THE TECHNOLOGICAL ASPECTS OF MILK DRINK PRODUCT AND KVASS FORTIFICATED WITH VITAMIN C

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Abstract
Food fortification, i.e., the addition of nutrients to specific foods based on the dietary habits and nutritional status of the target population, is one of the most popular nutritional interventions for improving the population's nutritional status. Nutrient stability under normal conditions of storage and use is one of the important factors determining the effectiveness of a food-fortification programmer. From a technical standpoint, nutritional stability during formulation, preparation, and processing is very crucial in determining the effective production of fortified foods. In the year 2000, the US Food and Nutrition Board recommended a tolerable upper intake level (UL) for vitamin C of two grams daily in order to prevent most adults from several health and safety issues such as experiencing osmotic diarrhea and gastrointestinal disturbances. Deficiency of vitamin C is usually a result of a low consumption of fresh fruits and vegetables, caused by any one or a combination of factors such as seasonal unavailability, transportation difficulties and/or unaffordable cost. As the vitamin C content of cow's milk is low, infants represent a further subgroup that is potentially high risk for vitamin C deficiency.
The research is focused on the evaluating the influence of technological parameters on vitamin C content and stability in milk drinks and in kvass. The samples of milk drinks prepared from the raw milk and vitamin C, and kvass prepared of the rye malt, water, sugar and yeast with different vitamin content.
Results show that main factor for controlling content of vitamin C in milk drinks is temperature of pasteurization. The biggest losses of vitamin obtain during 85 °C pasteurization temperature. Other important factors affecting content of vitamin C in milk drinks are keeping temperature and keeping time. The best storage temperature is 6 °C and time - 2 days. The study of kvass showed that vitamin C content during fermentation reduces the double, so it is appropriate to drink enriched with vitamin C after fermentation. It is recommended to drink vitamin C added so that people have a glass (about 200 ml) to obtain the required daily intake, which is: for children - 50 mg / day, and adults - about 80 to 90 mg / day. The pasteurization affecting of vitamin C loss, and it is recommended pasteurization process to change to a sterile filtration.

Keywords: fortification, milk drinks, kvass, vitamin C.

1. INTRODUCTION

Interest in micronutrient malnutrition has increased greatly over the last few years. The public health implications of micronutrient malnutrition are potentially huge, and are especially significant when it comes to designing strategies for the prevention and control of diseases such as HIV/AIDS, malaria and tuberculosis, and diet-related chronic diseases [1].
The reason for the increased attention to the problem of micronutrient malnutrition is that it is not uniquely the concern of poor countries. The increased consumption in industrialized countries (and increasingly in those in social and economic transition) of highly-processed energy-dense but micronutrient-poor foods, is likely to adversely affect micronutrient intake and status. With so much accumulated experience, the conditions under which food fortification can be recommended as a strategic option for controlling micronutrient malnutrition are now better understood. The success of a fortification programme can be measured through its public health impact and its sustainability.
Vitamin C is a redox system comprised of ascorbic acid and dehydroascorbic acid, and as such acts as an electron donor. Its main metabolic function is the maintenance of collagen formation. It is also an important antioxidant.
Severe vitamin C deficiency still occurs periodically in displaced populations maintained for long periods of time (i.e. 3–6

months) on food aid and without access to fresh fruit and vegetables [2]. Outbreaks have been repeatedly reported from refugee camps in the Horn of Africa (i.e. Ethiopia, Kenya, Somalia, Sudan) and Nepal.

The prevalence of mild vitamin C deficiency worldwide is probably fairly high. Hampl [3] maintain that, in the United States have indicated that the prevalence of marginal vitamin C deficiency (defined as less than 0.3mg ascorbic acid per 100 ml serum) is about 9% in women and 13% in men. The clinical symptoms of scurvy include follicular hyperkeratosis, hemorrhagic manifestations, swollen joints, swollen bleeding gums and peripheral edema, and even death. These symptoms appear within 3–4 months of consuming diets with a very low vitamin C content (<2mg per day). From the other side, vitamin C increases the absorption of non-haem iron from foods, so a low intake of vitamin C will exacerbate any iron deficiency problems, especially in individuals who consume only small amounts of meat, fish or poultry. The addition of vitamin C to ironfortified foods greatly improves the absorption of the iron.

Ascorbic acid and ascorbyl palmitate are often added to oils, fats, soft drinks and various other foods as a way of improving the stability of other added micronutrients (e.g. vitamin A) or as an iron absorption enhancer. However, ascorbic acid is itself relatively unstable in the presence of oxygen, metals, humidity and/or high temperatures. To retain vitamin C integrity (especially during storage), foods must therefore be appropriately packaged, or the ascorbic acid encapsulated.

The addition of vitamin C to commercially processed foods such as dry milk, infant formulas, cereal-based complementary foods, chocolate drink powders and beverages has been found to be successful in increasing intakes of this nutrient. As sugar helps to protect the ascorbic acid in soft drinks, sugar has been proposed as a possible vehicle for the vitamin.

The kvass is one of the best nonalcoholic beverages. It is inferior to none in the respect of taste and alimentary properties. It was invented more than 1000 years ago. Nowadays it has also a well-deserved popularity.

Kvass, which is made of rye or barley malt, has not only high taste properties, but it invigorates and improves metabolism. In its health effect it is similar to kefir, sour clotted milk, koumiss and acidophilus milk. Kvass as the product of lactic fermentation regulates work of gastrointestinal tract, prevents from reproduction of pathogenic bacteria, it tonics, improves metabolism and work of cardiovascular system. These healing properties of kvass can be explained by the availability of lactic acid, vitamins, free amino acids, sugar and diverse trace elements.

At kvass is made of rye malt, what set conditions for the rich chemical composition of this product. Rye has many healthy substances. So, there is 80 g calcium, 340 g phosphorus, 13 g Fe, 1,8 g copper, 8g manganese, 5 g molybdenum, 3,5 g zinc, 11 g cobalt in 100 g rye corn. Those elements act an important part in metabolic control and their intake into the organism is quite desirable. Along with the trace substances more than 10 amino acids goes into the organism, and 8 of them are essential. In consideration of it importance of traditional malt beverage becomes more influential. The number of vitamins in the kvass is not very large, but their regular intake into the organism has a positive effect. There are such vitamins as B1 (0,2 mg), carotin (0,2 mg), pyridoxine (0,2 mg), riboflavin (0,2 mg), vitamin PP (1,2 mg), H and E in 100 g of the rye. There are proteins (2 g), carbohydrates (50 g), organic acids (3 g) and above-listed vitamins in 1 l of the kvass.

It affirms again the great importance of kvass as an everyday beverage, which is made of the natural products. The cooking of kvass on the old recipes is a quite complicated, tedious and long procedure. The steep of the grain, it's sprouting, steaming, drying, grinding and worth preparation last more than 70 days. But nowadays kvass concentrate or powdered malt can be bought, and the kvass can be made of it. The kvass is worth consuming as often as possible [4].

There are some results that vitamin C was stable only in orange juice at the original pH values. Under pH=4, beer was also a good matrix for vitamin C addition, but only at low storage temperature (4oC). Vitamin E addition increased the stability of ascorbic acid ($p<0.05$) even at room temperature. [5]
Kvass chemical composition is very similar to beer.
The aim of our work was to evaluate the influence of technological parameters on vitamin C content and stability in milk drinks and in kvass.

2. MATERIALS AND METHODS

The raw milk mixtures of 3,5 fat and multivitamin or orange juices were %used for the production of milk drinks. The juices were chose the source of vitamin C, because the sensory characteristics of the drinks were better than fortified with pure vitamin C.
The milk drinks were prepared in two ways: 1) the milk mixtures were pasteurized at 75 °C, 85 °C, 90 °C temperatures during 2-3 s. After pasteurization the mixtures were cooled to 20 °C and fortified with juices (30 % of milk), 2) prepared milk mixtures were fortified with vitamin C and then pasteurized. All prepared milk drinks were storage at 6 °C, 18 °C and 22 °C temperatures from 1 to 7 days.
For the production of kvass we used the stale dark rye bread, water, active dry yeast and sugar. From the bread, water and sugar was produced extract. The fermentation was 24 hours at the 20 °C temperature. The kvass samples were storage at 6 °C.
It was also carried out a series of samples, when kvass before fermentation was enriched with vitamin C: 1 sample - control sample; Sample 2 – 454,55 mg/L vitamin C, Sample 3 – 681,82 mg/L, Sample 4 – 909,09 mg/L, 5 sample – 681,82 mg/L. Vitamin C was added to the pasteurized fermented drinks.
The vitamin C content of the samples were measured by 2.6 - Dichloroindophenol Titrimetric method [6].

3. RESULTS

The effect of pasteurization temperature on the vitamin content of the samples is shown in Figure 1.

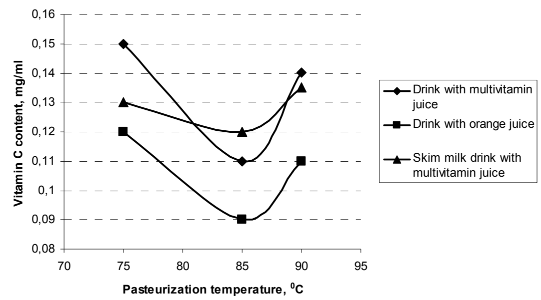

Fig.1. The influence of pasteurization temperature on the vitamin C content of drinks.

The results indicated vitamin C content significant decrease was largest (20 %) of samples with multivitamin juice at 85 °C pasteurization temperature. The samples with orange juice hadn`t significant changes of vitamin content.
The effect of storage temperature on the vitamin content of milk drinks is shown in Figure 2 and 3. According to our results, the most stable content of vitamin was at 6 °C temperature compare with content at 22 °C temperature. The differences may be explained by the chemical changes during storage at this temperature. However, more investigations are necessary to prove this hypothesis.
According to our results on Fig.1 and 2, the temperature showed a smaller influence to skim milk drinks compare to normalized milk drinks. It can be assumed that milk fat has low heat conductivity and protect vitamin C.

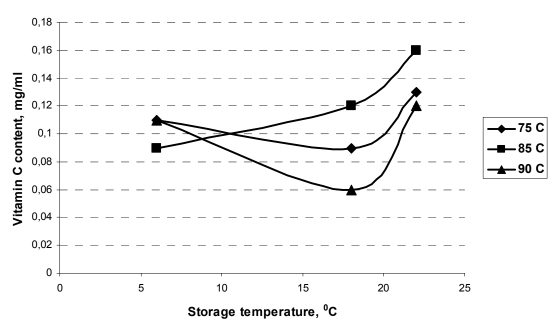

Fig.2. The influence of storage temperature on the content of vitamin C of skim milk drinks.

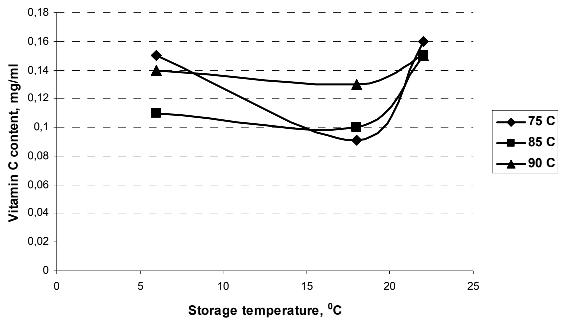

Fig.3. The influence of storage temperature on the content of vitamin C of milk drinks.

The experiments conducted with storage duration showed (Fig. 4, 5, 6) that vitamin C content decreased from 36 % to 27 % in skim milk drinks and from 175 % to 50 % in normalized milk drinks with multivitamin juice when they were kept from 1 to 7 days. The same tendency was observed in milk drinks with orange juice - from 81 % to 77 % of vitamin C losses. These results agree with the indicates obtain by Chávez-Servín et. all [7].

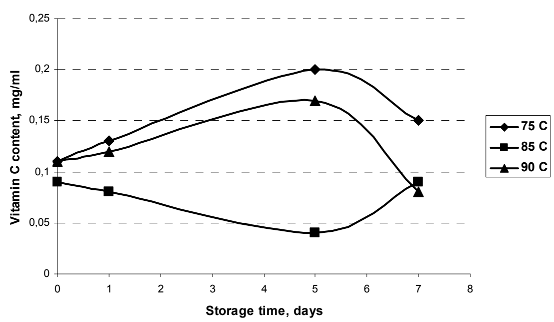

Fig.4. The influence of storage time on the content of vitamin C of skim milk drinks.

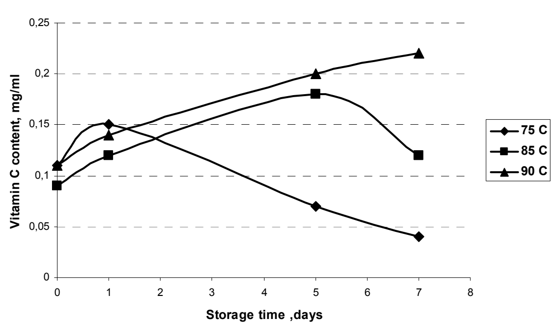

Fig.5. The influence of storage time on the content of vitamin C of milk drinks with multivitamin juice.

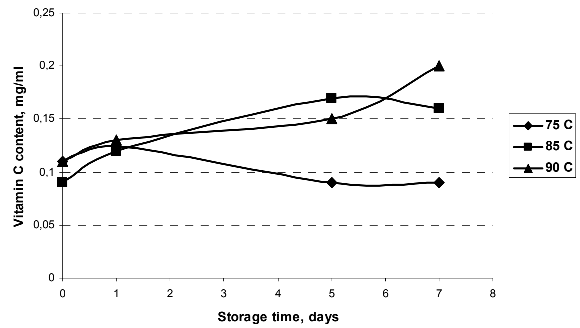

Fig.6. The influence of storage time on the content of vitamin C of milk drinks with orange juice.

It was study the stability of vitamin C in the kvass during the fermentation and storage. During the kvass fermentation process vitamin C content decreased. This is shown in Figure 7.

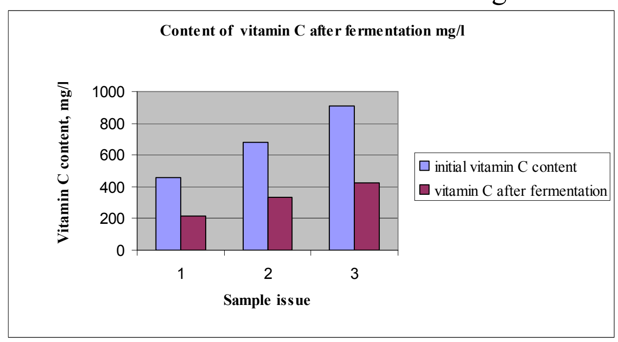

Fig.7. Changes in vitamin C content during fermentation.

Vitamin C content changes during storage are shown in Figure 8.

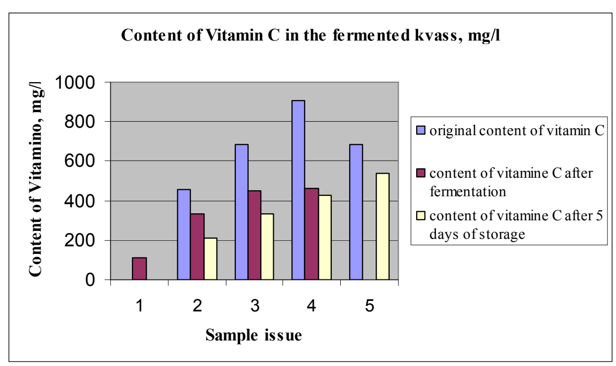

Fig. 8. Vitamin C content changes during storage

Vitamin C content changes during longer storage are shown in Figure 9.

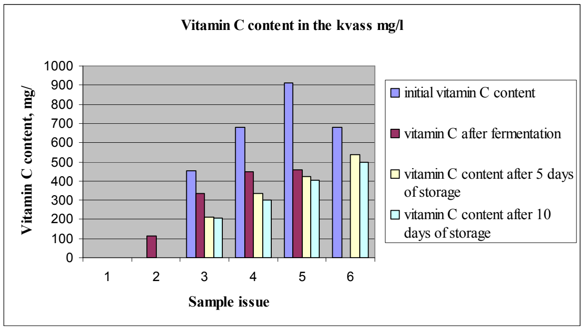

Fig. 9. Vitamin C content changes during longer storage

Our results showed that vitamin C content during storage decreased further, but less than during the first five days.
Kvass with added vitamin C was a pleasant sour taste, certainly had some influence, is that vitamin C is acetylsalicylic acid.

4. CONCLUSIONS

The main factor for controlling content of vitamin C in milk drinks is pasteurization temperature. The biggest losses of vitamin C obtain during 85 °C pasteurization temperature. The best milk drinks storage temperature was determined 6 °C and duration - 2 days.
Kvass with Vitamin C is the pleasant taste (soft acid).
The study of kvass showed that vitamin C content during fermentation reduces the double, so it is appropriate to drink enriched with vitamin C after fermentation.
The pasteurization temperature affected of vitamin C loss in this case recommended instead of pasteurization to use the sterile filtration.
It is recommended to drink the kvass fortified with vitamin C that people have a glass (about 200 ml) to obtain the required daily intake, which is: for children - 50 mg/day, and adults - about 80 to 90 mg/day.

5. REFERENCES

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