Chemical, bacteriological and sensory quality indices of whey-fruit drinks*

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Summary

There is a great quantity of whey as by-product in cheese industry. Because of its biological-nutritive value, whey is a rich raw material that can be used in food, pharmaceutical and chemical industries.

One of its uses in food-industry is in the production of different whey-based beverages. In 1990 Dairy of Maribor was the first in Slovenia that started with production of whey fruit beverages. As it was the first such product with commercial name Lambada thereafter we present technological process of production of Lambada with various fruit tastes (lemon, orange, exotic, actinidy, mango, and others), its organoleptic, chemical and bacteriological characteristics. We present also its energetic and dietetic value, and some marketing characteristics and offering problems relative to Lambada.

Additional index words: Whey-fruit drink Lambada, composition, sensory evaluation, energy value, nutritive value.

Introduction

Whey is a secondary product in milk industry. It is a by – product in the production of cheese, casein or other products of coagulated milk. As the cheese-production all over the world is rather large, there is a lot of remaining whey, due to the fact that whey makes 80% of milk used.

Chemical structure and biological and nutritive values of whey make it very valuable in the nutrition of people and animals. By throwing it away we don't loose only valuable materials but also polute the environment causing enormous ecological damage.

Chemical structure of whey depends on the quality of milk and on the sort of cheese produced. According to Kosikowsky (1977) whey consists of 93.7% of water and 6.3% of dry matter containing lactose, proteins, fats, minerals, microelements, vitamins and ash. Schormüller divides whey in sweet, that contains at least 5.5% dry matter and 0.1–0.2% lactic acid, and sour, containing at least 5.2% dry matter and 0.4–0,6% lactic acid.

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Due to riboflavin (cca 0.4 mg %), the colour of whey is pale green. Whey contains 5-6% dry matter, 0.3–0.5% whey proteins, traces of fat, 4.5–5.5% lactose, a graet deal of minerals and vitamin B_6 (0.3 mg%). Whey proteins are of large nutritive value. The most important whey proteins are albumines that can be found in three different shapes. Whey proteins contain all essential aminoacids that are indispensable in human nutrition. Contents and relationships of essential aminoacids in whey are better than in other food. That is why whey is more nutritious then an egg, which is usually used for comparison (Jekat and Kofrany 1970).

It's also important to stress the caloric value of whey that is according to Geigy (1977), 25 kcal (105 kJ). Therefore whey is a product of great nutritive and bilogical but little caloric value so it can be used in diets and food industry.

In spite of all the above mentioned facts whey is still not used enough as a secondary raw material. In our country it is used even less than in more developed countries. The manufacturing of whey into whey powder began in our country only ten years ago. The production of fruit drinks started in 1990.

Different whey beverages, fermented or unfermented, gassy or not gassy, soft or with a small % of alcohol, made from deproteinised whey, or proteins or vitamins added are known all over the world. The French consume whey drink named Latella (also produced in Austria and Croatia), the Swiss have got Rivella (Austria and Netherlands), in Sweden Arla produces Natures' wonder, in Ireland Clona dew, in Russia Tworog, Kwas, Detskiy, Bodrost, in USA Oway, Tai, chocolate drinks and lolly, in India Parag, and in Slovenia Lambada.

Material and methods of work

Lambada, belonging to milky fruit beverages, is made from pasteurised whey to which fruit sirup and a certain amount of sugar are added. If necessary, the citric acid is added to reduce the pH. It is sold in plastic cups covered with alu cap.
Declaration on the plastic cup is as follows:
Producer: Dairy of Maribor, 5 Osojnik street
– fruit base – 3%
– proteins (whey proteins) – 0.6%
– carbohydrates (lactose, sacharose) – 9%
– minerals (P, Ca, K, Na, Mg) – 0.65%
Contents: 0.18 l
Taste of fruit: pressed on the cap
Expiry date: pressed on the cap
Keep cool!

Lambada samples for organoleptic and chemical analyses are taken in Dairy of Maribor immediately after the production. Organoleptic analyses consisted of 20 Lambada samples with 8 different fruit tastes. Total of 160 samples was tested. Evaluation was done by 7 experts according to the point system.

While Lambada was presented, 350 consumers were asked to assess its taste and quality.

25 Lambada samples (8 different fruit tastes) have been analysed for fat, protein, and carbohydrates quantity and pH values.

Milcotester Milco Scan 133 (A/S N. FOSS Electric Denmark), was used for chemical analyses. Values of pH were measured on pH-Meter Iskra, type MA 5740.

Parts of fat, proteins and carbohydrates as well as total energy value (TEV), expressed in kJ, were calculated on the basis of chemical analysis, according to the formulae (Southgate, and Barrett, 1966)

EV of proteins (p) = % p × 4.74 × 4.184
EV of carbohydrates (c) = % c × 3.95 × 4.184
EV of fats (f) = % F × 7.90 × 4.184

TEV is the total of energy values of proteins, carbohydrates and fat.

Bacteriological analyses of samples taken from the same Lambada products were carried out on the day of production, the 7 th, 14th and 21st day after production. Samples were stored at 1–4°C.

Dietetic evaluation on the basis of chemical analyses, organoleptic evaluation and osmopolar analyses was done by the Institute of hygiene of the Medicial Faculty in Ljubljana.

Results and discussion

1. Results of the sensory evaluation of Lambada

Lambada is a clear, to a bit turbid, milky drink without a special »attractive« taste. Its colour, taste and smell depend on the sort of added fruit. It tastes fresh, a bit sweet but mostly sour. To neutralise a rather strong taste of whey it is recommended to add water, as it is done in the production of similar drinks in the world.

The results of the sensory evaluation by experts are shown in table 1, the results of the consumers' opinion are shown in table 2.

Consumers have found Lambada very good, refreshing, it satisfies thirst, but it should be in pints or two pints packages. Quality and taste need not change and the price is acceptable. Some consumers didn't like the strong taste of whey, not enough fruit – ful or too sugary flavour.

2. Results of the chemical analysis of Lambada

Chemical composition of Lambada is largely equable (table 3). The quantity of fat varying from 0.39 to 0.57%., proteins from 0.68 to 0.89% and of carbohydrates from 9.55 to 10.39%. On average, Lambada contained 0.5% fat, 0.75% proteins and 9.76% carbohydrates. The average pH value was 4.18 (4.00 – 4.48).

3. Energetic value and single constituents parts in Lambada composition

Average common energetic value of Lambada was 199.93 kJ (185.59–207.39

Table 1 Organoleptic evaluation of Lambada
Tablica 1. Organoleptička ocjena Lambade

(n = 160)

Juice Sok	Taste Okus	Smell Miris	Colour Boja	Sediment Sediment	Appearance Opći izgled	Total Ukupno
Exotic Egzotik	11.38	1.98	1.98	3.00	1.00	19.34
Orange Naranča	11.83	1.36	1.93	2.92	0.96	19.00
Actinidia Kivi	11.04	1.96	1.99	3.00	1.00	18.99
Appricot Marelica	10.96	1.92	1.86	2.92	1.00	18.66
Pineapple Ananas	10.87	1.60	1.97	3.00	1.00	18.44
Lemon Limun	10.65	1.47	1.95	2.87	0.90	17.84
Mango Mango	9.11	1.64	1.80	2.99	0.84	16.38
Maracuja Marakuja	9.25	1.40	1.72	2.86	0.98	16.21
Points Bodovi	0–12	0–2	0–2	0–3	0–1	0–20

kJ) depending on energy values of fat, proteins and carbohydrates, their average (minima – maxima) being 19.55 kJ (15.17 – 22.18 kJ), 12.95 kJ (11.66–15.27 kJ) and 167.43 kJ (152.67–178.23 kJ) respectively.

Energetic value participation of Lambada single components decreased on average from the biggest 83.74% (82.26–85.94%) in carbohydrates, to 9.78% (7.60–10.99%) in fat and the least 6.48% (5.93–7.72%) in proteins.

4. The results of the microbiological quality analysis of Lambada

According to Lambada samples Microbiological food quality regulations free from pathogen Bacteria. The number of colony forming units was below 100.000/ml in all samples taken immediately after production or on the 7th, 14th and 21st day afterwards.

Therefore, due to the number of colony forming units and organoleptic characteristics of Lambada, its expiry date was fixed on 21st day from the day of production.

Table 2. The results of consumers' survey on Lambada drink quality
Tablica 2. Rezultati ankete o kakvoći napitka Lambada

Age groups in years Starostne grupe po godinama	Nr. of questioned Broj anketiranih			Lambada is: Lambada je:								Lambada is: Lambada je:								Tastes: Okusi:									
				Excellent Odlična		Very good Jako dobra		Good Dobra		Not good Nije dobra		Too sweet Preslatka		Enough sweet Dovoljno slatka		Not sweet enough Premalo slatka		Sour Kisela		Pineapple Ananas		Actinidia Kivi		Mango orange Mango naranča		Lemon Limun		Exotic Egzotik	
	M	F	Total Ukupno	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
from 10 to 20 year od 10 – 20 godina	31	25	56	11	13	8	5	10	6	2	1	2	2	25	21	2	2	2	–	10	9	4	–	4	4	2	6	8	8
from 21 to 30 year od 21 – 30 godina	27	27	54	10	7	9	8	8	9	–	3	3	2	21	17	1	2	–	–	11	9	3	5	2	4	7	6	9	10
from 31 to 40 year od 31 – 40 godina	20	28	48	5	13	9	9	6	5	–	1	1	3	19	25	–	–	–	–	14	13	6	3	4	3	4	12	–	8
from 41 to 50 year od 41 – 50 godina	24	40	64	3	20	14	13	7	7	–	–	3	3	16	35	2	1	2	1	12	25	5	10	3	4	9	10	5	13
from 51 to 60 year od 51 – 60 godina	22	42	64	9	24	10	14	3	5	–	–	–	2	21	39	1	–	–	2	11	22	6	1	4	5	10	13	11	16
from 61 on od 61 dalje	28	36	64	17	18	9	9	2	7	–	2	3	1	25	32	–	1	–	1	15	12	6	8	5	5	7	13	4	15
Total Ukupno	152	198	350	55	95	59	58	36	39	2	7	12	13	127	169	6	6	4	4	73	90	30	27	22	25	39	60	37	70
% regarding to age U % obzirom na starost	43	57	100	15	27	17	17	10	11	1	2	4	4	37	49	2	2	1	1	20	26	9	8	6	7	11	17	11	20
Total % of questioned Ukupan % od svih anketiranih				42%		34%		21%		3%		8%		86%		4%		2%		46%		17%		13%		28%		31%	

Table 3 Chemical composition of Lambada in %
Tablica 3. Kemijski sastav Lambade u %

n = 25

Sample-taste Uzorak-okus	Fats Masti	Proteins Bjelančevine	Carbohydrates Ugljikohidrati	pH
1. Pineapple	0.53	0.78	10.01	4.33
2. Ananas	0.53	0.75	9.57	4.25
3. "	0.51	0.74	9.60	4.24
4. "	0.52	0.79	9.84	4.29
5. "	0.41	0.77	10.39	4.05
6. Lemon	0.57	0.75	9.78	4.03
7. Limun	0.57	0.71	9.76	4.06
8. "	0.53	0.73	9.82	4.05
9. "	0.52	0.73	9.64	4.18
10. "	0.46	0.68	9.74	4.00
11. Exotic	0.53	0.72	9.85	4.15
12. Egzotik	0.57	0.73	9.80	4.12
13. "	0.54	0.74	9.84	4.12
14. "	0.42	0.73	9.84	4.10
15. Maracuja	0.48	0.83	8.90	4.33
16. Marakuja	0.40	0.77	10.24	4.22
17. "	0.39	0.76	9.99	4.13
18. Orange	0.48	0.89	9.55	4.48
19. Naranča	0.50	0.77	9.65	4.32
20. "	0.51	0.73	9.56	4.22
21. Actinidia	0.53	0.73	9.75	4.16
22. Kivi	0.48	0.80	9.62	4.14
23. "	0.52	0.78	9.64	4.32
24. Mango	0.54	0.74	9.82	4.22
25. Mango	0.52	0.72	9.81	4.10
Ukupno: Total:	12.56	18.87	244.01	104.61
Prosjek: Average:	0.50	0.75	9.76	4.18

5. Dietetic value of Lambada

The Institute of hygiene at the Faculty of Medicine in Ljubljana gave the following evaluation of Lambada (10th July 1990): It is refreshing drink, biological by containing minimum of fat (0.51%) and proteins (0.7%) than 10% of carbohydrates, 4.5% lactose and 6% added sacharose. The drink is extremely rich in minerals (especially Ca – 1090 mg/kg and Na 420 mg/kg). Its osmopolarity is 672 m Osm/kg. We can recommend this nourishing drink in everyday diet of healthy and sick people. As it contains sacharose it is not recommended in larger quantities to children till 14 not even in diets. Due to its large amount of Ca, it is recommended to pregnant women and older people if they are allowed to take

Na. It is not recommended to hypertonics. The beverage can be used by sportsmen. To substitute the loss of water, it is recommended to disolve it with water (1 : 1) to 300 m Osm/kg.

If the beverage is cheaper than milk and fruit juices, it can take an important place in everyday food.

Discussion

Besides the above mentioned qualities of Lambada, its low price is worth mentioning. For better understanding here is the production price an the retail price given in DM. Production price was from 0.16 DM in 1990 to 0.26 Dm in 1991. The retail price in shops was from 0.22 DM in 1990 to 0.36 DM in 1991. The price was 12% lower than the price of yoghurt and about 25% lower than the average price of fruit juices.

In spite of Lambada's high nutritive value, low energy value and good organoleptic evaluation, we have to mention certain marketing problems. As first, packaging was unpopular and unpractical, although the straw was added. It would be much more practical selling Lambada in pints and two pints tetrapack or purepack packages.

We are convinced that in offering Lambada as first whey drink on the ex-Yugoslav marker our comercial department failed. Unfortunatelly, Lambada is not produced any more which is a pitty for the consumer, producer and for our environment.

Conclusions

From the results of the research on hygienic, chemical and sensory indices of Lambada, produced in the Dairy of Maribor, following conclusions can be drawn:

1. Lambada is a clear to a bit turbid, refreshinig milky drink, its specific colour, smell and taste, depend on the added fruit.
2. The experts as well as the consumers found its organoleptic characteristics good.
3. Chemical composition is equable. Average quantity being: fat 0,5%, proteins 0.75% and carbohydrates 9.76%.
4. Average energy value is 199.93 kJ and carbohydrates 83.74% (167,43 kJ) are its largest part, its smaller parts are fat 9.78% (19.55 kJ) and proteins 6.48% (12.95 kJ).
5. According to the Microbiological food quality regulations the number of colony forming units of Bacteria was below 100.000/ml. There were no sings of pathogen Bacteria.
6. Due to the compositions of whey Lambada is a valuable nutritive – biological milky drink of low energy value. So it can be recommended in everyday diet.

KEMIJSKA BAKTERIOLOŠKA I ORGANOLEPTIČKA SVOJSTVA VOĆNIH NAPITAKA OD SIRUTKE

Sažetak

U industriji sira proizvode se i ogromne količine nuzproizvoda sirutke. Kako je po biološko-prehrambenoj vrijednosti bogat materijal, nastoji je se što više upotrijebiti u prehrambenoj, farmaceutskoj i kemijskoj industriji.

Jedna od primjena sirutke u prehrambenoj industriji je i proizvodnja različitih napitaka. Tako je u Sloveniji, 1990., Mariborska mljekara počela proizvoditi voćne napitke na bazi sirutke. Kako se radi o novom proizvodu s komercijalnim imenom Lambada različitih okusa ovisno o dodanom voću (limun, naranča, egsotik, ananas, kivi, mango i drugih) u radu se navode rezultati istraživanja njenih organoleptičkih, kemijskih i bakterioloških svojstava. Prikazana je energetska i dietetska vrijednost, kao i neke tržišne karakteristike i problemi prilikom plasmana tog novog proizvoda od sirutke na tržište.

Riječi natuknice: Sirutkin napitak s voćem – Lambada, organoleptička ocjena, energetska vrijednost, hranjive vrijednosti.

Literatura

AMUNDSON, C.H. (1967): **American Dairy Review, 29,** 94.

GEIGY, J.R. (1977): Wissenschaftliche Tabellen, 8 Ed. CIBAGEIGY AG Bazel.

JEKAT, F.K. i E. KOFRANY (1970): **Z. Physiological Chemistry 351,** 47.

KOSIKOWSKY, F.V. (1977): Cheese and Fermented Milk Products 2nd edition, Edwards Brothers Inc., ANN Arbor, Mich., 450.

MANN, E.J. (1988): **Dairy Industries International 1,** 6.

POKORN, D. (1990): Dietetska ocena Lambade, Medicinska fakulteta v Ljubljani.

ROBINSON, R.K. i A.Y. TAMIME (1978): **Dairy Industries International 43,** (3), 14.

SCHORMULLER, J. (1974): Lehrbuch der Lebensmittelchemie, 2 Ed. – Springer, Berlin – Heidelberg – New York.

SOUTHGATE D.A.T., BARRETT I.M. (1966): **Brit. J. nutrit., 20,** 363-72.

SURAZYNSKI, A., J. CHUDY i Z. ALEKSIECZYK (1967): **Journal of Nutrition and Dietetics 4,** 118.

ZALL, R.R. (1979): Food Processing Waste Management, The AVI Publishing Co, Inc. Wesport, Connecticut.

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