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QUALITATIVE DETERMINATION OF LACTO-FERMENTED PRODUCTS FOUND IN THE COMMERCIAL NETWORK OF IAŞI COUNTY

D. BECEANU[*], Roxana Mihaela ANGHEL

University of Agricultural Sciences and Veterinary Medicine, Iaşi

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ABSTRACT - Pickling is a semiconservation method by which they try to obtain the necessary concentration of lactic acid in a saline solution, through bacterial fermentation, starting from the glucides existing in products. In this scientific paper, we made a comparative study between lacto-fermented products from the commercial network and lacto-fermented products obtained in a different way (iodated/non-iodated salt) through the household pickling method. Overall, we had 14 samples of lacto-fermented products, nine samples from supermarkets and five samples of sauerkraut with iodated and non-iodated salt. During the carrying out of the study, we also followed the highlighting of iodated salt effects on the conservation process of vegetables by pickling. Through the chemical analyses and the physical determinations effectuated, we have tried to show the differences existing between the products purchased from the commercial network and those obtained by household pickling.

Key words: lacto-fermentation, vegetables, potassium iodide, quality

REZUMAT - Determinări calitative privind sortimentul de produse lactofermentate existente în rețeaua comercială a municipiului Iaşi. Murarea este un procedeu de semiconservare, prin care se urmăreşte obținerea, în soluție salină, prin fermentație bacteriană, a unei concentrații necesare de acid lactic, pornind de la glucidele existente în produse. În prezenta lucrare, s-a realizat un studiu comparativ între produse lactofermentate din rețeaua comercială şi produse lactofermentate obținute diferențiat (sare iodată/neiodată), prin procedeul de murare casnică. În total, au fost urmărite 14 probe de produse lactofermentate, nouă probe din supermarketuri şi cinci probe de varză murată cu sare iodată şi neiodată. Pe parcursul efectuării studiului s-a urmărit, de asemenea, punerea în evidență a efectelor pe care le are sarea iodată asupra procedeului de conservare a legumelor prin murare. Prin analizele chimice şi determinările fizice efectuate am încercat să evidențiem deosebirile care există între produsele din rețeaua comercială şi cele obținute prin procedeul de murare casnică.

Cuvinte cheie: lactofermentare, legume, iodură de potasiu, calitate

[*] E-mail: dumitru.beceanu@gmail.com

INTRODUCTION

Lacto-fermentation is a conservation method known from immemorial times. In Romanian, the terms pickles and brine (the covering liquid) derive from the Latin words *muria*, *muratiorum* (plural) that referred to products fermented in seawater concentrated in salts by boiling. (Beceanu, 2009)

At present, there is a culinary and food tradition related to these products in all areas of the world, among which Korea might occupy the most important place. They consider that Romanian people could obtain the necessary quantity of vitamin C during the cold season by consuming pickles, especially cabbage (keeping the terminology for 2000 years) (Beceanu , 2008, 2009)

Though many people consider it a more or less spontaneous process, in fact it is a complex technology more evolved, as the quantities of vegetables for the supply of a larger community are greater (Tirilly, Bourgeois, 1999).

MATERIALS AND METHODS

As a study material, we have used 14 samples of lacto-fermented products: a sample of pickled autumn tomatoes, three samples of pickled cucumbers and ten samples of sauerkraut. The samples under analysis are shown in *Table 1*.

Nine of ten samples were packed in vacuumed bags and five were packed in PET containers. In the Table, we mention the ingredients (water, salt, spices, preservatives, etc). The manufacturing companies are both Romanian and foreign (nine variants) to which we added five variants pickled under household conditions, each of them different by the type of used salt (Salrom – iodated cooking salt, Xion and Niki – iodated sea salt, Albito and Elcirom – non-iodated cooking salt).

As analytical methods, we have used standard versions for:

- Titrable acidity (g ac. lactic/100 g product) – titrimetric method;
- Vitamin C (mg/100 g product) - titrimetric method with 2.6 diclorfelolindofenol;
- NaCl content (g/100 g product) - Mohr method;
- Soluble dry matter (^{0}Bx) - refractometry.

Sensory analysis was carried out by collective assessment as stipulated standard (appearance, colour, texture, taste, smell), points scale method.

Table 1- The products under analysis

Nr.	Product	Net mass (g)	Producer Distributor	Ingredients	Package
1	Pickled cucumbers Roadele Naturii	504	OVM TOTAL 2003 S.R.L.	Cucumbers, water, salt, dill	Vacuum
2	Pickled autumn tomatoes Roadele Naturii	1020	OVM TOTAL 2003 S.R.L.	Autumn tomatoes, salt, dill	Vacuum

Nr.	Product	Net mass (g)	Producer Distributor	Ingredients	Package
3	Sauerkraut Roadele Naturii	814	OVM TOTAL 2003 S.R.L.	Cabbage, salt, dill	Vacuum
4	Pickled cucumbers Putina Soacrei	738	S.C. MAGIC RADU S.R.L. Bucureşti	Cucumbers, water, salt, horseradish, dill	Vacuum
5	Sauerkraut Putina Soacrei	2082	S.C. MAGIC RADU S.R.L. Bucureşti	Cabbage, salt, dill	Vacuum
6	Sauerkraut Mama Nina	2000	FIX CO S.R.L.; Bucureşti	Cabbage, water, salt, dill, spices: potassium sorbate	Vacuum
7	Pickled cucumbers Dorsvet Plus	500	Dorsvet Plus s.r.o. Kechnet 130 Slovensko	Cucumbers (7-12 cm), brine (water, salt, spices, preservative E 202	Vacuum
8	Shredded cabbage Dorsvet Plus	1000	Dorsvet Plus s.r.o. Kechnet 130 Slovensko	White cabbage shredded, mixed spices, brine water, salt, preservative E 211, 224	Vacuum
9	Head cabbage Dorsvet Plus	1000	Dorsvet Plus s.r.o. Kechnet 130 l Slovensko	White cabbage, salt, water, preservative E 211, E 224	Vacuum
10	Sauerkraut with salt Salrom	5000	Household pickling	Cabbage, salt, water	PET Container
11	Sauerkraut with Xion	5000	Household pickling	Cabbage, salt, water	PET Container
12	Sauerkraut with salt Niki	5000	Household pickling	Cabbage, salt, water	PET Container
13	Sauerkraut with salt Albito	5000	Household pickling	Cabbage, salt, water	PET Container
14	Sauerkraut with salt Elcirom	5000	Household pickling	Cabbage, salt, water	PET Container

RESULTS AND DISCUSSION

The content of titrating acidity (*Table 2*) recorded values between 0.6 g lactic acid/100 g of product (pickled cucumbers RN) and about 2.0 g lactic acid/100 g of product (sauerkraut D P). The maximum extreme has the highest (positive) deviation from average (about 0.9 g lactic acid/100 g of product).

Under household conditions, shredded cabbage had practically the same values of lactic acidity (by one-third lower values than the average of factory made products), although the five variants differed by the type of used salt *(*** 1975*).

The content of ascorbic acid (*Table 2*) ranged between 1.2 and 10.0 mg/100 g of product, the average of variants being about 4.2 mg/100 g of

product. We noticed five variants with very low values, two variants with a content close to the average (PS sauerkraut and DP pickled head of cabbage), and two variants with a double content, as compared to the average (DP pickled cucumbers and DP shredded sauerkraut) (****1975*).

The sauerkraut pickled in household conditions (*Table 3*) recorded practically the same values of lactic acidity (third lower values though the five variants were different by the types of used salt) (***1975).

For the variants pickled under household conditions, the average content of ascorbic acid (*Table 3*) was three times higher, due to the lack of additional conservation treatments using high temperatures. In this case, too, we have noticed the highest values of 18.4 mg/100 g of product for the sauerkraut pickled with Niki salt and the lowest values of about 9.2 mg/100 g of product for the variant pickled with Elcirom salt. There was no obvious correlation between the content/lack of iodine additives and the ascorbic acid content (Hura, 2003; Beceanu *et al.,* 2005)

The average percentage content in NaCl (*Table 4*) was 2.33%. We noticed two variants with half the average content (DP sauerkraut), six variants close to the average and one single variant with double values as compared to the average (RN sauerkraut) (***1975).

Table 2 - Titratable acidity and vitamin C content of commercial network products

Nr.	Product	Titratable acidity (g lactic acid/100 g prod)	Vitamin C (mg/100 g prod)
1	Pickled cucumbers Roadele Naturii	**0.59**	**1.23**
2	Pickled autumn tomatoes Roadele Naturii	0.69	1.69
3	Sauerkraut Roadele Naturii	0.59	2.11
4	Pickled cucumbers Putina Soacrei	0.79	1.23
5	Sauerkraut Putina Soacrei	1.48	5.10
6	Sauerkraut Mama Nina	1.28	1.23
7	Pickled cucumbers Dorsvet Plus	0.88	**10.03**
8	Shredded cabbage Dorsvet Plus	1.28	9.32
9	Head cabbage Dorsvet Plus	**1.97**	5.45

Table 3 - Titratable acidity and vitamin C content of household pickling

Nr.	Product	Titratable acidity (g lactic acid/100 g prod)	Vitamin C (mg/100 g prod)
1	Sauerkraut with salt Salrom	0.69	14.9
2	Sauerkraut with Xion	0.69	16.5
3	Sauerkraut with salt Niki	0.69	**18.4**
4	Sauerkraut with salt Albito	0.69	16.5
5	Sauerkraut with salt Elcirom	0.69	**9.15**

Table 4 - Salt, soluble dry matter and total dry matter content in commercial network products

Nr.	Product	NaCl %	SUS Bx	SUT %
1	Pickled cucumbers Roadele Naturii	2.52	4	5.11
2	Pickled autumn tomatoes Roadele Naturii	2.61	**3**	5.94
3	Sauerkraut Roadele Naturii	**4.11**	4.6	**8.28**
4	Pickled cucumbers Putina Soacrei	2.59	5.2	5.15
5	Sauerkraut Putina Soacrei	2.04	3	6.96
6	Sauerkraut Mama Nina	2.34	4.8	5.95
7	Pickled cucumbers Dorsvet Plus	2.50	5	4.40
8	Shredded cabbage Dorsvet Plus	1.20	5	**4.25**
9	Head cabbage Dorsvet Plus	**1.14**	**5.8**	6.05

Table 5 - Salt, soluble dry matter and total dry matter content in products of household pickling

Nr.	Product	NaCl %	SUS ^{0}Bx	SUT %
1	Sauerkraut with salt Salrom	**3.02**	4.2	5.44
2	Sauerkraut with Xion	2.74	**4.6**	**6**
3	Sauerkraut with salt Niki	2.39	4.6	5.70
4	Sauerkraut with salt Albito	2.15	4.6	5.84
5	Sauerkraut with salt Elcirom	2.09	4	**5.25**

The pickled products based on cabbage had an average content of soluble dry matter (about 4.7 ^{0}Bx) superior to those based on cucumbers (4.2^{0}Bx), and autumn tomatoes (4^{0}Bx).

The total dry matter recorded a value of 5.8 %, and we noticed six lower or close values to the average and only three values superior to the average (DP pickled head of cabbage, PS sauerkraut and RN sauerkraut). The values corresponding to the SUS content do not correspond proportionally and wholly to SUT values.

For the sauerkraut picked under household conditions (*Table 5*), the average of the five variants was about 2.5 g NaCl %, noticing that there were three values closer to the average, as well as two variants having a content of ± 1g NaCl % (sauerkraut pickled with Salrom salt and one pickled with Elcirom salt). We may notice a predominance of superior percentage values for the variants pickled with iodated salt.

The total dry matter of the household variants recorded an average of 5.6 %, with more important positive deviations for the sample pickled with Xion salt and negative for the sample pickled with Elcirom salt (***1975**).**

Table 6 - Sensorial analysis of samples

No.	Product	Aspect of content	Colour	Consistency	Taste and smell
1	Roadele Naturii pickles	- 5-7 cm healthy cucumbers, without wrinkles, and undamaged;	- green up to light green colour, without spots or burns; - the cover liquid is clear and yellow;	- cucumbers are crisp with a hard pulp;	- specific taste and smell without foreign taste or smell;
2	Roadele Naturii pickled autumn tomatoes	- whole healthy autumn tomatoes of uniform sizes;	- green and yellow colour specific to the fresh autumn tomatoes; - the cover liquid is clear and yellow;	- hard, elastic and crisp;	- specific to pickled autumn tomatoes and ingredients used for pickling, without foreign taste or smell; - **strong salty taste**;
3	Roadele Naturii sauerkraut	-2 whole heads of cabbage of small size	- white-yellowish colour; - the cover liquid is clear and yellow;	- the cabbage is hard, elastic, juicy and its leaves come out easily;	- **very salty taste**, slightly sour without foreign taste or smell;
4	Putina Soacrei pickles	- small cucumbers specific to the species;	- dark green colour, without spots or burns; - the cover liquid is clear and in an adequate quantity without impurities	- cucumbers are hard but there are also **soft cucumbers;**	- smell and taste specific to pickles; - **highly salty taste;**
5	Putina Soacrei sauerkraut	- an average size head of cabbage;	- yellow colour but there are also yellow-greenish leaves; - the cover liquid is clear and white-yellowish;	- the cabbage is hard, elastic and its leaves come out easily;	- slightly sour smell and taste specific to sauerkraut; - without mould smell or taste;
6	Mama Nina sauerkraut	- a large size head of cabbage;	- yellow colour but at the bottom of packing we may notice dark green leaves; - the cover liquid is sufficient and yellow-greenish;	- the cabbage is hard, elastic, juicy and its leaves come out easily;	- smell and taste specific to sauerkraut, flavoured, pleasant without foreign smell or taste;
7	Dorsvet Plus pickles	- regular shape cucumbers specific to the species, without damages; - the cover liquid contains dill seeds;	- non-uniform dark green colour; - the cover liquid is sufficient but it is slightly turbid;	- cucumbers are crisp with a hard pulp;	- pleasant, very sour and flavoured state; - no foreign smell or taste;

No.	Product	Aspect of content	Colour	Consistency	Taste and smell
8	Dorsvet Plus chopped sauerkraut	- uniformly chopped cabbage;	- uniform white-yellowish colour and the cover liquid is clear and in a reduced quantity;	- cabbage is hard, elastic and crisp;	- very sour taste, relatively salty, without foreign taste;
9	Dorsvet Plus sauerkraut head	-a chopped head of cabbage;	- uniform yellow-golden colour; - the cover liquid is clear and in an adequate quantity without impurities;	- cabbage is hard, elastic and crisp;	- smell and taste characteristic to sauerkraut; - slightly salty taste and sour, without foreign taste;
10	Salrom salt sauerkraut	- uniformly chopped cabbage;	- slightly transparent white-yellowish colour; - clear liquid;	- cabbage is hard, elastic and crisp;	- pleasant taste and smell, moderately salty, sour specific to the species - the liquid has a cabbage flavour;
11	Xion salt sauerkraut	- uniformly chopped cabbage;	- slightly transparent white-yellowish colour; - clear liquid;	- cabbage is hard, elastic and crisp;	- pleasant, sour taste and smell, slightly salty; - no foreign smell or taste;
12	Niki salt sauerkraut	- uniformly chopped cabbage;	- slightly transparent white-yellowish colour; - clear liquid;	- cabbage is hard, elastic and crisp;	- pleasant smell and taste characteristic to the assortment, slightly salty and the liquid has a cabbage flavour;
13	Albito salt sauerkraut	- uniformly chopped cabbage;	- slightly transparent white-yellowish colour; - clear liquid;	- cabbage is hard, elastic and crisp;	- pleasant smell and taste, slightly salty characteristic to the assortment;
14	Elcirom salt sauerkraut	- uniformly chopped cabbage;	- slightly transparent white-yellowish colour; - clear liquid;	- cabbage is hard, elastic and crisp;	- pleasant smell and taste characteristic to the assortment.

As for the sensorial analysis (*Table 6*), there were no deficiencies in terms of content. As deficiencies related to the colour of products, we noticed a certain non-uniformity of it for the PS sauerkraut, MN sauerkraut, DP pickled cucumbers. As for consistence, there were deficiencies for the PS pickled cucumbers (that are partially soft). Taste recorded deficiencies in the case of RN pickled autumn tomatoes and PS pickled cucumbers (an intense salty taste), as well as the DP sauerkraut (very sour taste) (***1975**).*

CONCLUSIONS

We notice an obvious difference between the products conserved by lacto-fermentation and pasteurization existing in the commercial network and the household products (thermally untreated) for all parameters, especially in terms of content of ascorbic acid.

The variants produced under household conditions recorded differences following the use of some different types of salt (non-iodated, additivated cooking salt or iodated sea salt).

The products obtained under household conditions stand out (in our case) by superior features; we must appreciate the steady quality of the existing sterilized products and their stability within the validity term.

In the commercial network, the products subjected to the sensorial qualitative control did not show major differences, except some colour non-uniformities and excessively intense tastes (salty or sour).

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