AENSIJournals

Advances inEnvironmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/AEB/

Production of beverage based on probiotic fermented mixture of malt extract and red fruit juices

[1]ZohreYahyaei Soofyani, [2]MahnazHashemiravan, [2]RezvanPourahmad

[1]MSc student, Department of Food Science and Technology, Varamin-Pishva Branch,Islamic Azad University,Varamin, Iran
[2]Department of Food Science and Technology, Varamin-Pishva Branch, Islamic Azad University,Varamin, Iran

ARTICLE INFO

Article history:
Received 12 October 2014
Received in revised form 26 December 2014
Accepted 1 January 2015
Available online 17 February 2015

Key words:
Probiotic beverage, Malt extract, Red fruit juices, Lactobacillus casei.

ABSTRACT

Probiotics describe as alivemicroorganismes that after use adequate amount will have beneficial effects on host health. Increase monosaccharides and disaccharides to substrate of fermented probiotic productions intensify growth several probiotics. In this study, production of beverage based on mixture of malt extract and red fruit juices (mixed of apple, red grapes, pomegrante, blackberry, cranberry and black currant juices) by *Lactobacillus casei*carried out. Bacterial growth, pH, titratable acidity, brix and consumption of reduction sugars were checked during fermentation and 28 days of cold storage at 4 ˚C. For production of probiotic fermented mixture of malt extract and red fruit juices was prepared the microbial *Lactobacillus casei*suspension with initial concentration about $1.5x10^7$, $1.5 x10^8$*cfu/ml* and added from each microbial suspension to the mixture of malt extract with 2,4 ,6% concentrations and red fruit juices with 5,7.5,10% concentrations, This juice incubated at 37°C for 48 hours.The results revealed that bacteria growth well in mixture of malt extract and red fruit juices, they could decrease sugar value, decrease brix. The results revealed that the sample of $M_2B_1C_1$ (5% red fruit juices, 4% malt extract and $1.5 x10^7$*cfu/ml* of *Lactobacillus casei*) was considered as the best treatment. This samle had the maximum rates of cell viability during 4 weekes of cold storage at 4 ˚C.Totally the outcomes of this study revealed that mixture of malt extract and red fruit juices are a suitable substrate for the growth of lactic acid bacteria and production of functional beverage.

To Cite This Article: ZohreYahyaei Soofyani, MahnazHashemiravan, RezvanPourahmad, Production of beverage based on probiotic fermented mixture of malt extract and red fruit juices. ***Adv. Environ. Biol., 9(2),*** *762-769, 2015*

INTRODUCTION

One of the most important problems in the production of probiotic foods is the low viability of probiotic bacteria due to their sensitivity to unfavorable conditions of the food andgastrointestinaltract [17].

The effects attributed tothe probiotic bacteria includes the strengthening andenhancing immunity against intestinal infections,improving lactose consumption, preventing diarrhea and colon cancer, lowering cholesterol and reducing the incidence of stomach and intestinal diseases, better formation and recombination and balance ofmicrobial flora of intestine, improving calcium absorption and synthesis of vitamins promoting better digestion of proteins [2]. It is necessary to note that the activity of probiotic bacteria is not limited to the microbial flora of digestive system and also it is possible to function in microbial communities such as skin, respiratory tract and genital tract [8].

The wide variety of fruits and vegetables and many strains of Lactobacillus present a great opportunity for the development and industrialization of value-added non-dairy fermented beverages.Processingand producing fermented beverages is very effective to increase nutritional value, reduce waste and increase value added due to the high nutritional value of and their special position near the public,

Due to their high nutritional value and popularity, processing red fruit juices is so crucial because it can increase the nutritional value, reduce the wastes and increase added value. The aim of this study was to innovatea fermented beverage based on red fruit juice andmalt and increase the nutritional value of the beverage.Malt extract orgerminated barley extract is a brownsyrupobtained from sprouted barley seeds.This extract has many different uses due to the high enzymaticcharacteristics, diaceticstrength, lots of fermentable

Corresponding Author: MahnazHashemiravan, Department of Food Science and Technology, Varamin-Pishva Branch, Islamic Azad University,Varamin, Iran.
E-mail: m_hashemiravan@yahoo.com

sugars rapidlydegraded and absorbed, flavoring power and high nutritional value. Various amino acids, small proteins and various natural sugars contained in the malt extract increases its nutritional value [6].

Juices contain high levels of antioxidants,vitamins, minerals, dietary fiber and other nutrients,therefore areso useful and healthy[16,13].The aim of this workisproducing a probiotic fermented beverage based on red fruit juice and malt and determination of the optimum shelf life of the product according to the red fruit juice and malt extractconcentration,inoculation amount and density of probiotic bacteria and study of reducing sugar content, brix and viability of probiotic bacteria after fermentation and during the 28 days of storage at4 ˚C.

MATERIALS AND METHODS

2.1.Materials:

The materials used for manufacturing ofthe probiotic beverage includingred fruit juice concentrate which was a combination ofapple, red grape, pomegranate, cornberry, blackcurrent and blackberry,were prepared fromAlifard co. (Sanich)and "*Lactobacillus casei* 1608"the Organization of scientific and Industrial Research of Iran andmalt extractBehnoosh Iran, respectively.Malt extract with the ratios of 2, 4 and 6% was mixed with red fruit juice concentrate with the ratios of 5, 7.5 and 10% diluted by drinking water in a 100 ml flask. The samples were pasteurized ina water bath at 85°C for 10 min[1,3].

Table 1:treatments of study

treatments	Raition of red fruit juicesconcentrate (%)	the amount of bacteria (*cfu/ml*)	Rations ofMalt extract (%)
$M_1 B_1 C_1$	5	1.5×10^7	2
$M_1 B_1 C_2$	7.5	1.5×10^7	2
$M_1 B_1 C_3$	10	1.5×10^7	2
$M_1 B_2 C_1$	5	1.5×10^8	2
$M_1 B_2 C_2$	7.5	1.5×10^8	2
$M_1 B_2 C_3$	10	1.5×10^8	2
$M_2 B_1 C_1$	5	1.5×10^7	4
$M_2 B_1 C_2$	7.5	1.5×10^7	4
$M_2 B_1 C_3$	10	1.5×10^7	4
$M_2 B_2 C_1$	5	1.5×10^8	4
$M_2 B_2 C_2$	7.5	1.5×10^8	4
$M_2 B_2 C_3$	10	1.5×10^8	4
$M_3 B_1 C_1$	5	1.5×10^7	6
$M_3 B_1 C_2$	7.5	1.5×10^7	6
$M_3 B_1 C_3$	10	1.5×10^7	6
$M_3 B_2 C_1$	5	1.5×10^8	6
$M_3 B_2 C_2$	7.5	1.5×10^8	6
$M_3 B_2 C_3$	10	1.5×10^8	6
C	7.5	-	4

2.2.Strain preparation for inoculation:

The activation of *Lactobacillus casei* PTCC1608 was conducted in MRS broth and incubation at 37° C for 24 h. In order to provide the bacteriaculture mediumfor storage,about 10ml of the24h-mediumwas centrifuged at25°C and3500 rpm for 5 min [10]. About 5 mlof the 24 hours culture medium was inoculated to 95 ml of the sterile MRS brothand incubated at similar conditionfor more activation ofthe bacteria (the second stage of the culture) [10].To obtain single colonies of bacteria and ensure the viability of bacterial cells, the 24 h culture tubes were mixed in ashaker and cultured on MRS agar by streak platemethod.The plates were wrapped in

parafilm and incubated at 37° C for 48 h.After this period, the bacteria grown on the agar were used in the later stages of the study[12].

2.2.1.Microorganism inoculation:

The microbial inoculation was conducted by the McFarland method(Ashrafi, 2006) which was used to determine the amount of bacteria at the two levels of$1.5x10^7$and $1.5x10^8$*cfu/ml.*

2.2.2. Inoculation of microorganisms to samples:

10 ml of MRS broth was transferred to a sterile falcon by a sterile pipette in a laminar hood understerile conditionsand centrifuged at a speed of 3500 gfor 10 minutes. Then the supernatant fluid was separated [10]. Then some amount of sterilized distilled water was poured into the falconcontaining sediment to wash theremaining medium.The spectrophotometer was adjusted to0.5 McFarland,in fact the turbidity was equal to 0.5 McFarland times by the turbidity caused by 1.5 $x10^8$*cfu/ml* of the given bacterial strain.To prepare the bacterial population of $1.5x10^7$*cfu/ml*, 1 ml of the medium was moved toa falcon containing 9 ml of sterilized distilled water by a sterilized pipette. After that the strains were prepared for inoculation.

2.3. Fermentation of samples:

The fermentation was conducted by incubating falcons at 37°C for 48h. According to Saxelin*et al*. (1999), 37-40° C is an appropriate temperature range for the growth of probiotic bacteria, especially *Lactobacillus casei*. After fermentation, the flasks were stored at 4°C for 4 weeks to study the considered factors [22].

2.3. Tests:

2.3.1.Lactic acid bacteria counts:

Pour plateand decimal dilution methods were usedfor microbial counts according to SPC method. 1 ml of the dilution was poured into a sterile plate andthe sterilized MRS agar was spread on it.After the liquid medium converted into a solid one, the plates were transferred to an incubator of 37° C for 48 h.Then the grown colonies were counted by a colony counter after 48 hours. The number of colonies was multiplied by the inverse of the dilution according to the equation (1) and the final number wasreported as the colony number per milliliter (*cfu/ml*) [21].

Inverse of dilution factorxcolony number = (*cfu/ml*)colony number per millilitereq. (1)

2.3.2. Measurement of reducing sugar:

This test was conducted according to the National Standard No. 2685 and the final result was calculatedby the equation (2).

$$n=\frac{F\times100\times100}{V\times25}\text{eq.} \quad (2)$$

n = amount of reducing sugar (before hydrolysis) gr per 100gr
F = Fehling factor
V = consumed volume of the neutralizedsolution A.

2.3.3. Measurement of water soluble solids (Brix at 20 ° C):

For the measurement of water soluble solids,a digital refractometer (RX- 7000 α) wasused. The device was calibrated with distilled water before use. The number reading showed soluble solids per 100 g of sample[14].

2.3.4.Statistical analysis and design:

To examine the results, the factorial experimentin a completely randomized design was used. The datawas statistically analyzedbythe software SPSS 20and the mean values comparisonwas done by using Duncan's test at 95% confidence.

3. Results:

3.1. Evaluation of reducing sugarchanges in the beverages before fermentation, after 48 hours of fermentation at 37˚C and during the 4 weeks of storage at 4˚C:

The test results showed that the amount of malt extract, bacterial density, fruit juice concentration, storage and interaction between them did significantly influence on the amount of reducing sugars ($p<0.01$).

There was no significant difference between the sugar amount of thecontrol before fermentation and those ofthe treatments $M_2B_2C_2$ and $M_2B_1C_2$($p>0.05$).The highest amounts of sugar before fermentation belonged to the treatments $M_3B_1C_3$with the formulation of 10% fruit juice, 6% malt extract and bacterial density of 1.5×10^7*cfu/ml* and $M_3B_2C_3$with the formulation of 10% fruit juice, 6% malt extract and bacterial density of

1.5×10^{8}*cfu/ml*, respectively.There was no significant difference between the reducing sugar amount of the control and that of the treatment$M_3B_1C_1$after 48 hours of fermentation ($p>0.05$). The highest amount of reducing sugars after 48 hours belonged to treatment $M_3B_1C_3$with the formulation of 10% fruit juice, 6% malt extract and bacterial density of 1.5×10^{7}*cfu/ml*.

Moreover, no significant difference was observed between the amounts of reducing sugars of thecontrol andthe treatments $M_2B_1C_3$and $M_2B_2C_3$after one week of storage at the temperature 4˚C($p>0.05$). The highest amount of reducing sugar after a week of storage at 4˚C belonged to $M_3B_1C_3$ with the formulation of 10% fruit juice, 6% malt extract and bacterial density of 1.5×10^{7}*cfu/ml*.

There was no significant difference in the amount of reducing sugars of the control and that of $M_2B_1C_3$after two weeks of storage at 4˚C($p>0.05$). The highest concentration of reducing sugars after two weeks of storage at 4˚C was related to the treatment $M_3B_1C_3$ with the formulation of 10% fruit juice, 6% malt extract and bacterial density of 1.5×10^{7}*cfu/ml*.

Also, no significant difference was observed in the reducing sugar contents of the control and $M_2B_1C_3$ after 3 and 4 weeks of storage at 4˚C($p>0.05$). The highest amount of reducing sugar after 3 weeks of storage at 4˚C was related to the treatment$M_3B_1C_3$ with the formulation of 10% fruit juice, 6% malt extract and bacterial density of 1.5×10^{7}*cfu/ml*.

According to Figure 1, it was found that the changes insugar levels were similar at the times of examination. Also, the sugar contentwas significantly reduced after 48 hours of fermentation at 37˚C and four weeks of storage at 4 ˚C.

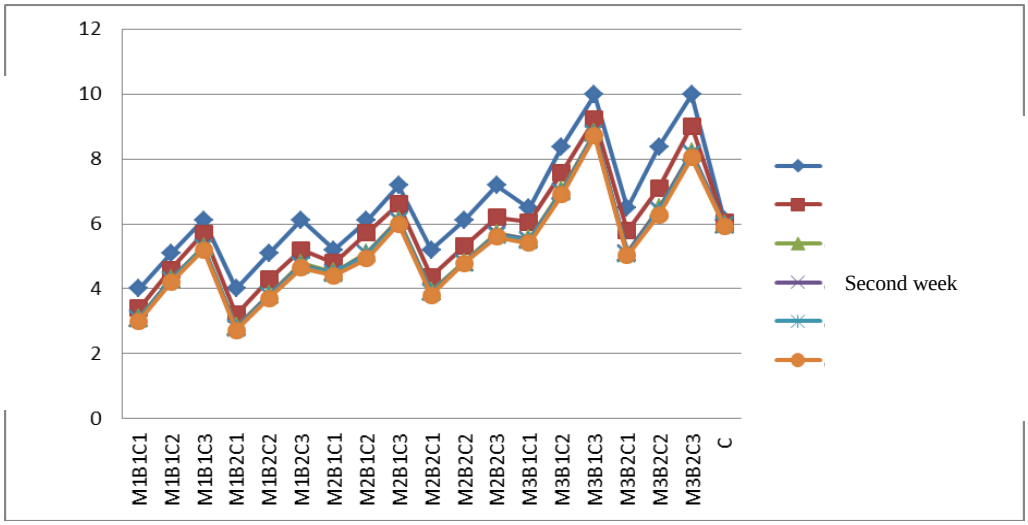

Fig. 1: The overall changes of reducing sugars of fermented beverage after 48 hours at 37 ˚C and four weeks at 4 ˚ C.

3.2.Evaluation of Brix changes in the beverages before fermentation, after 48 hours of fermentation at 37˚C and four weeks at 4˚C:

The results demonstrated that the amount of malt extract, bacterial density, fruitjuicecontent, as well as their interactions significantly affected the Brix ($p>0.01$).

There was no significant difference between the Brix of the controlbefore fermentation andthose of $M_2B_1C_2$ and $M_2B_2C_2$($p>0.05$).The highest values of Brix before fermentation were related to the treatments$M_3B_1C_3$ with the formulation of 10% fruit juice, 6% malt extract and bacterial density of 1.5×10^{7}*cfu/ml* and $M_3B_2C_3$with the formulation of 10% fruit juice, 6% malt extract and bacterial density 1.5×10^{8}*cfu/ml*, respectively.

A significant difference was observed between the Brix of the control after 48 hours of fermentation and during four weeks at4˚C and those of other treatments($p<0.01$). The highest value of Brix after 48 hours of fermentation belonged to the treatment M3B1C3 with the formulation of 10%fruit juice, 6% malt extract and bacterial density of 1.5×10^{7}*cfu/ml*.

According to Figure 2, it wasfound that the trends observed for the Brix variations at the times of investigation were similar and it significantly droppedafter 48 hours of fermentation at 37˚C and four weeks at 4˚C.

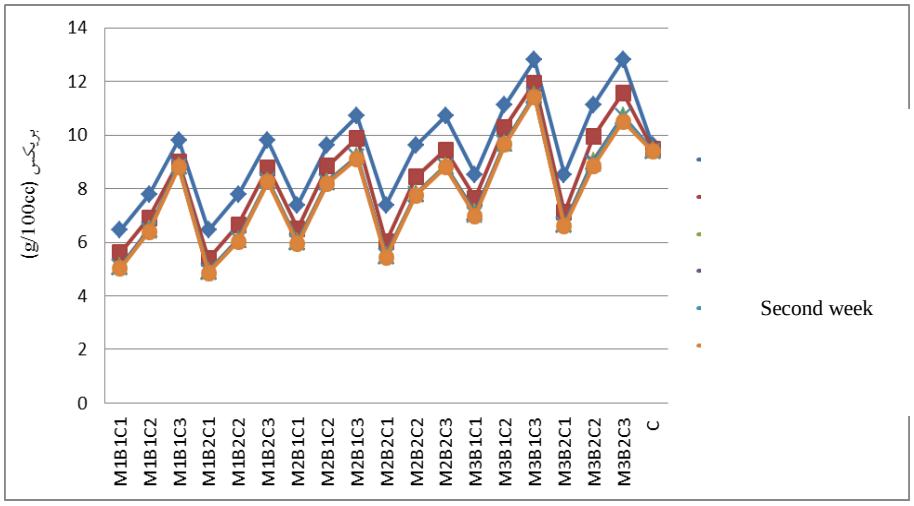

Fig. 2: The overall changes of Brix of fermented beverage after 48 hours at 37 ˚C and four weeks at 4 ˚ C.

3.3. Correlation between Brix and reducing sugars of the fermented beverage after 48 hours of fermentation at 37 ˚Cand four weeks storage at 4˚C:

Brix indicates the amount of dissolved solids in grams per 100g ofthe solution. It wasmeasured by refractometrymethod. Its value is roughly proportional to the amount of sugarcontained in the sample.After fermentation and four weeks storage at 4˚C, the Brix and reducing sugar values were reduced and as observed in Figure 3, there is a positive correlation between the values of Brix and reducing sugars.

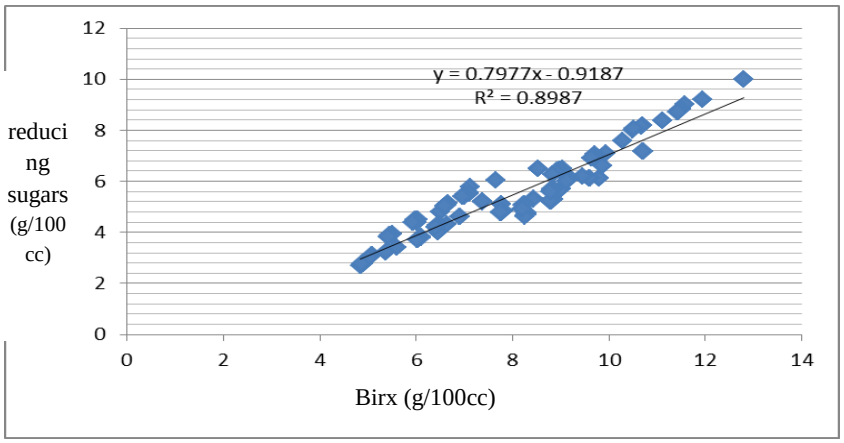

Fig. 3: The correlation between the Brix and reducing sugars before fermentation, after 48 hours of fermentation at 48 ˚C and four weeks storage at 4 ˚C.

3. 4. Evaluation of growth trendofL.casei in *cfu/ml*in the beverage before fermentation, after 48 hours of fermentation at 37 ˚C and four weeks at 4˚ C:

The results showed that the bacterial growth was significantly affected by the density of bacteria and the storage period($p<0.01$). But the effects of malt and fruit juice concentration did not show any significant differences($p>0.05$).The mutual interactions between the factors including "malt extract× density of bacteria", "malt extract × storage time", "malt extract × fruit juice concentration ", "fruit juice concentration × storage time" and "bacterial density × fruit juice concentration" did not show any significant difference in the growth of bacteria($p>0.05$). However, the interaction effect of "bacterial density×storagetime" on the bacterial growth was quite significant($p<0.01$). But the tripartite and quartet effects of the variables on the bacterialgrowth did not show any significant differences($p>0.05$).

The viability of the bacteria before fermentation showed no significant differences ($p>0.05$). There was no significant differencebetween the treatments inthe viability of L.caseiafter 48 hours of fermentation($p>0.05$).

There was no significant difference between the treatments in terms of theviability of L.casei after one week of storage of the beverage at 4˚C($p>0.05$).The viability values of L.casei were not significantly differentafter the two-week storage of the beverage at 4 ˚C($p>0.05$). Moreover, after three weeks of storage at 4˚C,the viabilities of L.caseiamong the treatments $M_2B_1C_1$,$M_3B_2C_2$ and $M_3B_2C_3$ didn't show any significant

differences ($p>0.05$). But the treatment $M_2B_1C_1$ did show a significant difference with other treatmentsafter four weeks of storage at 4˚C in terms of the viability of L.casei($p<0.01$).

According to Figure 4, it was found that the growth ofL.caseiincreased after 48 hours of fermentation at 37 ˚C and significantly reduced during four weeks of storage at 4˚C.

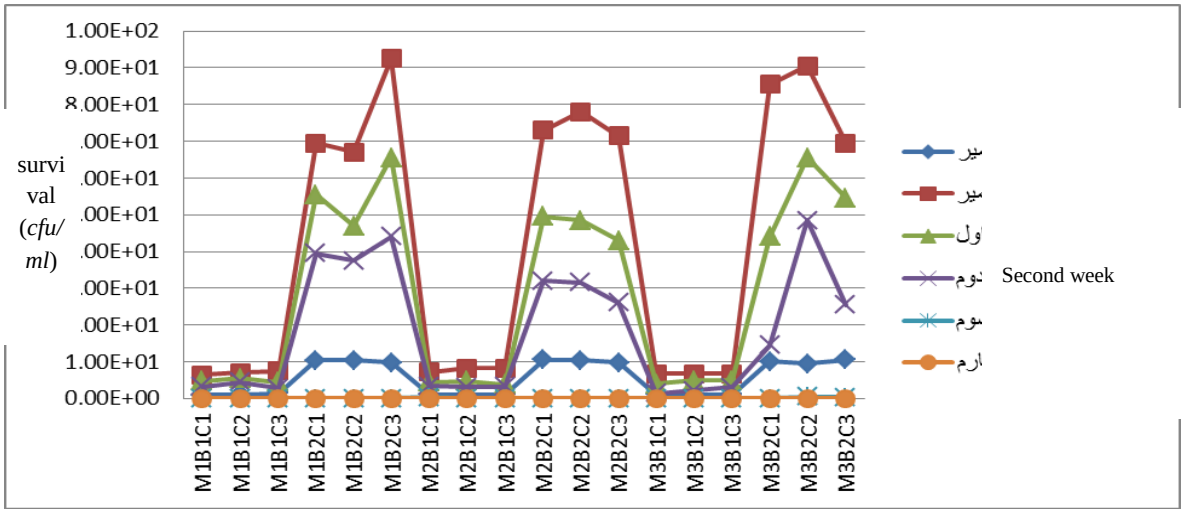

Fig. 4: The overall changes of the growth of L.casei of fermented beverage after 48 hours at 37 ˚C and four weeks at 4 ˚ C.

RESULTS AND DISCUSSION

4.1. Variation of reducing sugars and Brix during the fermentation and storage:

The results showed that the growth of bacteria was followed by decreasing the reducing sugar content and the Brix during the fermentation and storage that was consistent with the results obtained byShishe (2013), Nosrati (2013) and Moraru (2007).

However, controlling the fermentation time is also effective on the quality of product due to the consumption ofsugar and so production of organic acids.

These findings were inconsistent with the results of Vidal Fonteles*et al*. (2011)who had investigated the fermentation of melon juice to produce aprobiotic fermented drink. The latter investigation indicated that *Lactobacillus casei*is not capable of fermentingthe sugars naturally present in melon juice, without the need of supplements such as sucrose, or other nutrients.While the results of this study showed that *Lactobacillus casei*doesn't need any supplement such as sucrose and other nutrients to fermentthe sugars naturally present in red fruit juices and in case of existence of malt extract, it canferment, grow and be viable.

4.2.Variationsof the growth of probiotic bacteria during fermentation and storage:

The results of this study showed the increased levels of probiotic bacteria during fermentation, which confirms the results of Lee *et al*.,(2013).

The probiotic bacteria content was reduced within the four weeks of storage at 4˚C, so that the maximum survival of bacteria was two weeks for most of the treatments over the four weeks of storagewhich is in the range recommended by the Food and Drug Administration, only the treatments $M_3B_2C_2$containing7.5% red fruit juice, 6% malt extract and bacterial density of 1.5×10^8*cfu/ml*and $M_3B_2C_3$ containing 10% red fruit juices, 6% malt extract and bacterial density of 1.5×10^8*cfu/ml*had a retention time ofthree weeks and the treatment $M_2B_1C_1$containing 5% red fruit juices, 4% malt extract and bacterial density 1.5×10^8*cfu/ml* wasmaintainedfor four weeks. These findings confirm the results obtained by Seyedi(2011)who showed that the number of probiotic bacteria was reduced over the 28 days of storage.

The results were consistent with the findings by Ding and Shah (2008),who showed thatthe survivalof non-encapsulated probiotic bacteria in a mixture of red fruit juicesand malt extract rapidly declinedover 4 weeks in the refrigerator due to the acidic conditions of the beverage.Of coursecontrollingthe fermentation time is effective on the quality of the product.

The results obtained in this study weresimilar to the findings of Pereria*et al*.(2011) who found that the number of living cells of probiotic bacteria in a mixture of red fruit juices and malt extract was increased during 48 hours of fermentationat 37˚Canddecreased rapidlywithin 4 weeks in the refrigerator due to the acidic condition of the beverage.It is worth mentioning that the two inoculum levels of 1.5×10^7 and 1.5×10^8*cfu/ml*of *Lactobacillus casei*were appropriate.

Conclusion:

In this study, the factors including reducing sugars, Brix, viability of probiotic bacteria in a probiotic fermented drink consisted of malt extract in the ratios of 2, 4 and 6%, red fruit juice concentrate (a mixture of apple, pomegranate, red grapes, cornelian cherry, black raspberry and gooseberry juices) in the ratios of 5, 7.5 and 10% andthestrain of *Lactobacillus casei* attwo inoculum levelsof 1.5×10^7 and 1.5×10^8*cfu/ml* were examined. According to the results, it was concluded that the optimum condition of the beverage fermentation by the studied bacteria was37˚C for 48 hours. The number of theprobiotic bacteria was increased during the fermentation because of the consumption of sugar and nutrients contained in the malt extract andred fruit juice concentrateby the probiotic bacteria. Therefore, the amount of reducing sugars and Brix (water soluble solids) decreased. The maximum survival of the bacteria for most of the treatments over the four weeks of storage was 2 weeks, which was in the range recommended by the Food and Drug Administration.Only the treatments $M_3B_2C_2$containing 7.5% red fruit juice, 6% malt extract and bacterial density of 1.5×10^8*cfu/ml* and $M_3B_2C_3$ containing 10% red fruit juices, 6% malt extract and bacterial density of 1.5×10^8*cfu/ml* had a retention time of three weeks and the treatment $M_2B_1C_1$containing 5% red fruit juices, 4% malt extract and bacterial density 1.5×10^8*cfu/ml* wasmaintainedfor four weeks.

In conclusion, the results of this work showed that a mixture of red fruit juices and malt extract is a suitable environment for the growth of lactic acid bacteria and thus producing a functional beverage.

REFERENCES

[1] Aguiló-Aguayo, I.G., R. SolvinaFortuny and O. Martin-Belloso, 2007. Comparative study on color, viscosity and related enzymez of tomato juice treated by high intensity pulsed electric fields or heat. Journal of European Food Research and Technology, 227(2): 599-606.

[2] Ahmadi, A., S.A. Mortazavian, A. Milani, R. RezaeeMokarram, 2012. Assessment of survival of microencapsulated acidophilus bacteria (La-5) during the storage of synbiotic yogurt-ice cream, Food Science and Industry Researches of Iran, 3: 278-271.

[3] Alwazeer, D., C. Delbeau., C. Divies. And R. Cachon, 2003. Use of redox potential modification by gas improves microbial quality, color retention, and ascorbic acid stability of pasteurized orange juice. Journal of Food Microbiology, 89(1): 21-29.

[4] Ashrafi, F., 2002. Practical microbiology.First published compilation, Ahsan Press.

[5] Ding, W.K. and N.P. Shan,2008. Survival of free and microencapsulated probiotic bacteriain orange and apple juice. International Food Research Journal, 15(2): 219-232.

[6] Farrokhi, A.R., 2008. evaluation of Simultaneous effects of soy and malt extract on the growth of the probiotic bacteria of *Lactobacillus acidophilus* and *BifidobacteriumBifidum* in the production of probiotic milk and yogurt, professional PhD thesis of veterinary, No. 653, Islamic Azad University of Iran, Kazeroon branch.

[7] James, M.J., 1993. Modern food microbiology, translated by: Mortazavi, A., Haddad Parast, H., Farhoosh, R., Nasehi, B., RezaeeMokarram, R., Mashhad Press.

[8] KhosravaniDarani, K., M.R. Kooshki, 2008. Probiotics in milk and its product, Tehran, Marz-e-Danesh, pp: 1-4.

[9] Lee, P-R., C.X.Boo and Sh-Q.Liu., 2013. Fermentation of coconut water by probiotic strains *Lactobacillus acidophilus L10* and *Lactobacillus casei L26*, Annals of Microbiology,63(4): 1441-1450.

[10] Mokarram, R.R., S.A. Mortazavi. M.B. HabibiNajafi and F. Shahidi, 2009.The influence of multi stage alginate coating on survivability of potential probiotic bacteria in simulated gastric and intestinal juice. Food Research International., 42:1040-1045.

[11] Moraru, D., I. Bleoanca and R. Segal,2007. Probiotic vegetable Juices. Asia pac journal Nutrition, 17: 141-142.

[12] Mousavi, Z.E., S.M. Mousavi, S.H. Razavi, Z.Emam- Djomeh and H.Kiani,2011. Fermentation of pomegranate juice by probiotic lactic acid bacteria., World J MicrobiolBiotechnol, 27: 123-128.

[13] Nagpal, R., K.Ashwani and M.Kumar,2012. Fortification and fermentation of fruit juices with probiotic lactobacilli, Annals of Microbiology, 4(62): 1573-1578.

[14] Nameless, 2007. Fruit juices - Methods of test. Iran National Standard No. 2685.Institute of Standards and Industrial Research of Iran.

[15] Nosrati, R.,2013. Fermentation of vegetables juice by probiotic bacteria, Varamin- Pishva Branch, Islamic Azad University,Varamin, Iran.

[16] Pereira, A.L.F., T.C.Maciel and S. Rodrigues,2011. Probiotic beverage from cashew apple juice fermented with *Lactobacillus casei*, Food Research International,44: 1276-1283.

[17] Rezaee, R., M. Khamiri, M. A'lami, M. KashaniNejad, 2012. Effects of guar gum and Arabicgumon the survival of*Lactobacillus acidophilus (La5*) and *Bifidobacteriumlactis (Bb12)* in probiotic frozen yogurt, Iranian Food Science and Technology Research Journal, 8(371): 4-371.

[18] Seyedi, Sh., 2011, Probiotic orange juice, MS Thesis of Food Science, Agriculture Faculty, Islamic Azad University of Iran, Varamin branch.
[19] Shisheh, Sh., 2013, Production feasibility of a fermented probiotic mixture of barberry and sour cherryjuice, MS Thesis of Food Science,Agriculture Faculty, Islamic Azad University of Iran, Varamin branch.
[20] Vidal Fonteles, T., M.G.M.Costa, A.L.T.D.Jesus and S.Rodrigues, 2011. Optimization of the Fermentation of Cantaloupe Juice by *Lactobacillus casei NRRL B-442*, Food Bioprocess Technology,7(5): 2819-2826.
[21] Vinderola, C.G. and J.A. Reinheimer, 2000. Enumeration *Lactobacillus casei* in the presence of *L.acidophilus* .Bifidobacteria and lactic starter bacteria in fermented dairy products. International Dairy Journal, 10(4): 271-275.
[22] Yoon. K., E. Woodams and Y. Hang, 2004. Probiotication of tomato juice by lactic acid bacteria, The Journal of Microbiology, 42: 315-318.