 2).



Scheme. The technological scheme for Belgian Waffle Production *(composed by the authors)*.

As a result, the energy value of the Belgian waffle produced with homemade peanut butter has made 203.35 kcal/g, or 848.3 kJ/g, while in the Belgian waffle prepared with the store-bought peanut butter it is 197.45 kcal/g, or 823.6 kJ/g. The latter's indices are lower than those in the Belgian waffles with homemade butter by 5.9 kcal/g or by 24.7 kJ/g (Figure 1).

Among the mineral substances manganese and copper mostly prevail in the composition of peanut butter.

According to the German Federal Institute for Risk Assessment the following doses of manganese daily intake by the body for different age groups have been identified:

- individuals aged from 4 to 7 years old: 1.5-2 mg/day
- individuals aged from 7 to 10 years old: 2-3 mg/day
- individuals aged from 10 to 15 years old: 2-5 mg/day.

For adults and even pregnant women the daily intake for manganese is estimated as 3 mg (www.bfr.bund.de).

Table 1. The physicochemical indicators of Belgian waffles*

Variants	Physicochemical indicator	
	Moisture content, %	Acidity degree, 0 N
Control sample	20.0	2.5
Experimental sample	23.0	2.1

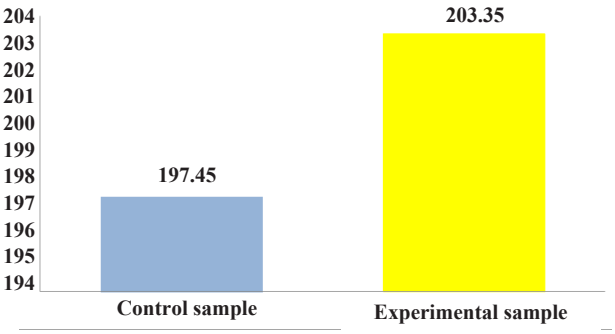


Figure 1. Energy value of Belgian waffles, kcal/g *(composed by the authors)*.

Table 2. The chemical composition of Belgian waffles for control and experimental samples*

Variants	Protein content, %			Oil mass, %			Mass fraction of total sugars, %		
	Replication I	Replication II	Average index	Replication I	Replication II	Average index	Replication I	Replication II	Average index
Control sample	12.1	12.6	12.3	11.5	11.7	11.6	10.8	10.9	10.85
Experimental sample	11.6	12.3	11,95	12.8	12.7	12,75	10.2	10.2	10.2

* Composed by the authors.

According to the above stated indices it turns out, that a piece of waffle produced with homemade butter, averagely weighing 150 g, satisfies 21 % of the required daily manganese portion in 7-10-year-old children, while that of manufactured with store-bought peanut butter ensures 18.75 % of the required daily manganese dose (Figure 2).

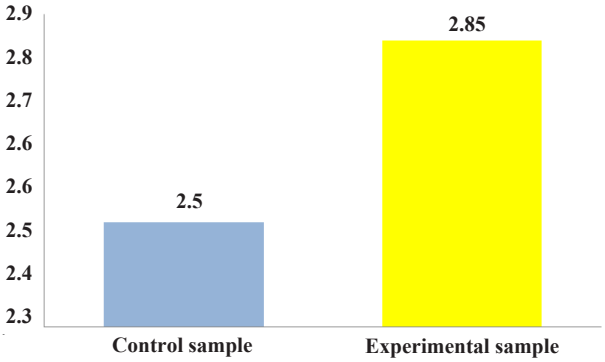


Figure 2. Manganese content in the Belgian waffles, mg/kg *(composed by the authors)*.

Copper is another key mineral substance in the human diet. Based on the circumstance that 50 % of the body-required copper is received via drinking water and the average daily intake for 10-18-year-old individuals makes 1.2 mg (www.bfr.bund.de), it becomes clear that a piece of 150 g Belgian waffle prepared with store-bought peanut butter will provide 26.25 % copper for the human body, while 150 g Belgian waffle produced with homemade peanut butter will supply 8.75 % more copper equaling to 35 % total copper amount (Figure 3).

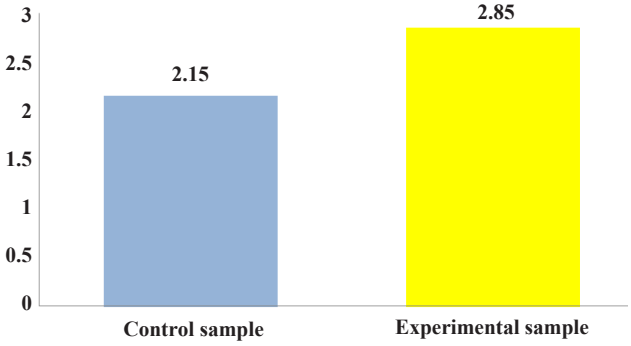


Figure 3. Copper content in the Belgian waffle, mg/kg *(composed by the authors)*.

To estimate the prime cost of the food products, the cost calculation per a piece of waffle (150 g) for each ingredients, as prioritized per the recipe, has been conducted and then, the depreciation and electricity costs of the baking machine were added as other costs assuming AMD 100 as a fixed value for each kilogram.

The calculation per the recipe was conducted on February 2, 2022, in one of the RA supermarkets in line with the prices fixed for that period. As a result, the prime cost of 150 g Belgian waffle prepared with store-bought peanut butter has made AMD 341.2 which is higher than that of estimated for the Belgian waffle manufactured with homemade peanut butter by 120.12 drams, since the latter's prime cost has been estimated as AMD 221.08 (Figure 4).

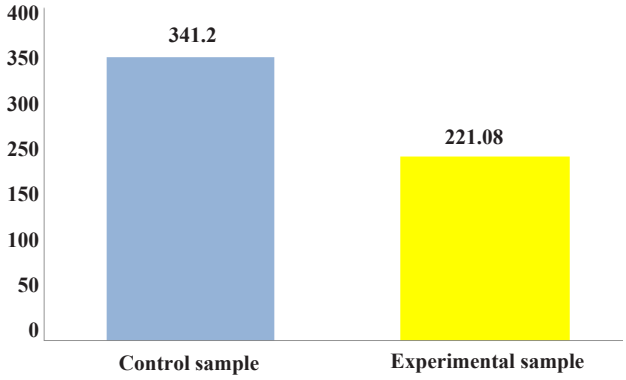


Figure 4. The prime cost of Belgian waffles per 150 g waffle piece, AMD *(composed by the authors)*.

Conclusion

Based on the conducted sientific research experiments, the following conclusions have been inferred:

1. In the result of conducted research, a scientifically justified technology for Belgian waffle manufacture via applying peanut butter has been developed.

2.The research findings point out that the indices of energy value, manganese and copper of the Belgian waffle manufactured with homemade peanut butter exceed the same indices of Belgian waffle prepared via store-bought peanut butter by 24.7 kJ/g, 0.35 mg/kg and 0.7 mg/kg, respectively.

3.According to the economic calculations, the Belgian waffle prepared with homemade peanut butter is more cost-effective (by AMD 120.12) per 150 g Belgian waffle than that of manufactured with store-bought peanut butter.

References

1. AOAC 974-27. AOAC Official Method 974.27 Cadmium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Silver, and Zinc in Water. Atomic Absorption Spectrophotometric Method.
2. Barbara Millen (2015). U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015–2020 Dietary Guidelines for Americans, 8th Edition, - p.144, Available at: http://health.gov/dietaryguidelines/2015/guidelines/ (accessed on 04.03.2022).
3. GOST-31902-2012. Confectionery. Methods of Determination of Fat Weight Fraction.
4. GOST-26889-86. Food-Stuffs and Food Additives. General Directions for Determination of Nitrogen Content by the Kjeldahl Method.
5. https://www.bfr.bund.de/cm/343/hoechstmengenvorschlaege-fuer-mangan-in-lebensmitteln-inklusive-nahrungsergaenzungsmitteln.pdf (accessed on 04.24.2022).
6. https://www.webmd.com/diet/peanut-butter-good-for-you#:~:text=Peanut%20butter%20is%20rich%20in,sugars%2C%20oils%2C%20and%20fats (accessed on 04.24.2022).
7. Koryachkina, S.Ya., Matveeva, T.V. (2011). Technology of Flour Confectionery Products: Textbook for Universities, St. Petersburg: Trinity Bridge, - 408 p.
8. Longman Li, Xiaobo Yang (2018). The Essential Element Manganese, Oxidative Stress, and Metabolic Diseases: Links and Interactions, Oxid Med Cell Longev. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5907490/ (accessed on 04. 03. 2022).
9. Louise Dye (2017). The Importance of Breakfast in Europe, Belgium, - p. 70, Available at: http://www.breakfastisbest.eu/docs/102017/BIB_Report_Importance_of_Breakfast_in_Europe_2017.pdf (accessed on 04.02 2022).

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