Official Journal Issued by Faculty of Veterinary Medicine

Benha Veterinary Medical Journal

Journal homepage: https://bvmj.journals.ekb.eg/

Since 1990

Original Paper

Quality assessment of yoghurt quality produced for foreign markets.

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ARTICLE INFO

Keywords

Yoghurt
Milk
Assessment

Received 06/04/2021
Accepted 28/04/2021
Available On-Line 01/07/2021

ABSTRACT

One hundred and forty random samples, 20 samples of plain yoghurt produced for foreign markets(F), 60 samples of plain yoghurt produced for local markets20 of each brand plain yoghurt (A, B, C) 60 samples of fruit yoghurt produced for local markets 20 for each brand (M, N, L) were collected from the marketing points. The collected samples were examined organoleptically, chemically, and microbiologically. The obtained results revealed that the highest score of examined yoghurt samples for sensory evaluation was F brand of examined plain yoghurt samples than fruit yoghurt samples (M, N, L). Acidity% in plain yoghurt samples were 0.90, 0.95, 1.06 and 0.98(F, A, B, C) respectively, while in case of fruit yoghurt samples were 0.92, 1.03 and 0.91(M, N, L) respectively. The mean coliform count/g in examined yoghurt samples was 1.85±1.01, 1.54 $x10^2$±0.07 $x10^2$ for plain yoghurt (B, C) while, 1.62 x10±1.12 x10 in fruit yoghurt (M)..The mean staphylococci count/g in examined natural yoghurt were (F, A, B,C) 0, 1.45x10±0.95x10C, 8.85x10±8.01x10 and1.54 x102±1.02x102 ,respectively. While in fruit yoghurt (M, N, L) the mean values were 1.62X102 ± 1.12 X 102, 9.25X10 ±8.01X10 and5.54 X 10 ± 4.01 X 10.

1. INTRODUCTION

Yoghurt is the most common and popular fermented dairy product in Egypt and various parts of the world. Its production and consumption are growing continuously due to its health benefits beside its high nutritive value (Ashraf and Shah, 2011).

Yoghurt has valuable nutritional as they supply high quality proteins and excellent source of calcium, phosphorous and potassium the carbohydrate content is easily absorbed even by lactose maldigestions (Bhattarai and Das, 2016).

Yoghurt is produced through the fermentation of milk lactose by Streptococcus thermophilus and Lactobacillus delbrueckii subsp pbulgaricus (Tamime and Robinson, 2007).

Despite yoghurt is generally considered as microbiologically stable, they may be subjected to contamination with acid tolerant fungi, which can grow at a wide pH range of 3 to 8 and cause sensory and economic problems (Girma et al., 2014). Such fungal contamination may constitute a risk for public health due to production of mycotoxin such as aflatoxins, which impair the cell mediated immune system of the consumer (Nwagu and Amadi, 2010).

Coliforms are still valid as post processing indicator for contamination in yoghurt industry since coliforms are unable to survive heat treatment applied during yoghurt manufacture. Coliforms are responsible for inferior quality or even unmarketable product (Yabaya and Idris, 2012).

Staphylococcus aureus (*S. aureus*) in yoghurt is an index of its contamination during processing, handling and packaging since they are often found on the outer surface. Moreover, Enterotoxigenic *S. aureus* strains may find opportunity to grow and multiply in the food leading to food poisoning among consumers. (Abdel hameed, 2011)

Due to continuous demand for yoghurt, and the increase of consumer's awareness of the product safety, therefore the present study was planned to evaluate yoghurt quality including organoleptic evaluation, chemical and microbiological examination.

2. MATERIAL AND METHODS

2.1 Collections of samples

A total of One hundred and forty random samples, 20 samples of plain yoghurt produced for foreign markets, 20 of each brand plain yoghurt (A, B, C) and 20 of fruit yoghurt for each brand (M, N, L) were collected from the importation points. The yoghurt packs were intact and within the valid date of consumption. The samples were transferred in ice box to the laboratory directly for examination.

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2.2. Preparation of yoghurt samples

Yoghurt samples were thoroughly mixed before being examined after opening of the yoghurt package using sterile stirrer.

2.3 Organoleptic evaluation of yoghurt samples

The plain and fruit yoghurt were organoleptically evaluated according to Body felt et al. (1988). The scores given were 10 points for flavour, 5 points for body and texture and 5points for appearance with an overall score of 20 points. The evaluation was done by 7 trained member panels from the Faculty of Veterinary Medicine, Menofia University.

2.4 Chemical examinations of yoghurt samples

Yoghurt samples were examined forTitratable acidity and Solid not fat according to (Chandanet al, 2006),Total solids according to(Anonymous, 1991),Fat% by Gerber Method (BSI696.1955).

2.5 Microbiological examination

Yoghurt samples were examined for total coliform count (APHA, 1992), total Staphylococcus aureuscount(AOAC, 2000),total yeast and mould count (IDF,1990).

2.6 Statistical analysis

Statistical comparisons were made by using one-way analysis of variance (ANOVA). The results were considered significantly different with P <0.05.as described by Clarke and Kempson

3. RESULTS

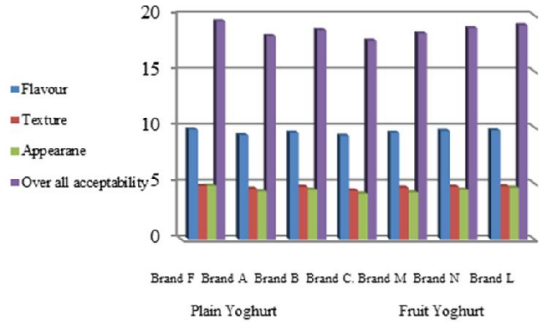

Figure (1): Statistical analytical results for the mean values of organoleptic evaluation of the examined yoghurt samples.

Table (1) chemical composition (fat, total solids, and milk solid not fat %) of the examined yoghurt samples (N= 20 of each)

Yoghurt sample		Fat% Mean± S.E	T.S% Mean± S.E	MSNF% Mean± S.E
Plain yoghurt	Brand F	4.53±0.26 ^{A}	15.5±0.49 ^{C}	10.97±0.
	Brand A	3.73±0.11 ^{B}	14.05±0.25 ^{C}	10.32±0.19 ^{D}
	Brand B	4.15±0.08 ^{A}	14.9±0.23 ^{C}	10.75±0.18 ^{D}
	Brand C	3.57±0.10 ^{B}	12.8±0.19 ^{D}	9.23±0.44 ^{E}
Fruit yoghurt	Brand M	2.84±0.09 ^{D}	21.52±0.26 ^{B}	18.68±0.31 ^{C}
	Brand N	3.14±0.11 ^{C}	27.28±0.11 ^{A}	24.14±0.05 ^{AB}
	Brand L	3.34±0.06 ^{C}	29.42±0.41 ^{A}	26.08±0.11 ^{A}

N= Number of examined samples. S.E= Standard Error.
Means with different letters in the same column are significantly different (p<0.05)

Table (2): Statistical analytical results of titratable acidity values of the examined yoghurt samples
(N= 20 of each)

Yoghurt sample		Min.	Max	Mean± S.E
Plain yoghurt	Brand F	0.65	1.15	0.90±0.05 ^{A}
	Brand A	0.55	1.35	0.95±0.02 ^{B}
	Brand B	0.69	1.44	1.06±0.01 ^{C}
	Brand C	0.75	1.21	0.98±0.03 ^{B}
Fruit yoghurt	Brand M	0.61	1.24	0.92±0.02 ^{A}
	Brand N	0.69	1.37	1.03±0.03 ^{C}
	Brand L	0.67	1.15	0.91±0.02 ^{A}

N= Number of examined samples. S.E= Standard Error
Means with different letters in the same column are significantly different (p<0.05).

Table (3): Statistical analytical results of Coliform count (MPN/ gm.) of the examined yoghurt samples
(N= 20 of each)

Yoghurt samples		Min.	Max	Mean± S.E
Plain yoghurt	Brand F	0	0	0
	Brand A	0	0	0
	Brand B	4	2.45x10	1.85±1.01 A
	Brand C	120	$2.15x10^{3}$	$1.54x10^{2}$±0.07x10 ^{2C}
Fruit yoghurt	Brand M	9	$1.24 x10^{2}$	1.62 x10±1.12x10 ^{B}
	Brand N	0	0	0
	Brand L	0	0	0

Table (4): Statistical analytical results of Staphylococcus auraus count of examined yoghurt samples
(N= 20 of each)

Yoghurt samples		Positive samples No	Positive samples %	Min.	Max.	Mean± S.E
Plain yoghurt	Brand F	0	0	0	0	0
	Brand A	2	10	$1.00x10^{2}$	$2.45x10^{2}$	1.45x10±0.95x10 ^{A}
	Brand B	3	15	$2.00x10^{2}$	$2.45x10^{2}$	8.85x10±8.01x10 ^{AB}
	Brand C	3	15	$1.00x10^{2}$	$3.00x10^{3}$	$1.54 x10^{2}$ ±1.02 $x10^{2}$ ^{C}
Fruit yoghurt	Brand M	4	20	$1.00x10^{3}$	1.243 x104	$1.62 x10^{2}$±$1.12x10^{2}$ C
	Brand N	4	20	$1.00x10^{2}$	$2.00x10^{3}$	9.25x10±8.01x10 ^{AB}
	Brand L	2	10	$1.00x10^{2}$	$2.00x10^{2}$	5.54 x10±4.01x10 ^{B}

N= Number of examined samples. S.E= Standard Error
Means with different letters in the same column are significantly different (p<0.05).

Table (5): Statistical analytical results of total yeast and mould count of examined yoghurt samples(N= 20 of each)

Yoghurt samples		Positive samples No	Positive samples %	Min.	Max.	Mean± S.E
Plain yoghurt	Brand F	8	40	1.00x10	$1.00x10^{2}$	1.35x10±1.19x10 ^{A}
	Brand A	13	65	1.00x10	$1.00x10^{3}$	9.85x10±4.01x10 ^{AB}
	Brand B	15	75	1.00x10	$1.45x10^{3}$	$1.55x10^{2}$ ±0.55x10^{2C}
	Brand C	16	80	2.00x10 ^{2}	$1.52x10^{4}$	$1.74 x10^{2}$±0.64 $x10^{2C}$
Fruit yoghurt	Brand M	15	75	1.00x10	$4.24x10^{4}$	$2.62 x10^{3}$±$2.12x10^{3D}$
	Brand N	13	65	1.00x10	$1.00x10^{3}$	9.25x10±4.35x10 ^{AB}
	Brand L	12	60	1.00x10	$1.00x10^{2}$	5.54 x10±1.45x10^{B}

N= Number of examined sample. S.E= Standard Error
Means with different letters in the same column are significantly different (p<0.05)

4. DISCUSSION

The organoleptic evaluation of dairy products is used to assess quality of product and helpful in pointing out the possible defects that may be found to improve the marketing and acceptability of the products.

Figure (1) revealed that the mean values of flavour of examined plain yoghurt for foreign market (F) was 9.72 ±0.05while flavour for other plain yoghurt brand (A,B, C) were 9.32±0.05, 9.54±0.03 and 9.27±0.1, respectively. The mean values of flavour of fruit yoghurt brands (M, N, L) were 9.53±0.03, 9.70±0.05and 9.74±0.05, respectively. The acidity of yoghurt plays a major role in yoghurt flavor and yoghurt flavor is the most critical and important determination of consumer acceptance. Higher acid content in yoghurt may due to excessive levels of lactic acids produced by starter culture metabolism, frequently encountered in plain yoghurt (Aiad, 2002). Body and texture:

Figure (1) revealed that the mean value of texture of examined plain yoghurt for foreign market (F) was 4.80±0.01, while in plain yoghurt (brands A, B and C) were 4.54±0.13, 4.72±0.02 and 4.38±0.1respectively. In fruit yoghurt (brands M, N and L) were 4.64±0.05, 4.73±0.02 and 4.77±0.02respectively.

The most detected defect of small scale yoghurt texture was weak body. Grainy yoghurt may be attributed to an excessive amount of culture, too high incubation temperature. The possible causes of weak yoghurt are low total milk solids content, under incubation in the fermentation stage and occasionally too high pasteurization temperature (Aiad, 2002)

Figure (1) showed that the mean value of appearance of examined plain yoghurt for foreign market (F) was 4.68, while in plain yoghurt brands (A, B and C) were 4.32, 4.45 and 4.12, respectively. In fruit yoghurt (brands A, B and C) were 4.23, 4.45 and 4.64, respectively. The most common defect of plain yoghurt appearance was whey off (synerssis). Free whey is a defect frequently caused by contraction of the coagulum or gel structure due to low milk solids content and may also result from excess acid development or may occur if the yoghurt is agitated or moved at a critical time during incubation when the pH of Yoghurt is at or above the isoelectric point of casein (pH=4.65) (Bodyfeltet al., 1988).

Overall score values of examined plain yoghurt for foreign market (F) has the highest score which 19.2 while flavor for other plain yoghurt brand (A,B, C) were 18.18, 18.71and 17.77,respectivelly. In fruit yoghurt brand (M, N and L) were 18.4, 18.88 and 19.15, respectively. The obtained values of plain yoghurt samples were run parallel to those recorded by Al-otaibi (2009). Comparatively lower values were recorded by Farindeet al., (2008).

The obtained values of fruit yoghurt agreed to some extent with that reported by Ghadgeet al., (2008).

The scores of flavour, texture and appearance of plain yoghurt samples were the lowest in comparison to that of yoghurt samples made for foreign markets this may be due to the quality of the milk used, starter culture, equipment, water, personal hygiene and packaging that is agreed with that reported by (Uddinet al.,2013) as plant made yoghurt were very pleasant and delicate flavors.

The results of organoleptic evaluation of fruit yoghurt samples showed high scores than that of plain yoghurt which may be attributed to the incorporation of fruit and sweeteners which increased its acceptance which agreed with that reported by Tarakci and Kucukoner (2003)

Inspection of Table (1) revealed that the fat % of examined plain yoghurt samples for foreign markets with mean values of 4.53 ± 0.26%. While in plain yoghurt brands (A, B, C) their mean values of fat % were 3.73± 0.11, 4.15 ± 0.08 and 3.57 ± 0.10%, respectively, while for examined fruit yoghurt samples brands (M, N, L) the mean values were 2.84 ± 0.09, 3.14 ± 0.11 and 3.34 ± 0.06, respectively.

Nearly similar values of large scale plain yoghurt samples brand A were reported by Hashim (2001) and brand B and C values were similar to that reported by Farindeetal., (2008). Comparatively lower values were obtained by Soomroet al., (2003).

Nearly similar values of fruit yoghurt were reported by Tarakci and Kucukoner (2003,). Relatively lower values were reported by El Bakri and Ibtisam (2009).

There was hardly any variation in fat content of different samples of plant made yoghurt probably because of good manufacturing practices i.e standardization of raw milk. Milk is used without standardization resulting in compositional variation from sample to sample similarly as milk composition varies from day to day or batch to batch (Youniset al., 2002).

Table (2) showed that the total solids % of plain yoghurt for foreign markets (F) was with mean values of 15.5± 0.49, while the total solids % of plain yoghurt brands (A, B, C) was 14.05 ± 0.25, 14.9 ± 0.23 and 12.8±0.19%, respectively. There was less variation in total solids of different samples of plain yoghurt brands most probably because of standardization of raw milk and quality control measures taken to ensure consistency of product (Youniset al., 2002)

While the total solids % of examined fruit yoghurt brands (M, N, L) with mean values of 21.52 ± 0.26, 27.28 ± 0.11 and 29.42 ± 0.41%, respectively. The fruit yoghurt samples had higher total solids than the plain yoghurt samples. This could be attributed to the variation of type of fruit between batches since sampling was done regardless of the type of fruit and the type of fruit yoghurt set yoghurt (fruit on bottom) or stirred El Bakri and Ibtisam (2009).

The results were nearly similar in plain yoghurt samples brand A and brand B to that reported by Salwaet al., (2004) respectively while brand C values were similar to that reported by El Bakri and Ibtisam (2009). Comparatively lower values were obtained by Khan etal., (2008).

The obtained values of fruit yoghurt samples were agreed to some extent with reported by El Bakri and Ibtisam (2009). Relatively lower values were reported by Tarakci and Kucukoner (2003).

The acidity% of examined yoghurt samples for foreign markets (F) was ranged from 0.65 to 1.15 with mean values of 0.90 ± 0.05.while plain yoghurt brands (A,B,C), their acidity % were ranged from 0.55 to 1.35 ,from 0.69 to 1.44 and from 0.75 to 1.21 respectively with mean values of 0.95± 0.02 , 1.06± 0.01 and 0.98 ± 0.03 respectively.(Table,2)

In fruit yoghurt brands, the acidity % were ranged from 0.61 to 1.24, from 0.69 to 1.37and from 0.67 to 1.15 respectively with mean values of 0.92± 0.02, 1.03 ± 0.03 and 0.91 ± 0.02, respectively.

The obtained result of plain yoghurt agreed to some extent with that reported by Musaigeret al., (1998). Comparatively lower values were obtained by Soomroet al.,(2003). Relatively higher values were reported by Ghadgeet al., (2008) and Nahla (2009). The obtained result of fruit yoghurt were run parallel to that recorded by Ali etal., (2004). Relatively higher results were reported by Walaa (2004) and Ghadgeetal., (2008). There was little variation in acidity of different samples of yoghurt this may be due to controlled incubation and postproduction handling and controlled storage at 4 °C (Youniset al., 2002).

Table (3) revealed that plain yoghurt samples for foreign markets (F) and plain yoghurt brands A Coliforms couldn't be detected in them, while in plain yoghurt brands B and C their coliform counts (MPN/g) ranged from 4 to 2.45 X 10 and from 120 to 2.15X 103 with mean count values of 1.85± 1.01 and l.54 X 102 ± 0.07 X 102, respectively. In fruit yoghurt brands, their coliforms count (MPN/g) in brand M was ranged from 9 to 1.24X 102 with mean count value of 1.62 X 10 ± 1.12 X 10 while brand N and L were free from coliforms.

The obtained counts of examined plain yoghurt samples brand A were run parallel with that obtained by Erkinand Eren(2008) while that of brand B and C were similar to that reported by Youniset al., (2002), while comparatively higher counts were recorded by Ahllamand Hanna (2006).

The obtained results of examined fruit yoghurt samples brands A and B were agree to some extent with that obtained by Tarakci and Kucukoner (2003) while comparatively higher counts were recorded by Walaa (2004) while relatively lower incidence and count were reported by Quieroz et al., (2002)

According to EOSQ(1000 /2005) which stipulated that, coliforms count shouldn't be more than 10 cell/gm or ml, so plain yoghurt brands B and C samples and fruit yogurt brand M were failed to comply with this standard.

The obtained results as recorded in Table (4) revealed that contamination level in plain yoghurt brands (A, Band C) have (8, 12 and12%), respectively. Their S. aureus counts with mean count values of 1.45x10±0.95x10C, 8.85x10±8.01x10 and1.54 x102±1.02x102, respectively.

In fruit yoghurt 16, 16 and 8% of examined brand M, brand N and brand L samples were contaminated. Their S. aureus counts ranged from 1.00 X 103to 1.24X 104 , from 1.00 X 102 to 2.00 X 103 and from 1.00 X 102 to 2.00 X 102 with mean count values of 1.62X102 ± 1.12 X 102, 9.25X10 ±8.01X10 and5.54 X 10 ± 4.01 X 10 respectively.

The obtained incidence of examined plain yoghurt samples were parallel to those obtained by Hassan, (2003) and Hamaad (2004). Higher incidence was obtained by Eman (2007). Nearly similar counts of brands B and C samples were obtained by Hanna Hamaad(2004) while brand A count agree to some extent with those reported by Eman (2007).

In fruit yoghurt their counts were similar to that reported by Belickova et al., (2001) while lower counts and incidence were reported by Abd El Hady (1998).Higher incidence were reported by Kozacinskiet al., (2003).

Plain and fruit yoghurt brands respectively failed to comply with (EOSQ) (1000-1650 /2005) which stipulated that, yoghurt /fruit yoghurt should be free from pathogenic microorganisms and their enterotoxins.

Moreover, presence of S. aureus in dairy products may originate from environmental sources as S. aureus is one of the most resistant non- spore forming human pathogens and can survive for extended period in a dry state. Food contaminations from air, dust, Sewage and water have been documented in several outbreaks.

Although S. aureus is a robust bacterium and can survive for long periods at low temperatures below those which permit growth. Yet, refrigeration at < 4 °C may be considered the only viable method for control of growth and toxin production (ICMSF, 1996 and Marthand Steel, 2001).

Inspection of Table (5) revealed that plain yoghurt brands (A,B and C),their contamination levels were 52 ,60 and 64% respectively and their counts ranged from 1.00 X 10 to l .00 X 103 , from 1.00 X 10 to l.45 X 103 and from 2.00 X 102 to 1.52 X 104 with mean values of 9.85 X 10 ± 4.01 X 10 , 1.55 X 102 ± 0.55 X 102 and 1.74 X 102±0.64X102 respectively.

In fruit yoghurt (brands A, B and C) their contamination levels were 75, 65 and 60%. Their counts ranged from 1.00 X 10 to 4.24 x104, from 1.00 X 10 to 1.00 X 103 and from 1.00 X 10 to 1.00 X 102 with mean count values of 2.62 X 103 ± 2.12 X 10 , 9.25X 10 ± 4.35 X 10 and5.54 X 10 ± 1.45 X 10 respectively.

The obtained counts of plain yoghurt samples were run parallel to that recorded by Hannaa (1999). Comparatively lower counts were recorded by Eman (2007) and Erkin and Iren (2008). Relatively higher counts were reported by Hamaad (2004) and Eman (2007).

In fruit yoghurt higher incidence were reported by El Bagoury and Mosaad (2002). The obtained counts of brand C agree to some extent, to those reported by El Bagoury and Mosaad(2002) and that of brands A and B agree to some extent with the obtained result of Nashwa et al., (2010).

On the other hand, moulds and yeasts have the ability to hydrolyse protein and lipids therefore, the growth of moulds as Alternaria, Geotrichum, Mucor and Penicillium species on the surface of dairy products lead to off flavours , while the growth of Aspergillus, Cladosporium, Mucor and Penicillium species may be responsible for bitterness and rancidity (Pitt and Hocking, 1998). Presence of yeasts and moulds in yoghurt is being indicative of poor sanitary practices in manufacturing and /or packaging.

5.CONCLUSION

The assessment of results obtained allow to conclude that most of fermented milk produced for foreign market don't satisfy the good sanitary conditions during production. Information given by the results of bacteriological examination reported here-in points out that the sanitary measures adopted during production and handling of this product is neglected in most cases as coliforms existed in some samples of yoghurt which are supposed to be heat treated before being manufactured.

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