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Study effect of Sunlight on the chemical composition of Milk

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Abstract:

Light-induced degradation reactions make a serious problem for the milk because of the development of flavors and a decrease in nutritional quality, materials of Packaging are important to avoid this particular degradation of milk. In this study, were divided milk into two groups (light exposed) + (light protected (foil overwrap)) under the same cooling conditions at 3°C for 15 days, those expectant during the show in stores of retail and markets. And the effect of this on the chemical composition of milk, the results of my study then showed that the appropriate blocking light with an overwrap of foil helped inhibit lipid and protein Lipolysis compared with the samples exposed to light under the same cooling conditions. Therefore, the appropriate Blocking of visible light with foil overwrap can increase milk's shelf life.

Keyword: whole Milk, foil, light exposed, high-density polyethylene

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1.Introduction:

Milk is a nutritional material of high nutrient content, it is an ideal medium for the growth of every class of human beings and It is also an ideal medium for the growth and multiplication of diverse microorganisms[1]. Consumed milk largely for high nutritional value but limited shelf life, as it cannot keep up quality for more than (2 - 3) days [2]. Milk and milk products are susceptible to light-induced oxidation reactions, which can negatively affect odor and flavor Photooxidation of milk occurs under the presence of light (artificial, sunlight)[3], is an indicating of degradation of milk during transportation[4]. Exposure of milk to light facilitates the degradation of amino acids and vitamin A, and fat oxidation [5]. Packaging materials are important to prevent this deterioration of milk [6], for this reason, packaging of dairy products to protect from light and give it a long shelf life [7]. Can be used specially designed packaging [8], to reduced light oxidation flavor [9], reducing material permeability and negative sensory characteristics for extending the shelf life better [10], That exposure to fluorescent light in stores becomes a significant problem[11]. The milk stored in bottles photo-oxidation experienced and lost vitamin[12]. Moreover, conveying milk products from the store to home in transparent containers[13]. Therefore, this study investigates the use of packaging that blocks detrimental light

wavelengths blocking visible light with labels to inhibit lipid oxidation and to evaluate its stability during storage.

2.Material and Methods

2.1 Experimental

In this study, whole milk was used by the Iranian company Kallah milk packaged in high-density polyethylene (HDPE) Bottle dimensions were 7.16" height × 3.29" width × 2.1" depth and a volume of 528 ml. The samples were divided into two groups (light exposed) + (light protected (foil overwrap)) under the same cooling conditions at 3°C [12] for 15 days [15]. The samples were divided into 11 groups each of which contained 5 replicates, and as follows:

T0: Standard samples stored for 0 days.

T1: samples stored for 3 days (light protected),
T2: samples stored for 3 days (light-exposed).

T3: samples stored for 6 days (light protected),
T4: samples stored for 6 days (light-exposed).

T5: samples stored for 9 days (light protected),
T6: samples stored for 9 days (light-exposed).

T7: samples stored for 12 days (light protected),
T8: samples stored for 12 days (light-exposed).

T9: samples stored for 15 days (light protected),
T10: samples stored for 15 days (light-exposed).

2.2. Chemical Analysis

2.2.1. Determination of Fat

The fat content was measured using the Gerber method [16].

2.2.2. Determination of Total Protein and Casein

Total Protein content and Casein of milk were assessed utilizing the modified method of Castillo et al,[17] .

2.2.3. Determination of Lipolysis

Lipolysis was calculated as acid degree value, acid value, and free fatty acid, according to the reported procedure given by [18].

2.3. Statistical Analysis

The experimental results were analyzed statistically, using the SAS program. In addition, multiple range testing of Duncan's correlation coefficient was used to compare results between the various parameters. Statistical analysis is described as mean ± standard deviation, and is found to be statistically significant at $p < .05$.

3. Results and discussion

3.1. Total protein & casein:

Total protein and casein concentrations had decreased in all formulas. The differences in Total protein and casein were due to The proteolytic activities in milk, including proteolytic enzymes from proteolytic systems, which can be functionally divided into cell-surface-associated proteinases that hydrolyze caseins to oligopeptides, and peptide transport systems that transport the oligopeptide and numerous intracellular peptidases [19]. The average initial Total protein concentration in milk for this study (2.99667 %), casein (2.58333 %) for both replications; all protein and casein concentrations values throughout the study were at that level or decreased with time and light exposure. protein degradation is undesirable in food systems because it decreases the nutritional value of the food protein and casein concentration in milk decreased over the 15 days of evaluation in all packages [Table 1]. protein and casein in milk from the light-protected treatment did not change significantly ($P > 0.05$), compared with the exposure to light through d 15, protein and casein concentration in milk in the light protected package was significantly higher (<0.05) than in light exposed package due to light exposure.The reason for the differences in the protein ratios between the treatments to the destruction of proteins by the activity of protein – modifying enzymes found naturally in milk [20] resistance to thermal transactions, which re-activity during the storage of cooled but less active in the

transactions stored in the darkness, These results came in line with the results obtained by those[6] who observed the breakdown of protein and vitamins and the oxidation of milk fat when storing the samples in light.

3.2. Fat content:

Statistical analysis showed that the effects of storage on fat were significant ($p < .05$). The fat in all samples tended to decrease during the storage period (Table 1). Fat slightly decreased in light-protected treatment, compared to those light exposed package. Lipase enzyme hydrolyze fat in milk to release a large amount of free fatty acid and affect yogurt flavors [21]. Lipase increased the production of free fatty acids in milk from the exposure to light compared with the light-protected treatment Fat content on the zero-day for formulas T0 was (4.29667). On day 3, fat had decreased to 4.29000, 3.99333 in the formulas T1 and T2 respectively. The fat values decreased to (3.79667) and (1.89000) in formulas T9 and T10 respectively after 15 days. Fat was decreased by lipase enzymes, which lipolysis fat, thus liberating free fatty acids, in raw milk or in pasteurized products total lipase activity is sufficient to induce rapid hydrolysis of a large proportion of the fat [22]. Previous studies of lipid degradation in dairy products have found that degradation is due to the secretion and activity of high-temperature bacterial-resistant lipase enzymes rather than lipid degradation by natural lipase enzymes in milk [23].

Table1. Summary of statistical significance of chemical Analysis (Total Protein, Casein and Fat) for milk packaged in high-density polyethylene (HDPE) with different experimental levels (light exposed and light protected) compared with controls over 15 day at 3C°.

Treatment	Total Protein%	Casein%	Fat%
To	a 2.99667 ± 0.00577	a 2.58333 ± 0.00577	a 4.29667± 0.00577
T1	a 2.98667 ± 0.00577	a 2.57667 ± 0.00577	a 4.29000 ± 0.01000
T2	a 2.86333 ± 0.00577	c 2.39000 ± 0.01000	C 3.99333 ± 0.00577
T3	a 2.98667 ± 0.00577	a 2.59000 ± 0.01000	a 4.29000 ± 0.01000
T4	a 2.82000 ± 0.01000	d 2.19000 ± 0.01000	e 3.49667 ± 0.00577
T5	a 2.97333 ± 0.00577	a 2.53667 ± 0.00577	b 4.20000 ± 0.00000
T6	b 1.57667 ± 0.00577	e 1.77000 ± 0.01000	f 3.19000 ± 0.01000
T7	a 2.96000 ± 0.01000	a 2.54000 ± 0.01000	c 4.00000 ± 0.0000
T8	c 1.36670 ± 0.00577	f 1.21000 ± 0.01000	g 2.99333 ± 0.00577
T9	a 2.94333 ± 0.00577	b 2.49000 ± 0.01000	d 3.79667± 0.00577
T10	c 1.39000 ± 0.01000	g 1.16000 ± 0.01000	h 1.89000 ± 0.01000

Data are presented as the means ± standard deviation,different letters within each column indicate significant differences ($p \leq 0.05$).

3.3. Acid Degree value (ADV), Acid value (AV), and free fatty acid (FFA):

The acid degree values of the milk samples from day 0 to day 15 are summarized in Table 2. ADV on day 0 at 3°C for T0, was 0.17000, while ADV on day 3 at 3°C for T1, and T2 were 0.17000 and 1.71333 respectively. After day 15, acid degree value had increased to 0.29667 and 2.16000 in the samples T9 and T10 respectively. Lipolysis values were higher in milk from the exposure to light compared with the light-protected treatment. Elevation of acid degree values suggests degradation in the nutritional and sensory consistency of dairy products during storage [24]. These ADV findings suggest that storage time and temperature, and their interactions, have a major effect on the lipolysis of experimental goat's cheeses. The (AV) of all yogurt samples tended to increase during the storage period (Table 2). The AV values at 0 day at 3C° for T0, were 0.04333. After then acid value had increased in the samples. Free fatty acid (FFA) differences between the samples were significant $p < 0.05$. The FFA of all formulas tended to increase during storage [Table2]. The free fatty acid content increases in milk during processing and storage[25]. In general, the increased ADV, AV, and FFA values were related to the increment of acidity in milk samples, which suggests the degradation of dairy sensory qualities during storage[26].

Table 2. Summary of statistical significance of Chemical Analysis (Acid Degree value, Acid value, and Free Fatty acid) for milk packaged in high-density polyethylene (HDPE) with different experimental levels (light exposed and light protected) compared with controls over 15 days at 3C°.

Treatment	Free Fatty acid	Acid value	Acid Degree value
To	**j** **0.01333 ± 0.00577**	**j** **0.04333 ± 0.0057**	**f** **0.17000 ± 0.01000**
T1	**j** **0.02333 ± 0.00577**	**i** **0.05333 ± 0.00577**	**f** **0.17000 ± 0.01000**
T2	**e** **1.29667 ± 0.01155**	**K** **0.02333 ± 0.00577**	**b** **1.71333 ± 0.00577**
T3	**i** **0.04667 ± 0.00577**	**h** **0.08333 ± 0.00577**	**ef** **0.19000 ± 0.01000**
T4	**d** **1.57333 ± 0.00577**	**c** **1.54000 ± 0.01000**	**d** **1.15300 ± 0.569**
T5	**h** **0.07667 ± 0.00577**	**g** **0.42000 ± 0.01000**	**e** **0.22000 ± 0.1000**
T6	**c** **2.79333 ± 0.00577**	**b** **2.58000 ± 0.01000**	**c** **1.58000 ± 0.572**
T7	**g** **0.09000 ± 0.00000**	**f** **0.52000 ± 0.01000**	**e** **0.26000 ± 0.01000**
T8	**b** **3.92000 ± 0.01000**	**d** **0.82000 ± 0.01000**	**a** **2.02000 ± 0.01000**
T9	**f** **1.21333 ± 0.00577**	**e** **0.69667 ± 0.01155**	**e** **0.29667 ± 0.01155**
T10	**a** **5.46667 ± 0.00577**	**a** **2.92000 ± 0.01000**	**a** **2.16000 ± 0.01000**

Data are presented as the means ± standard deviation, different letters within each column indicate significant differences ($p \leq 0.05$).

4. Conclusions:

The chemical studies shown Packaging of milk by foil overwrap assisted in obtaining extension storage of milk around about up to 15 days. Further, since there are several types of food whose quality is impaired when they are exposed to light can be used this knowledge to several types of food to protect from light.

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