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# EFFECT OF STARTER CULTURE ON THE QUALITY AND YIELD OF KARISH CHEESE MADE FROM BUFFALO'S MILK

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## ABSTRACT

Karish cheese was made from fresh buffaloes' skim milk (0.5% fat) using a commercial starter culture DOM 1® (*Lactococcus lactis* subsp*. lactis and Lactococcus lactis* subsp*. cremoris* (1:1)) and with natural starter from good quality karish cheese. Four treatments were made by using 1 & 2% natural starter culture (YS-1 and YS-2, respectively) and with 1 & 2% of DOM 1® starter culture (DS-1 and DS-2, respectively). Yield of the resultant cheeses were calculated. Chemical, microbiological and sensory characteristics of cheeses were monitored when fresh and during 60 days of storage at 5±2°C. Gross composition of all resultant cheeses was within the Egyptian legal limits for Karish cheese. The highest cheese yield (25.4%) was obtained when 2% of DOM 1® starter culture was added (DS-2). This increase in the cheese yield of DS-2 was associated with an increase in the cheese moisture content by 2.7% compared with YS-1 and 1.1% compared with YS-2 treatments. The pH values were decreased during storage period, but both YS-1 and YS-2 treatments had lower pH-values than DS-1 and DS-2 treatments. The highest values of SN and SN/TN were observed in the DS-2 cheese treatment. This could be an indication of more proteolysis occurred when 2% of the DOM 1® starter culture was used. DS-1 and DS-2 treatments showed a reduction in the losses of TS and TN contents in the pickling solution during storage compared with YS-1 and YS-2 treatments. It was also observed that YS-1 and YS-2 treatments had higher total viable bacterial and mold & yeast counts than that in DS-1 and DS-2 treatments. On the other hand, there was a slight increase in the total sensory score of the DS-2 treatment. It can be concluded that manufacture of karish cheese by using 2% DOM 1® improved cheese yield, organoleptic properties and decreased losses of cheese components in pickling solution.

**Keywords**: Karish – starter – storage period – buffaloe's milk.

## INTRODUCTION

The emphasis on control of caloric intake, especially in developed countries, in the past 20 years has largely been responsible for the highly spread of low fat cheese market. In the past, the recommended guidelines of a number of health organizations claimed that the daily energy derived from dietary fat shouldn't exceed 30% in order to reduce the incidence of related morbidity and mortality. A link between a high consumption of dietary fat and obesity, coronary heart diseases and certain types of cancer was established (Miller and Rolls, 1996). During the last fifteen years the distribution of low fat cheese around the world has significantly accelerated because of the dietary guidelines and desire for consumption of low fat products (Mistry, 2001). As consequence, consumers' purchase of low fat cheese has increased.

One of the popular Egyptian low fat cheeses is called Karish or Kareish cheese. It is one of the ancient Egyptian, skimmed-milk, white soft, lactic acid cheeses (Robinson and Tamime, 1993). To retain the typical flavor and body characteristics of Karish cheese, the addition of pure starter cultures to pasteurized milk, prior to manufacture, was investigated. Single cultures of lactococci or yoghurt starters have been used by several researchers: *Lact. lactis* subsp. *Lactis* + *Lact. lactis* subsp. *cremoris* (El-Zayat and Omar, 1987)

and *Lactobacillus delbruekii* sub sp. *bulgaricus* + *Str. salvarius* sub sp. *thermophilus* (Abd El-Salam *et al.*, 1984; El-Shibiny *et al.*, 1984, Robinson and Tamime, 1993). In another study, Karish cheese was manufactured by using different types of dairy starter cultures (Effat *et al.,* 2001).

In order to make Karish cheese with a good characteristics, selection of proper starter culture is important as it can affect the yield and characteristics of the final product. It is interesting to examine different strains from the available commercial starter cultures in the market to explore the effective strains with specific technological properties in relation to Karish cheese.

Therefore, the effect of using starter culture on the yield and characteristics of Karish cheese was studied. Karish cheese was made using two cultures by two different ratios (1% and 2%).

## MATERIALS AND METHODS

Fresh raw buffalo's milk was obtained from El-Gawhara Factory, El-Asafra, Dakahlia, Egypt.

DOM 1® Starter culture consists of: *Lactococcus lactis* subsp. *lactis and Lactococcus lactis supsp. cremoris* (1: 1) obtained from centro sperimentale del lotte (SPA), Italy (YS) and natural starter from good quality karish cheese (DS).

Iodized Salt, Produced by El-Nasr Saline's Co, Alex, Egypt, Calcium chloride "flakes 77%" was obtained from Kemira Kemi AB, Helsingborg, Sweden, Potassium Sorbate was obtained from Z.K.W., China and Citric Acid was obtained from ADWIC Laboratory Chemicals.

**Manufacture of Karish cheese:**

Karish cheese was made according to the method of Ezz El-Din (1978) with some modifications. Fresh buffalo's milk was warmed to 30 – 35◦C, separated with Alfa-Laval separator (2 ton/hour). Skim buffalo's milk was heat treated (Alfa-Laval pasteurizer 2 ton/hour) at 80◦C/ 15 sec and cooled down to 35 – 38◦C. The cheese milk was divided into four portions, 500 kg each. The first two portions were inculcated with the YS starter culture in a portion of 1% (YS-1) and 2% (YS-2). The other two portions were inculcated with the DOM 1® (DS) starter culture in a portion of 1% (DS-1) and 2% (DS-2).

200-gram calcium chloride per one ton of skim buffalo's milk (0.02%) was added. Then the milk was incubated at 37 – 39◦C. After complete coagulation, the curd was ladled in mats as in primitive method and 2.5 % salt was added to the curd (100 gram salt / 4 Kg curd), then the cheese curd was moved to refrigerator overnight at 5±2◦C. Each Karish cheese treatment was taken out and weighted for calculating cheese yield, then packaged in plastic jars (10 Kg each). Pickling solution was prepared from 6 Kg salt, 200 gram potassium sorbate, 100 gram calcium chloride, 50 gram citric acid and 94 Kg pasteurized water and the pH value of this solution at the end was 4.5. The cheese jars finally were sealed and stored in refrigerator at 5±2◦C for 60 days. Cheese samples were taken for chemical, microbiological and organoleptic measurements after 24 hour (zero time), 15, 30, 45, and 60 days. Also, losses of cheese components in pickling solutions were analyzed during storage period.

**Chemical and Microbiological analysis of Milk and cheese samples:**

Fat percentage was determined by the standard Gerber method according to the British Standard Institute (1962). Total nitrogen (TN %), soluble nitrogen (SN %) and non protein nitrogen (NPN %) of milk and cheese samples were evaluated by Micro Kjeldahl technique (AOAC, 1990). Total solids (TS) percentage of milk and Karish cheese were determined gravimetrically using the method of Oser (1965), pH values and salt content of both milk and Karish cheese samples were measured according to Ling (1963).

Total bacterial and mould & yeast counts were determined according to APHA (1985), meanwhile most probable number (MPN) of coliform was determined according to APHA (1980) using Mac Conkey broth. For detecting and enumerating staphylococci, appropriate dilutions of the examined cheese samples were plated with staphylococcus medium No. 110 (Difco, 1974).

**Organoleptic properties:**

The organoleptic properties were assessed as suggested by ADSA (1987). Data reported are the average of three measurements per replicate.

## RESULTS AND DISCUSSION

The chemical composition of cheese milk is shown in Table (1).

**Table (1): Chemical composition of buffalo's milk used for manufacture of Karish cheese with different starter cultures.**

| | Fat % | TS % | SNF % | pH values | Acidity % | TP % |
|---|---|---|---|---|---|---|
| **Fresh Buffaloes milk** | 7.5 | 16.26 | 8.76 | 6.62 | 0.18 | 4.565 |
| **Skim milk** | 0.50 | 9.49 | 8.99 | 6.65 | 0.17 | 5.050 |

**TS: total solids, SNF: solids not fat, TP: total protein**

**Yield of Karish cheese:**

The effect of starter culture on the yield of Karish cheese made from skim buffalo's milk is shown in Fig. (1).

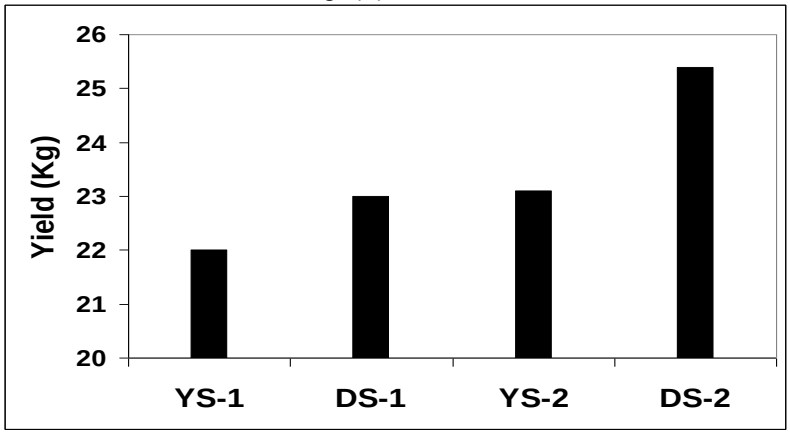


**Fig. (1): Yield of Karish cheese (Kg cheese / 100 Kg milk) made from skim buffalo's milk with different starter cultures.**

**YS-1and YS-2: Natural Starter culture (1 and 2%, respectively).**
**DS-1and DS-2: DOM 1® starter culture (1 and 2%, respectively).**

It can be noticed that the yield of karish cheese was increased by using DOM1® starter culture (23 and 25.4% for DS-1 and DS-2, respectively) than that when natural starter culture was used (22 and 23.1% for YS-1 and YS-2, respectively). The highest cheese yield was obtained when 2% of DOM 1® was used (DS-2) which was 10% higher than that of YS-2.

The increase in yield of DS-1 and DS-2 treatments was parallel to the decrease in their total solids content, or in another words with an increase in their moisture content (as presented in Table 2). This increase in the cheese yield of DS-2 was associated with an increase in the cheese moisture content by 2.7% compared with YS-1 and 1.1% compared with YS-2 treatments (As can be calculated from TS data presented in Table 2). This indicated that the increase in yield might be due to an increase in the moisture content. Similar finding was previously found by other authors (Ahmed *et al.,* 2005). Also, the yield values of treatments were within the values reported by other researchers (Ibrahim *et al*., 1990 and Blassy & Ismail, 2003).

**Table (2): Chemical composition of Karish cheese made from skim buffalo's milk with different starter cultures.**

| Item | Storage period (days) | Treatments | | | |
|---|---|---|---|---|---|
| | | YS-1 | DS-1 | YS-2 | DS-2 |
| TS% | 0 | 22.807 | 21.492 | 21.568 | 20.734 |
| | 15 | 23.425 | 22.102 | 22.981 | 21.699 |
| | 30 | 23.901 | 22.830 | 22.990 | 22.578 |
| | 45 | 24.342 | 23.416 | 23.652 | 23.779 |
| | 60 | 24.861 | 24.875 | 24.008 | 24.576 |
| pH value | 0 | 4.55 | 4.43 | 4.43 | 4.40 |
| | 15 | 4.53 | 4.35 | 4.40 | 4.33 |
| | 30 | 4.30 | 4.30 | 4.00 | 4.18 |
| | 45 | 4.18 | 4.22 | 3.80 | 4.09 |
| | 60 | 3.79 | 4.11 | 3.62 | 4.07 |
| Fat % | 0 | 1.20 | 1.30 | 1.30 | 1.45 |
| | 15 | 1.40 | 1.40 | 1.50 | 1.50 |
| | 30 | 1.70 | 1.70 | 1.80 | 1.80 |
| | 45 | 1.80 | 1.80 | 1.90 | 2.00 |
| | 60 | 1.90 | 2.00 | 2.10 | 2.20 |
| Fat / DM% | 0 | 5.262 | 6.048 | 6.027 | 6.993 |
| | 15 | 5.976 | 6.334 | 6.527 | 6.913 |
| | 30 | 7.113 | 7.446 | 7.829 | 7.972 |
| | 45 | 7.395 | 7.687 | 8.033 | 8.411 |
| | 60 | 7.642 | 8.040 | 8.747 | 8.952 |
| Salt % | 0 | 1.501 | 1.521 | 1.469 | 1.425 |
| | 15 | 1.582 | 1.599 | 1.698 | 1.686 |
| | 30 | 1.643 | 1.734 | 1.887 | 1.821 |
| | 45 | 1.787 | 1.895 | 1.973 | 1.952 |
| | 60 | 1.891 | 2.135 | 2.540 | 2.023 |
| Salt / water% | 0 | 1.944 | 1.937 | 1.873 | 1.797 |
| | 15 | 2.066 | 2.053 | 2.204 | 2.153 |
| | 30 | 2.159 | 2.247 | 2.450 | 2.352 |
| | 45 | 2.362 | 2.474 | 2.584 | 2.561 |
| | 60 | 2.516 | 2.842 | 3.342 | 2.682 |

**YS-1and YS-2: Natural Starter culture (1 and 2%, respectively).**
**DS-1and DS-2: DOM1® starter culture (1 and 2%, respectively).**
**TS: total solids, DM: dry matter and W.: water**

**Chemical composition of Karish cheese:**

The chemical composition of Karish cheese as affected by the type of starter culture is presented in Table (2). It is observed that TS, fat, fat/DM %, salt and salt/water % contents of Karish cheese gradually increased. The pH values were decreased during storage period, but both YS-1 and YS-2 treatments had lower pH-values than DS-1 and DS-2 treatments. Although there was a slight reduction in the TS as a result of using DS culture. On the contrary, the salt% and salt/water% during storage were increased during storage period, but both YS treatments had lower than both DS treatments. Results showed that type of starter culture, storage period have a clear effect on the fat/DM%, salt, and salt/water% of the resulted Karish cheeses. Similar trends were found by (Abu Dawood, 2002; Blassy & Ismail, 2003 and Effat *et al.*, 2001).

Also, the values of fat/DM% and TS content of the obtained Karish cheeses almostly fall in the range of the values stated by Egyptian Standards 1008-2005 (Fat/DM < 10%, moisture < 75%) at the end of the pickling period.

**Nitrogenous compounds of Karish cheese:**

Table (3) shows the nitrogenous compounds of Karish cheese made using different starter cultures during storage. It is cleared that the entire nitrogenous compound presented in Table (3) were increased during storage except the values of TN/DM% which decreased during storage. This reduction of the TN/DM might be a result of increasing cheese T.S. % during storage (Table 2) and losses of some hydrolised protein fractions in the pickling solution.

The increase in the values of soluble nitrogen (SN), SN/TN, non-protein nitrogen (NPN) and NPN/TN values of all treatments during storage period might be attributed to proteolysis of cheese protein. Also, it can be noticed during storage that the highest values of SN and SN/TN were observed in the cheese treatment made by 2% DS culture. This could be an indication of more proteolysis occurred when 2% of the DS culture was used as a result of the increased moisture content in these treatments compared with YS-1 and YS-2. These results are inline with those mentioned by Omar *et al* (1999). Besides, the protein content of the obtained Karish cheeses fall in the range stated by Egyptian Standards 1008-2005 (Protein > 10%).

**Analysis of Karish pickling solution:**

Results of cheese pickling solution analysis were tabulated in Table (4). It is noticed that pH-values was comparable between all treatments except a slight reduction in the pH- values occurred in treatment YS-2 during 60 days of storage. The losses of TS and TN contents in pickling solution were slightly higher in all treatments made using YS culture compared with that made from DS culture. These results are in agreement with Blassy & Ismail (2003).

**Microbiological properties of Karish cheese:**

It is obviously shown from the results in Table (5) that Karish cheese made using YS culture (YS-1 & YS-2) had higher total viable bacterial and mould & yeast counts than other treatments made using DS culture. DS-1 treatment had the lowest total microbial and mold & yeast counts when fresh and during storage period. Data showed a deferent effect between cultures, storage period, the total microbial and mold & yeast counts in Karish cheese treatments.

**Table (3): Nitrogenous compounds of Karish cheese made from skim buffalo's milk by using different starter cultures.**

| Item | Storage period (days) | Treatments | | | |
|---|---|---|---|---|---|
| | | YS-1 | DS-1 | YS-2 | DS-2 |
| T.N. % | 0 | 2.462 | 2.376 | 2.368 | 2.435 |
| | 15 | 2.495 | 2.435 | 2.401 | 2.497 |
| | 30 | 2.503 | 2.464 | 2.423 | 2.501 |
| | 45 | 2.514 | 2.479 | 2.469 | 2.528 |
| | 60 | 2.561 | 2.503 | 2.496 | 2.549 |
| TN/DM % | 0 | 10.795 | 11.055 | 10.979 | 11.744 |
| | 15 | 10.651 | 11.017 | 10.447 | 11.507 |
| | 30 | 10.472 | 10.793 | 10.539 | 11.077 |
| | 45 | 10.327 | 10.580 | 10.438 | 10.631 |
| | 60 | 10.663 | 10.062 | 10.396 | 10.372 |
| SN% | 0 | 0.495 | 0.473 | 0.474 | 0.487 |
| | 15 | 0.538 | 0.511 | 0.512 | 0.547 |
| | 30 | 0.566 | 0.536 | 0.532 | 0.564 |
| | 45 | 0.600 | 0.571 | 0.552 | 0.585 |
| | 60 | 0.626 | 0.608 | 0.598 | 0.646 |
| SN / TN % | 0 | 20.105 | 19.907 | 20.016 | 20.000 |
| | 15 | 21.563 | 20.985 | 21.324 | 21.906 |
| | 30 | 22.613 | 21.753 | 21.956 | 22.551 |
| | 45 | 23.866 | 23.033 | 22.357 | 23.141 |
| | 60 | 24.443 | 24.290 | 23.958 | 25.343 |
| NPN % | 0 | 0.104 | 0.101 | 0.131 | 0.107 |
| | 15 | 0.133 | 0.125 | 0.138 | 0.136 |
| | 30 | 0.144 | 0.137 | 0.145 | 0.143 |
| | 45 | 0.159 | 0.154 | 0.166 | 0.164 |
| | 60 | 0.178 | 0.164 | 0.174 | 0.189 |
| NPN / TN% | 0 | 4.224 | 4.250 | 5.532 | 4.394 |
| | 15 | 5.330 | 5.133 | 5.747 | 5.446 |
| | 30 | 5.753 | 5.560 | 5.984 | 5.717 |
| | 45 | 6.324 | 6.212 | 6.723 | 6.487 |
| | 60 | 6.950 | 6.552 | 6.971 | 7.414 |

**YS-1and YS-2: Natural Starter culture (1 and 2%, respectively).**
**DS-1and DS-2: DOM1 starter culture (1 and 2%, respectively).**
**TN: total nitrogen, DM: dry matter, SN: soluble nitrogen, NPN: non-protein nitrogen**

**Table (4): Chemical composition of pickling solutions used for Karish cheese through out storing period.**

| Item | Storage period (days) | Treatments | | | |
|---|---|---|---|---|---|
| | | YS-1 | DS-1 | YS-2 | DS-2 |
| pH value | 0 | 4.50 | 4.50 | 4.50 | 4.50 |
| | 15 | 4.43 | 4.42 | 4.37 | 4.41 |
| | 30 | 4.41 | 4.40 | 4.25 | 4.40 |
| | 45 | 4.31 | 4.32 | 4.12 | 4.32 |
| | 60 | 4.25 | 4.28 | 3.91 | 4.21 |
| TN% | 0 | 0.030 | 0.031 | 0.040 | 0.036 |
| | 15 | 0.033 | 0.036 | 0.058 | 0.038 |
| | 30 | 0.059 | 0.026 | 0.078 | 0.053 |
| | 45 | 0.078 | 0.077 | 0.097 | 0.087 |
| | 60 | 0.099 | 0.099 | 0.121 | 0.096 |

**YS-1and YS-2: Natural Starter culture (1 and 2%, respectively).**
**DS-1and DS-2: DOM1 starter culture (1 and 2%, respectively).**
**TS: total solids, TN: total nitrogen**

**Table (5): Microbiological analysis of Karish cheese made from skim buffalo's milk by using different starter culture.**

| Microbial Groups | Storage period (Days) | Treatments | | | |
|---|---|---|---|---|---|
| | | YS-1 | DS-1 | YS-2 | DS-2 |
| Total viable count (x $10^5$) | 0 | 337 | 65 | 415 | 183 |
| | 15 | 265 | 55 | 375 | 162 |
| | 30 | 220 | 49 | 297 | 123 |
| | 45 | 183 | 46 | 229 | 97 |
| | 60 | 112 | 43 | 175 | 75 |
| Mould and Yeast (x $10^2$) | 0 | 30 | 9 | 68 | 32 |
| | 15 | 66 | 23 | 123 | 52 |
| | 30 | 95 | 56 | 183 | 73 |
| | 45 | 137 | 63 | 226 | 85 |
| | 60 | 178 | 69 | 299 | 102 |

**YS-1and YS-2: Natural Starter culture (1 and 2%, respectively).**
**DS-1and DS-2: DOM1 starter culture (1 and 2%, respectively).**

In all treatments, total viable count was reduced during storage period, while mould and yeast count showed an opposite trend as it was increased during storage. This may be attributed to the effect of high acidity on the different microbial groups (Hammer & Bable, 1957; Foster, *et al*., 1958 and Ibrahim *et al*., 1990).

It could also be observed that non of the different cheese treatments contained any of staphylococcal or coliform microorganisms during the present work, this may be due to the high heat treatment used, high technology and health requirements used.

**Organoleptic evaluation of Karish cheese:**

The results of the sensory evaluation of Karish cheese when fresh and during storage are given in Table (6). When 1% of both YS and DS cultures were used, there was no effect on their organoleptic properties. However, there was a slight increase in the total sensory score when 2% of DS was used.

Results showed that both cultures and storage period have a marked effect on appearance, body, texture, flavor and total score points of cheese treatments.

**Table (6): Organoleptic properties of Karish cheese made from skim buffalo's milk by using different starter cultures.**

| Organoleptic properties | Score | Storage period (Days) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | | 15 | | 30 | | 45 | | 60 | |
| | | YS-1 | DS-1 | YS-1 | DS-1 | YS-1 | DS-1 | YS-1 | DS-1 | YS-1 | DS-1 |
| Appearance | 15 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 12 | 11 | 12 |
| Body & Texture | 35 | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 32 | 30 | 31 |
| Flavor | 50 | 47 | 47 | 45 | 46 | 44 | 45 | 43 | 44 | 42 | 43 |
| Total | 100 | 91 | 91 | 89 | 90 | 88 | 90 | 85 | 88 | 83 | 86 |
| | | YS-2 | DS-2 | YS-2 | DS-2 | YS-2 | DS-2 | YS-2 | DS-2 | YS-2 | DS-2 |
| Appearance | 15 | 12 | 13 | 12 | 13 | 12 | 13 | 11 | 12 | 11 | 11 |
| Body & Texture | 35 | 31 | 33 | 31 | 33 | 30 | 32 | 30 | 31 | 29 | 30 |
| Flavor | 50 | 47 | 48 | 44 | 45 | 42 | 44 | 40 | 43 | 39 | 42 |
| Total | 100 | 90 | 94 | 87 | 91 | 84 | 89 | 81 | 86 | 79 | 83 |

**YS-1and YS-2: Natural Starter culture (1 and 2%, respectively).**
**DS-1and DS-2: DOM1 starter culture (1 and 2%, respectively).**

However, it was reported that Karish cheese made from milk and inoculated with *Lactococcus lactis subsp. lactis* had the best organoleptic properties, nutritive value and lower production costs (Azzam and Salama, 2003). Also, Younis (1998) found that karish cheese had high acceptability scores after 15 days of storage, but had lower scores when they were fresh and after 30 days. These results are consistent with those of other investigators who used EPS-producing lactic starter cultures to improve the sensory attributes of Karish cheese (Ahmed *et al.* 2005).

In conclusion, this study has shown that using 1 and 2% of DS culture showed a positive impact on the yield and characteristics of Karish cheese. Chemical analysis and sensory evaluation indicated that Karish cheese made using DS culture was better than that made with YS culture. Also, there was a reduction in the loss of the cheese components in the pickling solution during storage. Such improvements in the cheese yield and characteristics could increase both producer profits and consumer acceptability of this type of cheese. In addition, Hassan *et al.* (2003) found that *Lac. lactis subsp. cremoris* can produce exoplysaccharid. Therefore, it is thought that the DS culture could have the ability to produce exopolysaccaride which in turn can improve water holding capacity, yield and sensory characteristics of the resultant cheese. Further work is needed to explore whether the DS culture have the ability to produce polysaccharide or not.

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## تأثير نوع البادئ علي جودة وتصافي الجبن القريش المُصنع من اللبن الجاموسي

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تم تصنيع الجبن القريش من اللبن الفرز الجاموسي (نسبة الدهن ٠,٥%) علي نطاق تجاري بإضافة بادئ DOM 1® والذي يتكون من (*Lactococcus lactis* subsp. *lactis and Lactococcus lactis* subsp. *cremoris* (1: 1)) والمجموعة الثانية بإضافة بادئ القريش البلدي من جبن جيد.

استخدمت أربعة معاملات عن طريق إضافة البادئ من النوعين السابقين بنسبة ١, ٢% من كلا النوعين, وتم حساب التصافي للجبن القريش الناتج وتمت إجراء التحليلات الكيميائية والإختبارات البكتيريولوجية والخواص الحسية للجبن القريش الطازج وخلال ٦٠ يوم من التخزين في جو الثلاجة علي (٥ ±٢ °م), وكانت كل النتائج في حدود النتائج المقررة في المواصفات القياسية المصرية للجبن القريش.

وجد أن أعلي تصافي في الجبن الناتج كان ٢٥,٤% تم الحصول عليه عند إستخدام بادئ DOM 1® بنسبة ٢% (DS-2) وهذه الزيادة في محصول الجبن نتجت عن زيادة في نسبة الرطوبة في الجبن بنسبة ٢,٧% عن المعاملة YS-1, (١,١%) عن المعاملة YS-2, ولوحظ إنخفاض في قيم الـ pH في المعاملات YS-1, YS-2 عن المعاملات DS-1, DS-2 والتي كانت الإنخفاضات بها أقل. لوحظ وجود نسب عالية في محتوي الجبن من النيتروجين الذائب ونسبة النيتروجين الذائب إلي النيتروجين الكلي في الجبن الناتج من المعاملة DS-2 ويمكن تفسير هذا الأمر بأن هذه الزيادة قد تكون مؤشراً لمزيد من التحلل البروتيني في حالة إستخدام نسبة ٢% من بادئ DOM 1® .

وجد إنخفاض في نسبة المادة الصلبة الكلية والمحتوي من النيتروجين الكلي في الجبن الناتج من المعاملتين DS-1, DS-2 في محلول الحفظ الذي يتم حفظ الجبن فيه أثناء مدة التخزين مقارنة بالمعاملتين YS-1, YS-2, وجد أن العدد البكتيري الكلي وأعداد الفطريات والخمائر في المعاملات YS-1, YS-2 أعلي من الأعداد في المعاملتين DS-1, DS-2 بينما علي الجانب الآخر كانت قيم الصفات الحسية في المعاملة DS-2 هي الأعلي عن بقية المعاملات الأخرى.

في النهاية يخلص البحث إلي أن استخدام نسبة بادئ ٢% DOM 1® تحسن من التصافي في الجبن القريش وتؤدي إلي إنتاج جبن ذو صفات حسية جيدة مع وجود أقل نسبة فاقد من مكونات الجبن في محلول الحفظ أثناء التخزين.

**قام بتحكيم البحث**

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