

## QUALITY ASSESSMENT OF SOME LOCAL AND IMPORTED CHEESES.\*

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**Abstract:** Local and imported dairy cheese samples were collected from market and were compared with the Egyptian standards .Samples of white soft cheese, Feta, Roquefort and Edam cheese were chemically and microbiologically evaluated. The results revealed the following :The moisture content of white soft cheese comply with standards , whereas , fat content was less then standards in double cream soft cheese .Moisture content in some samples of Feta cheese did not comply with standards , whereas F/DM comply with standards

.Moisture and F/DM contents of imported Edam cheese comply with standards . During storage in refrigerator , the F / DM ,acidity and total nitrogen were increased .Moisture ,fat ,salt and acidity contents of Roquefort cheese are in harmony with those of standards .The total microbial count, proteolytic, psychrotrophic bacteria and yeasts& molds of different cheeses varied among products and companies .On the other hand , coliform bacteria were not detected in all examined cheeses.

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**Key words:** assessment, local, imported cheeses.

### Introduction

White soft pickled cheese "Domiaty type" is the most popular cheese variety in Egypt and other Arab countries. A great amount of milk is used in making it to be consumed either fresh or after ripening for few months in a pickling solution (Ibrahim, 1991). Domiaty cheese is characterized by direct salting of cheese milk before renneting. The amount of salt added depending on the season of the year, ripening temperature and the microbiological quality of cheese milk (Abou-Donia, 1986).

Feta cheese is a special type of white brined Greek cheese which is increasing popularly worldwide. The popularity of this type of cheese is mainly due to its unique flavour and good digestibility, the traditional variety of Feta was originally made only from sheep's or goat's milk by the conventional method. Today, most Feta cheese is made from cow's milk either fresh or recombined using ultrafiltration technique (Abd El-Malek and Abd El-Khair, 2002).

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Edam cheese was first made in the vicinity of Edam in the province of North Holland, Netherlands. It is known in the Netherlands by various local names, such as Manbollen, Katzenkopf, and Tete de Maure. Like Gouda, it is a semisoft to hard, sweet-curd cheese made from cow's milk but now the fat content of the milk is usually reduced to about 2.5 percent. When the cheese is made for export, the fat content is indicated on the label, according to government specifications. Edam is made also in the United States (National Cheese Institute (NCI), 1978).

Blue-veined cheese (Roquefort-type) is made only from ewe's milk, usually not pasteurized. The cheese may be made in local dairies, but it must be transported to ripen in the caves near the village Roquefort Aveyron. The method of manufacture for Danish blue is virtually the same as that for Roquefort except the homogenized cow's milk is used and the ripening period is shorter in the Netherlands (deBoer and Kuik, 1987). A French regulation limits use of the word Roquefort to cheese made in the Roquefort area from ewe's milk. Other French cheese of the blue-veined type is called Bleu cheese, and blue-veined type cheese made in the United States and other countries is known as Blue cheese. In addition, the

distinctive blue-veined cheeses of England is Stilton and that of Italy Gorgonzola (NCI, 1978).

Therefore, the present study was undertaken to evaluate some local and imported cheeses for some chemical and microbial analyses and how far these analyses comply with the Egyptian standards. Generally, the ultimate goal of this study was to help dairy industry to produce healthy and safe food to the consumers. Also, with these information appropriate action can be taken to minimize risk.

## **Materials and Methods**

### **Source of Cheese Samples.**

#### **White Soft Cheese.**

Local white soft cheese samples were collected from the fresh production of four different sources (Domty, Green Land, El-Misrieen Co. and Laboratory cheese). Domty (Domiaty cheese) was full cream soft cheese with vegetable fats, Green land (white soft cheese) was double cream, El-Misreen (white soft cheese) was half cream cheese with vegetable fats and laboratory cheese was full cream white soft cheese. Five square packages of each were brought from the product of each company. Package contained 450, 1000, 1000 and 250 g cheese respectively. Samples of cheese were at the 4<sup>th</sup> or 5<sup>th</sup> d. after manufacturing and were considered as fresh cheese.

Local Feta cheese samples were collected from the fresh production of four different companies (Green Land, Domty, El-Misrieen and Panda Co.). Five square packages of each were brought from the product of each company. Every package contained 250 g cheese. Samples of cheese were at the 3<sup>rd</sup> or 4<sup>th</sup> day after manufacturing and were served as fresh cheese.

#### **Semi Hard Cheese.**

Imported Edam cheese was collected from local market. Two packages from imported cheese were brought from the product; the weight was 1000 g from imported Edam cheese. The cheese samples stored at 5-7°C for 30 d.

Imported blue-veined (Roqueforti Type) cheese samples were collected. Five square packages of different four companies (Lady Barid - Snow White - Rosen Borg and Viking) were brought from local market. Every package contained 100 g.

#### **Methods of Analysis.**

##### **Chemical Analysis.**

All samples were analysed when fresh but some of them analysed during storage such as imported Edam cheese (Analyses were carried out at 0, 15 and 30 days of storage at refrigerator temperature.

Moisture content, titratable acidity, total nitrogen content

(T.N.) and soluble nitrogen content (S.N.) were determined according to (A.O.A.C., 2000). The fat content of cheese samples was estimated as described by Agarawella and Sharma (1961).

##### **Salt Content.**

For determination of salt content of the cheese samples, the method adopted by Pearson (1975)

##### **Microbiological Analysis.**

##### **Preparation of Samples.**

Ten grams of cheese was carefully weighed and emulsified in sterile mortar with 2 percent sodium citrate solution which were added gradually with titrating until the mixture became creamy in consistency and as uniform as possible. The mixture was then carefully transferred to a sterile volumetric flask of 100 ml capacity and the volume was made to the mark by adding sterile water. This 1:10 dilution of cheese was then used for making serial dilutions required for the microbiological analysis.

##### **Microbial Count.**

Bacterial count and isolation were done as described in the Manual of Microbiological Methods (1957). Identification of the bacterial isolates was carried out according to Chalmers (1962).

Proteolytic bacteria were identified as described by Ewings *et al.* (1984).

Psychrotrophic bacteria. Psychrotrophic bacteria in samples were carried out as described for the standard plate count except incubation of plates were at 7+1 for 10 days (Vedamuthu *et al.*, 1978). The presence of coliform bacteria was tested by the inoculation of milk samples or their dilution into Mac Conkey broth (Mohran, 1971). Duplicate tubes were used and incubated at 37°C for 24 hours. Detection of aerobic and anaerobic spores were determined by (Mohamed, 2000).

Yeasts and molds in samples were counted on Czapek dox agar medium with adding an antibiotic (Difco). Production of aflatoxins and sterigmatocystin as described by (Chelkowski *et al.*, 1974; Josefsson). Data of chemical properties were subjected to statistical analysis using F test. Means were compared using L.S.D. test (Gomez and Gomez, 1984).

Egyptian standards of soft cheese (Double cream) ES (No. 1008/2000).

Egyptian standards of soft cheese with vegetable fats ES (No. 1867/1990).

Egyptian standards for soft cheese (Full cream) ES (No. 1008/2000).

Egyptian standards of mold ripened-blue cheese ES (No. 1183/1998).

Egyptian standards of semi-hard cheese (Edam cheese) ES (No. 1183/1998).

## **Results and Discussion**

### **White Soft Cheese.**

#### **Moisture Content.**

Data in Table (1) show that the moisture contents of full cream and double cream soft cheese are nearly similar to those reported by Rakshy and Attia (1979) and Youssef *et al.* (1982). They indicated that the moisture content increased with the decrease of fat content.

However, moisture contents of half cream soft cheese are not in agreement with those results. Whereas, moisture content of laboratory cheese was lower than that of companies cheese. The moisture contents of full cream and laboratory soft cheese are in agreement with those of Aly and Galal (2002). Generally, our results comply with Egyptian standards for soft cheese with vegetable fats, double cream soft cheese and general standards for soft cheese.

Statistical analysis of the present results showed that moisture content of full cream, double cream, and laboratory white soft cheese had highly significant ( $P < 0.01$ ) differences among companies and laboratory

### **Cheese Acidity**

The titratable acidity of fresh white soft cheese from laboratory and different companies are given in Table (1). The acidity ranged from 0.26 to 0.69% in different examined market white soft cheese. These results are in harmony with those of Abdou *et al.* (1976), Youssef *et al.* (1982), Ibrahim (1991), El-Sissi (1996), and Aly & Galal (2002). The statistical analysis showed that acidity had highly significant ( $P<0.01$ ) differences among companies and laboratory.

### **Salt Content**

The changes occurred in salt contents of fresh soft cheese are shown in Table (1). Also, the changes in salt concentrations in cheese serum are tabulated. The salt contents ranged from 3.11 to 6.32% in different white soft cheese. These results are in agreement with those reported by Rakshy and Attia (1979) and Youssef *et al.* (1982), Ibrahim (1991) and El-Sissi (1996). The statistical analysis showed that salt and salt in serum content had highly significant ( $P<0.01$ ) differences among companies and laboratory.

### **Fat content**

Table (1) shows that the fat contents of cheese were 20, 13.3, 24 and 30% for Domty, El-Misrieen, Green Land and Laboratory soft cheese, respectively. Whereas the fat

contents in dry matter of cheese were 50.31, 34.6, 58.67 and 64.1% for Domty, El-Misrieen, Green Land and Laboratory soft cheese, respectively.

These results of full cream and half cream soft cheese are in agreement with those reported by Ibrahim (1991), Rakshy and Attia (1979), Yossef *et al.* (1982), and Aly & Galal (2002). The statistical analysis showed that there were highly significant ( $P<0.01$ ) differences among companies and laboratory. Table (1) indicated that samples obtained from Green Land had fat in dry matter % less than the limit that it was mentioned in the Egyptian standards for double cream soft cheese. In contrast, the other three examined samples are in harmony with Egyptian standards.

### **Nitrogen Constituents.**

#### **Total Nitrogen (T.N) in Cheese.**

Data in Table (1) shows the differences in the total nitrogen contents of fresh white soft cheese calculated as a percentage in fresh weight (T.N) and (T.N/DM %). The T.N. ranged from 1.57 to 1.86% and (T.N/DM) ranged from 3.35 to 4.56% in fresh white soft cheese. These results are in harmony with those of El-Koussy *et al.* (1977b), Ibrahim (1991), El-Sissi (1996), and Hofi *et al.* (2001). The statistical analysis showed that there were highly

significant ( $P < 0.01$ ) differences among companies and laboratory.

#### **Soluble Nitrogen (S.N) Contents.**

Results in Table (1) shows the soluble nitrogen content (S.N.%) and (S.N./T.N.%) of fresh white soft cheese. They ranged from 0.42 to 0.56% and from 23.96 to 35.57% respectively. These results were higher than those reported by (El-Sissi, 1996, and Aly & Galal, 2002).

Table (1) indicates that fresh product of El-Misrieen company had lower S.N. content than Domty, Green Land and laboratory. This may be due to many factors such as activity of used starter and kind of coagulant. On the other hand, the S.N. /T.N. contents of fresh cheeses obtained from the companies and laboratory were varied. The product from Domty had the lowest value followed by that from laboratory cheese, whereas the highest value was given by Green Land and El-Misrieen white soft cheese. Statistical analysis of present results showed that there were highly significant ( $P < 0.01$ ) variations in both S.N. and S.N. /T.N. % values in the examined white soft cheese depending on the companies and laboratory.

#### **Microbiological Analysis.**

##### **The Total Microbial Counts.**

Table (5) shows the standard plate count of fresh white soft cheese in different companies and Laboratory. Similar results were obtained by (Ibrahim, 1991). The total microbial counts (T.M.C.) in all cheese samples were varied among studied companies, the microbial load of Domty fresh white cheese sample was higher than those of Green Land, El-Misrieen and Laboratory cheese. The average of T.M.C. was ranged from  $20 \times 10^3$  to  $65 \times 10^6$  cfu/g in laboratory and Domty cheese. The decrease of T.M.C. may be due to the differences of heat treatment of cheese milk, the added salt amount, and other inhibitor additives to cheese or its pickling solution, these results are in harmony with those of El-Sissi (1996).

##### **Proteolytic Bacterial Count (P.B.C.)**

Table (5) shows the proteolytic bacterial counts (P.B.C.) of fresh white soft cheese from three companies and laboratory. The count of proteolytic bacteria was varied among examined samples. This may be due to the different salt and milk fat content. These results are similar to those obtained by El-Sissi (1996).

### **Psychrotrophic Bacterial Count.**

Results in Table (5) shows that the psychrotrophic bacterial count in fresh white soft cheese from laboratory and different companies ranged from  $20 \times 10^3$  to  $20 \times 10^5$  cfu/g in Domty and El-Misrieen company cheese, respectively. Whereas, they were not detected in laboratory cheese, this may be due to its higher content of salt. These results are in accord with those of El-Gazzar *et al.* (2002), who observed that the psychrotrophic bacterial count decreased with the increase of salt concentration of cheese milk.

### **Coliform Bacteria.**

Table (5) shows the coliform bacteria in white soft cheese from laboratory and different companies. Data revealed that coliform bacteria were not detected in all examined cheese samples. These results are in agreement with those of Egyptian standards. The absence of coliform bacteria in white soft cheese samples from laboratory and different companies may be attributed to the heat treatment of cheese milk and to high hygienic conditions throughout the manufacture process.

### **Anaerobic Sporeforming Bacteria.**

The average of anaerobic sporeforming bacteria was positive for dilutions  $10^{-1}$  of Domty, El-Misrieen and Laboratory white soft cheese and was positive for dilution  $10^{-2}$  of Green Land cheese.

### **Count of Yeasts and Molds.**

Table (5) shows the count of yeasts and molds in white soft cheese. They were  $7.5 \times 10^2$  cfu/g in Domty and Green Land cheese, while, they were not detected in El-Misrieen and Laboratory cheese.

### **Feta Cheese**

#### **Moisture Content.**

Data in Table (2) shows that the results are nearly similar to those of Alichanidis *et al.* (1984), Katsiari and Voutsinas (1994) and Aly (1995). The highest of moisture content for Feta cheese than white soft cheese may be due to the higher whey proteins content of ultrafiltered milk which led to the increase in water retention (Mehriz *et al.*, 1995). On the other hand, the moisture content of three companies (Domty, Green Land, El-Misrieen) was more than moisture limit content of Egyptian standards, but one company (Panda) is in agreement with that of standards. The statistical analysis showed that the moisture content in Feta cheese was highly significant ( $P < 0.01$ ) differences among companies. This may be due to many factors such as starter, storage temperature and coagulant.

#### **Cheese Acidity.**

The titratable acidity of fresh Feta cheese from different companies are given in Table (2). The results and statistical analysis showed that the acidity content of El-Misrieen was a highly

significant ( $P < 0.01$ ) than those of Domty, Panda and Green Land. Such differences may be due to using rennet in some companies and others using starter and rennet.

#### **Salt Content.**

Table (2) indicates that the average of salt content was differences in mean values could be attributed to the amount of salt added to used milk (El-Sissi, 1996). The average of salt in serum content was 5.21, 5.47, 5.67 and 7.18 for Domty, El-Misrieen, Panda and Green Land, respectively. On the other hand, the salt content of all companies did not exceed the limit salt content of Egyptian standards. Statistically, there were highly significant ( $P < 0.01$ ) differences in salt contents among the studied companies.

#### **Fat Content.**

Fat contents of Feta cheese from different companies are given in Table (2). the average F/DM content of Feta cheese are in agreement with those of Tzanetakis and Litopoulou-Tzanetaki (1992). The F/DM content in all studied companies comply with Egyptian standards.

Statistically, there were highly significant differences ( $P < 0.01$ ) among studied companies in the fat and F/DM contents.

#### **Total Nitrogen.**

Data of Feta cheese (T.N) are shown in Table (2) Results revealed that there were some

differences in T.N. % and T.N/D.M.% among the four examined samples. The product of Green Land company was characterized with the higher values, while the lowest values were found in the product of El-Miserieen company.

The T.N. and T.N/DM % ranged higher protein content than that of soft cheese may be due to use UF membranes which allowed the separation of lower molecular mass compounds such as lactose and minerals into permeate while retaining protein and fat (Hofi *et al.*, 2001). Statistical analysis showed that there was a highly significant difference ( $P < 0.01$ ) in T.N and T.N/DM content among studied companies. The total protein contents of Feta cheese are in agreement with those of Egyptian standards.

#### **Soluble Nitrogen (S.N.) Content.**

Table (2) shows the changes in S.N. and S.N/T.N. content of the examined Feta cheese from different four companies. The values of S.N. % in Feta cheese are in agreement with those reported by (Abd-Rabou and El-Senaity, 2000). The highest values of S.N. and S.N/T.N % were found in Domty company and the lowest values were found in Green Land company. The statistical analysis showed that there was a highly significant difference ( $P < 0.01$ ) in S.N and S.N/T.N content among tested companies.



**Table(1):** Chemical composition of some local white soft cheese.

Components (%) Companies & Lab.	Moisture	Moisture (S.M) <sup>a</sup>	Fat	Fat/DM	Fat/Dry matter (DM) (S.F) <sup>b</sup>	Salt in Cheese	Salt in Serum <sup>c</sup>	Acidity	Total nitrogen (T.N)	T.N/DM	Soluble nitrogen (S.N)	S.N/T.N	Total protein
Domty	60.25	100.42 <sup>A</sup>	20.00 <sup>C</sup>	50.31	125.79 <sup>B</sup>	4.56 <sup>B</sup>	7.57 <sup>B</sup>	0.36 <sup>C</sup>	1.57 <sup>C</sup>	3.95 <sup>C</sup>	0.55 <sup>A</sup>	35.49 <sup>A</sup>	10.02 <sup>C</sup>
Green Land	59.11	98.53 <sup>B</sup>	24.00 <sup>B</sup>	58.67	97.79 <sup>D</sup>	3.33 <sup>C</sup>	5.63 <sup>C</sup>	0.42 <sup>B</sup>	1.75 <sup>B</sup>	4.29 <sup>B</sup>	0.56 <sup>A</sup>	31.88 <sup>B</sup>	11.19 <sup>A</sup>
Laboratory	61.62	85.81 <sup>D</sup>	30.00 <sup>A</sup>	64.10	106.84 <sup>C</sup>	6.32 <sup>A</sup>	11.87 <sup>A</sup>	0.69 <sup>A</sup>	1.86 <sup>A</sup>	3.35 <sup>D</sup>	0.56 <sup>A</sup>	35.57 <sup>A</sup>	11.02 <sup>B</sup>
El-Masrieen	56.88	94.80 <sup>C</sup>	13.30 <sup>D</sup>	34.60	173.27 <sup>A</sup>	3.11 <sup>D</sup>	5.05 <sup>B</sup>	0.26 <sup>D</sup>	1.75 <sup>B</sup>	4.56 <sup>A</sup>	0.42 <sup>B</sup>	23.96 <sup>C</sup>	11.17 <sup>A</sup>
LSD	-	0.0221	7596.9	-	0.0507	0.0086	0.0866	0.0143	0.0086	0.0167	0.0031	0.2362	0.435

<sup>a</sup> S.M. = Moisture/standard moisture.

<sup>b</sup> S.F. = (Fat/DM)/standard (Fat/DM).

<sup>c</sup> Salt in serum (calculated as percentage of cheese moisture content).

\* Means have similar letters are insignificant. In contrast, means have different letters are significant.

**Table(2):** Chemical composition of some local Feta cheese.

Components (%) Companies & Lab.	Moistur e	Moisture (S.M) <sup>a</sup>	Fat	Fat/DM	Fat/DM (S.F) <sup>b</sup>	Salt in cheese	Salt in Cheese (S.S) <sup>c</sup>	Salt in Serum	Acidity	Total nitroge n (T.N.)	T.N/DM	Soluble nitrogen (S.N.)	S.N/T.N	Total protein
Domty	63.96	103.16 <sup>B</sup>	19.00 <sup>B</sup>	52.58	131.46 <sup>A</sup>	3.34	66.80 <sup>C</sup>	5.21 <sup>D</sup>	0.186 <sup>B</sup>	1.688 <sup>B</sup>	4.6780 <sup>B</sup>	0.496 <sup>A</sup>	29.366 <sup>A</sup>	107.64 <sup>B</sup>
Panda	61.91	99.86 <sup>D</sup>	20.00 <sup>A</sup>	52.51	131.29 <sup>AB</sup>	3.51	70.32 <sup>B</sup>	5.67 <sup>B</sup>	0.182 <sup>B</sup>	1.700 <sup>B</sup>	4.0116 <sup>D</sup>	0.456 <sup>B</sup>	27.070 <sup>C</sup>	107.40 <sup>B</sup>
Green Land	63.72	102.77 <sup>C</sup>	19.00 <sup>C</sup>	52.36	130.91 <sup>B</sup>	4.58	91.60 <sup>A</sup>	7.18 <sup>A</sup>	0.180 <sup>B</sup>	1.760 <sup>A</sup>	4.7940 <sup>A</sup>	0.430 <sup>C</sup>	24.430 <sup>D</sup>	112.24 <sup>A</sup>
El-Masrieen	64.17	103.50 <sup>A</sup>	18.00 <sup>D</sup>	50.23	125.59 <sup>C</sup>	3.51	70.36 <sup>B</sup>	5.47 <sup>C</sup>	0.196 <sup>A</sup>	1.570 <sup>C</sup>	4.3200 <sup>C</sup>	0.454 <sup>B</sup>	28.918 <sup>B</sup>	100.40 <sup>C</sup>
LSD	-	0.0243	0.000	-	0.4974	-	0.305	0.0278	0.0062	0.0279	0.0699	0.0082	0.1879	-

<sup>a</sup> S.M. = Moisture/standard moisture.

<sup>b</sup> S.F. = (Fat/DM)/standard (Fat/DM).

<sup>c</sup> S.S. = Salt/standard salt.

## **Microbiological Analysis.**

### **Total Microbial Count.**

Total microbial count (T.M.C.) of Feta cheese are presented in Table (5). These results are in agreement with those reported by (Abdel-Fatah *et al.*, 1998).

### **Proteolytic Bacterial Counts**

Proteolytic bacterial counts (P.B.C.) are presented in Table (5), the average of P.B.C. in Feta cheese ranged from 20 to  $3 \times 10^3$  cfu/g. This difference may be due to the different contents of salt and post-processing contamination during handling after processing, these results are in agreement with those of El-Sissi (1996).

### **Psychrotrophic Bacterial Counts**

Table (5) indicates that psychrotrophic bacterial count in fresh Feta cheese from different companies ranged from  $10^2$  to  $2 \times 10^4$  cfu/g in Panda and El-Misrieen cheese whereas it was  $17 \times 10^2$  cfu/g in Domty cheese but was not detected in Green Land cheese. These may be due to its salt content. These results are in agreement with those reported by El-Gazzar *et al.* (2002).

### **Coliform Bacteria**

Table (5) shows that coliform bacteria were not detected in all studied Feta cheese samples. The absence of coliform bacteria from Feta cheese samples could be attributed to the processing temperature seemed to be

sufficient to destroy them; these results are in harmony with those of Abdel-Fatah *et al.* (1998).

### **Anaerobic Sporeforming Bacteria.**

The average of anaerobic bacteria was positive for dilutions  $10^{-1}$  of Panda, Green Land and El-Misrieen Feta cheese and were not detected in Domty cheese.

### **Yeasts and Molds Counts.**

Table (5) shows the count of yeasts and molds in Feta cheese samples. Data revealed that yeasts and molds were not detected in cheese samples. These results are in agreement with those established by Egyptian standards.

### **Semi Hard Cheese.**

#### **Edam Cheese.**

#### **Moisture Content.**

Change in the moisture contents of fresh imported Edam cheese and during storage at refrigerator temperature are given in Table (3). These results are in harmony with those of (Kucukoner and Haque, 2003). At the end of storage period (30 d), it was found that loss in moisture during storage at cold temperature, the average percentage was 40.91% in examined imported Edam cheese. This result is in agreement with those of Farahat *et al.*, (1978) and El-Koussy *et al.*, (1977a). Statistical analysis showed that there was highly significant ( $P < 0.01$ ) difference in moisture content of cheese as affected by storage period. Imported fresh Edam cheese had a moisture

content does not exceed maximum limit which was mentioned in Egyptian standards.

#### • Cheese Acidity.

Table (3) shows the changes occurred in the values of titratable acidity of imported Edam cheese as affected by cold storage period, it was observed that the average of acidity was 1.08 % in imported cheese. This value was increased significantly ( $P < 0.01$ ) during storage. This may be due to the starters used in cheese manufacture.

#### Salt Contents.

The changes occurred in salt content of imported Edam cheese when at zero time as well as during cold storage are presented in Table (3). Also, the changes in salt concentration in cheese serum are tabulated. The average of salt content was 2.78% in fresh imported Edam cheese. The salt content increased significantly ( $P < 0.01$ ) in imported Edam cheese during storage period. As might be expected, the gradual increase in salt content could be attributed to the loss of moisture. Our results are in agreement with those reported by El-Koussy *et al.*, (1977a) and Amer *et al.*, (1977).

The average of salt content in serum was 6.24 for imported Edam cheese. These values increased significantly ( $P < 0.01$ ) as affected by storage period. The salt content is in agreement with those of

Egyptian standards for imported Edam cheese.

#### Fat Content.

The fat content and F/DM of imported Edam cheese was determined at the beginning of analysis and during storage for 30 days at refrigerator temperature (Table 3).

The average of fat content of imported Edam cheese was 24% at zero time. Calculating fat as percentage of dry matter (F/DM) was 43.34%. The average of fat and F/DM content increased at the end of storage period at refrigerator temperature in imported Edam cheese. The fat and F/DM% increased significantly during storage. Generally, as cheese moisture decreased during storage, fat percent of cheese was increased. These results are in accord with those of Amer *et al.*, (1977) and Girgs *et al.*, (1983). The F/DM% complies with those of Egyptian standards for imported Edam cheese.

#### Total Nitrogen.

Table (3) indicates the total nitrogen (T.N) and T.N/DM of imported Edam cheese at zero time and during storage period. The average of T.N. % was 4.22 for imported Edam cheese, respectively. During cold storage period the nitrogen content increased significantly ( $P < 0.01$ ) in imported cheese. These results are nearly similar to those reported by

Kucnknor and Haque (2003). Data showed that there was no significant difference of T.N/DM during storage for imported cheese.

### **Soluble Nitrogen Content.**

Results in Table (3) shows the soluble nitrogen content (S.N) and (S.N/T.N %) of imported Edam cheese when at zero time and during storage at refrigerator temperature. The average content of (S.N) and (S.N/T.N %) was 0.21 and 5.04% in imported cheese. At the end of storage period the (S.N) and (S.N/T.N %) increased significantly ( $P < 0.01$ ) in imported Edam cheese.

### **Microbiological Analysis.**

#### **Total Microbial Count.**

Results in Table (6) shows the total microbial count of imported Edam cheese at zero time and during storage period. The total microbial count increased throughout the storage period in imported Edam cheese. These results are in agreement with those of (El-Gazzar *et al.*, 2002).

The differences in the predominant bacterial groups in imported Edam cheese when fresh and during the storage for 30 days was characterized with the presence of streptococci group at high rate (80%) of isolates, the incidence of micrococci was (20%) of isolates, while bacilli was found in a rate of (0%) in imported Edam cheese at zero time. At the

end of cold storage period, the higher rate of isolates was found to be the bacilli and micrococci groups while streptococci group was decreased during cold storage period.

#### **Proteolytic Bacteria.**

Table (6) summarizes proteolytic bacterial count of imported Edam cheese. The proteolytic bacteria was not detected at first stage of storage period but it was  $2 \times 10^6$  cfu/g at the end of 30 d (storage period) in imported cheese.

#### **Psychrotrophic Bacteria**

Table (6) shows that the psychrotrophic bacterial count was  $5 \times 10^4$  cfu/g for imported cheese. Whereas, it was  $5 \times 10^6$  cfu/g at the end of storage period for imported cheese.

#### **Coliform Bacteria.**

Data in Table (6) revealed that coliform bacteria were not detected in cheese samples when at zero time or during cold storage period, the absence of such bacteria may be due to the high hygienic condition throughout the manufacture process.

#### **Anaerobic Sporeforming Bacteria**

The average of anaerobic bacteria was positive for dilution  $10^{-1}$  in fresh imported Edam cheese, whereas, positive for dilution  $10^{-2}$  and  $10^{-3}$  after 15 and 30 d of storage at refrigerator temperature, respectively. Molds

and yeasts were not detected at zero time cheese or during cold storage period in imported Edam cheese (Table 6).

### **Blue-Veined Cheese**

#### **Moisture Content.**

Results in Table (4) indicate the moisture/standard moisture content of blue-veined cheese from different companies. The results are in harmony with those reported by Morris *et al.* (1954) and El-Gendy and Hanafy (2001) and are nearly similar to those reported by El-Gendy and El-Badawi (1973). On the other hand, the moisture content in all samples are in agreement with those of Egyptian standard. The statistical analysis of moisture content in blue-veined cheese showed highly significant ( $P < 0.01$ ) differences among companies.

#### **Cheese Acidity.**

The titratable acidity of imported blue-veined cheese from different companies are given in Table (4). The average of acidity ranged from 2.74 to 4.21% are nearly in agreement with those reported by Gomaa *et al.* (1993) and El-Gendy and Hanafy (2001). Statistically, there were significant ( $P < 0.05$ ) differences between both types of cheese among examined types of cheese.

#### **Salt Content.**

Table (4) indicates that the averages of salt content are in harmony with those reported by

Mahmoud *et al.*, (1982). The average of salt content/serum ranged from 9.34 to 10.87%. These results are nearly in agreement with those of El-Gendy and El-Badawi, (1973) and El-Gendy and Hanafy, (2001). The salt content in all cheese samples did not exceed the limit salt content which was reported in Egyptian standards. Statistically, there were highly significant ( $P < 0.01$ ) differences among examined types. The variations in the salt content between cheese types were attributed to the variations in markets demand.

#### **Fat Content.**

Fat determination of blue-veined cheese from different companies are presented in Table (4). These results are nearly similar to those of Mahmoud *et al.* (1982) and Gomaa *et al.* (1993). The fat contents in dry matter are nearly similar to those reported by El-Gendy and Hanafy (2001). In all samples fat/dry matter % was not less than the limit was mentioned in Egyptian standards (Table 4). Statistically, there were highly significant ( $P < 0.01$ ) differences between companies in fat and F/DM %.

#### **Total Nitrogen.**

Table (4) shows that the average of total nitrogen content ranged from 3.34 to 3.61%. These results are in agreement with those reported by (Mahmoud *et al.*, 1982 and Gomaa *et al.*, 1993). Table (4)

**Table(3):** Changes in composition in imported Edam cheese held at refrigerator temperature for 30 d.

Storage period (d)	Components (%)	Moisture	Fat	Fat/DM	Salt in Cheese	Salt in Serum	Acidity	Total nitrogen (T.N.)	T.N/DM	Soluble nitrogen (S.N.)	S.N/T.N	Total protein
	Types											
Fresh	Imported	44.55	24.00	43.34	2.78	6.24	1.08	4.22	7.61	0.210	5.04	26.92
15	Imported	44.33	25.13	45.02	3.06	6.90	1.16	4.37	7.84	0.220	5.10	27.87
30	Imported	40.91	26.13	44.22	3.38	8.27	1.35	4.37	7.40	0.630	14.46	27.92

**Table(4):** Chemical composition of imported blue-veined cheese.

Components (%)	Moisture	Moisture (S.M) <sup>a</sup>	Fat	Fat/DM	Fat/DN (S.F) <sup>b</sup>	Acidity	Salt in cheese	Salt in cheese (S.S.) <sup>c</sup>	Salt in serum	Total nitrogen (T.N.)	T.N/DM	Soluble nitrogen (S.N.)	S.N/T.N	Total protein
Companies.														
Lady Barid	43.19	86.38 <sup>C</sup>	32.118 <sup>B</sup>	56.53	117.77 <sup>B</sup>	4.2160 <sup>A</sup>	4.67	93.44 <sup>B</sup>	10.814 <sup>B</sup>	3.348 <sup>D</sup>	5.706 <sup>B</sup>	1.19 <sup>A</sup>	29.892 <sup>A</sup>	24.448 <sup>A</sup>
Snow White	43.31	86.63 <sup>B</sup>	30.060 <sup>D</sup>	53.05	110.52 <sup>C</sup>	2.740 <sup>B</sup>	4.71	94.32 <sup>A</sup>	10.874 <sup>A</sup>	3.572 <sup>B</sup>	6.296 <sup>A</sup>	1.44 <sup>A</sup>	40.196 <sup>A</sup>	22.77 <sup>A</sup>
Viking	41.08	82.16 <sup>D</sup>	31.040 <sup>C</sup>	52.64	109.68 <sup>D</sup>	3.374 <sup>A</sup>	4.30	86.08 <sup>C</sup>	10.462 <sup>C</sup>	3.612 <sup>A</sup>	6.126 <sup>A</sup>	1.35 <sup>A</sup>	37.716 <sup>A</sup>	23.028 <sup>A</sup>
Rosen borage	44.13	88.26 <sup>A</sup>	35.080 <sup>A</sup>	62.78	130.80 <sup>A</sup>	3.2480 <sup>B</sup>	4.12	82.56 <sup>D</sup>	9.342 <sup>D</sup>	3.50 <sup>C</sup>	6.262 <sup>A</sup>	1.13 <sup>A</sup>	32.186 <sup>A</sup>	21.65 <sup>A</sup>
LSD	-	0.053	0.0623	-	0.175	0.9129	-	0.3602	0.0448	0.0163	0.2742	27.656	11.062	4.817

<sup>a</sup> S.M. = Moisture/standard moisture.<sup>b</sup> S.F. = Fat/standard fat.<sup>c</sup> S.S. = Salt/standard salt.

shows that the average of T.N/DM was 5.70 to 6.29%. There were highly significant ( $P < 0.01$ ) differences in total nitrogen content among companies.

#### **Soluble Nitrogen (S.N) Content.**

Table (4) revealed that the average of soluble nitrogen content ranged from 1.13 to 1.44%. These results are in harmony with findings previously reported by (Mahmoud *et al.*, 1982). Table (4) shows that the average of (S.N/T.N) ranged from 29.98 to 40.19%. This higher average of the degradation of protein is mainly due to the action of bacterial enzymes. Statistical analysis showed that the (S.N%) and (S.N/T.N%) had no significant differences among tested companies.

#### **Microbiological Analysis.**

##### **Total Microbial Count.**

Table (5) summarizes the total microbial count in imported blue-veined cheese from different companies. The average of total microbial count ranged from  $13 \times 10^6$  to  $90 \times 10^6$  cfu/g. These results are nearly in agreement with those of (Gomaa *et al.*, 1993).

**Proteolytic Bacteria.** Table (5) shows that the average of proteolytic bacteria count ranged from  $3 \times 10^5$  to  $18 \times 10^5$  cfu/g. This difference may be due to the different acidity values, which

inhibited the proteolytic bacteria (Mahmoud *et al.*, 1982).

**Coliform Bacteria.** Results in Table (5) indicate that the coliform bacteria were not detected in cheese samples, the absence of coliform bacteria may be attributed to the high hygienic conditions throughout the manufacture process.

**Anaerobic Sporeforming Bacteria.** The anaerobic sporeforming bacteria was positive for dilutions  $10^{-1}$  for all studied companies.

**Psychrotrophic Bacteria.** Table (5) shows that the psychrotrophic bacteria were not detected in imported cheese samples. These results are in agreement with those reported by (Gomaa *et al.*, 1993).

**Isolation and Identification of Molds Content.** The mycological analysis of blue-veined cheese indicated that the Rosen Borg cheese was contaminated with *Aspergillus niger* besides *Penicillium roqueforti*, but Snow White had other fungal species such as *Aspergillus flavus* besides *Penicillium roqueforti*, whereas, Lady Biard and Viking companies were free from any fungal species except *Penicillium roqueforti*. The present study revealed that cheese were found to be free from toxin. These results are in accord with those of (El-Gendy and Hanafy, 2001).

**Table(5):** Microbial content of cheeses from laboratory and different companies.

Types	Companies & Laboratory	Microbial count cfu/g of cheese				
		Total microbial count cfu/g l	Psychrotrophic	Proteolytic	Coliform	Yeasts and molds
1. white soft cheese	Domty	$65 \times 10^6$	$20 \times 10^3$	$4 \times 10^3$	0.0	$7.5 \times 10^2$
	Green Land	$30 \times 10^4$	$12 \times 10^4$	$2 \times 10^4$	0.0	$7.5 \times 10^2$
	Laboratory	$20 \times 10^3$	0.0	$3 \times 10^2$	0.0	0.0
	El-Masrieen	$15 \times 10^6$	$20 \times 10^5$	$5 \times 10^5$	0.0	0.0
2. Feta cheese	Domty	$27 \times 10^3$	$17 \times 10^2$	$3 \times 10^2$	0.0	0.0
	Panda	$3.4 \times 10^2$	$10^2$	20	0.0	0.0
	Green Land	$6 \times 10^3$	0.0	$10^3$	0.0	0.0
	El-Masrieen	$9 \times 10^4$	$2 \times 10^4$	$3 \times 10^3$	0.0	0.0
3. Blue-veined cheese	Lady Barid	$22 \times 10^6$	0.0	$3 \times 10^5$	0.0	-
	SnowWhite	$58 \times 10^6$	0.0	$7 \times 10^5$	0.0	-
	Viking	$13 \times 10^6$	0.0	$18 \times 10^5$	0.0	-
	Rosen borage	$90 \times 10^6$	0.0	$15 \times 10^5$	0.0	-

**Table(6):** Changes in microbial content of imported Edam cheese during storage at refrigerator temperature.

Storage	Types	Microbial count cfu/g of cheese				
		Total Microbial count cfu/g l	Psychrotrophic	Proteolytic	Coliform	Yeasts and molds
0	Imported	$12 \times 10^6$	$5 \times 10^4$	0.0	0.0	0.0
15	Imported	$18 \times 10^6$	$14 \times 10^4$	0.0	0.0	0.0
30	Imported	$24 \times 10^6$	$5 \times 10^6$	$2 \times 10^6$	0.0	0.0

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## تقييم جودة بعض أنواع الجبن المحلية والمستوردة.\*

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في هذه الدراسة تم تجميع عينات لمنتجات جبن محلية و مستوردة لبعض الشركات والمعامل ومقارنتها بالموصفات القياسية المصرية ، وقد تم التقييم الكيماوي والميكروبيولوجي لكل من الجبن الأبيض الطري و الجبن الدبل كريم و الجبن ألفتا كمنتجات محلية ، و الجبن الر克福وروالجبن الايدام كمنتجات مستوردة . ويمكن تلخيص أهم النتائج المتحصل عليها على النحو التالي :

- كانت نسبة الرطوبة في الجبن الأبيض الطري مطابقة مع ما حددته المواصفات القياسية ، اما الدهن فقد قلت نسبته في الجبن الدبل كريم عن المحدد في المواصفات القياسية .

- كانت نسبة الرطوبة في بعض عينات الجبن الفيتا اقل من النسبة التي أقرتها المواصفات القياسية ، أما نسبة الدهن في المادة الجافة ، فقد اتفقت مع المواصفات القياسية للمعينات المختبرة .

- لم تقل نسبة الدهن والرطوبة في الجبن الايدام عما أقرته المواصفات القياسية في عينات الجبن المستورد ، كما أن نسبة الدهن والنتروجين الكلى زادت أثناء التخزين .

- أظهرت النتائج أن العدد الكلي للميكروبات و البكتريا المحللة للبروتين و البكتريا التي تنمو على درجة حرارة الثلاجة و الخمائر و الفطريات في العينات السابقة اختلفت بين الشركات و المعامل المنتجة ، كما لم تظهر بكتريا القولون في جميع الجبن المختبرة.

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