WHEY RECOVERY AND NUTRACEUTICAL PRODUCTS – PRELIMINARY DATA

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Abstract

Purpose of our work: *This work proposed some fresh nutraceutical drinks based on whey resulted from milk processing technology. For this we collected fresh whey from a milk plant from Timis County and we prepared some beverages based on whey – as the majority ingredient. As secondary ingredients we used fresh pineapple, fresh kiwi, fresh ginger, powdered cinnamon, powdered anise, and in some products we add honey.*

Materials and methods: *We proposed 4 different products with whey as a the majority ingredient: one beverage was prepared (blended) from whey, pineapple, and cinnamon; one with whey, pineapple, kiwi, and cinnamon; one with whey, pineapple, cinnamon, honey, ginger, and anise; and one prepared from whey, honey, and ginger. After 48 hours we analyzed the total content of lipids (Gerber method), acidity (Soxthlet-Henkel method), protein content (modified Steinegger method), dry matter and humidity (thermo-balance method).*

Results: *The total content of lipids was 0.00% in fresh whey, and was very low in all prepared samples (0.2-0.4%); acidity was 3.8°T for whey and varied between 5.8-18.8°T in prepared samples– depending on the fruit content; total protein was registered as 1.64g/100g for whey, with variations between 1.55-2.52g/100g product; fresh whey had the highest water content (95.69%), with variations between 86.19-91.96 for our proposed whey-drinks.*

Conclusions: *Whey is a valuable nutritional product that can be used for preparing fresh drinks with nutraceutical properties. Our preliminary data demonstrate that proposed drinks are very good for hydrating, being low in lipids and containing valuable and easy digesting proteins. Adding fresh pineapple, kiwi, ginger, honey and cinnamon to our products we improved the nutritive value of our products, especially by increasing the vitamins and minerals content. Also due to our ingredients we proposed four fresh nutraceutical products with very good antioxidant capacity.*

Key words: whey, nutraceutical products

INTRODUCTION

In milk, but especially cheese processing technologies, whey is a byproduct, in large quantities, available in high quantities mainly in spring and summer. Referring to whey nutritional characteristics, the most important components are the proteins – which are very easy digested, are used in some diseases prevention, in weight management suppressing energy intake, in recovery after diseases or physical effort, and very important in stimulation of insulin secretion – especially in type 2 diabetes [10].

The most important proteins in whey are represented by immunoglobulin, α-lactalbumin and β-lactoglobulin, lacto-peroxidase, bovine serum albumin, and lactoferrin – with high biologic value [3].

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Researches proved the whey can be used in prevention and treatment of various diseases, being anti-carcinogenic and anti-miocrobial, having immune-modulatory activity, presenting good inhibition activity for angiotensin-converting enzyme, having very good effect in lowering the glycemia in diabetic patients [6].

Whey is an optimal ingredient of isocaloric diet, assuring a low content of carbohydrates and lipids, biologic valuable but not too much proteins, vitamins and minerals from natural cheese byproduct. Due to this very important nutritional characteristic is a very important ingredient in the bodybuilders' diet.

Whey biochemical composition differing due to the milk type (cow, sheep, goat), but generally whey contain essential amino acids, vitamins – mostly hydro-soluble vitamins, and minerals. Also, whey is very good ingredient in preparation of dairy products due to its functional properties as good gelation, emulsifying, and foaming agent [8].

Adding fruits or various spices to whey, gives the possibility to obtain interesting nutraceutical products with high antioxidant properties, easy digested, low energetic value, rich in vitamins, minerals and enzymes, and pleasant taste.

MATERIALS AND METHODS

To prepare the samples, first we collected fresh cheese whey from a milk processing plant from Timis County, west of Romania. For preparation of nutraceutical samples we also used fresh pineapple, fresh kiwi, fresh ginger, powdered cinnamon, powdered anise, and honey. We used a blender to homogenize the pineapple, kiwi, and ginger pieces. Whey was fresh, stored during transportation in disposable plastic bottles at refrigeration temperature, preparation was fast after all ingredients were weighed, and was preserved in refrigerated conditions until the laboratory analytical analyses were performed.

In laboratory we performed some analyses in order to determine the total fat and protein content, acidity, total water content and we calculated dry matter for each sample.

For all type of samples we analyzed five samples, and the results were given as average of the five measurements.

First sample (S1) was fresh whey collected directly from the milk plant. The second sample (S2) was formed from 66.6% whey, 33.35% pineapple, and 0.05% powder cinnamon. The third (S3) sample was prepared from 59.5% whey, 19.83% pineapple, 19.83% kiwi, 0.79% ginger, and 0.05% cinnamon. The forth (S4) samples was prepared from 66.177% whey, 24.27% pineapple, 8.82% honey, 0.66% ginger, 0.05% anise, and 0.023% cinnamon. The fifth (S5) sample was prepared from 83.72% whey, 0.1% fresh ginger, and 16.18% honey.

All samples were well homogenized, stored into plastic disposable bottles, in refrigeration conditions for 48 hours, until we performed the analytical tests.

From each sample we analyzed the quantity of total lipids – applying Gerber method; total proteins – using modified Steinegger method; acidity – with Soxthlet-Henkel method, and moisture (humidity or water) – Sartorius thermo-balance.

RESULTS AND DISCUSSIONS

Whey and prepared samples were preliminary analyzed for total content of fat and proteins, we determined the acidity of samples – having in view that we used fresh fruits and some spices with preservation role.

Also we determined the total content of water and solids in all samples, to evaluate the possible role for hydration and medical and physical recovery.

Regarding the whey protein, these can be used in different forms to enhance the nutraceutical value of products. Thus, a group of researchers from Denmark, tested hydration properties of microencapsulated whey protein in non-fat milk systems. The results of their experiment demonstrated that particle characteristics of microencapsulated whey protein are very important in gel network formation and interaction with the rest of biochemical components [9].

We knew from the beginning that whey is the base of our products, and whey is low or free of lipids, but adding some other ingredients the fat content varied for prepared samples from 0.2% (for S2 and S5) to 0.4% (for S3). The protein content was generally very low, but S3 (with kiwi) presented the highest content of protein - 2.52g/100g fresh

product. Also, S3 presented the highest value for acidity, for sure due to its ingredients (fresh pineapple and kiwi), and the lowest acidity was normally registered in whey - fig. 1.

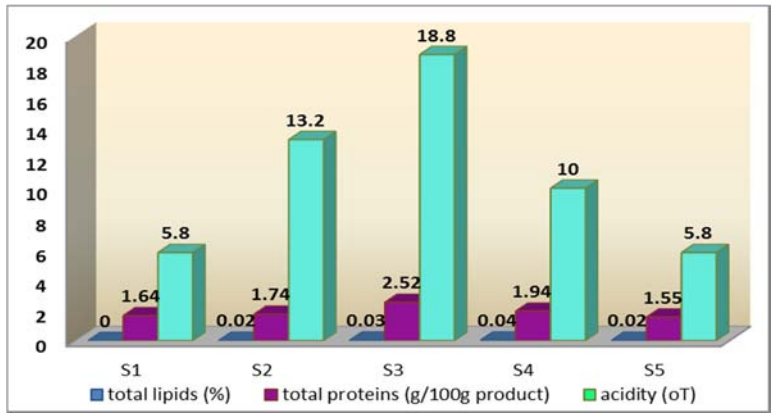

Fig. 1 Total fat, total protein and acidity in whey and nutraceutical prepared samples

Literature data are very rich in researches about isolation and characterization of whey proteins. Thus, Gaspard and her team reported that concentrated milk protein (79% protein) reconstituted at 13.5% protein is heat-stable. Also, k-casein acts like an accompanying component, with important role in controlling the whey protein aggregation – effect which was intensify in the presence of αs-casein and β-casein [4].

Another very interesting study presents a method of isolation and formation of pectin-whey protein nano-complexes used as carriers of oil extracted from orange peel. This experiment was design to preserve the properties of orange peel oil and to control the release of oil particles. Pectin and whey protein are very good and complex components for nano-complexes. This system was tested as a carrying of volatile oil particles. The nano -complex microstructure and morphology is responsible for chemical reaction between pectin and whey protein, and for chemical bond formation, too [5].

We also evaluated the water and dry matter content in all samples, especially because we wanted to propose these products as adjuvants in weight management, in physical and medical recovery – fig. 2.

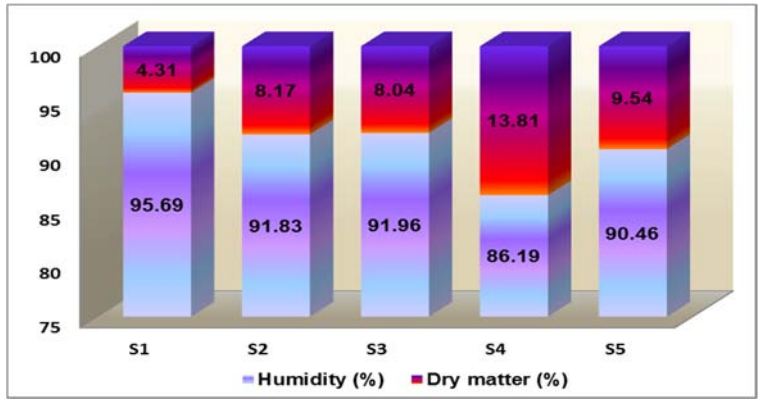

Fig. 2 Water and solids content in whey and prepared samples

There are different studies regarding the ingredients of some dietary products. Thus, a team from Spain proposed a technology of dairy desserts, by adding dairy proteins extracted from whey. The results suggested that products with low fat content and dairy protein addition are a very good option for dairy desserts. Low fat content is important for decreasing the energy density product; while dairy proteins increased the satiety capacity of the consumers [2].

A research team from Spain tested a method of obtaining fast whey protein hydrolysate. This product – hydrolysates based on cheese whey protein complies with the high health requirements of European guidelines for infants – especially used in formulas designed to reduce the allergic reaction to milk protein by infants. The hydrolysate formula can be obtained fast applying a treatment of whey protein with pepsin, which offer the obtaining a different product of whey protein isolates. The results prove that whey protein hydrolysate is a very good ingredient for food products designed for patients with milk allergy and for probiotic foods which induce better tolerance to whey protein [7].

Due to nutritional properties of whey, and because whey is considered as by-product in milk processing plants, this valuable product could be used as a base of nutaceutical products – fresh and preserved, for all ages, for health people and athletes. Whey is a water product resulted from cheese production, very low in lipids, with easy to digest proteins, with minerals and hydrosoluble vitamins. Whey could be used as basic ingredient of supplement nutraceutical – fresh and preserved drinks.

Due to whey composition in organic compounds, the treatment of whey with acids or high temperature can irreversible distorts the whey proteins. Thus, nanofiltration in one stage gave the best protein recovery from cheese whey. In cascade operation for recovery the cheese whey, the best results were obtained using a combination of two techniques – nanofiltration and reverse osmosis [1, 11, 12].

CONCLUSION

Whey is a biologic, natural by-product of cheese technology. It is a very good source of valuable proteins, is low in lipids, and is rich in hydro-soluble vitamins, and minerals.

Used as a base of nutraceutical products, offer good stability, good aggregation, and can be utilized as a base of micro- or nano-encapsulation products – which can be the molecular or complex carrier for different biologic active systems (like volatile oils).

Whey can be recovery from milk industry using forward osmosis, ultrafiltration, anofiltration, and can be concentrated or encapsulated.

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