WAYS OF OPTIMIZING THE NUTRITIONAL VALUE OF DIETETIC PASTRY PRODUCTS

***Iuliana CIOARBĂ [1], Ana BATARIUC [2]**
[1]Ştefan cel Mare University of Suceava, Faculty of Food Engineering, Universităţii street, number 13, postal code 720229 Suceava, Romania, iulianac@usv.ro
*Corresponding author
[2] DSVSA Suceava, Scurta street, number 2, postal code 720223 Suceava, Romania, any_b03@yahoo.com
Received 20 February 2011, accepted 19 May 2011

Abstract: *A balanced nutrition means a diet which contains necessary nutrients in proper proportions for our body's health. The lately led studies prove that the persons whose diets are poor in vegetable fibers are more exposed to degenerative diseases such as: constipation, colitis, and diabetes or colon cancer. The general concern for the development of functional foods has led to reconsidering the use of dietary fibres in food production and thus researches on their physiological role for human organism had been initiated. The vegetable fibers represent an important compound of the diet for they don't fatten and they ensure a good digestion. The purpose of this paper was to find some ways to improve the nutritional value of a dietetic pastry product based on sweeteners. For accomplishing this, the water used in preparing the fibre-rich product was replaced by carrot juice. Thus, a general improvement of the nutritive value could be noticed, but with a slight growth of the energetic value of the final product, a growth that was determined also by the use of some caloric sweeteners. Good knowledge of the nutritional value of food is a basic condition in order to be able to appreciate their quality level and nutrition specialists should be interested in optimizing it.*

Keywords*: diet, fiber, nutritive value, sweetener.*

1. Introduction

Nutrition is the science of dietary. It refers to the food digestion, nutritional needs, and food science and food behavior [1].

A correct diet ensures a normal and harmonious development of the growing organism; it ensures health and resistance at the harmful environment factors and a high intellectual and physical capacity as well as a prolonged life expectancy [2].

When the organism receives all the nutrient substances (especially those un-synthesizable ones) in the correct quantities for its needs the diet is "proper". In this case it constitutes one of the main ways that can influence favorably the health state of the individual or of the collectivity from many aspects: the harmonious growth and development of the youngsters and youth, the maintenance in the normal limits of some somatic parameters (body weight, height etc.), physiologic parameters (the normal functioning of the body systems) and biochemical parameters (the maintenance in normal concentrations of the blood and tissues constituents in children and adults, the enhancement of the working ability, the adaptation and resistance to the environment unfavorable factors) [3].

The nutritional mistakes can aggravate a series of diseases of the digestive system and of the attached organs: gastritis, ulcers, entero-colitis, chronic constipation, diseases of the biliary ways, chronic pancreatitis, cancer etc.

Most of the technological processing used in the modern food industry determine a diminishing of the nutritive substances content of the raw

materials subjected to the processing and most of the resulting food stuff has a high energetic density on low basis of active biological compounds [4]. Presented in an attractive way from the sensory point of view they influence the human's diet behavior as they select products from the first shelf according to their appealing nature without thinking of their nutritive qualities.

Under the conditions of globalization of the food stuff market, consumers' attention is driven by the new food stuff products, different from those which they were used to and those with insufficiently explained labels like: "dietetic food"', "light food", "fast food", "food supplements", "functional food" [5].

The rediscovering of the diet influence upon the human health led to the appearance of the functional foods as foods with prevention and improvement properties upon the different non contagious chronic diseases (NCD) such as the type 2 diabetes, obesity, cardio diseases, different forms of cancer, diseases that have a higher and higher incidence and strongly contribute to a high mortality ratio.

The general preoccupation for the functional foods development generated the need of studying and utilization of new food ingredients with a role in the maintenance and improvement of the health state [6]. Thus, the using of nutritional fibers was reconsidered in the food production and several studies regarding their physiological role in the human body were initiated [7].

Consequently, cereal fibers are important for the health of the human body and play an important part in the good functioning of the digestive system, of the vascular system but also in treating diabetes and controlling weight [8].

The specialists recommend a daily average consumption of 20 – 35 gr of fibers but people generally consume only 9 – 12 gr daily if not even less. A poor fiber diet can cause a series of unpleasant things starting with the bloating sensation, flatulence, hemorrhoids, varicosity and even heart and colon cancer.

The prevention as well as the control of diabetes is based on the medical examination but mostly on the careful daily diet of the patient. The three basically diet principles: sugars, fats and proteins must be found in certain ratios in the normal diet ratios that are modified in the case of the diabetes mellitus or in the case of the predisposition for this disease. In the case of diabetes mellitus the diet fibers especially of those insoluble can improve the blood glucose control decreasing the hyper insulin and the plasmatic concentrations of the lipids in type 2 diabetes facts that confer an ideal cardiovascular protection [9].

The previous research has shown that bran reduces the endothelium inflammation and improves its functioning. The diabetics are generally advised to consume lots of integral cereals and choose brown rice in favor of white rice.

The nutritional value of bakery products is increased by the enhancement with substances that they do not normally contain in a sufficient ratio or lack them totally [10]. The protean enhancement can be made by adding during the fabrication process protean rich substances especially those with high lysine content [11]. Bran and especially bran particles of flour (which are richer in lysine than the grain endosperm) can have an important role in increasing the lysine content [12]. To use them as addition it is necessary to process them in the fermentative way or to increase the human assimilation degree of the proteins contained.

Being very rich in the vitamins B group (B_1, B_2, B_3, B_5, B_6, B_8, B_9), in amino acids and minerals (sodium, potassium, magnesium, calcium etc.), enzymes, minor elements (90% of them are found in

bran) and vegetal fibers, wheat bran has numerous medical properties: they improve the digestion, are emollients especially for the stomach and intestines, laxative, nutritional, re-comforting, re-mineralizing, general tonics, help with decreasing the cholesterol and the fat deposits from certain organs. They are recommended in diseases such as: the endocrine diseases (regulate the glands due to their high mineral, amino acid and vitamin content), adenophaty, anemia, cancer, the different dermatosis, diabetes mellitus, epilepsy, obesity, neuro muscular diseases, neurological, cardio, liver ones, the convalescence period and most of the HYPO or HYPER diseases as bran contributes in regulating the entire body functions [13].

Even though they are not a nutrient the vegetal fibers represent an important component of the diet for they don't fatten and they ensure a good digestion.

This type of dietetic pastry was made for being introduced in human diet as the studies that have been led lately show that the humans whose diet is poor in vegetal fibers are more affected by the degenerative diseases such as constipation, colitis, and diabetes or colon cancer.

The fabrication recipe for the dietetic pastry products (for 100 kg finished product) is presented in the following table:

Table 1
The fabrication recipe for the dietetic pastry products

Ingredients	**Quantity (Kg)**
Flour type 650	41.95
Dietetic flour	41.95
Wheat bran	35.96
Sun flower oil	1.90
Sodium bicarbonate	0.87
Ammonium bicarbonate	0.87
Salt	0.73
Water	62.92
Sweetener	5.5

2. Materials and Method:

Organoleptic examination [14]

The principle of the method:

The organoleptic examination consists in evaluating the organoleptic characteristics of the products with the aid of the sensory organs and it is led upon the whole or sliced product (halves or slices).

Humidity's determination [15]

The principle of the method:

The sample is dried at the temperature of 103 ± 2ºC, for 40 minutes, afterwards the mass loss is being calculated.

Acidity's determination [16]

The principle of the method:

The water extract of the analyzed sample is titrated with a sodium hydroxide solution of 0.1n in the presence of phenolphthalein as indicator.

Total sugar determination by the iodine-metric method (Schoorl method) [16]

The principle of the method:

An alkaline solution of cupric salt is reduced at heat with the aid of a reducing sugar from the sample analyzed. The resulting cupric oxide is titrated indirectly with a sodium thiosulphate solution.

Fats determination [16]

The principle of the method:

The fat is extracted from the sample with petroleum ether or ethyl ether in the Soxhlet device, and then it is evaporated and dried till constant weight and then weighed.

Protean substances determination [17]

The principle of the method:

The mineralization of the organic substances with H_2SO_4 in the presence of a catalyst. The alkalinization of the reaction product followed by the freed ammonia distillation and titration.

We calculate the nitrogen content and multiply the result with a conventional

factor to obtain the raw protean content. This multiplication factor is 6,25.

3. Results and Discussion

After having made the product according to the established recipe we performed the organoleptic examination, determined acidity, fat content, proteins and sugar content as well as humidity in the product (in comparison with its version) by replacing water in the fabrication recipe by carrot juice.

In each of the two versions of the dietetic pastry products (with water and carrot juice) three types of different sweeteners were introduced:

- Saccharine and cyclamate sweetener (Clio) which contains 20,82% sodium cyclamate and 5,58% saccharine with an energetic value of 0 calories;
- Dextrose, saccharine and acesulfame K sweetener (Dolcificante) with an energetic value of 360 kcal/530 kJ per 100 g;
- Pure fructose (Fruttil) with an energetic value of 400 kcal/1700 kJ per 100 g.

6 samples were obtained:

1 – with Clio sweetener;
2 – with Dolcificante sweetener;
3 – with Fruttil sweetener;
4 – with Clio sweetener and carrot juice;
5 –with Dolcificante sweetener and carrot juice;
6 – with Fruttil sweetener and carrot juice.

We made two samples, one with water (7) and one with carrot juice (8) in which we did not introduce any type of sweetener and they served as reference samples.

Initially the first six samples were subjected to an organoleptic examination regarding appearance, form, consistency, color, flavor and taste. We distributed individual sensory analysis papers to 25 examiners with ages between 21 and 52 to see which of the six samples got the highest mark. The marks were centralized in a sensory analysis centralization paper. Following the marks obtained by the six samples we can assess that the replacing of water by carrot juice was appreciated by the examiners, carrot juice bringing the highest marks especially regarding color, flavor and taste.

After the organoleptic examination of the six samples along with the reference samples the physico-chemical determinations were made. From this point of view the characteristics determined were humidity, acidity, protean content, fat content and total sugar content.

From the humidity point of view some difference between the reference samples and those prepared with water, the humidity content (U = 20.13%) was a little higher than in the samples prepared with carrot juice (U = 18.86%) was noticed.

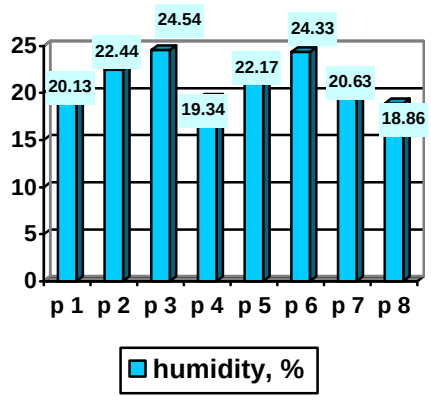

Fig. 3. The humidity's variation for the dietetic pastry products

Regarding the influence of the sweetener used we observed a humidity increase in the order Clio→Dolcificante→ Fruttil, both in the cases where the water was used and where the carrot juice was used. The humidity increase in this order is explained by the fact that in the same order the sweetener's hygroscopicity also increases.

The increase is of 10,29% (Clio→Dolcificante), and of 8.55% (Dolcificante→Fruttil) in the case of the series prepared with water and of 12.76% (Clio→Dolcificante), and 8.87%

(Dolcificante→Fruttil) for the series prepared with carrot juice.

In comparison with the reference sample in the case of carrot juice we saw a humidity increase with 22.48% when using the Fruttil sweetener.

The pastry products acidity is of maximum 3 degrees of acidity. The acidity values of the dietetic pastry products are given in the following graphic representation.

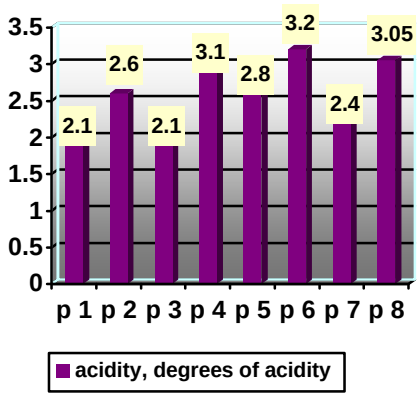

Fig. 4. The acidity's variation for the dietetic pastry products

First of all we noticed an increase of acidity (over 3 degrees of acidity established for pastry products) in the case of the samples prepared with carrot juice. In the case of the samples prepared with water, acidity is between the limits imposed. An increase of 8.34% was seen in the sample 2 (Dolcificante) in comparison with the reference sample 7, while the other two samples (1 and 3) had their acidity below the value of the reference sample.

In the case of the samples prepared with carrot juice we saw an over limit of the limit imposed in the cases of sample 4 (Clio and carrot juice) and 6 (Fruttil and carrot juice), an over linit with 1.64%, and 4.92% in comparison with the reference sample 8.

We have to compare the two reference samples we can say that there is an acidity increase with 27.09% when replacing the water by carrot juice.

Regarding the protein content of the eight samples we noticed slight differences between the samples prepared with water and those prepared with carrot juice.

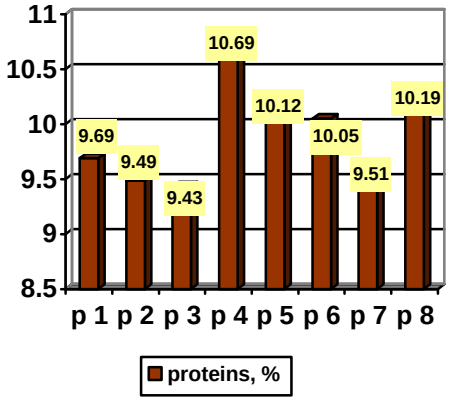

Fig. 5. The proteins content variation in dietetic pastry products

The carrot juice did not significantly alter the proteins content of the product, the difference between water reference sample and carrot juice sample being of 6.67%. There was as well noticed an increase in the cases of the samples where Clio sweetener was added, the difference between sample 1 (Clio) and sample 4 (Clio and carrot juice) being of 9.35%.

Regarding the total sugar content we saw many differences determined both by the sweeteners and the carrot juice used. First of all we saw a difference between the sample prepared with water and those prepared with the carrot juice in the way that they have increased the total sugar content. This thing was also well noticed in the reference samples. The total sugar content of the reference sample 8 prepared with carrot juice is with 68.36% higher

than that of reference sample 7 prepared with water.

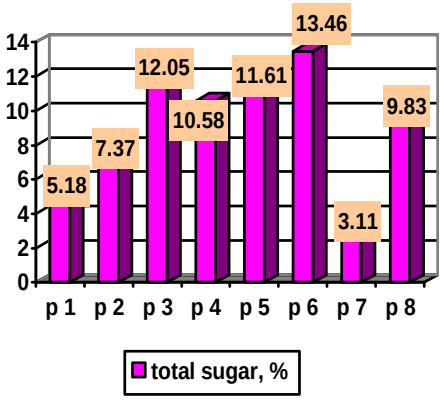

Fig. 6. The total sugar content variation for the dietetic pastry products

Another aspect noticed is an increase of the total sugar in the order of the energetic addition of the sweeteners used fact seen in the samples with water as well as in the ones with carrot juice. The order of the total sugar increase is sample 1→ sample 2→ sample 3, and sample 4→ sample 5→ sample 6, as the energetic addition brought by the mixture dextrose+saccharine+acesulfame K is higher than that brought by cyclamate+saccharine, and that brought by fructose is higher than that brought by the mixture dextrose+saccharine+acesulfame K. In comparison with sample 1 the total sugar content of sample 3 increased with 57.01%, and in comparison with sample 2 with 29.71%. The total sugar content of sample 6 increased with 21.39% in comparison with sample 4, and in comparison with sample 5 with 13.74%.

The fat content of the pastry products must be as high as 35%. The carrot juice used instead of water in the samples 4, 5 and 6 having fat content of 0.3g/100 g, did not influence significantly the fat content of the finished product, the differences being slight.

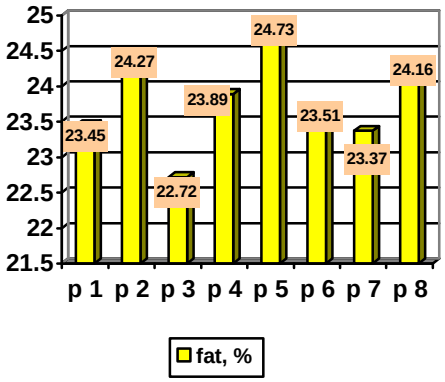

Fig. 7. The fat content variation for the dietetic pastry products

The reference sample 8 with carrot juice had a fat content with 3.27% higher than the reference sample with water 7. We also observed an increased content in the samples 2 and 5 where the Dolcificante sweetener was introduced. Sample 2 had a fat content with 3.86% higher than the reference sample 7 and sample 5 with 2.36% higher than reference sample 8. We must say that all the samples had a fat content in the limit imposed for the pastry products.

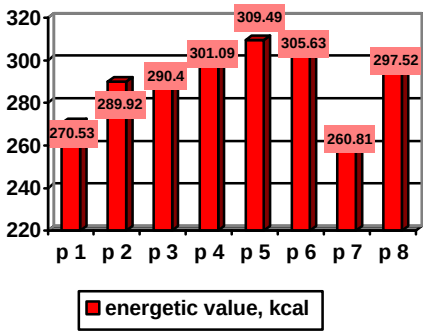

Fig. 8. The energetic value variation for the dietetic pastry products

The energetic value (expressed in kilocalories or kilojoules/ 100g of product) is the one that determines the food quantitative appearance, the covering of the daily individual energetic intake and being given by the calorigen trofins: sugars, fats and proteins.

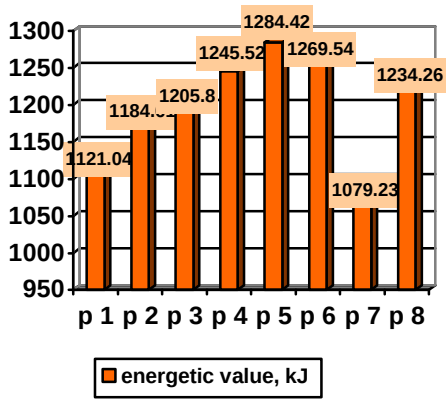

Fig. 9. The energetic value variation in kJ for the dietetic pastry products

From the energetic value point of view we noticed an increase in the products containing dextrose or fructose as well as a higher value in the products containing carrot juice in comparison with those containing water.

The samples 1, 2 and 3 had an energetic value of 3.73%, 11.17% and 11.35% higher than the reference sample 7. In the same way the samples 4, 5 and 6 had an energetic value of 1.2%, 18.67% and 17.19% higher than the reference sample 8. This thing was due in both cases to the calorigen sweetener adding. The use of carrot juice brought an energetic adding to the samples, increasing the energetic value by 12.33% in the case of the reference sample 8 prepared with carrot juice in comparison with he reference sample 7 prepared with water.

4. Conclusion

To determine the nutritional value of a food product supposes to emphasize the ratio between the daily necessary of nutritive substances and the substances given by a unit of product (usually 100g).

When we talk about the nutritional value of a product we usually refer to:

- the psycho-sensorial value given by the organoleptic and aesthetic value;
- the biological value given by the essential amino acids, vitamins and mineral substances;
- the energetic value- the number of kilocalories resulted by the body burnings of sugars, fats and protides;
- the hygienic-sanitary value given by the ratio between the useful and worthless substances and the absence of impurities and some harmful substances.

From the psycho-sensorial value point of view the dietetic pastry products prepared with carrot juice had an organoleptic and aesthetic value superior to that of the products prepared with water. Carotene in carrot juice brings a plus of color to the product enhancing its appearance. The additions of vitamins (vitamins *A, B, C)*, mineral salts and elements like iron, magnesium, calcium, potassium phosphorus, sodium, of carotene and asparagine leads to the increase of the biological value.

The carrot juice addition modifies the energetic value of the products in the sense of increasing it up to 12.33%.

The products have a high hygienic-sanitary value being rich in useful substances, lacking impurities, harmful substances, non nutritional substances and microbiological contaminants.

Regarding the sweeteners used we have noticed that first of all they influence the energetic value of the products producing its increase when they are calorigen, leading to the increase of the total sugar content and influencing the products' humidity according to their hygroscopicity.

When a diet is scientifically made we have to know the nutritive value of the food products, this fact being a basic condition for appreciating their quality level, their general enhancement, being a preoccupation for the specialists in this field.

5. References

1. SEGAL, R., *Principiile nutriţiei*, Editura Academica, Galaţi, 2002;
2. IONETE, E., *Ghid naţional de bune practici pentru siguranţa alimentelor. Produse de patiserie şi cofetărie*, Editura Uranus, Bucureşti, 2006;
3. RĂDULESCU, E., *Alimentaţie inteligentă*, Editura ,,Viaţă şi Sănătate", Bucureşti, 2003;
4. LEONTE Mihai, *Tehnologii, utilaje, reţete si controlul calităţii in industria de panificaţie, patiserie cofetărie, biscuiţi si paste făinoase*, Editura Millenium, Piatra Neamţ, 2004;
5. COSTIN, C.M, SEGAL, R., *Alimente funcţionale*, Ed. Academica, Galaţi, 1999;
6. BANU, C., *Biotehnologii în industria alimentară*, Editura Tehnică, Bucureşti, 2000;
7. DABIJA Adriana, TULBURE Monica, *Valorificarea produselor secundare din industria berii*, Editura Pim, Iaşi, 2010;
8. RĂDUCANU, A.E., *Cercetări privind utilizarea fibrelor alimentare în produse de panificaţie* – Teză de doctorat, USAMV, Bucureşti, 2008;
9. BORDEI Despina, *Tehnologia moderna a panificaţiei*, Editura Agir, Bucureşti, 2005;
10. MOLDOVEANU, Gh., *Tehnologia panificaţiei*, Editura tehnică, Bucureşti, 1992;
11. MOLDOVEANU, Gh., *Procedee moderne folosite la controlul proceselor tehnologice în industria morăritului*, Editura tehnică, Bucureşti, 1994;
12. MORARU, C., *Tehnologii moderne în industria morăritului*, Editura Tehnică, Bucureşti, 1988
13. GIURGIU, E., *Tărâţele de grâu,* revista Formula AS, nr. 713/2006;
14. BORDEI, D. ş.a., *Controlul calităţii în industria panificaţiei. Metode de analiză*, Editura Academica, Galaţi, 2007;
15. *** SR ISO 712:2005 *Cereale şi produse cerealiere. Determinarea umidităţii. Metodă practică de referinţă.*
16. *** SR 91:2007 *Pâine şi produse proaspete de patiserie. Metode de analiză;*
17. *** SR EN ISO 20483:2007 *Cereale şi leguminoase. Determinarea conţinutului de azot şi calculul conţinutului de proteină brută – metoda Kjeldhal.*