# Effect of kefir stsarter on the chemical, microbiological and sensory properties of karish cheese

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**Abstract**: Chemical (acidity, lactose and soluble nitrogen), microbiological (total count (T.C.), *Lactobacillus, Streptococcus* and Yeast & Mold), and sensorial properties of Kariesh cheese produced with rennet and different starter cultures (rennet ($T_1$), kefir ($T_2$), yoghurt ($T_3$), rennet +kefir ($T_4$), rennet +yoghurt ($T_5$) and kefir+yoghurt ($T_6$) were examined during storage at 4ºC for 30 days. Initial titratable acidity values of Karish cheese samples produced using kefir starter culture in fresh cheese were higher than those produced using rennet or yoghurt starter. At the end of storage period, titratable acidity values of Karish cheese samples increased. Lactose content decreased during the storage period in all Kariesh cheese samples, while there was a more decline in treatments which contain Kefir. Karish cheese samples produced using kefir, kefir plus rennet or kefir plus yoghurt showed the highest numbers of total count and yeast & mold while, Karish cheese produced using rennet or yoghurt starter had the lowest numbers of total count and yeast & mold. All Karish cheese samples (except rennet cheese) showed the highest lactobacilli and streptococci counts. Sensory analysis showed significant differences ($p<0.05$) between treatments. Treatment 6 (1.5% Kefir + 1.5% yoghurt starter (1:1)) recorded the highest degree of flavor, appearance and texture characteristics. Results indicated that using kefir starter increasing shelf life of Karish cheese. Furthermore, improved sensory characteristics.

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## 1. Introduction

Cheese is an important integral part of diet consumed in Egypt. It is consumed almost three times a day. There are many traditional local cheese type produced in local regions. Karish cheese is one of the most popular local types of fresh soft cheese in Egyptian cities **[1].**Karish, Kariesh, or Kareish cheese is one of the most popular soft fresh skimmed milk, lactic cheese. It contains most of the skim milk constituents including protein, small amount of sugar, some of water, soluble vitamins and most of the calcium and phosphorus **[2]**. Kariesh cheese is considered to be one of the most important traditional Egyptian dairy products, commonly made in the Egyptian countryside, especially in small villages, as low-income people such as farmers use Kariesh cheese in their diet owing to its high protein content, low fat and price **[3].**

Kefir cheese is produced through the use of kefir grains, rather than an additional rennet or acid. The kefir cheese could be made by cold straining or by heating. It has a very tangy, rich flavor and creamy texture **[4]**. Kefir is the product of fermentation of milk with kefir grains. It is described as a symbiotic association between lactic and acetic bacteria and yeast. Kefir is an acid, viscous, slightly carbonated dairy beverage **[5]**, and related to a variety of health benefits **[6]**. Traditionally kefir grains have been used for centuries in many countries as the natural starter. Making cheese from kefir is easy and it contains all the beneficial probiotic microorganisms that kefir famous for.

Many researchers have been proposed to improve therapeutic effect of Karish cheese. One of the most common approaches is to modify the manufacturing procedure in order to increase the *Bifidobacterium***[7]**. The main therapeutic benefits of *Bifidobacterium*are: immune enhancement, prevention of diarrhea disease and colon cancer, enhancement of immunity against intestinal infections, prevention of upper gastrointestinal tract diseases and hypercholesterolemia, improvement in lactose utilization, and stabilization of the gut mucosal barrier **[8].**

Hence, several approaches have been investigated to improve the flavor and texture of low-fat cheese e.g., modification of conventional manufacturing process, use of enzymes, additives stabilizers and fat replacers, especially designed starters or adjunct cultures **[9,10 and 11].** The objective of this study was to improve characteristics of Karish cheese.

## 2. Materials and Methods

### 2.1. Materials

Fresh raw buffalo's skimmed milk was obtained from the unit dairy technology, Faculty of Agriculture, Cairo University, Egypt. Skimmed milk powder was obtained from Dairy America, Inc., 4974 East Clinton way, California, United States of America (3.8% moisture, 33.4% protein, 7.9% ash and 54.1% lactose). Rennet powder was obtained from Marzyme-Marschall$^{TM}$ Damisco, France, Z, Avenue Brun, Faulquier, 38470 (France).Commercial fine grade salt (NaCl) was obtained from El-Nasr for salt production company. Yoghurt starter culture consisted of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcous salivarious* subsp. *thermophiles* (YC-X11) in the form of freeze-dried lactic culture for Direct Vat Set (DVS) were obtained from Chr. Hansen's Lab., Denmark. Kefir grains were obtained from laboratory of Dr. Morsi El-Soda, Faculty of Agriculture, Alexandria University, Egypt. All microbiological media used were ready made: MRS agar, M17 agar and violet red bile agar were obtained from Biolife Italiano S.R.L. Viale Monza, 272-20128 Milano, Italy. Nutrient agar and plate count agar were obtained from Titan Biotech LTD – Bhiwadi – 301019 - Rajasthan – India. Yeast and mold medium was prepared from: agar agar, malt extract powder, peptone, yeast extract powder and dextrose.

### 2.2. Methods

Skim milk was heated to 72°C for 15 sec and cooled to 35°C, then divided into 6 equal portions for the addition of rennet and 5 different starters.

The 1st portion (control) was added rennet.

The 2nd portion was inoculated with 1.5% kefir starter.

The 3rd portion was inoculated with 1.5% yoghurt starter.

The 4th portion was inoculated with rennet + 1.5% kefir starter.

The 5th portion was inoculated with rennet + 1.5% yoghurt starter.

The 6th portion was inoculated with 1.5% kefir starter +1.5% yoghurt starter (1:1). Treatments were incubated at 32°C up to curdling. The curds were cut and brine salted.

### 2.3. Chemical analysis

Titratable acidity and soluble nitrogen content were determined as described **[12].**Lactose content was determined according to **[13].**

### 2.4. Sensory evaluation

Sensory evaluation of cheese was carried out according to **[14]** by a regular taste and texture panel of 20 staff members of the Dairy Department in Food Technology Research Institute.

### 2.5. Statistical analysis

Data were analyzed statistically using the MSTAT-C (ver. 2.10, MSU, USA) package on a personal computer. All experiments were carried out in triplicates. Differences were considered significant at $P< 0.05$**.**

## 3. Results and discussion

### 3.1. Chemical composition

Titratable acidity of Kariesh cheese produced by rennet and different starters is shown in Table (1).Initial titratable acidity values of Karish cheese samples produced using kefir starter culture in fresh cheese were higher than those produced using rennet or yoghurt starter. At the end of storage period, titratable acidity values of Karish cheese samples increased while$T_6$ (1.5% kefir + 1.5% yoghurt starter (1:1)) showed the highest value. Obtained results are in agreement with **[15].**

Lactose content Table (2) decreased during the storage period in all Kariesh cheese samples, while there was a more decline in treatments which contain kefir.

The increasing in titratable acidity and decreasing of lactose content due to the production of organic acids (primarily lactic acid) with lactic acid bacteria responsible for most of fermentation of sugars. Observed in our study were in agreement with the previous findings of **[16]**.

Obtained data in Table (3) represent the levels of soluble nitrogen in different treatments. There was a pronounced increase ($P>0.05$) in soluble nitrogen content during storage period this is due to a continuous proteolytic process. However, obtained data is consistent with the findings of **[17]**.

### 3.2. Microbiological analysis

The effect of the starter culture type on microbiological properties of Karish cheese was shown in Table (4). Karish cheese samples produced using kefir, kefir plus rennet or kefir plus yoghurt showed the highest numbers of total count and yeast & mold while, Karish cheese produced using rennet or yoghurt starter had the lowest numbers. All Karish cheese samples (except rennet cheese) showed the highest lactobacilli and streptococci counts. This is related to the Microflora composition of starter cultures used **[18]** showed that cheese produced using kefir had more lactobacilli and streptococci.

### 3.3. Sensory evaluation

Data in Table (5) describes the results of sensory evaluation for different treatments of Kariesh cheeses. Sensory analysis showed significant differences ($p<0.05$) between treatments. Treatment 6 (1.5% kefir + 1.5% yoghurt starter (1:1)) recorded the highest degree of flavor, appearance and texture characteristics. There was a gradual decline in the flavor, appearance and texture characteristics

beginning of the third week of storage as a result of increasing of protein degradation with prolong of storage period. Obtained data concurs with those of **[19].** Finally, $T_6$ represent best total score comparing with other treatments**.**

## 4. Conclusion

According to the obtained results, use of kefir as a starter culture in Karish cheese manufacture increased shelf life as compared to control cheese. Furthermore, Karish cheese produced using kefir as a starter culture improving sensory characteristics.

**Table (1): Titratable acidity % of Karish cheese manufactured from buffalo's skim milk with rennet and different starters during storage at 4±1˚C.**

| Treatments | Storage period (weeks) | | | | |
|---|---|---|---|---|---|
| | Zero | 1 | 2 | 3 | 4 |
| $T_1$ | $0.884^{T}$ | $0.890^{T}$ | $0.891^{T}$ | $0.892^{T}$ | $0.893^{T}$ |
| $T_2$ | $1.028^{N}$ | $1.029^{N}$ | $1.039^{N}$ | $1.273^{F}$ | $1.285^{E}$ |
| $T_3$ | $0.937^{S}$ | $0.973^{QR}$ | $0.986^{OP}$ | $1.065^{M}$ | $1.210^{H}$ |
| $T_4$ | $1.036^{N}$ | $1.127^{K}$ | $1.232^{G}$ | $1.413^{D}$ | $1.511^{C}$ |
| $T_5$ | $0.962^{R}$ | $0.976^{PQ}$ | $0.996^{O}$ | $1.093^{L}$ | $1.267^{F}$ |
| $T_6$ | $1.153^{J}$ | $1.178^{I}$ | $1.411^{D}$ | $1.538^{B}$ | $1.600^{A}$ |
| $LSD_{0.05}$ | 0.01155 | | | | |

**$T_1$:** rennet **$T_2$:**1.5% kefir
**$T_3$:** 1.5% yoghurt starter **$T_4$:** rennet & 1.5% kefir
**$T_5$:** rennet & 1.5% yoghurt starter **$T_6$:**kefir & yoghurt starter (1:1)
Means with different letters are significantly different from each other.

**Table (2): Lactose content % of Karish cheese manufactured from buffalo's skim milk with rennet and different starters during storage at 4±1˚C.**

| Treatments | Storage period (weeks) | | | | |
|---|---|---|---|---|---|
| | Zero | 1 | 2 | 3 | 4 |
| $T_1$ | $4.50^{A}$ | $4.44^{A}$ | $4.30^{B}$ | $4.25^{B}$ | $4.00^{C}$ |
| $T_2$ | $3.98^{C}$ | $3.26^{E}$ | $2.77^{J}$ | $2.54^{K}$ | $2.21^{LM}$ |
| $T_3$ | $4.08^{C}$ | $3.75^{D}$ | $3.00^{GH}$ | $2.98^{H}$ | $2.85^{IJ}$ |
| $T_4$ | $3.75^{D}$ | $3.11^{F}$ | $2.52^{K}$ | $2.48^{K}$ | $2.29^{L}$ |
| $T_5$ | $4.00^{C}$ | $3.67^{D}$ | $2.96^{H}$ | $2.94^{HI}$ | $2.84^{IJ}$ |
| $T_6$ | $3.74^{D}$ | $3.10^{FG}$ | $2.46^{K}$ | $2.12^{M}$ | $1.68^{N}$ |
| $LSD_{0.05}$ | 0.1034 | | | | |

$T_1$, $T_2$, $T_3$, $T_4$, $T_5$ and $T_6$ see Table (1)

**Table (3): Soluble nitrogen % of Karish cheese manufactured from buffalo's skim milk with rennet and different starters during storage at 4±1˚C.**

| Treatments | Storage period (weeks) | | | | |
|---|---|---|---|---|---|
| | Zero | 1 | 2 | 3 | 4 |
| $T_1$ | $0.630^{H}$ | $0.630^{H}$ | $0.642^{H}$ | $0.683^{EFGH}$ | $0.820^{CD}$ |
| $T_2$ | $0.632^{H}$ | $0.642^{H}$ | $0.675^{FGH}$ | $0.733^{EF}$ | $0.865^{BC}$ |
| $T_3$ | $0.630^{H}$ | $0.631^{H}$ | $0.651^{GH}$ | $0.690^{EFGH}$ | $0.834^{BC}$ |
| $T_4$ | $0.633^{H}$ | $0.677^{EFGH}$ | $0.716^{EFG}$ | $0.750^{DE}$ | $0.897^{B}$ |
| $T_5$ | $0.632^{H}$ | $0.633^{H}$ | $0.660^{FGH}$ | $0.700^{EFGH}$ | $0.840^{BC}$ |
| $T_6$ | $0.635^{H}$ | $0.834^{BC}$ | $0.865^{BC}$ | $0.889^{BC}$ | $0.989^{A}$ |
| $LSD_{0.05}$ | 0.07304 | | | | |

$T_1$, $T_2$, $T_3$, $T_4$, $T_5$and $T_6$ see Table (1)

**Table (4): Total count (log CFU/g), Lactobacilli count (log CFU/g), Streptococci count (log CFU/g) and Yeast & mold count (log CFU/g) of Karish cheese manufactured from buffalo's skim milk with rennet and different starters during storage at 4±1˚C.**

| Treatments | Storage period (weeks) | | | | |
|---|---|---|---|---|---|
| | Zero | 1 | 2 | 3 | 4 |
| | | | **Total count (log CFU/g)** | | |
| $T_1$ | $2.25^{N}$ | $3.41^{M}$ | $3.73^{L}$ | $3.80^{L}$ | $3.46^{M}$ |
| $T_2$ | $7.50^{G}$ | $7.87^{F}$ | $8.21^{E}$ | $8.86^{AB}$ | $8.65^{CD}$ |
| $T_3$ | $5.60^{K}$ | $5.89^{J}$ | $6.25^{I}$ | $6.89^{H}$ | $6.72^{H}$ |
| $T_4$ | $7.48^{G}$ | $7.88^{F}$ | $8.21^{E}$ | $8.85^{ABC}$ | $8.64^{D}$ |
| $T_5$ | $5.59^{K}$ | $5.90^{J}$ | $6.29^{I}$ | $6.89^{H}$ | $6.70^{H}$ |
| $T_6$ | $7.62^{G}$ | $7.95^{F}$ | $8.35^{E}$ | $8.95^{A}$ | $8.73^{BCD}$ |
| $LSD_{0.05}$ | | | 0.2000 | | |
| | | | **Lactobacilli count (log CFU/g)** | | |
| $T_1$ | $ND^{K}$ | $ND^{K}$ | $ND^{K}$ | $ND^{K}$ | $ND^{K}$ |
| $T_2$ | $6.55^{J}$ | $6.60^{J}$ | $7.33^{DEF}$ | $7.89^{ABC}$ | $7.46^{D}$ |
| $T_3$ | $6.89^{I}$ | $7.21^{FG}$ | $7.45^{DE}$ | $7.95^{AB}$ | $7.73^{C}$ |
| $T_4$ | $6.53^{J}$ | $6.62^{J}$ | $7.35^{DEF}$ | $7.84^{ABC}$ | $7.44^{DE}$ |
| $T_5$ | $6.96^{HI}$ | $7.18^{FG}$ | $7.42^{DE}$ | $7.93^{AB}$ | $7.74^{C}$ |
| $T_6$ | $7.11^{GH}$ | $7.27^{EFG}$ | $7.79^{BC}$ | $8.00^{A}$ | $7.80^{BC}$ |
| $LSD_{0.05}$ | | | 0.1862 | | |
| | | | **Streptococci count (log CFU/g)** | | |
| $T_1$ | $ND^{L}$ | $ND^{L}$ | $ND^{L}$ | $ND^{L}$ | $ND^{L}$ |
| $T_2$ | $6.56^{K}$ | $6.81^{J}$ | $7.11^{GHI}$ | $7.35^{BCD}$ | $7.22^{DEFGH}$ |
| $T_3$ | $7.05^{HI}$ | $7.17^{EFGHI}$ | $7.23^{DEFG}$ | $7.46^{BC}$ | $7.06^{GHI}$ |
| $T_4$ | $6.55^{K}$ | $6.83^{J}$ | $7.13^{FGHI}$ | $7.30^{CDEF}$ | $7.18^{DEFGHI}$ |
| $T_5$ | $7.02^{I}$ | $7.15^{FGHI}$ | $7.22^{DEFGH}$ | $7.48^{B}$ | $7.08^{GHI}$ |
| $T_6$ | $7.08^{GHI}$ | $7.20^{DEFGH}$ | $7.34^{BCDE}$ | $7.68^{A}$ | $7.19^{DEFGHI}$ |
| $LSD_{0.05}$ | | | 0.1789 | | |
| | | | **Yeast & mold count (log CFU/g)** | | |
| $T_1$ | $ND^{N}$ | $1.89^{M}$ | $1.95^{KLM}$ | $2.10^{JKLM}$ | $2.40^{GHI}$ |
| $T_2$ | $5.88^{F}$ | $6.02^{DEF}$ | $6.24^{CD}$ | $6.30^{BC}$ | $6.36^{BC}$ |
| $T_3$ | $ND^{N}$ | $1.93^{LM}$ | $2.00^{KLM}$ | $2.19^{IJK}$ | $2.49^{GH}$ |
| $T_4$ | $5.80^{F}$ | $5.98^{EF}$ | $6.20^{CDE}$ | $6.30^{BC}$ | $6.33^{BC}$ |
| $T_5$ | $ND^{N}$ | $1.98^{KLM}$ | $2.15^{JKL}$ | $2.25^{HIJ}$ | $2.53^{G}$ |
| $T_6$ | $6.00^{DEF}$ | $6.20^{CDE}$ | $6.35^{BC}$ | $6.50^{AB}$ | $6.61^{A}$ |
| $LSD_{0.05}$ | | | 0.2477 | | |

$T_1$, $T_2$, $T_3$, $T_4$, $T_5$ and $T_6$ see Table (1) ND: not detected.

**Table (5): Sensory evaluation of Karish cheese manufactured from buffalo's skim milk with rennet and different starters during storage at 4±1˚C.**

| Treatments | Storage period (weeks) | | | | |
|---|---|---|---|---|---|
| | Zero | 1 | 2 | 3 | 4 |
| | | | **Flavor (50)** | | |
| $T_1$ | $40.4^{HI}$ | $41.6^{FGH}$ | $42.5^{FGH}$ | $38.0^{IJ}$ | $37.0^{J}$ |
| $T_2$ | $46.0^{ABCDE}$ | $46.7^{ABCD}$ | $46.7^{ABCD}$ | $45.6^{BCDE}$ | $43.3^{EFGH}$ |
| $T_3$ | $43.2^{EFGH}$ | $44.6^{CDEF}$ | $45.7^{BCDE}$ | $42.4^{FGH}$ | $40.6^{HI}$ |
| $T_4$ | $46.0^{ABCDE}$ | $46.7^{ABCD}$ | $47.0^{ABC}$ | $45.6^{BCDE}$ | $44.2^{CDEF}$ |
| $T_5$ | $42.2^{FGH}$ | $43.8^{DEFG}$ | $45.7^{BCDE}$ | $41.0^{GHI}$ | $40.3^{HI}$ |
| $T_6$ | $48.2^{AB}$ | $48.5^{AB}$ | $49.0^{A}$ | $47.0^{ABC}$ | $46.4^{ABCD}$ |
| $LSD_{0.05}$ | | | 1.085 | | |
| | | | **Appearance (10)** | | |
| $T_1$ | $8.0^{CDEFG}$ | $7.0^{HIJ}$ | $7.0^{HIJ}$ | $6.5^{IK}$ | $6.0^{K}$ |
| $T_2$ | $9.0^{AB}$ | $9.0^{AB}$ | $8.8^{ABC}$ | $8.6^{ABCD}$ | $7.8^{DEFGH}$ |
| $T_3$ | $8.0^{CDEFG}$ | $7.7^{EFGHI}$ | $7.7^{EFGHI}$ | $7.7^{EFGHI}$ | $7.2^{GHIJ}$ |
| $T_4$ | $8.4^{ABCDE}$ | $8.2^{BCDEF}$ | $8.0^{CDEFG}$ | $7.8^{DEFGH}$ | $7.5^{FGHI}$ |
| $T_5$ | $8.3^{BCDEF}$ | $7.5^{FGHI}$ | $7.5^{FGHI}$ | $7.2^{GHIJ}$ | $6.9^{IJ}$ |
| $T_6$ | $9.2^{A}$ | $9.2^{A}$ | $8.9^{AB}$ | $8.8^{ABC}$ | $8.6^{ABCD}$ |
| $LSD_{0.05}$ | | | 0.8704 | | |
| | | | **Body&texture (40)** | | |
| $T_1$ | $33.0^{H}$ | $32.9^{H}$ | $30.2^{KL}$ | $30.0^{KL}$ | $29.0^{L}$ |
| $T_2$ | $37.0^{BC}$ | $36.6^{BCD}$ | $35.6^{CDE}$ | $33.2^{GH}$ | $32.0^{HIJ}$ |
| $T_3$ | $35.2^{DE}$ | $35.0^{DEF}$ | $32.2^{HIJ}$ | $31.2^{IJK}$ | $31.0^{IJK}$ |
| $T_4$ | $38.2^{AB}$ | $37.8^{AB}$ | $35.7^{CDE}$ | $35.0^{DEF}$ | $33.4^{FGH}$ |
| $T_5$ | $34.8^{EFG}$ | $34.7^{EFG}$ | $32.6^{HI}$ | $30.9^{JK}$ | $30.8^{JK}$ |
| $T_6$ | $38.8^{A}$ | $38.7^{A}$ | $38.0^{AB}$ | $37.5^{AB}$ | $35.4^{CDE}$ |
| $LSD_{0.05}$ | | | 1.608 | | |
| | | | **Total score (100)** | | |
| $T_1$ | $81.4^{IJ}$ | $81.5^{IJ}$ | $79.7^{JK}$ | $74.5^{L}$ | $72.0^{L}$ |
| $T_2$ | $92.0^{C}$ | $92.3^{C}$ | $91.1^{CD}$ | $87.4^{EFG}$ | $83.1^{HI}$ |
| $T_3$ | $86.4^{GH}$ | $87.3^{FG}$ | $85.6^{GH}$ | $81.3^{IJK}$ | $78.8^{JK}$ |
| $T_4$ | $92.6^{BC}$ | $92.7^{BC}$ | $90.7^{CDE}$ | $88.4^{DEFG}$ | $85.1^{GH}$ |
| $T_5$ | $85.3^{GH}$ | $86.0^{GH}$ | $85.8^{GH}$ | $79.1^{JK}$ | $78.0^{K}$ |
| $T_6$ | $96.2^{A}$ | $96.4^{A}$ | $95.9^{AB}$ | $93.3^{ABC}$ | $90.4^{CDEF}$ |
| $LSD_{0.05}$ | | | 3.314 | | |

$T_1$, $T_2$, $T_3$, $T_4$, $T_5$ and $T_6$ see Table (1)

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