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Improving the chemical properties of Monterey cheese by Debaryomyces hansenii yeast as adjunct starter

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Abstract - *Debaryomyces hansenii yeast was grown in Malt Extract Broth medium at 30 °C for 5 days until the total count reached 5.6 x10[8] colony forming units / milliliter, Monterey cheese was made from cow's milk and adding of starter bacteria Lactococcus lactis subsp. lactis and Lactococcus lactis subsp.cremoris with D.hansenii yeast as adjunct starter in 2% for each treatment included M1 (100% starter bacteria) ,M2 (50% starter bacteria + 50% live D.hansenii) and M3 (50% starter bacteria + 50% dead D.hansenii),the ripening of Monterey cheese was done at 15°C and (85% relative humidity) for 56 days. The highest value of soluble nitrogen was 0.8 in M2 treatment after 3 days of ripening, the lowest value of soluble nitrogen (SN) was 0.24 in M1 treatment. The highest value of non-protein nitrogen was 0.33 in M2 treatment after 3 days of ripening, the lowest value of non-protein nitrogen (NPN) was 0.13 in M1treatment, The highest value of acid degree value was 0.74 in M2 treatment after 3 days of ripening, the lowest value of acid degree value (ADV) was 0.68 in M3 treatment, the highest value of Thiobarbituric Acid (TBA) was 0.81 in M1treatment after 3 days of ripening, the lowest value of TBA was 0.51in M2 treatment ,The highest value of pH was 5.16 in M2 treatment after 3 days of ripening, while the lowest value of pH was4.76 in M1 treatment.*

Research paper sited from the master thesis of the second researcher.

***Key Words*: Debaryomyces hansenii, Monterey cheese, NPN, ADV, TBA.**

1. INTRODUCTION

Debaryomyces hansenii yeast is a mesophilic yeast, the best temperature for its growth was 30° C, it had a pH range 4-6 and water activity of 0.99. It was classified as saline-tolerant for its ability to grow in salt concentration ranges from 3-5% ,as well as its ability to grow in aerobic and anaerobic conditions, but the growth in anaerobic is less than aerobic, it is heterotroph since it is free from chlorophyll. *D.hansenii* yeast had several antimicrobial properties, including nutrient competition, pH change, production of high concentrations of ethanol alcohol, destruction of bacterial toxins by yeast proteolytic enzymes and inhibition of intestinal cell binding (2).

Mehlomakulu reported (12) the *D.hansenii* had enzymatic degradation of lipids (triglyceride to diglyceride, then to free fatty acids and glycerol which is necessary to develop cheese flavor), the main factors of lipid degradation in cheese include the lipase enzyme produced from the starter bacteria (lactic acid bacteria) and the adjunct starter (*D.hansenii* yeast) to improve the flavor of cheeses , the short-chain fatty acids contribute directly to the enhancement of flavor, but fatty acids can act as raw materials to produce a wide range of other flavor compounds such as esters and methyl ketones that give distinctive flavors to the cheeses.

Debaryomyces are characterized as safe, non-pathogenic and salt tolerant properties, and can be found in low water activity such as sea water, meat, cheese, fruits and soil (16).

D.hansenii yeast was used as important eukaryotic starter for its role in food manufacturing and production. It was flavor enhancer in food products varieties for its ability to produce flavor compounds and production of lipase enzyme, which develop flavor during meat process and fermentation (13).

Cheeses are common foods in many countries because of their health benefits associated with their consumption, The health benefits of cheese include the natural, therapeutic foods properties, an anti-tumor food, shown to reduce diabetes as well as a rich source of dietary calcium, vitamins, phosphorus and high nutritional value protein as well as other ingredients (6, 15).

Monterey cheese is made from cow's milk and is one of the semi-dry American cheeses that ripened from1-6 months (4).

Monterey cheese is a concentrated food made from liquid bovine milk. It was made from pasteurized milk to kill pathogenic microorganisms and reduces the number of other microorganisms, encouraged the starter growth, which allowing the flavor development (8). The aim of this study to add *D.hansenii* yeast as adjunct starter in manufacture of Monterey cheese and studying some chemical changes include pH, proteolytic and lipolytic effects of cheese during maturation.

2. MATERIALS AND METHODS:

Monterey cheese was made from cow's milk after pasteurization at 65° C for 30 minutes and then milk was cooled to 32°C, *Lactococcus lactis* subsp *lactis* and

Lactococcus lactis subsp. *cremoris* were added, and *D.hansenii* yeast was added as adjunct starter in 2% ,for each treatment ,included M1 (100% starter bacteria), M2 (50% starter bacteria + 50% live yeast) , and M3 (50% starter bacteria and 50% dead yeast) , 0.1% of microbial rennet made from *Mucor miehei* was added ,wait until coagulation ,curd was cut and cooked at 32°C for 30 minutes, whey separated then fill the cheese in molds and salt (NaCl) added in 2% , cheese molds pressed for 24 hour, paraffin wax was heated at 118°C for 5 seconds then covered the cheese (3). Ripening was carried out at 15°C with 85% relative humidity for 56 days. Cheese pH was tested according to the method given in (5). The soluble nitrogen for all treatments was estimated according to the method given in (11).Non protein nitrogen was tested according to the method given in(10).Acid degree value was estimated according to the method given in(9).TBA was estimated according to the method given in(14).

3. RESULTS AND DISCUSSION

Chart (1) showed the pH values in Monterey cheese during ripening periods. The highest value of pH at 3 days of ripening was 5.16 for (M2) treatment, the lowest value of pH was 4.76 belong to M1 treatment.

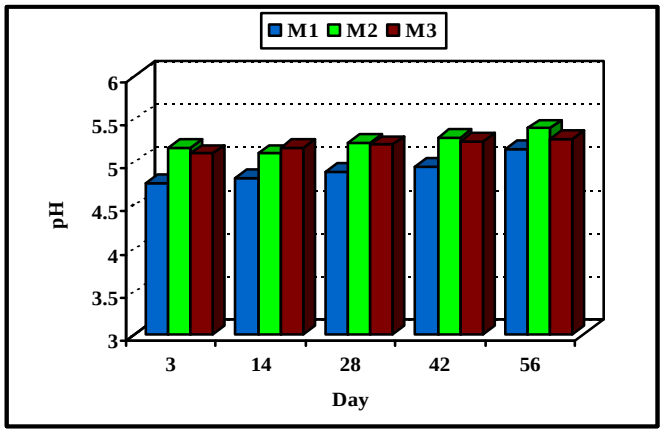

Chart -1: pH values in Monterey cheese treated with *D.hansenii* yeast

The results showed an increase in the pH values in the Monterey cheese for all treatments after 56 days of ripening period, at this period the highest value of pH was 5.39 in M2, while the lowest value of pH was 5.15 in M1 treatment. the increasing may be due to the activity of the enzymes analyzed protein produced from starters which produce base compounds that increase pH value in cheese (4).

Chart (2) showed soluble nitrogen values in Monterey cheese during ripening periods. The highest value of SN at 3 days of ripening was 0.8 for (M2) treatment, the lowest value SN was 0.24 belong to M1 treatment.

The results showed an increase in the soluble nitrogen values in the Monterey cheese for all treatments after 56 days of ripening period, at this period the highest value of SN was 1.11 in M2,while the lowest value of SN was 0.54 in M1 treatment. Increasing of SN may be due to the ability of the starters to produce enzymes analyzed protein (proteases and peptidases) produced from starters that used to acceleration of ripening (17).

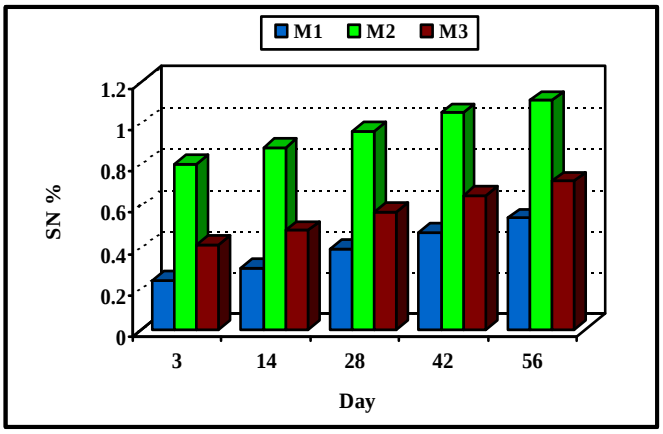

Chart -2: Soluble nitrogen values in Monterey cheese treated with *D.hansenii* yeast

Chart (3) showed non-protein nitrogen values in Monterey cheese during ripening periods. The highest value of NPN at 3 days of ripening was 0.33for (M2) treatment, the lowest value of NPN was 0.13 belong to M1 treatment.

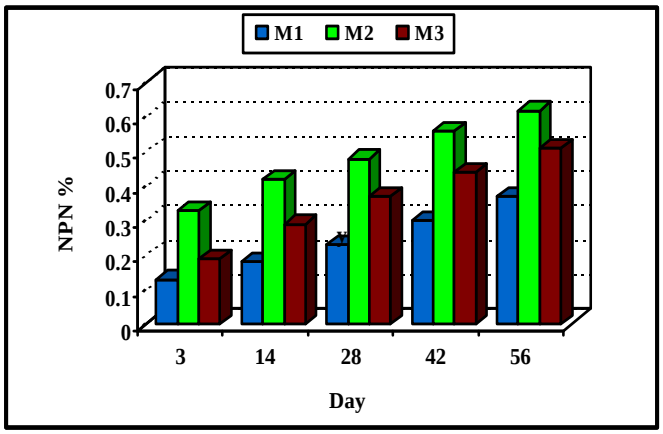

Chart -3: Non-protein nitrogen values in Monterey cheese treated with *D.hansenii* yeast

The results showed an increase in the NPN values in the Monterey cheese after 56 days of ripening period, at this period the highest value of NPN was 0.62 in M2, while the lowest value of NPN was 0.37 in M1 treatment. The increasing may be due to the activity of the enzymes which degradation of protein produced from starters which increased of NPN directly proportional with ripening periods when using microbial enzymes (18).

Chart (4) showed the acid degree values in Monterey cheese during ripening periods. The highest ADV value at 3 days of ripening was 0.74 for (M2) treatment, the lowest highest value of ADV was 0.68 belong to M3 treatment.

The results showed an increase of ADV in the Monterey cheese for all treatments after 56 days of ripening period, at this period the highest ADV value was1.65 in M2, while the lowest value was 1.27 in M3 treatment. The increasing may be due to the lipases activity which analyzed lipids produced from starters (1).

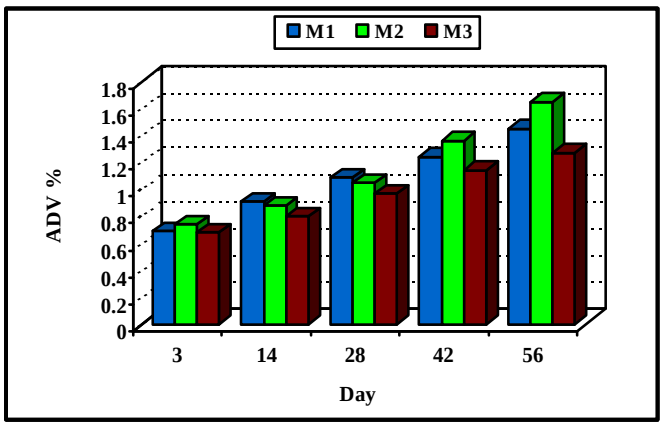

Chart -4: Acid degree value in Monterey cheese treated with *D.hansenii* yeast

Chart (5) showed Thiobarbituric Acid values in Monterey cheese during ripening periods. The highest value of TBA at 3 days of ripening was 0.81 for (M1) treatment, the lowest value of TBA was 0.51 belong to M2 treatment.

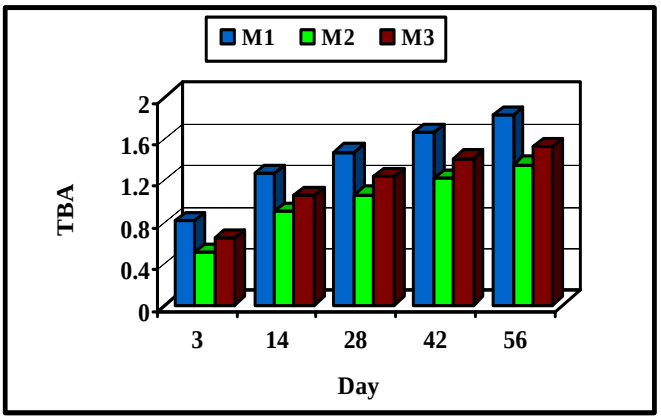

Chart -5: TBA values in Monterey cheese treated with *D.hansenii* yeast

The results showed an increase in the TBA values in the Monterey cheese after 56 days of ripening period, at this period the highest value TBA was1.83 in M1,while the lowest value of TBA was 1.35 in M2 treatment. The increasing may be due to the activity of the enzymes analyzed lipids produced from starters (7).

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