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ВЛИЯНИЕ КАРДАМОНА, КОРИЦЫ И ИМБИРЯ НА СОХРАНЕНИЕ КАЧЕСТВА СЛИВОЧНОГО МАСЛА

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Аннотация: Прогорклость - одно из основных проявлений ухудшения качества несоленого сливочного масла. В этом исследовании оценивалось влияние кардамона, корицы и имбиря в качестве антиоксидантов и противомикробных агентов на прогорклость масла при разной дозировке. К несоленому маслу добавляли коммерчески доступные 0,15%, 0,20 и 0,25% концентрированного кардамона, 0,05%, 0,10% и 0,15% концентрированной корицы, 0,10%, 0,15% и 0,20% концентрированных имбирных эссенций. Обработанные и контрольные образцы свежего масла хранили при 40°C. Число свободных жирных кислот (FFAV), пероксидное число (PV) и количество липолитических бактерий (LBC) в обработанных и контрольных образцах масла исследовали на 7, 21 и 35 дни. Все обработки с различными уровнями оказывают значительное влияние ($P < 0,05$) на FFAV, PV и LBC сливочного масла, поэтому существует меньшая восприимчивость к прогорклости. В масле, обработанном эссенцией кардамона, наибольшее снижение FFAV, PV и LBC наблюдалось при уровне концентрации 0,25%, в то время как наименьшее снижение FFAV, PV и LBC наблюдалось при уровне концентрации 0,15%. В масле, обработанном эссенцией корицы, наибольшее снижение FFAV, PV и LBC наблюдалось при уровне концентрации 0,15%, а наименьшее снижение FFAV, PV и LBC наблюдалось при уровне концентрации 0,05%. В масле, обработанном имбирной эссенцией, наибольшее снижение FFAV, PV и LBC

наблюдалось при уровне концентрации 0,20%, в то время как наименьшее снижение FFAV и LBC наблюдалось при уровне концентрации 0,10%, а наименьшее снижение PV наблюдалось при уровне концентрации 0,15% и 0,10% уровней концентрации. Состав масла существенно не изменился ($P > 0,05$) с обработанными эссенциями специй. Можно сделать вывод, что добавление эссенции специй может устранить прогорклость несоленого масла.

Ключевые слова: Сливочное масло, Прогорклость, Специи, Число свободных жирных кислот, Перекисное число, количество липолитических бактерий.

IMPACT OF CARDAMOM, CINNAMON AND GINGER ON KEEPING QUALITY OF BUTTER

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Abstract: Rancidity is one of the major quality deterioration which occurs in unsalted butter. In this study the effects of cardamom, cinnamon and ginger as antioxidants and antimicrobial agents on the rancidity of butter under different strengths were evaluated. Commercially available 0.15%, 0.20% and 0.25% concentrated cardamom, 0.05%, 0.10% and 0.15% concentrated cinnamon, 0.10%, 0.15% and 0.20% concentrated ginger essences were added to unsalted butter. The treated and control fresh butter samples were stored at 4^o C. Free fatty acid value (FFAV), Peroxide value (PV) and Lipolytic bacteria count (LBC) of the treated and control butter samples were examined on the 7th, 21st and 35th days. All treatments with the various levels have a significant effect ($P < 0.05$) on the FFAV, PV and LBC of the butter, therefore there is less susceptibility for rancidity. The butter treated with cardamom essence, the highest reduction of FFAV, PV and LBC were observed at 0.25% concentration level while the lowest reduction of FFAV, PV and LBC observed at 0.15% concentration level. The butter treated with cinnamon essence, the highest reduction of FFAV, PV and LBC were observed at 0.15% concentration level while the lowest reduction of FFAV, PV and LBC observed at 0.05% concentration level. The butter treated with ginger essence, the highest reduction of FFAV, PV and LBC were observed at 0.20% concentration level while the lowest reduction of FFAV

and LBC observed at 0.10% concentration level and the lowest reduction of PV was observed at 0.15% and 0.10% concentration levels. Proximate compositions of the butter were not significantly changed ($P > 0.05$) with the treated spices essences. It can be concluded that addition of spices essence can eliminate the rancidity of unsalted butter.

Keywords: Butter, Rancidity, Spices, Free fatty acid value, Peroxide value, Lipolytic bacteria count.

Introduction

A wide variety of products are manufactured by processing raw milk into dairy products. Among them, butter is one of the primarily fat sources and an important source of dietary energy. Butter contains 80% milk fat and can be salted or unsalted. Besides fats, butter contains small percentages of proteins, vitamins, sugar and water [5] (Idoui et al, 2010). Butter fats are combination of saturated fats and unsaturated fats. Saturated fatty acids are very stable. Unsaturated fatty acids have the most reactive sites on the fatty acid chain and are easily attacked by oxygen, hydrogen, and enzymes [3] (Hamilton, 1989).

According to fat content and fat composition of butter, it can be quickly spoils due to the development of rancidity. Rancidity is the development of any off flavors, odors, colors and textures due to decomposition of butter fat. There are four types of rancidities occurring in butter, namely, hydrolytic, microbial, oxidative and odors absorbed rancidities [11] (Rady and Badr, 2003). In hydrolytic rancidity, water hydrolyzes the ester bonds in triglycerides. Microorganisms use their enzymes such as lipases and proteases to break down fat in microbial rancidity. As a result of oxidative rancidity, the unsaturated fatty acids readily undergo oxidation [9] (Pamela and Richard, 1994). Rancidity reduces the keeping quality of the product [8] (Namki, 1990) and it creates toxic compounds such as peroxidised fatty acids, polymeric material, oxidized sterols and creates health problems such as digestive distress, depletes the vitamins, heart disease, foster cancer development etc Therefore, it is very essential to eliminate the rancidity development in butter.

Microbial and oxidative rancidity can be effectively control by adding antioxidant and antimicrobial substance (give the reference). Antioxidants are often added to fat-containing foods to delay the onset or slow the development of rancidity due to oxidation [4] (Helmut, 1997). The addition of antimicrobial agents can also delay or prevent rancidification by inhibiting the growth of bacteria or other micro-

organisms [6] (Leistner, 1992). Most of the spices have significant antioxidative effects [12] (Suhaj, 2006) and antimicrobial effects [15] (Zaika, 1988).

This study was carried out to investigate effect of antimicrobial and anti-oxidative activities of cardamom (*Elettaria cardamomum*), cinnamon (*Cinnamomum zeylanicum*) and ginger (*Zingiber officinale*) on rancidity of unsalted butter. Cardamom, cinnamon and ginger are the few spices that contain antioxidants and antimicrobial agents and they are commonly available in market as essences.

Literature review

A wide variety of products are manufactured by processing raw milk into various dairy products. Among them, butter is one of the creamer dairy products which is manufactured by using milk fat. Butter has more than 80% milk fat and made by churning fresh or fermented cream. It has been produced since ancient times and was an internationally traded commodity as early as the 14th century [11, 14] (Varnam and Sutherland, 1994, Rady and Badr, 2003). Butter is a water-in-oil emulsion that results from an inversion of the cream, an oil-in-water emulsion. It is widely used as a seasoning in cooking, suggesting that it plays an important role in the formation of flavors during heating and it is may be salted or unsalted [10] (Peterson and Reineccius, 2003).

Considering quality defects, butter spoilage is most often due to the development of chemical rancidity, microbiological problems do also occur in the form of cheesy, putrid or fruity odors and the rancid flavor produced by hydrolysis [11] (Rady and Badr, 2003). Rancidity is the chemical decomposition of fats, oils and other lipids. Rancidity affects undesirable odors and flavors in food [9] (Pamela and Richard, 1994). Three pathways for rancidification are recognized, those are; Hydrolytic rancidity, Microbial rancidity, and Oxidative rancidity.

The rancidity of food is a great concern in the shelf life of foods. Lipid oxidation decreases food safety and nutritional quality by formation of potentially toxic products and secondary oxidation products during cooking or processing [7] (Malliard *et al.*, 1996). Rancid foods form harmful free radicals in the body, which are known to cause cellular damage and have been associated with diabetes, digestive distress and deplete the body of vitamins B and E. Rancid food can also cause damage to DNA, accelerate aging, promote tissue degeneration and foster cancer development. Free radicals produced by rancid food can cause damage to arteries as well act as carcinogens, substances that can cause cancer. Eating rancid food will expose to accelerate aging, raised cholesterol levels, obesity and weight gain.

Antioxidants are often added to fat-containing foods to delay the onset or slow the development of rancidity due to oxidation [4] (Helmut, 1997). Rancidification can also be decreased, but not completely eliminated, by storing fats and oils in a cool, dark place with little exposure to oxygen or free radicals. The addition, antimicrobial agents can also delay or prevent rancidity by inhibiting the growth of bacteria or other micro-organisms [6] (Leistner, 1992). Consumer awareness and concern that synthetic chemical additives may have some toxic or even carcinogenic effects, has increased the demand for high-quality, minimally processed foods with extended shelf-life, preferably free from or with a reduced level of added chemical antimicrobial agents [16] (Zink, 1997). Therefore, there is growing interest in using natural antimicrobial compounds, including extracts of herbs and spices, as preservatives for food [13] (Smid and Gorris, 1999). Spices can have significant anti-oxidative effects [12] (Suhaj, 2006). Spices contain products of secondary metabolism such as phenolics, phenolic acids, quinones, flavonoids, tannins. Many of these phytochemicals are rich sources of antioxidants [2] (Deans & Ritchie, 1987).

Materials and Methods

Study was carried out at Pelwatte dairy industries (Pvt) limited in Sri Lanka by using unsalted butter and commercially available 1.25% strengthens cardamom (*Elettaria cardamomum*), cinnamon (*Cinnamomum zeylanicum*) and ginger (*Zingiber officinale*) essences. Control and three treatments and three levels of each treatment were prepared by using unsalted butter and commercially available spices essences. Three replicates were prepared for each level. Commercially available 0.15%, 0.20% and 0.25% concentrated cardamom, 0.05%, 0.10% and 0.15% concentrated cinnamon, 0.10%, 0.15% and 0.20% concentrated ginger essences were added to unsalted butter. The treated and control fresh butter samples were stored at 4 0C.

Physiochemical analysis

Free fatty acid value (FFAV) and Peroxide value (PV) of the treated and control butter samples were examined on the end of the 1st, 3rd and 5th weeks. Proximate compositions (moisture content, fat content, crude protein content, ash content and Iodine value) of the treated and control butter samples were examined at the 1st week. Moisture content was measured by using Halogen moisture analyzer (JT-K series). Fat content was determined by using Gerber method. Protein content was determined by using kjeldahl method. Ash content was determined by using muffle furnace. Iodine value was determined by iodometric titration (AOAC,

1995) method. Free fatty acid value was determined by using method described AOAC (2000). Peroxide values of samples were determined by iodometric titration (AOAC, 1995) method.

Microbiological analysis

Lipolytic bacteria count (LBC) of the treated and control butter samples were examined on the end of the 1st, 3rd and 5th weeks. Lipolytic bacteria count was estimated by using method described Idoui et al. (2010). Coliform count was estimated by using violet red bile agar test and Yeast and Mould was estimated by using potato dextrose agar test. Liquid phase of the butter samples were separated as described by Idoui and karam (2008) for coliform bacteria count, yeast and mould count.

Sensory evaluation procedure

Sensory evaluation was conduct by using questioner and tasting panel with 20 members at Pelwatte dairy industries Ltd. It was checked for appearance, color, odor, taste, texture and overall acceptability.

Statistical analysis procedure of data

Statistical analysis was conducted using ANOVA (significant level 0.05) SAS 9.0 (2002) software and Tukey mean separation procedure. Sensory evaluation data were analyzed using non-parametric Kruskal-Wallis Test of Minitab computer analysis program.

Results and discussion

All the spice essences treated butter samples have a significant effect with control for FFAV, PV and LBC of the butter. Results indicate that the probability value (P) of FFAV, PV and LBC is lower than the significant level ($P < 0.05$), thereby less susceptibility for rancidity.

Figure 01. Effect of cardamom essence on FFA value of butter

The butter treated with cardamom essence, the highest reduction of FFAV (figure 01), PV and LBC were observed at 0.25% concentration level while the lowest reduction of FFAV, PV and LBC observed at 0.15% concentration level.

The butter treated with cinnamon essence, the highest reduction of FFAV, PV (figure02) and LBC were observed at 0.15% concentration level while the lowest reduction of FFAV, PV and LBC observed at 0.05% concentration level.

Figure 02: Effects of cinnamon essence on PA value of butter

The butter treated with ginger essence, the highest reduction of FFAV, PV and LBC (figure3) were observed at 0.20% concentration level while the lowest reduction

of FFAV and LBC observed at 0.10% concentration level and the lowest reduction of PV was observed at 0.15% and 0.10% concentration levels.

Figure 03. Effects of ginger essence on LBC of butter

All treatments with the various levels have a significant effect with control for yeast and mould count of the butter. Results indicate that the probability value (P) of yeast and mould count is lower than the significant level ($P < 0.05$). As an example figure 04 shows the effect of cinnamon on yeast and mould count. Results indicate that the probability value (P) of yeast and mould count is lower than the significant level ($P < 0.05$). Proximate compositions of the butter were not significantly changed ($P > 0.05$) with the treated spices essences.

Figure 04. Effect of cinnamon essence yeast and mould count of butter

According to sensory evaluation (figure 05) all the spices treated butter showed significant ($P < 0.05$) effect on overall acceptability with control. All the spices treated butter showed lower rank than control. It's indicates butter treated with spices

change overall acceptability of the butter. The butter without treated essences shows highest rank for overall acceptability while the butter treated with 0.25% cardamom essence (0.25g cardamom / 100g of butter) showed lowest average rank overall acceptability.

Figure 05. Change of sensory characters of butter with spices essence

It can be concluded that addition of commercially available cardamom, cinnamon and ginger spices essence can eliminate the rancidity of unsalted butter. Further studies should be carried out for investigating the individual chemical compounds of each spice that are responsible for acting as an antimicrobial and anti-oxidative.

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