

Low Calorie Soy Milk Product Fortified with Beta-Carotene

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Abstract

The purposes of the study on low calorie soy milk product fortified with beta-carotene were 1) to study the suitable content of carrot, which was one source of beta-carotene, and sugar 2) to study the physical and chemical quality of the product 3) to study shelf- life of the product and 4) to investigate the product acceptance. Standard soy milk formula was studied and fortified with 3 levels of carrot and reduced 4 levels of sugar content. The 3x4 factorial Design was used to experiment and 9-points hedonic scale was used for sensory evaluation from 30 panelists.

The results were found as follows:

1. For the content of carrot and sugar, the panelists had the acceptance of carrot with 2000 gram and 65% of sugar reduction. The use of carrot and sugar had significant ($p < 0.05$) effects on over all liking and milk's taste.

2. For the physical quality, it was found that L^* value was 6.50, a^* value was 20.13, b^* value was 10.44, viscosity was 27.80 centipoint, total soluble solid was 11.33 ± 0.01 degree Brix and ph was 6.55. For the chemical quality, 100 gram of soy milk fortified with beta-carotene contained 37.45 kcal energy, 2.48 g protein, 0.01 g fat, 6.86 g carbohydrate and 3.18 ml beta- carotene.

3. For shelf-life study, it was found that the product did not change when kept in the temperature of 7 degree Celsius for 0-10 days except for 11-14 days. Total bacteria count was 4.8×10^3 CFU/cm³ when compared to Thai Community Product Standard (529/2547), it should be found lower than 1×10^4 colony/ 1 cm³. It was evidently found that low calorie soy milk fortified with beta-carotene was safety for consumer when kept for 14 days.

4. For the product acceptance, it was found that 93% of the consumer satisfied the product price of 10 baht per 200 ml consumption.

Key words: Soy Milk, Beta-Carotene, Low Calorie

Introduction

Research Problems

Soy milk or soybean milk is a healthy and popular beverage which is high in protein, linoleic acid, phospholipids acid in lecithin which helps increasing HDL cholesterol, phytoestrogen which is estrogen hormone-like chemicals naturally found in plants especially in soy bean and it is naturally lactose free but it contains sucrose sugar which is another alternative for people who are allergic to cow's milk or have diarrhea. Therefore, soy milk is suitable to be a food supplementary because of its cheap price. Carrot is a source of beta-carotene which is a precursor of vitamin A and antioxidant compounds which prevent oxidation reactions, degenerative eye diseases maintain skin health and reduce heart diseases and coronary risk. Nowadays, beta-carotene substances synthesized with chemical processes, bacteria, fungi, yeast and algae increases cancer risk. Carrot juice is another beverage which is risk of bacteria contamination. Also, sugar-sweetened beverage is a risk of being overweight and high energy.

Research Objectives

1. To study the suitable content of carrot and sugar in low calorie soy milk product fortified with beta-carotene.
2. To study the physical and chemical quality of low calorie soy milk product fortified with beta-carotene.
3. To study shelf- life of the product
4. To investigate the product acceptance.

Methodology

1. Study 3 of original formulae of soy milk and evaluate sensory testing by 9-points hedonic scale with 30 panelists, who are expert in the art of food and drink, from Food and Nutrition Department and Food Science and Nutrition Department, Faculty of Home Economics technology, Rajamangala University of Technology Phra Nakhon. Carrot supplement and sugar reduction were added in the acceptable original formula in order to increase beta-carotene and reduce energy in soy milk.

2. Study carrot supplement and sugar reduction in soy milk to increase beta-carotene and reduce energy by adding 3 levels of carrot content; 1200, 1600, and 2000 gram of standard formula and adding 4 levels of sugar content; 65%, 75%, 85%, and 95%. 3x4 factorial Design was used to experiment

3. Study the product quality

3.1 Study the physical quality of soy milk for 3 formula in the following aspects;

- 3.1.1 Measurement of color quality
- 3.1.2 Measurement of viscosity value
- 3.1.3 Measurement of the soluble solids
- 3.1.4 Measurement of ph value

3.2 Study the nutritive value of low calorie soy milk fortified with beta-carotene in the following aspects;

- 3.2.1 Energy content analysis
- 3.2.2 Protein content analysis
- 3.2.3 Carbohydrate content analysis
- 3.2.4 Fat content analysis
- 3.2.5 Beta- carotene content analysis

4. Study shelf-life of the product which was kept in the temperature of 7 degree Celsius and bacteria counts after stored for 2, 4, 6, 8, 9, 10, 11, 12, 13, 14 days to study the change in total bacteria counts

5. Study the product acceptance from the consumers by using 100 of questionnaires dividing into 4 parts of general information, behavior and attitude information, nutrition information and product acceptance information. Data were analyzed by frequency and percentage.

6. Data analysis was done by ANOVA and compare means of 3 formulae of product by Duncan's new multiple range test (DMRT) and statistical significance level set at 0.05

Results of the Study

1. The acceptable formula of soy milk was from Thailand Institute of Scientific and Technological Research. The sensory evaluation of the panelist for overall liking, color, smell, taste and texture was 7.40, 7.70, 7.17, 6.87 and 7.27 respectively. The product ingredients were 500 gram of hulled soybean (8.33%), 5000 gram of water (83.34%) and 500 gram of sugar (8.33%)

2. For the study of carrot supplement and sugar reduction in soy milk to increase beta-carotene and reduce energy, it was found that the panelists had the acceptance of carrot with 2000 gram and 65% of sugar reduction. The sensory evaluation for the overall liking, taste and texture was 8.10, 8.10 and 7.60 respectively. The product ingredients were 500 gram of hulled soybean (6.51%), 5000 gram of water (65.15%), 2000 gram of carrot (26.06%) and 175 gram of sugar (2.28%).

3. The study of product quality

3.1 The study of physical quality

3.1.1 For the physical quality, it was found that L* value was 17.55, a* value was 13.38, b* was 29.79, viscosity value was 17.33 centipoise, total soluble solid was 14.83 degree Brix and pH was 6.77.

3.1.2 For the study of carrot supplement and sugar reduction in soy milk to increase beta-carotene and reduce energy, it was found that the panelists had the acceptance of carrot with 2000 gram and 65% of sugar reduction. L* value was 6.50, a* value was 20.13, b* was 11.33 and pH was 6.55

3.2 From the study the nutritive value of low calorie soy milk fortified with beta-carotene, it was found that the panelist had the acceptance of ingredients consisting of 500 gram of hulled soybean, 5000 gram of water, 2000 gram of carrot and 175 gram of sugar. Nutritive value was composed of 37.45 kcal of energy, 90.28 gram of moisture, 2.48 gram of protein, 0.01 gram of fat, 6.86 gram of carbohydrate, 0.37 gram of ash and 3.18 milligram of beta-carotene.

4. For the study shelf-life of the product kept in the temperature of 7 degree Celsius and stored for 0-10 days, it was found that the product did not change except for 11-14 days. Total bacteria count was 4.8×10^3 CFU/cm³ when compared to Thai Community Product Standard (529/2547), it should be found lower than 1×10^4 colony/ 1 cm.³ It was evidently found that low calorie soy milk fortified with beta-carotene was safety for consumer when kept for 14 days.

5. For the product acceptance from 100 of consumers, it was found that most of the consumers were knowledgeable in nutrition, the consumer had the acceptance on the low calorie product fortified with beta-carotene, the overall liking was at the medium level and the consumer satisfied the product price of 10 baht per 200 ml consumption.

Results and Discussion

Low calorie soy milk fortified with beta-carotene product not only reduced sugar of 65% but also lowered the fat and energy. However, it affects beta-carotene digestion. Therefore, this product should be a food supplementary. When kept for days, it is precipitated. For industry production, hydrochloride may be used to prevent the precipitation or stick with "Shake before drinking" on label package.

Recommendation

1. Soy milk fortified with beta-carotene product in this study contains lower fat and serves low energy when compared to standard one, so it affects beta-carotene digestion. Therefore, this product should be a food supplementary.

2. When soy milk fortified with beta-carotene product is kept for days, it is precipitated and uninteresting. For the further study, suspendible composition should be used to prevent the precipitation of soybean fortified with beta-carotene.

Reference

- กองโภชนาการ. 2544. **ตารางแสดงคุณค่าทางโภชนาการของอาหารไทย**. กระทรวงสาธารณสุข, นนทบุรี.
- _____. 2546. **ปริมาณสารอาหารอ้างอิงที่ควรได้รับประจำวัน สำหรับคนไทย พ.ศ. 2546**. กระทรวงสาธารณสุข, นนทบุรี.
- คมสัน หุตะแพทย์ และวารีย์ ยินดีชาติ. 2542. **ถั่วเหลืองพืชมหัศจรรย์สารพัดประโยชน์**. สำนักพิมพ์เกษตรธรรมชาติ, กรุงเทพฯ.
- ณรงค์ นิยมวิทย์. 2526. **วิทยาศาสตร์การประกอบอาหาร**. ภาควิชาคหกรรมศาสตร์ คณะเกษตร มหาวิทยาลัยเกษตรศาสตร์, กรุงเทพฯ.
- ธีระ เอกสมทรงเมษฐ์. 2545. **ถั่วเหลือง (Soybean : Glycine max)**. มหาวิทยาลัยสงขลานครินทร์, สงขลา.
- Anderson, J.J. Band S. C. and Garner. 2000. **The Soybean as a source of bioactive molecules**, pp. 239-270. In M.K. Schmidl and T.p.Labuza, eds. **Essentials of Function Foods**.
- Ediriweera, N.D. 1996. **Affect of calcium salt in minising beany flavor in Soymilk. In the processing of the second internationnal soybean processing and utilization Kasetsart Univervsity**. Bangkok, 166-170.
- Liu, K. 1997. **Soybean : chemistry, technology and utilization**. champmam & hall, newyork.
- Lu, A. 2002. **Soya Beverage : An All-in-one package**. **Food and Beverage**. Asia. 16-20.
- Omenn, GS., Goodman GE., and MD., Thornquist. 1996. **Effects of combination of beta – carotene and vitamin A on lung cancer and cardiovascular disease**. N Engl J Med ; 334 : 1150-5.
- Macrac, R.R.K. Robinson and M.J. Sadler. 1993. **Encyclopedia of Food Science Food Technology and Nutrition**. Academic Press Inc., New York.
- Riaz, M.N. 1999. **Soybean as functional foods**. **Cereal foods world**.44 (2): 88-92.rich lipoprotein fraction of men. **Am J Clin Nutr**. 1998 Jul; 68(1): 82-9.
- Snyder, H.E. and T.W., Kwon. 1987. **Soybean Utilization**. AVI Publishing, New York

Sungpuag P., S. Tangchitpianvit., U. Chittchang, and E. Wasantwisut. 1999. Retinol and beta carotene content of indigenous raw and home – prepared food in Northeast Thailand. Food Chem 1999; 64: 163-7.

Tan teeratan, K., Al. Nalson and L.S. Wei. 1997. Processing of soymilk Free from Bean and other off-Flavors. Proceedings world soybean research Canterence V, Thailand.