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## 7.0 SUMMARY

One hundred random samples of UHT milk (50 packages plain and 50 packages with flavour) arranged in three brands (brand I: 40 samples, 20 plain and 20 with flavours; brand II: 30 samples, 15 plain and 15 with flavour; brand III, 30 samples, 15 plain and 15 with flavour).

The UHT milk samples of the three brands of different manufacture dates were collected from different supermarkets and transferred to the laboratory in clean and dry plastic packages where they were subjected directly to physicochemical and microbiological examinations.

### **The obtained results revealed that:**

#### **Sensory evaluation:**

- The sensory evaluation of all examined samples revealed that 85 samples were found in good, clean, attractive and sound packages while only 15 samples found in dirty non-attractive packages distributed in 9 plain and 6 flavoured UHT milk samples and distributed on the three brands subjected for examination as follows: brand I (one plain and two flavoured UHT milk samples), brand II (5 plain and one flavoured sample), brand III (3 plain and 3 flavoured UHT milk samples).
- The sensory evaluation revealed also that 82 samples of good normal flavour of milk while 18 samples of abnormal flavour were found in dirty packages (as described before) arranged in 10 plain and 8 flavoured UHT milk samples and distributed on the three brands as follows: (one plain and 3 flavoured), (5 plain and 2 flavoured) and (4 plain and 3 flavoured) for brands I, II and III, respectively.
- The sensory evaluation of the colour revealed that all examined samples appeared in normal colour of milk.

#### **Turbidity test:**

- The obtained data revealed that all samples that subjected to the turbidity test were negative which indicate efficient sterilization (temperature-time combination).

#### **Alcohol precipitation test (APT):**

- From all examined samples only 17 samples were positive for APT which indicates bad keeping quality while 83 samples were negative that indicates good keeping quality.
- From the total examined plain samples only 9 samples were positive while only 8 samples from the total examined flavoured UHT milk samples were positive for APT.
- The frequency of positive samples for APT of both (plain and flavoured) samples of brands I, II and III were (1, 2), (5, 1) and (3, 5), respectively.

#### **pH value:**

- The mean pH value of the total examined UHT milk samples was  $6.51 \pm 0.01$ . The value for (plain and flavoured) UHT milk samples was  $6.57 \pm 0.01$  and  $6.45 \pm 0.01$ , respectively. The mean value of the examined samples of brands I, II and III were 6.52

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$\pm 0.02$ ,  $6.48 \pm 0.01$  and  $6.53 \pm 0.02$ , respectively. The mean value of the examined plain and flavoured UHT milk samples of brands I, II and III were ( $6.59 \pm 0.02$ ,  $6.45 \pm 0.01$ ), ( $6.53 \pm 0.02$ ,  $6.43 \pm 0.01$ ) and ( $6.58 \pm 0.02$ ,  $6.48 \pm 0.02$ ), respectively.

### **Titratable acidity percent:**

- The mean value of titratable acidity % of all examined UHT milk samples was  $0.18 \pm 0.05\%$ . The mean value of all examined (plain and flavoured) samples of UHT milk was  $0.17 \pm 0.002$  and  $0.19 \pm 0.002\%$ , respectively. The mean value of the examined samples of brands I, II and III was  $0.17 \pm 0.003$ ,  $0.19 \pm 0.003$  and  $0.18 \pm 0.003\%$ , respectively. The mean value of examined plain and flavoured UHT milk of brands I, II and III were ( $0.16 \pm 0.003$ ,  $0.19 \pm 0.002\%$ ), ( $0.18 \pm 0.004$ ,  $0.20 \pm 0.004\%$ ) and ( $0.17 \pm 0.004$  and  $0.19 \pm 0.003\%$ ), respectively.

### **Fat content:**

- The mean value of all UHT milk samples was  $2.50 \pm 0.08\%$ . The mean value of all examined (plain and flavoured) UHT milk samples was  $3.16 \pm 0.02$  and  $1.83 \pm 0.07\%$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $2.50 \pm 0.13$ ,  $2.57 \pm 0.13$  and  $2.42 \pm 0.13\%$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $3.25 \pm 0.04$ ,  $1.75 \pm 0.09\%$ ), ( $3.16 \pm 0.02$ ,  $1.97 \pm 0.15\%$ ) and ( $3.05 \pm 0.02$ ,  $1.97 \pm 0.11\%$ ), respectively.

### **Protein content:**

- The mean value of all UHT milk samples was  $3.38 \pm 0.02\%$ . The mean value of examined (plain and flavoured) UHT milk samples was  $3.41 \pm 0.02$  and  $3.34 \pm 0.02\%$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $3.38 \pm 0.03$ ,  $3.40 \pm 0.03$  and  $3.34 \pm 0.02\%$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $3.40 \pm 0.04$ ,  $3.36 \pm 0.04\%$ ), ( $3.49 \pm 0.05$ ,  $3.32 \pm 0.03\%$ ) and ( $3.34 \pm 0.03$ ,  $3.35 \pm 0.03\%$ ), respectively.

### **Total colony count (cfu/ml):**

- The mean value of all UHT milk samples was  $2.34 \times 10^2 \pm 20.60$ . The mean value of examined (plain and flavoured) UHT milk samples was  $1.81 \times 10^2 \pm 22.73$  and  $2.89 \times 10^2 \pm 33.25$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $1.80 \times 10^2 \pm 20.68$ ,  $1.54 \times 10^2 \pm 35.90$  and  $3.68 \times 10^2 \pm 42.07$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $1.68 \times 10^2 \pm 28.15$ ,  $1.93 \times 10^2 \pm 30.76$ ), ( $1.96 \times 10^2 \pm 57.73$ ,  $93.33 \pm 16.33$ ) and ( $1.87 \times 10^2 \pm 39.85$ ,  $5.36 \times 10^2 \pm 35.63$ ), respectively.

### **Total psychrotrophic count (cfu/ml):**

- The mean value of all UHT milk samples was  $1.03 \times 10^2 \pm 7.82$ . The mean value of all examined (plain and flavoured) UHT milk samples was  $0.75 \times 10^2 \pm 8.53$  and  $1.32 \times 10^2 \pm 11.59$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $0.88 \times 10^2 \pm 8.62$ ,  $0.66 \times 10^2 \pm 12.11$  and  $1.48 \times 10^2 \pm 15.84$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $0.71 \times 10^2 \pm 8.73$ ,  $1.09 \times 10^2 \pm 14.42$ ), ( $0.70 \times 10^2 \pm 19$ ,  $0.60 \times 10^2 \pm 6.31$ ) and ( $0.91 \times 10^2 \pm 0.24$ ,  $1.84 \times 10^2 \pm 14.24$ ), respectively.

**Total thermoduric count (cfu/ml):**

- The mean value of all UHT milk samples was  $1.03 \times 10^2 \pm 8.67$ . The mean value of all examined (plain and flavoured) UHT milk samples was  $0.87 \times 10^2 \pm 8.81$  and  $1.18 \times 10^2 \pm 0.14 \times 10^2$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $0.95 \times 10^2 \pm 0.10 \times 10^2$ ,  $0.63 \times 10^2 \pm 0.13 \times 10^2$  and  $1.46 \times 10^2 \pm 0.19 \times 10^2$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $0.86 \times 10^2 \pm 0.12 \times 10^2$ ,  $1.04 \times 10^2 \pm 0.17 \times 10^2$ ), ( $0.90 \times 10^2 \pm 0.22 \times 10^2$ ,  $0.35 \times 10^2 \pm 5.63$ ) and ( $0.86 \times 10^2 \pm 16$ ,  $1.91 \times 10^2 \pm 0.27 \times 10^2$ ), respectively.

**Total coliform count (cfu/ml):**

- The mean value of all UHT milk samples was  $0.18 \times 10^2 \pm 0.02 \times 10^2$ . The mean value of all examined (plain and flavoured) UHT milk samples was  $0.16 \times 10^2 \pm 0.02 \times 10^2$  and  $0.20 \times 10^2 \pm 0.03 \times 10^2$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $0.23 \times 10^2 \pm 0.03 \times 10^2$ ,  $0.13 \times 10^2 \pm 0.02 \times 10^2$  and  $0.20 \times 10^2 \pm 0.03 \times 10^2$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $0$ ,  $0.25 \times 10^2 \pm 0.05 \times 10^2$ ), ( $0.14 \times 10^2 \pm 0.02 \times 10^2$ ,  $0$ ) and ( $0.20 \times 10^2 \pm 0.05 \times 10^2$ ,  $0.20 \times 10^2 \pm 0.05 \times 10^2$ ), respectively.

- **Identification of the isolated coliforms** recovered the following Enterobacter spp. (39.13%), *Escherichia coli* (13.04%), *Klebsiella pneumoniae ozaenae* (17.39%) Proteus spp. (21.74%) and *Citrobacter freundii* (8.70%), respectively from the total positive samples.

**Total aerobic sporeformers count (cfu/ml):**

- The mean value of all UHT milk samples was  $0.84 \times 10^2 \pm 8.16$ . The mean value of all examined plain and flavoured UHT milk samples was  $0.74 \times 10^2 \pm 8.97$  and  $0.91 \times 10^2 \pm 12.44$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $0.68 \times 10^2 \pm 8.21$ ,  $0.48 \times 10^2 \pm 13.41$  and  $1.22 \times 10^2 \pm 14.81$ , respectively. The mean value of the examined plain and flavoured UHT milk samples within brands I, II and III was ( $0.80 \times 10^2 \pm 11.30$ ,  $0.25 \times 10^2 \pm 5$ ), ( $0.64 \times 10^2 \pm 21.36$ ,  $0.26 \times 10^2 \pm 4$ ) and ( $0.79 \times 10^2 \pm 16.39$ ,  $1.44 \times 10^2 \pm 18.33$ ), respectively.
- **Identification of the isolated aerobic spore formers** revealed the following: *Bacillus cereus* (28.57%), *B. subtilis* (19.05%), *B. megaterium* (14.29%), *B. stearotherophilus* (12.69%), *B. coagulans* (11.11%) and *B. lichniformis* (14.29%).

**Total fungal count (cfu/ml):**

- The mean value of all UHT milk samples was  $0.22 \times 10^2 \pm 0.02 \times 10^2$ . The mean value of all examined (plain and flavoured) UHT milk samples was  $0.23 \times 10^2 \pm 0.05 \times 10^2$  and  $0.22 \times 10^2 \pm 0.03 \times 10^2$ , respectively. The mean value of all examined UHT milk samples of brands I, II and III was  $0.24 \times 10^2 \pm 0.05 \times 10^2$ ,  $0.22 \times 10^2 \pm 0.05 \times 10^2$  and  $0.22 \times 10^2 \pm 0.03 \times 10^2$ , respectively. The mean value of the examined (plain and flavoured) UHT milk samples within brands I, II and III was ( $0.32 \times 10^2 \pm 0.12 \times 10^2$ ,  $0.20 \times 10^2 \pm 0.05 \times 10^2$ ), ( $0.18 \times 10^2 \pm 0.04 \times 10^2$ ,  $0.24 \times 10^2 \pm 0.08 \times 10^2$ ) and ( $0.16 \times 10^2 \pm 0.06 \times 10^2$ ,  $0.23 \times 10^2 \pm 0.04 \times 10^2$ ), respectively.
- **Identification of isolated mould and yeasts** revealed the following: Moulds. *Aspergillus flavus* (18.03%), *Aspergillus fumigatus* (13.11%), *Aspergillus niger*

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(22.95%), *Penicillium* spp. (22.95%), *Cladosporium* spp. (6.56%) and *Alternaria* spp. (3.28%). Yeasts: *Candida albicans* (9.84%) and *Rhodotorulla* spp. (3.28%).

- The economic and public health importance of the isolated organisms as well as suggested measures for improving the quality of UHT milk were discussed.

### Experimental study:

Eight random UHT milk samples (4 plain and 4 flavoured) were left opened in refrigerator at 8 °C and subjected for physical, chemical and bacteriological examinations daily until the samples became unfit for consumption.

- **At zero day of examination.** The UHT milk samples were apparently normal and the mean values of acidity (%), pH value, TCC (cfu/ml) and total psychrotrophic count (cfu/ml) of all plain and flavoured samples were ( $0.18 \pm 0.004$ ,  $0.18 \pm 0.005\%$ ), ( $6.62 \pm 0.04$ ,  $6.52 \pm 0.04$ ), ( $7.50 \times 10 \pm 4.78 \times 10$ ,  $3.25 \times 10^2 \pm 4.79 \times 10$ ) and ( $2.50 \times 10 \pm 2.50 \times 10$ ,  $1.50 \times 10^2 \pm 2.89 \times 10$ ), respectively.
- **At the second day of examination.** The milk samples still apparently normal and the mean values of acidity (%), pH value, TCC (cfu/ml) and total psychrotrophic count (cfu/ml) of all (plain and flavoured) samples were ( $0.20 \pm 0.004$ ,  $0.20 \pm 0.003\%$ ), ( $6.55 \pm 0.03$ ,  $6.46 \pm 0.03$ ), ( $1.50 \times 10^3 \pm 2.89 \times 10^2$ ,  $3.75 \times 10^3 \pm 1.55 \times 10$ ) and ( $4 \times 10^2 \pm 7.07 \times 10$ ,  $9.50 \times 10^2 \pm 9.57 \times 10$ ), respectively.
- **At the third day of examination.** The UHT milk samples still apparently normal (colour and flavour) and the mean values of acidity (%), pH value, TCC (cfu/ml) and total psychrotrophic count (cfu/ml) of all plain and flavoured samples were ( $0.22 \pm 0.007$ ,  $0.23 \pm 0.005\%$ ), ( $6.43 \pm 0.01$ ,  $6.40 \pm 0.02$ ), ( $1.15 \times 10^5 \pm 9.57 \times 10$ ,  $2.85 \times 10^3 \pm 2.75 \times 10^4$ ) and ( $2 \times 10^4$ ,  $3 \times 10^4 \pm 5.77 \times 10^3$ ), respectively.
- **At the fourth day of examination.** The organoleptic examination of UHT milk samples of both kinds revealed that slightly change in the taste of milk (somewhat bitter) and the colour deviated than normal. The mean values of acidity (%), pH value, TCC (cfu/ml) and total psychrotrophic count (cfu/ml) of all plain and flavoured samples were ( $0.27 \pm 0.005$ ,  $0.28 \pm 0.005\%$ ), ( $6.28 \pm 0.03$ ,  $6.26 \pm 0.40$ ), ( $2.90 \times 10^7 \pm 2.65 \times 10^6$ ,  $4.75 \times 10^7 \pm 3.59 \times 10^6$ ) and ( $8 \times 10^6 \pm 8.16 \times 10^5$ ,  $6.5 \times 10^6 \pm 2.18 \times 10^6$ ), respectively.
- **At the fifth day of examination.** The organoleptic examination revealed that either plain or flavoured UHT milk became bitter in taste especially the flavoured samples where the bitter taste was more observed. The consistency of the milk became slightly thicker while the colour was somewhat near normal. So, the milk was considered as non-fit for human consumption. The mean values of acidity (%), pH value, TCC (cfu/ml) and total psychrotrophic count (cfu/ml) of all plain and flavoured samples were ( $0.29 \pm 0.006$ ,  $0.30 \pm 0.004$ ), ( $6.01 \pm 0.07$ ,  $6.04 \pm 0.09$ ), ( $2.41 \times 10^8 \pm 9.68 \times 10^6$ ,  $2.73 \times 10^8 \pm 6.24 \times 10^6$ ) and ( $7.50 \times 10^7$ ,  $7.70 \times 10^7$ ), respectively.
- **At the 6<sup>th</sup> day of examination.** The organoleptic examination showed that either plain and flavoured UHT milk samples became extremely bitter in taste, the milk lost its normal color, and the consistency became thicker (gelatinous). The milk was completely unfit for human consumption. The mean values of acidity (%), pH value, TCC (cfu/ml) and total psychrotrophic count (cfu/ml) of all plain and flavoured samples were ( $0.33 \pm 0.005$ ,  $0.35 \pm 0.003$ ), ( $5.75 \pm 0.03$ ,  $5.65 \pm 0.03$ ), (non-countable, non-countable) and ( $2.45 \times 10^8 \pm 5.91 \times 10^6$ ,  $2.86 \times 10^8 \pm 8.08 \times 10^6$ ), respectively.
- From the previous results we advice the consumer to consume the UHT milk that left opened in refrigerator in a period not more than 2 days from the time of opening the package.