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A STUDY ON THE ADVISABILITY OF THE USE OF COCONUT OIL IN BAKERY PRODUCTS

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Abstract: *The main objective is to capitalize on the use of coconut oil and improve edible products in terms of nutrient value. The experimental research aims to establish how this component reacts and how it influences certain technological processes in the breadmaking industry. The purpose of this paper is to establish the quantity of the main nutrients contained in this kind of products and at the same time to create products intended for a certain category of consumers. Even if it is recommended to reduce bread consumption, this sort of bakery products are holding one of the top positions in everyday nutrition and for some people they are indispensable. Therefore, in order to bring a contribution of sustenances and fibres that are frequently missing from products, we decided to add coconut oil.*

Keywords: *bread, cocos oil, quality.*

1. Introduction

The technological process, as well as the assortment of bakery products from Romania was subjected to the influence of Viennese specificity in breadmaking, which was passed on and then developed by the local population according to their own taste, particularly with regard to bread products.

2. Objectives

The importance of bakery products in meeting the population's food requirements entails that it is a factor which determines the development of bread in Romania in an accelerated pace.

Fat influences its rheological properties (it decreases the amount of water used for kneading, due to its absorption by the surface protein and starch granules, reducing hydration and thus delaying the formation of gluten and dough), the mechanic machinability of the dough (prevents dough from sticking by 83, a characteristic of the moulding machine), the yeast fermentation activity (is inhibited when the quantity of fat exceeds 10%), the quality of bread (improves the elasticity of the skin and the flesh and keep the freshness of bread).[4]

Coconut oil is used throughout the world in both food and non-food purposes. Detergent industry depends to a large extent on coconut and palm oil due to their high content of lauric acid. Coconut oil is

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used for the manufacture of pastry products, for roasting, due to two main features: high degree of saturation and good stability.

In terms of physical properties coconut oil has a hard, consistency but fragile at low temperatures, having the melting temperature below 30 °C. The oil is also subjected to a hydrolysis process, short-chain acids being fractional distillated in products with different degrees of purity, which are then turned into alcohols, amides or esters p for being used in detergents, plastics. However, unrefined oil extracted from the coconut has an unpleasant odor due to the volatile substances, including free fatty acids and other impurities. There are different procedures for the purification of raw oil that include operations such as neutralization, bleaching, deodorizing.

Coconut oil contains triacilgrlicerol, free fatty acid, partial glycerides, phospholipids, tocopherols, sterols, pigments, volatile substances, trace of metals and oxidation products. Triglycerides constitute the most significant part, 90-95%. These are the components that need to be purified without removing minor useful compounds. Free fatty acids, phospholipids, pigments, traces of metals are items that must be removed. These impurities are not supported because they give color to the oil, determine the appearance of the foam and precipitate in heat. [2]

The low melting point is not caused by a large degree of unsaturation, as in the case of most vegetable oils, but by the low molecular weight of glycerides. The most important physical property of coconut oil, is that it suddenly passes from a solid to a liquid state, without going through a process of softening a degree, in a low-temperature range. From this point of view it resembles coconut butter. This is the consequence of the melting behavior of the presence of fatty acids and triacilglicerol.

Accounting for a 90% extent, fatty acids, coconut oil are saturated and are present in most myristic and lauric acids as well as in the palmitic ones. They have a melting point of 44°C, 54°C respectively 63°C. Thus the difference between the melting points of the main acids is 19 ° c. On the other hand, the majority of fatty acids with high molecular mass such as linoleic acids, linolenic, oleic, palmitic and stearic acids, have melting points between-7 ° C to 70 ° C, with a difference of 77 ° C.

Raw coconut oil has a relatively low phospholipid content, 0.2%, as compared to other types of vegetable oils, 1-3%. The largest part of phospholipids is lecithin which account for 34.6% of the total amount. These compounds vary according to the source of origin, but most times they are removed in the refining process.

Tocopherols are antioxidants that are found in vegetable oils, their presence preventing oxidation. When compared to other types of vegetable oils, coconut oil is low in tocopherols, 40-100ppm.[2]

The benefits of coconut oil

A high content of acids with short chain length helps to increase the rate of metabolism, helping in weight loss, improve the level of good cholesterol, HDL. It represents a source of energy, recommended in case of tiredness. S found that coconut oil has antioxidant and antimicrobial properties, because the fatty acids, under the influence of enzymes turn into compounds such as monocaprin, monolaurin that are systemic antifungal agents. They battle against viruses, intestinal worms, bacteria, proving effective protection against Candida albicans. When coconut oil is consumed regularly, it has benefical effects on the gastrointestinal tract. It can also be used to protect the epidermis, having a beneficial effect on hydration. That's why coconut oil is also widely used in the cosmetics industry.

Physical properties Table 1

Physical properties	Sunflower oil	Coconut oil
Melting point [°C]	-	25
Burning point [°C]	232	177
Density at 20°C, [g/cm^3]	0.92	0.924
Water solubility	Insoluble in water	

Composition of coconut oil fatty acid Table 2

Fatty acids	The interval during which they are present in coconut oil	Fatty acids	The interval during which they are present in coconut oil
Capronic	0.4-0.6	Miristic	16.8-19.2
Caprilic	6.9-9.4	Palmitic	7.7-9.7
Capric	6.2-7.8	Stearic	2.3-3.2
Lauric	45.9-50.3	Oleic	5.4-7.4

3. Material and Methods

In order to achieve the objectives of this study, there has been more evidence when we used type 650 raw white flour with aditives, organic coconut oil, sunflower oil, water, yeast for baking. In the context of experimental research on the measurement of physical-chemical parameters of the raw materials the following tools were used: an alveograph, tools for the determination of gluten - Glutomatic Perten 2200, Metler scale, Analytical scale.

For the determination of moisture the Metler Toledo scale MJ33 with infrared rays technology, fitted with heat-producing metal elements was used. Repeatability of results is of 0,01%, temperature range is 50-160°C, the maximum quantity of the sample which can be processed is of 35 g.

The Chopin Alveograph measures and records the strength of the gluten from dough by measuring the force required to swell and burst a bubble of dough. Value of P indicates the force required to inflate the bubble dough. It is indicated by the maximum height of the curve and expressed in mm. The value of L represents the extensibility of the dough before that bubble bursts. This is indicated by the length of the curve and expressed in mm. The P/L ratio represents the ratio of dough strength and extensibility. The value of W is represented by the area under the curve and is expressed in joules.

This tool determines the viscosity by measuring the resistance of a paste of flour and water in a mixer.[1]

The volume of bread is determined using the Fornet apparatus. The method is based on the measuring the volume of rapeseed displaced by the product to be analysed and reporting it as a percentage.

The porosity-pore volume represents the 100 g of core. The elasticity of the core was determined by means of the classical method. This method involves pressing a piece of core of some form and measuring the return to shape after pressing in a given amount of time. To determine the acidity of bread obtained aqueous extract of the sample to be analysed is used. It is treated with a sodium hydroxide solution 0,1N, in the presence of phenolphthalein as indicator, until the advent of a pale pink coloration, that persists for a minute.

The moisture samples thus obtained are determined using the LJ 16 Metler Toledo scale. To find out the value of the height/diameter ratio of the unntouched products the maximum height (H) is measured within a period, with an accuracy of 0.1 cm. In the case of notched products, the maximum and minimum height of the products in the notched area and the average arithmetic mean of the two values is measured. For the purpose of determining the diameter (D) measurement with a gradual ruler, two perpendicular diameters are set and the mean value is calculated.

4. Results and Discussions

Results and discussions Table 3

Features	**Sample 1**	**Sample 2**	**Sample 3**	**Sample 4**	**Sample 5**
Diameter [cm]	16.7	17.5	17.75	16.3	16.3
Height [cm]	8.9	8.9	8.7	7	7.6
H/D	0.532	0.508	0.490	0.429	0.466
Weight [g]	309	311.5	315	322.9	323
Volume [cm^3/ 100g]	642	624	616	486	483
Elasticity [% min]	92.7	94	94.3	86.7	90
Porosity [% min]	84.4	83.8	85.4	80.6	80.5
Acidity [degree]	1.6	1.6	1.8	1.2	1.2
Moisture [% max]	42.65	41.3	40.72	34.3	33.5

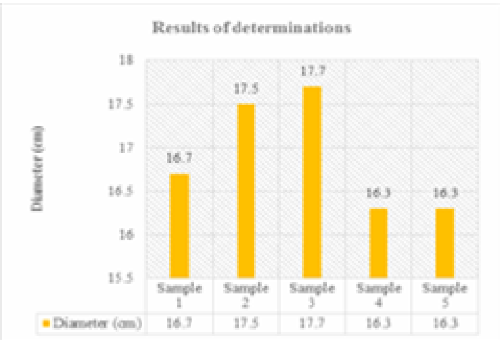

Fig. 1. *Diameter determination for five samples*

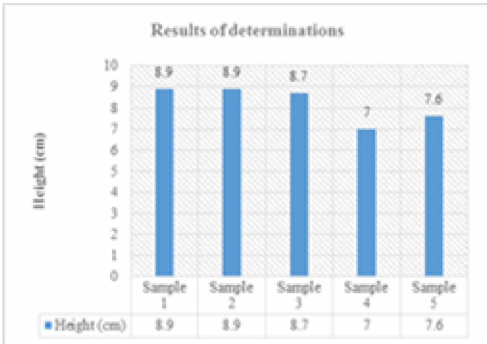

Fig. 2. *Height determination for five samples*

Fig. 3. *H/D proportion determination for five samples*

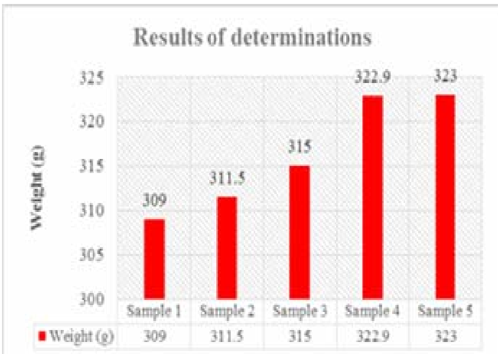

Fig. 4. *Weight determination for five samples*

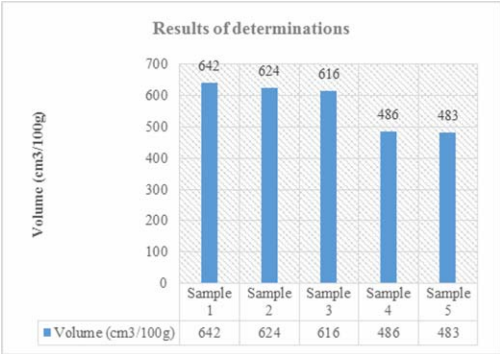

Fig. 5. *Volume determination for five samples*

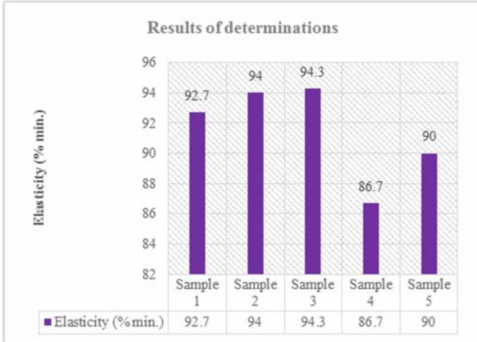

Fig. 6. *Elasticity determination for five samples*

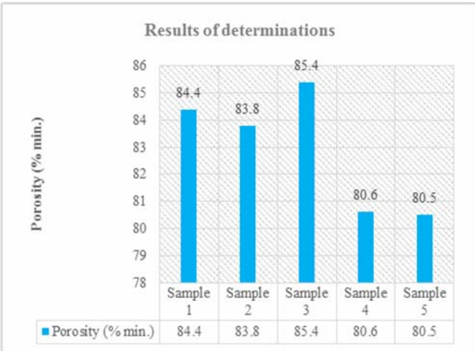

Fig. 7. *Porosity determination for five samples*

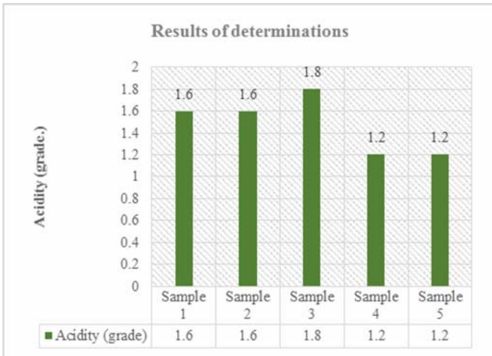

Fig. 8. *Acidity determination for five samples*

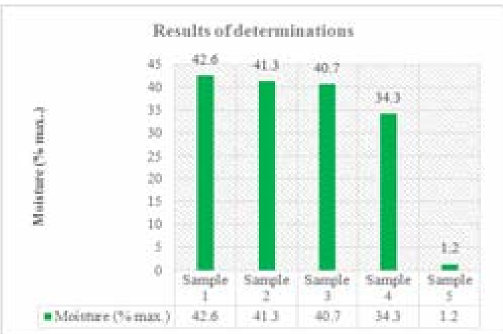

Fig. 9. *Moisture determination for five samples*

Regarding the results from diagram 1, concerning the diameter of the five samples it can be observed that sample 3 has a diameter of about 17.7 cm. A near value was obtained for sample 2 – 17.5 cm. A lower value of about 16.7 cm corresponds to sample 1. Samples 4 and 5 had equal values of 16.3 cm. We can conclude that for sample number 3 the registered value was the highest, proving the fact that by adding coconut oil, the diameter of the products was positively influenced, as compared to sample number 1 where sunflower oil was added.

In the case of diagram 2, it can be observed that in case of samples 1, 2 and 3 the extracted values were roughly equal – 8.9 cm and 8.7 cm. On the other hand, in case of sample number 4 a lower value of about 7 cm was obtained, that highlights the fact that by reducing the quantity of water, the absorption of oil in the mass of dough is weighted.

Diagram 3 shows the results of the proportion H/D concerning the 5 samples. By analyzing the values obtained it can be easily observed that the highest value, of 0,532 was achieved for sample 1 where sunflower oil was used. For samples 2, 3 and 5 the values were fairly equal, a fact that denotes a negative effect on the H/D proportion after the addition of coconut oil, in comparison to the results obtained for sample 1, where sunflower oil was used. For sample 4, a lower value was obtained – 0.429. Regarding graph number 4, the 5 samples were examined by their weight. Thereby, samples number 1, 2 and 3 approached values of 309 g, 311.5 g and 315g. Sample 4 had the value of 322.9 g, caused by the addition of coconut oil in a large quantity.

In graph number 5 it can be observed that samples 1, 2 and 3 had the highest volume – 642 cm^3/100g, 624 cm^3/100 g and 616 cm^3/100g. Samples 4 and 5 had a lower volume – 486 cm^3/100g and 483 cm^3/100g.

Analyzing the elasticity of the samples in graph 6, we can observe how in case of sample 3, by adding 10% coconut oil, the value of the elasticity parameter raised to the value of 94.3%. After adding sunflower oil, for sample 1, the value of the parameter is diminished – 92.7%, due to the high density of sunflower oil.

Concerning diagram 7, the higher values of the porosity parameter was obtained for sample 3 – 85.4%, due to the addition of 10% coconut oil. We can conclude that by adding coconut oil to the dough, the porosity is positively influenced. Samples 1 and 2 reached approximately equal values of 84.4% and 83.8%, due to the almost equal quantity of oil added. Samples 4 and 5 were obtained by adding 20 % oil.

Graph 8 contains the values of acidity for our five samples. The highest value was obtained for sample 3 – 1.8 degrees that contains in its composition 10% coconut oil. Samples number 1 and 2, containing 5% of sunflower oil or 5% coconut oil, reached lower values of 1.6 degrees. The last samples 4 and 5, reached the lowest values of 1.2 degrees, a fact that indicates that a high acidity product was obtained.

The last graph – number 9 shows the results of the moisture determination for the five samples. The highest value was obtained for sample 1 – 42.6% and the lowest for sample 5 – 1.2%. The result of the first sample was due to the high content of water of the sunflower oil. In comparison, the results of samples 2 and 3, were lowest – 41.3% and 40.7% due to the fact that coconut oil had a low water content.

In the case of sample 1, sunflower oil is added gradually. The oil shall be incorporated more difficultly, that's why kneading lasts 9 minutes. The formed dough is soft, slightly sticky, but does not raise problems in modeling. After rising, it presents a good volume, being stable at notching. The baking process has a good development, finally getting a good volume.

Sample 2 was made with 5% coconut oil. While mixing, it appeared that it was incorporating more easily than when sunflower oil was added, and the time required is lower. After 5 minutes of mixing to the working speed of 5, the oil is fully incorporated, so the second phase of mixing lasts 7 minutes. The dough is more related, it does not paste, it is more stable to notching after rising. Coconut oil positively influences rheological properties, because a higher volume and better stability, as compared to the sample with 5% sunflower oil, are obtained. During baking a slight flattening is observed, however, the finished product has a better overall appearance, the crust is smooth and there is a satisfactory final volume.

For sample 3, coconut oil was added at the beginning of the mixing process. It could be observed that it was very well incorporated, the second phase of mixing having a duration of 7 min, just like with sample 2, even if a double amount of oil is added. The dough has elastic consistency,
it is less sticky than the previous sample, it has a pleasant smell, without any pronounced odour of cocos. As the amount of coconut oil increases, so does the quality of the dough, this working as an enzyme removal phenomenon. At the final shaping, the dough is smooth, but after notching the leavening is stable, having a satisfactory volume. After baking, a type of bread with a pleasant appearance, with a fine crust and good final volume is obtained.

For sample 4, the amount of water added decreased to 42% because of the increased percentage of oil added, namely of 20%. Coconut oil is incorporated in 2 stages: 60% of the amount shall be added in the first stage of mixing and another 40% in the second stage of the process. It is observed that the dough breaks during the mixing, the oil is much more difficultly incorporated and that's why the time required of the second stage of the process takes up to 13 minutes. The dough is linked, tougher, unwieldy, feels oily, has the characteristics of pastry. Consistency is good, there is also good elasticity, but airsheds appeared on the surface of the dough, this fact thus showing that the protein network is poor.

Leavening is cumbersome, the volume is lower, the dough falling to the notch before leavening. During baking it presents a weak progress and the final volume is small.

The finished product has a hot oily core, gummy, however, the crust is good, crispy, strong aroma with a nutty flavor.

Sample 5 used 20% sunflower oil that has been added gradually in the process of mixing. Unlike coconut oil, the addition is made easier, the dough does not present the same characteristics of breaking during mixing. However the time taken for this process is 13 minutes. The finished product has hot oily core, gummy, however, the crust is good, crispy, strong aroma with nutty flavor. Dough consistency is good, the dough is not an oily paste. On the surface, the piece of dough is broken, not forming small „skin”, discontinuities appear, because of glutenic network being weakened. The indenting before leavening has the appearance of oily dough and it is more similar to pastry. However, the quality of the dough is better than that of the dough with coconut oil. After rising, the dough notching process is performed. During baking there is weak progress, but it is, however, much better than in the case of sample 4.

White bread is fragile, it has a strong oily taste and a pleasant odour.

Fig. 10. *Bread samples obtained*

5. Conclusions

Within the experimental research it has been found that coconut oil in moderate proportions, namely 10%, has a positive influence of the rheological properties of dough. It is elastic, easily molded, it does not allow sticking of the mixer's component parts. The oil has been solid, it is easily and quickly incorporated into the dough. In the process of rising, it has been observed that the dough has retained notching gas thus resulting in a satisfactory volume. The piece of dough has a pleasant aspect, it is smooth, discontinuities did not appear in the protein network, as compared to samples with 20% coconut oil or sunflower seeds oil. Gluten was formed properly, and the activity of yeast was not braked. Thus, we can say that 10% coconut oil constitutes the optimal quantity to obtain a dough with good features.

In the case of the finished product, bread containing 10% coconut oil presents the best porosity and elasticity of the core.

Bread with 5% sunflower oil tastes bland, the crust is thin, but has a faint odor of oil that the consumer dislikes. Compared to this, the bread with 5% coconut oil has a pleasant smell and taste. Regarding the dough stage, certain improvements have been noticed, namely because oil is incorporated, it is more easily tied, being a less sticky dough. Bread with 20% sunflower oil has a pronounced taste, the oil smell is less enjoyable as compared to the bread with 20% coconut oil. Both samples were crumbly, but the core samples with coconut oil were preferred to those containing sunflower oil.

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