

INFLUENCE OF SOME SUPPLEMENTS ON LACTIC ACID FERMENTATION OF CABBAGE JUICE

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Abstract

The study is part of the researches made in order to obtain lacto-fermented juices with probiotic character. A lot of raw materials (vegetables and fruits) were tested and the dynamics of the fermentation parameters in function of many factors was observed. This study aims to increase the biologic value of the lacto-fermented juices by the addition of the onion juice and garlic juice. The objectives include the obtain higher chemical and sensitive parameters those obtained for witness sample. The juice was obtained by pressing and filtration of the crushed cabbage. After the filtration, the juice was pasteurized and fortified by the addition of the onion juice and garlic juice (0,2%). All the samples was fermented with *Lb. Acidophilus* (0,2g/l) at 37 deg. C. The pH of probiotic juice was measured with an electronic pH meter. The dosing of the reducing sugar calculated as the glucose has been effectuated using the DNS method. Titrable acidity, expressed as g lactic acid/100mL, was determined by titration with NaOH 0.1N

The results were emphasized a pH value by 3,55 for M sample, 3,58 for C and 3,59 for G. The sugar content was by 2,96 g/100ml for the M sample, 2,15 for the C, respectively 2,38 for the G. sample.

The conclusions were that the G sample wasn't satisfactory from the sensorial point of view, while the C sample had a higher content of lactic acid, underlined through a minor pH, respectively a lower content of glucose comparatively with the M sample.

Keywords: probiotic, lacto-fermented juices, biologic value, onion and garlic juice.

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1. INTRODUCTION

This study aims increases biologic value of the lacto fermentation juices by the addition of the onion juice and garlic juice. The objectives include the obtain higher chemical and sensitive parameters those obtained for witness sample.

Carrot juice has a high nutritional value as it is an important source of carotene. (Buruleanu L., *et al.*,2008) It is easily digestible, refreshing and delicious. It contains valuable vitamins and lots of minerals. (Kohajdová Z., Karovičová J., 2004) It has a wholesome effect in juice cures thanks to its acid-neutralizing action and has a low glycemic index. The result is a good metabolism and a good digestion, the bases of good health. (FAO/WHO, 2001)

The preservation by lactic fermentation, of vegetal products is an important technology because of the nutritional, therapeutically and probiotical aspects, the researches concerning on the selection of the microbial trunks and on

the assurance of the prime matter's quality. (Kanlanzopoulos, G., 1997; Kun S., *et al.* 2008).

The agents of the lactic fermentation are the lactic bacteria which exist in a big diversity. (Kullisaar, T., 2002; Leroy, F., De Vuyst, L., 2004). The proliferation of lactobacilli in fermented vegetables enhances their digestibility and increases vitamin levels. These beneficial organisms produce numerous helpful enzymes as well as antibiotic and anti carcinogenic substances.

Their main by-product, lactic acid, not only keeps vegetables and fruits in a state of perfect preservation but also promotes the growth of healthy flora throughout the intestine. (Battcock, M., Azam-Ali, S., 1998)

Because in the juice may also develop and unused microorganisms that can delay the lactic fermentation and efficiency, use added juice onion and garlic. The substances fitoncide of the onion and garlic juices

inhibits strains of helicobacter, *E. coli*, *Staphylococcus*, and *Streptococcus*, without harming beneficial digestive bacteria. Researchers at the University of Kansas found garlic, cloves, cinnamon, oregano, and sage kill *E. coli*. (Bookspan, J.)

Fitoncid action of juice additives can be assessed by the rate of decrease of pH, titrable acidity, reducing sugar metabolism and sensorial analysis. (Rakin M., *et al.*, 2004; Manea, I., Buruleanu, L., 2010)

2. MATHERIAL AND METHODS

After conditioning, cabbage was transformed into juices with a domestic juice maker. The juices were thermal treated at 80 deg.C/10min. All the samples were rapidly cooled at 40 deg. C.

This way the substratum was prepared for inoculation with pure culture.

A Christian Hansen lyophilized pure culture of *Lactobacillus acidophilus* was used for juice's fermentation. The fermentation temperature was 37 deg. C (the optimum temperature for this strain).

The samples volume was about 100ml and the lactic acid fermentation was realised in sterile bottles covered with the cotton stopper of the tube by metal folia. Each tube represented a single sample and the experiments were performed in double.

Were used the following samples: cabbage juice (control batch M), cabbage juice with 0,2% onion juice (sample C), cabbage juice with 0,2% garlic juice (sample G).

The dosing of the reducing sugar calculated as the glucose has been effectuated using the 3,5 dinitrosalicilic acid, DNS method, which is a colorimetric method, described by Segal *et al.*, in 2000, Rani *et al.*, 2001, McCleary *et al.*, 2002. The results were expressed as g glucose/100mL.

Titrable acidity, expressed as g lactic acid/100mL, was determined by titration with NaOH 0.1N in the presence of phenolphthalein. The pH has been determined using an electronic pH-meter.

The lactic acid fermentation was performed in a thermostat at 37⁰C during 48 hours. The samples were investigated during the lactic acid fermentation through chemical analysis at 2, 4, 6, 8, 24 and 24 hours.

3. RESULTS AND DISCUSSIONS

Initial parameters of the analyzed samples are written in Table 1.

Table 1 The parameters before at the lactic acid fermentation of cabbage juices

Sample / Parameter	M	C	G
pH	6.3	6.24	6.27
Titrable acidity, Lactic acid g/100ml	0.13	0.202	0.137
Glucose, g/100ml	4.32	4.71	5.68

The addition of the garlic juice caused a significant increase in the reducing sugar content in the sample G. In order to emphasize the degree of purity of the lactic fermentation was followed rate of pH decline. In this respect, the calculated maximum acidification rate, taking into account the dynamics of pH during the 24 hours of fermentation Fig. 1.

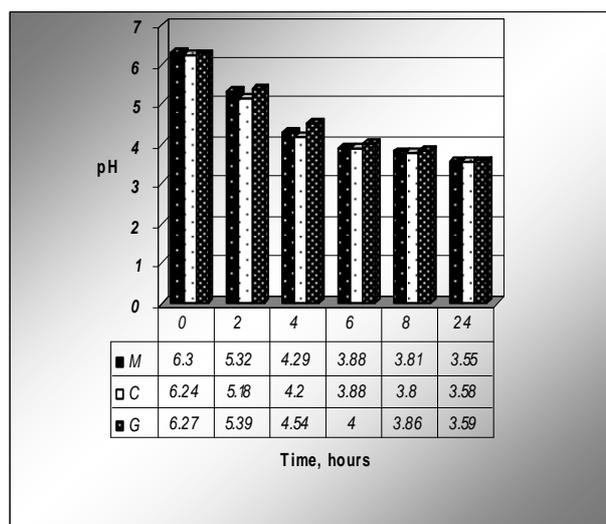


Fig. 1 The evolution of the pH during the lactic acid fermentation

After 2 hours the pH decreases faster sample C, and after 6 hours is equal to the sample M, which is important for the stability of juice. It seems that the addition onion juice to decrease accelerates in pH. After 24 hours sample G has the highest pH, which is reflected in appearance to be unfit.

No very significant differences were also observed on running of the fermentative process.

The acidity titrable was the largest in the sample without additives (0, 17 g/100ml) and sample C was smallest the acid lactic content (0,125 g/100ml). (Figure 2)

If the increase of the titrable acidity of the juices was relative slowly.

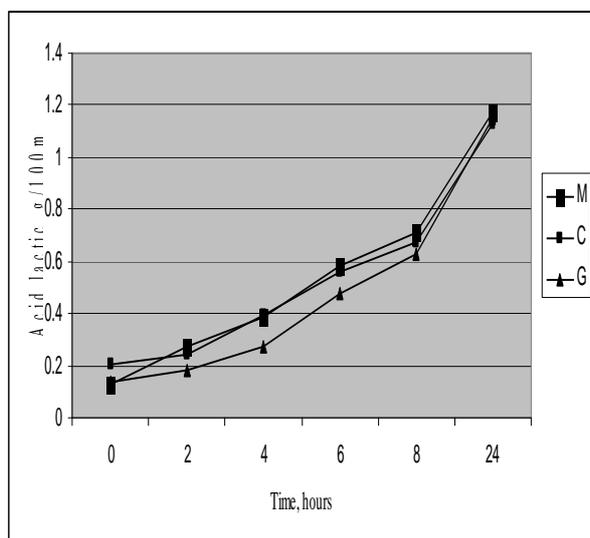


Figure 2 The evolution of the acidity titrable in the lactic fermentation of cabbage juice samples

The maximum rate of acidification v_{max} was calculated as the time variation of pH (dpH/dt) and expressed as pH units/min. Other kinetic parameters were also calculated: time to reach v_{max} (t_{max} , hours), time to reach pH 5.0 (tpH 5,0, hours), time to complete the fermentation (tpH 4,2, hours). (Table 2)

Table 2 Acidification kinetic parameters of fermentation of cabbage juices

Sample	$v_{max} \cdot 10^{-3}$ (units/min.)	t_{max} (h)	tpH 5,0 (h)	tpH 4,2 (h)
M	8.37	4	2.65	4.43
C	8.83	2	2.3	4
G	7.33	2	2.3	5.4

Numerous authors were indicated the pH value 4.2 as being a parameter that guarantee a shelf life of the fermented juices while maintaining the temperature of refrigeration.

The highest rate of decrease in pH was to sample C (8.83units/min.) and the maximum time was 2 h for samples M and G.

Also the speed of decrease pH in the sample with added garlic was the smallest ($7,33 \cdot 10^{-3}$ units/min) and time needed to complete lactic fermentation was the lowest (5,4h).

Also time to reach pH 5 was 2.3 h for samples with additives, compared to 2.65 for the control batch M. From this point of view the samples with onion and garlic have attained the first value of pH 5, which shows that fermentation within the speed higher than the blank sample.

The period for improvement of fermentation, as some authors of pH 4.2 was 4 hours for sample C and 5.4 hours for sample G. After 24 hours the pH dropped further to 3.59 sample G but had a look filante juice, unfit for consumption.

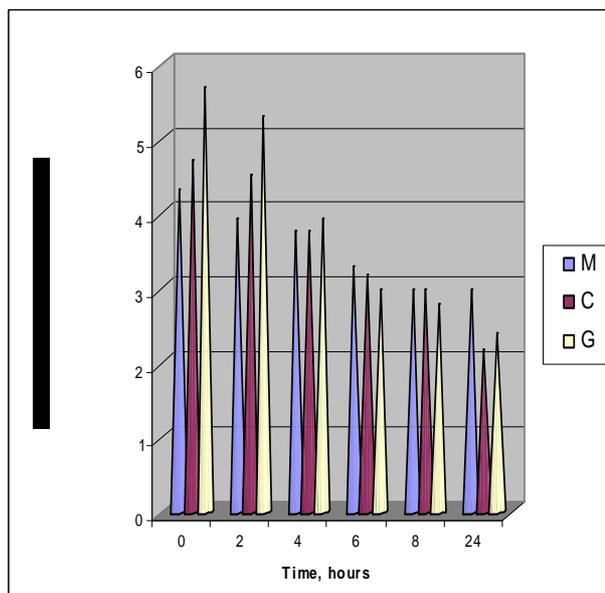


Figure 3 The evolution of the reducing sugars content in the lactic fermentation of cabbage juices

In Figure 3, is seen the evolution of the reducing sugars content in the case the lactic acid fermentation. The reducing sugar metabolism was more intense for samples

juice with supplements (C and G) that in control batch M.

The influence of supplements on the dynamics of this parameter can be observed in especially in samples C and G. The metabolism of carbohydrates into lactic acid takes place with a higher yield in samples with garlic and onion juice, compared with the control sample. Thus reducing sugar conversion was 58% in sample G, of 54,35% in sample C and 31,48% in the control sample M.

4. CONCLUSIONS

Lacto fermented cabbage juice with garlic achieve validity parameters (pH 4.2) after 5.4 hours, then refrigerated cooling recommended. The cabbage juice lacto fermented with onion shows a fermentation pure in that pH 4.2 is reached after 4 hours and also keeps sensory characteristics after 24 hours.

The addition of onion juice is beneficial lactic fermentation, both in terms of intensity decreasing pH and sensory properties. The residual sugar content is enough to be a balance between acidity and sugar, consumers liked.

Garlic sample not corresponded sensorial and do not have stability even if it has a residual sugar content higher than the sample with added onion juice. C sample has an high content of lactic acid.

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