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الفطريات والخمائر المتواجدة في اللبن الجاف ومخلوط الأيس كريم الجاف المطعم بالأنصاف المختلفة

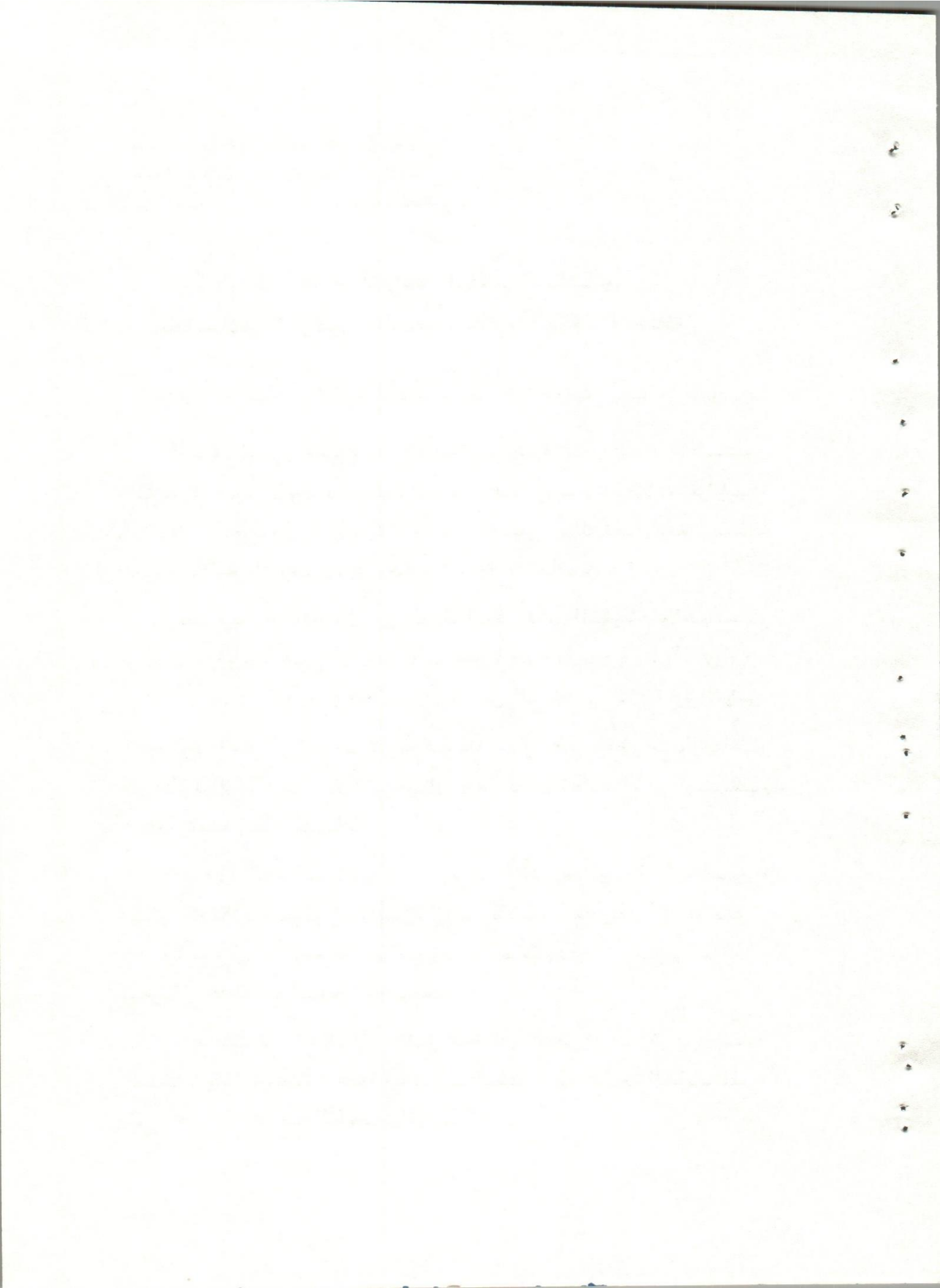
فوزى أبو الخير ، توفيق البسيوني ، أحمد عبد الحميد ، مصطفى خليل

أجريت الدراسة على عدد ٧١ عينة من بودرة اللبن الجاف الكامل والمنزوع الدسم ومخلوط الأيس كريم المطعم بالشيكولاته والبرتقال والفراولة والفانيليا جمعت من مصنع سخا لمنتجات الألبان وذلك لعزل وتصنيف الفطريات المحتمل وجودها في هذه المنتجات الجافة .

وقد دلت النتائج على أن متوسط العد الكلي للفطريات والخمائر في الجرام الواحد هي ١٠×٩٤١ ، ١٠×١١٤٥ ، ١٠×١١ ، ١٣٧×١٠ .
 ١٠×١٢٣٨ ، ١٠×٤٢٣ لكل من المنتجات السابقة على التوالي .
وقد اتضح أن أكثر المنتجات المجففة احتواءً على الفطريات والخمائر هو مخلوط الأيس كريم المطعم بالبرتقال وأقلهما هو مخلوط الأيس كريم الجاف المطعم بالفانيليا .

تم عزل الفطريات الاتية وهي أصناف : الأسرجيلس ، البنسيليوم ، الميكور ، والكلا د وسوريم والريزويس والابسيد يابنسب متفاوتة ، كما تواجدت هذه الأنواع من الأسرجيلس في المنتجات الجافة وهي أسرجيلس نيجر ، أسرجيلس فليفس ، أسرجيلس فيوميغيتس .

وقد تمت مناقشة النتائج وتأثير الفطريات المعزولة على كل من هذه المنتجات وكذلك مناقشة أهمية الفطريات المعزولة على الصحة العامة والاشتراطات الصحية الواجب توافرها .



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ENUMERATION OF MOLDS AND YEASTS IN DRIED MILK AND ICE-CREAM PRODUCTS

(With 4 Tables)

By

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SUMMARY

A total of 71 samples representing dried whole and skim milk, dried ice-cream mix with chocolate, orange, strawberry and vanillia were collected from Sakha processing dairy plant and examined for incidence of molds and yeasts. The mean colony count of molds and yeasts/g. of the examined samples were $9.41 \pm 1.1 \times 10^2$, $11.45 \pm 1.33 \times 10^2$, $11.0 \pm 1.49 \times 10^2$, $13.7 \pm 0.56 \times 10^2$, $12.38 \pm 1.3 \times 10^2$ and $4.23 \pm 0.59 \times 10^2$, respectively. Dried ice-cream mix with orange reveal higher count more than other dried milk products, while lower count was observed in dried ice-cream with vanillia. All dried milk and ice-cream products were heavily contaminated with yeasts. Lower count also observed in dried ice-cream mix with vanillia. Molds isolated were belonged to six genera, Aspergillus, Penicillium, Mucor, Cladosporium, Rhizopus and Absidia spp. Identification of the isolated Aspergillus revealed that *A.niger*, *A.flavus* and *A.fumigatus* could be isolated in different percentages. The public health importance of the existing fungi as well as suggested measures for improving the quality of the dried products are discussed.

INTRODUCTION

The quality of dairy products as they reach the consumer depends not only on the condition of the raw material but also on the changes which may take place during manufacture, storage and distribution. As various species of molds and yeasts find dairy products an excellent media for growth, thus inducing certain undesirable changes (MOSSSEL, 1975; JAY, 1978; NAKOE and YONEYA, 1978).

Among the important mold species usually responsible for food spoilage are Aspergillus, Penicillium, Mucor and Rhizopus. Moreover molds are capable of forming toxins (Masri, 1968; BULLERMAN and OLIVIGNI, 1974; BULLERMAN, 1976, 1980 and CIEGLER, 1977). In Egypt, aflatoxine producing molds were found in milk and other dairy products (MASRI, 1968 and GIRGIS *et al.* 1977). Molds and yeasts may reach the dairy products from many different sources, including faulty methods of manufacture and lack of sterilization. Plant environment plays also an important role in transmitting fungi species. A number of Aspergillus species can live as facultative endoparasite of insect and sometimes cause diseases in epizootic properties (PAPER and FENNELL, 1977). In some countries molds and yeasts count is considered as standard test for checking factory sanitation (FOSTER *et al.*, 1958 and DAVIS, 1966).

Important factors influencing the molds and yeasts population in dried milk products are the heat-treatment given to the milk prior to drying process and the method of drying the milk, further factor influencing the molds and yeasts are the extent to which microbial multiplication can occur prior to the drying process. The packaging process of dried products, addition of additives and flavouring agents, method of preservation and transportation may also allow the introduction of contamination particularly atmospheric contamination.

Owing to the fact that molds and yeasts are more or less abundant in nature and some are the most common cause of spoilage, others constitute a public health hazard, therefore this work was planned to secure the prevalence of molds and yeasts in dried milk and ice-cream products.

MATERIAL and METHODS

A total of seventy one samples of dried milk products including dried whole milk (12 sample), dried skim milk (11 sample) each 1 kg. weigh, dried ice-cream mix (Mist home quick, Mist milk and food company, Egypt) with chocolate (12 sample), with orange (10 sample), with strawberry (13 sample) and with vanillia (13 sample) each 200 g. weigh in retail packages as ready for sale. All samples were collected from Sakha processing dairy plant (processing code date - November 1983, expired date after six months).

In order to avoid contamination all the samples submitted unopened to the laboratory. After proper mixing of the stitched bags a representative portion was taken to prepare dil. 1 : 10 from which ten fold serial dil. were prepared according to the standard method (A. P. H. A. 1978). All the samples were subjected to mycological examination on malt extract agar (HARRIGAN, *et al.* 1976). Plates of malt extract was inoculated each with one ml. from each serial dil. before being incubated ($25^{\circ}\text{C} \pm 2$ for five days). The total mold and yeast colonies (TMYC), mold colonies (MC) and yeast colonies (YC) per g./sample was counted and registered.

Suspected colonies of isolated fungi were recognized by the morphological characters as well as microscopically according to RIPPON (1975), HARRIGAN (1976), SAMSON *et al.* (1976) and RAPER and FENNELL (1977).

RESULTS

The results are tabulated in tables 1, 2, 3 and 4.

DISCUSSION

Results presented in table (1) show that all examined samples of dried milk products proved to be contaminated with either molds or/and yeasts. 11 out of 12 samples (91.71%), 12 out of 13 samples (92.3%) of dried whole milk and ice-cream with vanillia contaminated with molds, while all other dried products contain molds in (100%). The results also revealed that all examined samples of dried ice-cream mix with orange and strawberry contaminated with yeast (100%), while samples of dried whole milk, skim milk, ice-cream mix with chocolate and vanillia contaminated with yeast in 75, 90.9, 83.3 and 69.23% of the examined samples, respectively.

The total molds and yeasts count, molds and yeasts count alone per g. of examined samples are presented in table (2). inspection of the data indicates that the total molds and yeasts count of dried whole and skim milk, dried ice-cream mix with chocolate, orange, strawberry and vanillia ranged from 3×10^2 to 16×10^2 , 3×10^2 to 18×10^2 , 15×10^2 to

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23×10^2 , 3×10^2 to 23×10^2 , 4×10^2 to 20×10^2 , 1×10^2 to 9×10^2 with value of 9.4×10^2 , 11.45×10^2 , 11×10^2 , 13.7×10^2 , 12.38×10^2 and 4.23×10^2 , respectively. The highest frequency distribution of the examined samples lies within the range of 400 - 800, 800 - 1200, 400 - 800, 1200 - 1600, 800 - 1600 and 0.00 to 400, respectively (Table 3).

The results achieved allow to conclude that all dried milk and ice-cream products were heavily contaminated with molds. Higher count was observed in dried ice-cream mix with orange (mean value $9.2 \times 10^2/g$); while lower count was detected in dried ice-cream mix with vanillia (mean value $2.92 \times 10^2/g$). The results obtained and recorded also in the same table pointed out that all dried products were heavily contaminated with yeasts. Lower count observed in dried ice-cream mix with vanillia (mean $1.3 \times 10^2/g$). The high count of molds and yeasts in dried milk products is indicative of the neglected sanitary measures adopted during processing, handling and packaging of this products. Presence of yeasts and molds in large numbers could constitute a public health hazard or may be responsible for undesirable changes and inferior quality of the products.

The percentage distribution of isolated molds from all dried products given in table (4) and revealed that five genera of molds could be identified from examined samples of whole dried milk. *Aspergillus* spp. were the most prevalent (50%), while *Mucor*, *Rhizopus* and *Absidia* were the lowest (13.3 %), *Penicillium* spp. lies inbetween (25 %), concerning fungi isolated from dried skim milk table (4) Pointed out that *Aspergillus* spp. was the most prevalent (45.45 %), followed by *Penicillium* (27.27 %), *Mucor*, *Cladosporium* and *Absidia* species were the least.

Fungi isolated from dried ice-cream mix with chocolate were *Aspergillus*, *Penicillium*, *Mucor*, *Cladosporium*, *Rhizopus* and *Absidia* spp. in the following percentage 33.33, 16.66, 16.66, 25, 25 and 16.66%, respectively. while in case of dried ice-cream with orange the percentage in descending manner was 70, 40, 30, 20 and 20% for *Aspergillus*, *Penicillium*, *Mucor*, *Cladosporium*, and *Rhizopus* spp., respectively.

Regarding the isolated fungi from dried ice-cream mix with strawberry. *Aspergillus*, species was the most prevalent (46.15%), while *Mucor* was the lowest (7.69%), *Penicillium*, *Cladosporium* and *Rhizopus* species lies inbetween. In case of dried ice-cream with vanillia *Aspergillus* and *Mucor* species were the most prevalent (23.07%). *Penicillium* was the lowest (7.69%), the other fungi species lies inbetween.

On further identification of genus *Aspergillus* *A. niger*, *A. flavus* and *A. fumigatus* proved to exist with an incidence percentage of 25, 16.66, 8.33, 18.18, 18.18, 9.09, 40, 10, 20, 27.7, 7.69, 15.38 and 15.38, 7.69, 0.0%, respectively for dried whole milk, skim milk, ice-cream mix with orange, strawberry and vanillia, while *A. niger* and *A. fumigatus* was only exist (16.16%) in dried ice-cream with chocolate.

From the public health point of view *A. fumigatus* often incriminated as a causative agent in many infection in man and animals (STATON, 1977), furthermore *A. flavus* was considered as mycotoxin producer. Aflatoxigenic fungi was recovered previously from milk and dried food products by NAKOE and YONEYA (1978), BASHIR *et al.* (1982). The results achieved allow to conclude that dried milk and ice-cream mix has been processed and packaged under neglected hygienic measures, moreover the objectionable heavy contamination of the dried products may be responsible for the undesirable changes and inferior quality of native dried milk and ice-cream products. Therefore sanitary control measures should be adopted to the dairy processing plants, method of processing, packaging, storage and distribution of the dried milk products.

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TABLE (1): Frequency distribution of the examined samples based on presence of molds and yeasts.

| Products | No. of examined samples | Contaminated samples with molds or/and yeast | | Contaminated samples with molds | | Contaminated samples with yeast | |
|--------------------------------|-------------------------|--|-----|---------------------------------|------|---------------------------------|-------|
| | | No. of +ve samples | % | No. of +ve samples | % | No. of +ve samples | % |
| Dried whole milk | 12 | 12 | 100 | 11 | 91.7 | 9 | 75 |
| Dried skim milk | 11 | 11 | 100 | 11 | 100 | 10 | 90.9 |
| Dried icecream with chocolate | 12 | 12 | 100 | 12 | 100 | 10 | 83.3 |
| Dried icecream with orange | 10 | 10 | 100 | 10 | 100 | 10 | 100 |
| Dried icecream with strawberry | 13 | 13 | 100 | 13 | 100 | 13 | 100 |
| Dried icecream with vanilla | 13 | 13 | 100 | 12 | 92.3 | 9 | 69.23 |

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TABLE (2): Statistical analytical results of molds and yeasts count/g, in different dried milk and ice-cream products.

| Dried products | No. of examined samples | TMYC/g- | | | MC/g- | | | YC/g- | | | | | |
|-------------------------------|-------------------------|-----------------|------------------|---------------------|------------------|-----------------|------------------|--------------------|------------------|-----------------|-----------------|--------------------|------------------|
| | | Min | Max | Mean | SE $\times 10^2$ | Min. | Max. | Mean | SE $\times 10^2$ | Min. | Max. | Mean | SE $\times 10^2$ |
| Whole milk | 12 | 3×10^2 | 16×10^2 | 9.4×10^2 | 1.01 | 0.00 | 14×10^2 | 7.2×10^2 | 0.98 | 0.00 | 6×10^2 | 2.25×10^2 | 0.52 |
| Skim milk | 11 | 3×10^2 | 18×10^2 | 11.45×10^2 | 1.55 | 2×10^2 | 15×10^2 | 8.64×10^2 | 1.4 | 0.00 | 8×10^2 | 2.82×10^2 | 0.75 |
| Ice-cream mix with chocolate | 12 | 5×10^2 | 25×10^2 | 11.0×10^2 | 1.49 | 3×10^2 | 16×10^2 | 7.7×10^2 | 1.15 | 0.00 | 9×10^2 | 3.33×10^2 | 0.9 |
| Ice-cream with orange | 10 | 3×10^2 | 25×10^2 | 13.7×10^2 | 0.56 | 2×10^2 | 17×10^2 | 9.2×10^2 | 0.51 | 1.10^2 | 8×10^2 | 4.5×10^2 | 0.49 |
| Ice-cream mix with strawberry | 15 | 4×10^2 | 20×10^2 | 12.58×10^2 | 1.5 | 2×10^2 | 15×10^2 | 8.6×10^2 | 1.1 | 2×10^2 | 9×10^2 | 3.69×10^2 | 0.61 |
| Ice-cream mix with vanilla | 15 | 1×10^2 | 9×10^2 | 4.25×10^2 | 0.59 | 0.00 | 6.10^2 | 2.92×10^2 | 0.44 | 0.00 | 3×10^2 | 1.31×10^2 | 0.49 |

TMYC = total molds and yeasts count MC = molds count YC = yeasts count

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TABLE (3): Frequency distribution of examined samples of dried milk products, based on their total molds and yeasts count.

| Interval | DRIED PRODUCTS | | | | | | | | | |
|---------------|----------------|----------------|------------------------------|---------------------------|-------------------------------|----------------------------|--|--|--|--|
| | Whole milk | Skim milk | ice-cream mix with chocolate | ice-cream mix with orange | ice-cream mix with strawberry | ice-cream mix with vanilla | | | | |
| | No. of samples | No. of samples | No. of samples | No. of samples | No. of samples | No. of samples | | | | |
| 0,00 - 400 | 1 | 1 | - | 1 | 1 | 7 | | | | |
| | 8,3 | 9,1 | - | 10 | 7,7 | 53,85 | | | | |
| 400 - 800 | 6 | 1 | 5 | 1 | 2 | 5 | | | | |
| | 50 | 9,1 | 41,7 | 10 | 15,4 | 38,46 | | | | |
| 800 - 1200 | 3 | 6 | 3 | 2 | 4 | 1 | | | | |
| | 25 | 54,55 | 25 | 20 | 30,8 | 7,70 | | | | |
| 1200 - 1600 | 2 | 1 | 3 | 3 | 4 | - | | | | |
| | 16,7 | 9,1 | 25 | 30 | 30,8 | - | | | | |
| 1600 - 2000 | - | 2 | 1 | 2 | 2 | - | | | | |
| | - | 18,18 | 8,3 | 20 | 15,4 | - | | | | |
| 2000 - 274000 | - | - | - | 1 | 10 | - | | | | |
| | - | - | - | 10 | - | - | | | | |
| Total | 17 | 11 | 12 | 10 | 13 | 15 | | | | |

TABLE (4): Incidence of isolated molds from examined samples of dried milk and ice-cream products.

| Molds isolated | whole milk | | | | skim milk | | | | Dried products | | | | | | | |
|--------------------------|----------------|-------|----------------|-------|------------------------------|----------------|---|---------------------------|----------------|-------|-------------------------------|----------------|---|----------------------------|----------------|-------|
| | No. of samples | % | No. of samples | % | ice-cream mix with Chocolate | No. of samples | % | ice-cream mix with orange | No. of samples | % | ice-cream mix with strawberry | No. of samples | % | ice-cream mix with vanilla | No. of samples | % |
| <i>Aspergillus</i> spp. | 6 | 50 | 5 | 45.45 | 4 | 33.33 | 7 | 70 | 6 | 46.15 | 3 | 23.07 | 3 | 23.07 | 3 | 23.07 |
| <i>A. niger</i> | 3 | 25 | 2 | 18.18 | 2 | 16.16 | 4 | 40 | 3 | 27.07 | 2 | 15.38 | 2 | 15.38 | 2 | 15.38 |
| <i>A. Flavus</i> | 2 | 16.66 | 2 | 18.18 | - | - | 1 | 10 | 1 | 7.69 | 1 | 7.69 | 1 | 7.69 | 1 | 7.69 |
| <i>A. Fumigatus</i> | 1 | 8.33 | 1 | 9.09 | 2 | 16.66 | 2 | 20 | 2 | 15.38 | 2 | 15.38 | - | - | - | - |
| <i>Penicillium</i> spp. | 3 | 25 | 3 | 27.27 | 2 | 16.66 | 4 | 40 | 3 | 23.07 | 3 | 23.07 | 1 | 7.69 | 1 | 7.69 |
| <i>Mucor</i> spp. | 2 | 13.3 | 2 | 18.18 | 2 | 16.16 | 3 | 30 | 1 | 7.69 | 3 | 23.07 | 3 | 23.07 | 3 | 23.07 |
| <i>Cladosporium</i> spp. | - | - | 2 | 18.18 | 3 | 25 | 2 | 20 | 2 | 15.38 | 3 | 23.07 | 2 | 15.38 | 2 | 15.38 |
| <i>Rhizopus</i> spp. | 2 | 13.3 | - | - | 3 | 25 | 2 | 20 | 2 | 15.38 | 2 | 15.38 | 2 | 15.38 | 2 | 15.38 |
| <i>Absidia</i> spp. | 2 | 13.3 | 2 | 18.18 | 2 | 16.66 | - | - | - | - | - | - | - | - | 2 | 15.38 |