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# Nutritive Value Of Curd Product Enriched With Wheat Germ.

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**ABSTRACT**

Curd is the most wholesome and frequently consumed milk product. The purpose of this study was to evaluate the impact of wheat germ to nutritional value of curd product. The recipe of curd milk comprises raw of fried wheat germ, walnut, sugar and curd mass. The results of the physical-chemical characteristics of curd products with fried wheat germ (treatments 4, 5, 6) showed high protein content (up to 17.1% in treatment 4), while the fat content was significantly lower in treatments (2.6%, 4.0% and 5.3%) than in control sample (16.5%). The same tendency was observed for carbohydrates content. Amino acid score of curd product exceeded 100% and showed the high daily level of satisfaction in nutrients.

**Keywords:** curd, amino acid, technology, wheat germ, recipe, milk

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## INTRODUCTION

Curd and curd products are the good source of animal protein, supplemented with functional ingredients. Among the milk products, curd contains high amount of easily digestible proteins. These proteins break down into different amino acids, such as choline, tryptophan, methionine, which is essential for human body [1]. Curd products provide good nutritional value and easy digestion and can be recommended for small children and elderly people with various digestive disorders. In addition to high content of amino acids and minerals, especially calcium, iron, copper, magnesium, curd contains vitamin B, vitamins A, E, P [5]. Curd is necessary for the normal functioning of all internal organs, in particular of bone tissue. It has positive effects to the heart and blood vessels functioning, the formation of red blood cells and nervous health [3]

Curd is the most wholesome and frequently consumed milk product by human. Nowadays, various types of curd are readily available and heavily marketed. Curd products vary in chemical composition, formulation, food additives and flavoring agents, such as sugar, nuts, cacao, vanillin, dried fruits, fruit jelly, honey, cinnamon et.c. Additionally, sweet butter or cream and sodium chloride is added. Due to the fat content, curd products are classified into fat (13-17%), semi-fat (5-9%) and non-fat curd products. High fat curd products contain 20-30% of fat [4].

Increasing the protein content in food products became the main field of study of scientists. Using of cereals and wheat germs in the formulation of milk products is of great interests in food science [5]. Introduction of plant additive to the milk products reduces the content of animal fat, increases mineral elements, vitamins, especially water soluble vitamins, and fiber [6].

Wheat grain and its products hold a most unique position among the grains of other plant crops. Wheat protein is one of the vital components in human nutrition, holding third part of all protein intakes in human. Wheat grain consists of bran, endosperm and germ. Particular interest should be placed to wheat germ [7]. Wheat germ is rich in nutrients. It contains almost all amino acids (18 from 20 amino acids), along with this 50% of total mass of germ is protein components and 25% of nutrients are presented mainly with sucrose, the majority of fat (about 15%) in wheat germ is polyunsaturated fat. Wheat germ is also source of vitamins, minerals and fiber [8].

Among the high protein content, it contains about 8–14% oil. Wheat germ oil contains more than 70% of polyunsaturated fatty acids with $\omega_6$ to $\omega_3$ ratio of around 3:1, which is optimal to lipid metabolism in human body [9]. Wheat germ oil also contains myristic, oleic, erucidic and about 10 nucleic acids. Also, it is a rich source of water-soluble vitamins ($B_1$, $B_2$, $B_6$, D, PP, panthothenic and folic acids) and fat-soluble vitamins (vitamin E and A). WG is considered the richest plant source of vitamin E (300–740 mg/kg dry matter) [10].

Regular intake of wheat germ oil has a revitalizing and tonic effect, increases the physical efficiency and the body's resistance to various infectious diseases. The wheat germ oil normalizes the function of endocrine glands, metabolism, improves digestion [11].

The purpose of this study was to determine the nutritive value of curd product.

## MATERIALS AND METHODS

### Technology of curd milk

Milk was sampled from the local farming and transported to the laboratory. On the first stage milk was filtrated through the special lavsan filtering bag and cooled to 10 °C. On the next stage milk was separated. For better separation the milk was heated to 35-45 °C. Then milk was pasteurized at 78 °C for 20-30 sec for killing all pathogenic microorganisms.

Milk soured with ferment containing (1 g per 1 l of milk). The combination of lactobacteria *Lactococcus lactis subsp. lactis*, *Lactococcus lactis subsp. diacetylactis* and *Lactococcus lactis subsp. cremoris* were used as ferment in production of curd product. After adding the ferment milk was intensively mixed and held for 6-8 h for souring. After souring it was heated to 65-70 °C and held for 30-40 min for whey separation. Obtained clot was boiled at 60-80 °C for 5 min, pressed for best whey separation and cooled. Then obtained

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curd product mixed with ingredients and heated at 60-63 °C for 15 s. The curd product was being cooled, packaged and stored in the refrigerator at – 2 – 4 °C.

**Determination of amino acid content**

Liquid chromatography was used to quantify amino acids. The instrument used was a "Shimadzu LC-20 Prominence" liquid chromatography system (Shimadzu, Japan) equipped with fluorometric and spectrophotometric detectors. The chromatographic column used was SUPELCO C18, 5 µm (Sigma-Aldrich, USA) offering a surface area of 200 m2/g. The chromatographic analysis was performed under a linear gradient with an eluent flow rate of 1.2 mL/min, and the column was heated in an oven at 400°C. Amino acids were detected using fluorometric and spectrophotometric detectors at wavelengths of 246 nm and 260 nm following acidic hydrolysis and treatment with a phenylisothiocyanate solution in isopropyl alcohol to give phenylthiohydantoins [14]. Identification and estimation has been performed with comparing to amino acid standard solution (AAS18 Sigma-Aldrich Denmark A/S, Brondby, Denmark) and plotting the calibration curve.

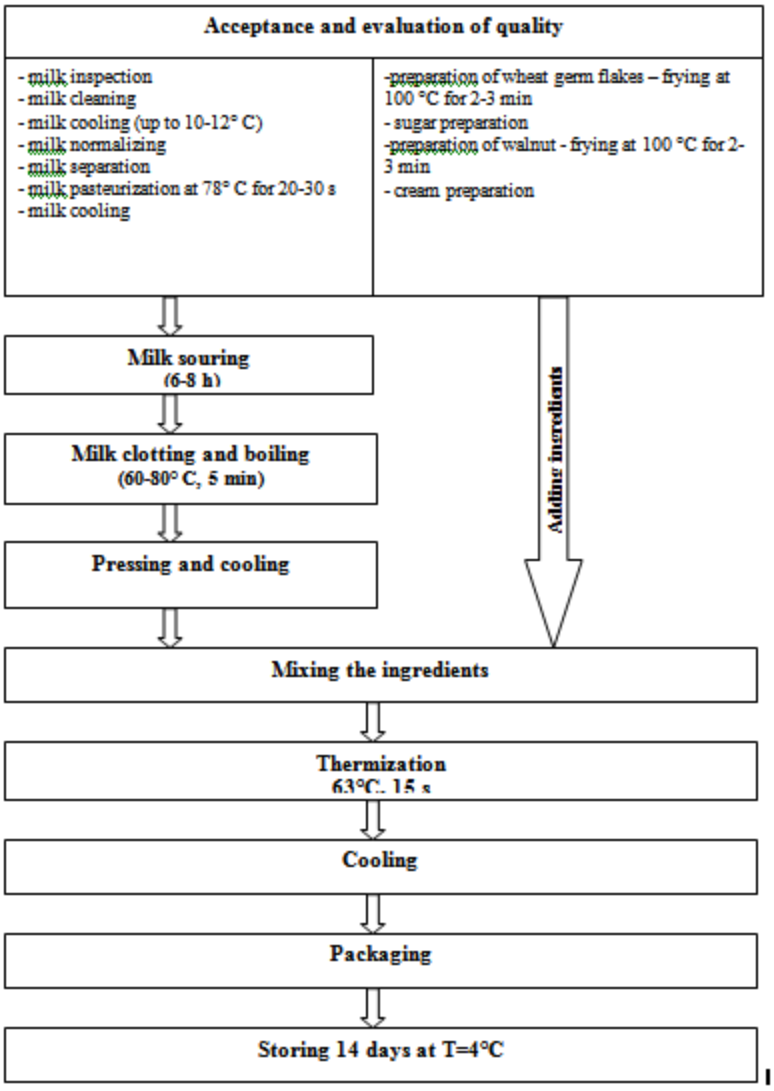


**Fig1: Flow chart of curd production**

In order to develop the recipe for a new product, six treatments of curd mass from the VIVO starter were prepared with the addition of raw and roasted wheat germ, walnuts and sugar. Treatments 1, 2 and 3 contained raw wheat germs, while treatments 4, 5 and 6 contained fried wheat germs. Also different amount of walnuts and sugar were added (Table 1).

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**Table 1: Recipe of curd product, %**

| Ingredient | Treatment | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Curd mass, 3,7% fat | 91 | 83 | 75 | 91 | 83 | 75 |
| Raw wheat germ | 1 | 2 | 3 | - | - | - |
| Fried wheat germ | - | - | - | 1 | 2 | 3 |
| Walnut | 3 | 5 | 7 | 3 | 5 | 7 |
| Sugar | 5 | 10 | 15 | 5 | 10 | 15 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

**Sensory evaluation**

Sensory evaluation was performed by a panel of seven (7) skilled persons. In case of defects in flavor and aroma (inadequate pronounced flavor, weedy flavor, slightly acid flavor), consistency and structure (powdery, faulty ice cream overrun, ice crystals presence), color, and packaging, the score mark was reduced for each defect according to the special sensory evaluation scale.

**Statistical Analysis**

Statistical analysis was performed using Statistica 12.0 (STATISTICA, 2014; StatSoft Inc., Tulsa, OK, USA). The differences between samples were evaluated using ANOVA method. The differences were considered to be statistically significant at $p \leq 0.05$.

## RESULTS AND DISCUSSION

The sensory evaluation of curd products with raw and fried wheat germs showed that treatments 4, 5 and 6 (curd products with fried wheat germ) had better flavor and taste.

**Table 2: Sensory evaluation of curd milk products**

| Treatment | Color | Taste | Flavor | Consistency and appearance |
|---|---|---|---|---|
| Treatment 1 | pale colour, cream-white | Clean, sour milk | Mildly sour with raw wheat flavor | Soft, spreadable |
| Treatment 2 | Creamy light brown color | Clean, sour milk | Mildly sour with expressed raw wheat flavor | Soft, spreadable with wheat germ particles |
| Treatment 3 | Creamy bright brown color | Clean, sour milk | Mildly sour with expressed raw wheat flavor | Dense consistency with expressed wheat germ particles |
| Treatment 4 | pale colour, cream-white | Clean, sour milk | Mildly sour flavor | Soft, spreadable |
| Treatment 5 | Creamy light brown color | Clean, sour milk | Mildly sour flavor | Soft, spreadable with wheat germ particles |
| Treatment 6 | Creamy bright brown color | With expresses taste of fried wheat germs | Mildly sour flavor | Dense consistency with expressed wheat germ particles |

Table 3 presents the results of physical-chemical characteristics of curd products.

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**Table 3: Physical-chemical characteristics of treatments 4, 5 and 6**

| Parameter | Control sample | Curd product | | |
|---|---|---|---|---|
| | | Treatment 4 | Treatment 5 | Treatment 6 |
| Protein | 12.0 | 17,1 | 16,2 | 15,3 |
| Fat | 16,5 | 2,6 | 4,0 | 5,3 |
| Carbohydrate | 9,5 | 2,2 | 2,6 | 3,0 |
| Ash | 0,9 | 1,19 | 1,179 | 0,356 |
| Moisture, % | 61.1 | 77,8 | 77,3 | 76,4 |
| Acidity, °T | 200 | 210 | 200 | 190 |

The total protein content in developed curd products was significantly higher than in control sample. Among the treatments, treatment 4 showed high content of protein (17.1%), while in treatments 5 and 6 these values were 16.2% and 15.3%, respectively. However, the fat content was significantly lower in treatments (2.6%, 4.0% and 5.3%) than in control sample (16.5%). The same tendency was observed for carbohydrates content.

**Table 4: Aminoacid composition of curd product, g/100g**

| Amino acid | Content, g/100 g | | Amino acid score, % | Dietary reference intake | Daily level of satisfaction, % |
|---|---|---|---|---|---|
| | Ideal protein | Curd product | | | |
| Valine | 5,0 | 8,9 | 178 | 40,2 | 22,5 |
| Isoleucine | 4,0 | 8,85 | 221 | 35,4 | 25.0 |
| Leucine | 7,0 | 16,28 | 233 | 109,5 | 14,87 |
| Lysine | 5,5 | 12,5 | 227 | 150 | 8,36 |
| Methionine | 3,5 | 4,2 | 120 | 110,4 | 3,8 |
| Threonine | 4,0 | 7,1 | 177,5 | 25,4 | 28 |
| Tryptophan | 1,0 | 1,6 | 160 | 30 | 5,5 |
| Phenylalanine | 6,0 | 8,3 | 138 | 30 | 27,6 |

The amino acid composition of curd product showed the high content of leucine (16.28 g/100g), lysine (12.50 g/100g), isoleucine (8.85 g/100g). Amino acid score of curd product exceeded 100% and showed the high daily level of satisfaction in nutrients.

## CONCLUSION

Using of plant raw material in the recipe of milk products extends the line of milk products and enriches with biologically active ingredients. Adding of 1% of fried wheat germ into the curd product recipe improves the nutritive and biological value and did not affect the sensory characteristics of milk product.

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