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سعادة أ. د. رئيس تحرير المجلة المصرية للدراسات المتخصصة المحترم

جامعة عين شمس، كلية التربية النوعية، القاهرة، مصر

تحية طيبة وبعد،،،

يسر **معامل التأثير والاستشهادات المرجعية للمجلات العلمية العربية (ارسيف – ARCIF)**، أحد مبادرات قاعدة بيانات "**معرفة**" للإنتاج والمحتوى العلمي، إعلامكم بأنه قد **أطلق التقرير السنوي التاسع للمجلات للعام 2024**.

ويسرنا تهنئتكم وإعلامكم بأن **المجلة المصرية للدراسات المتخصصة** الصادرة عن **جامعة عين شمس، كلية التربية النوعية، مصر، قد نجحت في تحقيق معايير اعتماد معامل "ارسيف Arcif"** المتوافقة مع المعايير العالمية، والتي يبلغ عددها **(32) معياراً**، وللاطلاع على هذه المعايير يمكنكم الدخول إلى الرابط التالي: http://e-marefa.net/arcif/criteria/

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تابع محتويات العدد

Physicochemical Properties, Phytochemical, and Anticancer Activity of Skimmed Buffalo, whole Cow, and Camel Yoghurts

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Abstract

Yoghurt contains beneficial probiotics from lactic acid fermentation, which makes its nutrients highly digestible, boosts gut health, and provides medicinal benefits. Therefore, this study investigated the physicochemical, phytochemical, microbiological, and biological (specifically related to breast cancer) properties of skimmed buffalo, whole cow, and camel milk yoghurts after 14 days. Different yoghurt types showed significant differences in physiochemical properties

Keywords: Yoghurt, Physicochemical, Phytochemical, L. acidophilus, Anticancer effect

ملخص:

العنوان : الخصائص الفيزيوكيميائية والحيوية والنشاط المضاد للسرطان للزبادي الجاموسى الخالي الدسم والبقري والإبل كامل الدسم

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زبادي البروبيوتيك، يعزز عملية الهضم، وصحة الأمعاء، وله فوائد طبية. لذلك، قامت الدراسة بمقارنة الخصائص الفيزيوكيميائية والحيوية والميكروبية والبيولوجية (السرطان الثدي) للزبادي المنتج من لبن الجاموس منزوع الدسم، والبقري، والإبل الكامل خلال 14 يومًا. أظهرت أنواع الزبادي المختلفة اختلافات كبيرة في الخواص الفيزيوكيميائية والحيوية

الكلمات الدالة : الزبادي، الفيزيوكيميائية ، المركبات الحيوية ,L. acidophilus ,التأثير المضاد لسرطان .

INTRODUCTION

Fermented dairy products, crucial to the diet, comprise a highly organized industry, marked by the establishment of the International Dairy Federation in 1903 (**Allen *et al.*, 2019**). Fermentation enhances organoleptic properties, digestibility, nutritional bioavailability, and shelf life. Fermented dairy products have benefited people since ancient times (**Melini *et al.*, 2019**). Furthermore, lactic acid-producing microbes ferment milk, elevate acidity, and remove anti-nutritional factors and toxic elements to prevent lactose intolerance. In addition, it converts organic compounds into easily digestible components (**Kaur *et al.*, 2020**).

Yoghurt, cheese, and kefir products enhance immunity and treat many ailments. Antioxidant and antibacterial compounds are anti-inflammatory, antidiabetic, and anti-atherosclerotic. Research shows they fight inflammatory bowel illnesses, diarrhea, hypersensitivity, and more. Moreover, the added bacteria in these products influence gut health and the immune system (**Al-Manhel, 2018**)

Additionally, yoghurt is a globally popular fermented dairy product. As well as, yoghurt, through the fermentation process, generates lactic acids like *Streptococcus thermophilus* and *Lactobacillus delbrueckii subsbulgaricus* as well as bioactive compounds, providing health benefits like improved immune function, and lowering blood cholesterol, and improving the digestion of lactose (**Khider *et al.*, 2022)**. Moreover, they may assist in treating conditions such as hypertension, allergies, metabolic defects, and heart diseases (**Farag *et al.*, 2022**). As well, yoghurt inhibits tumor growth by reducing inflammation, increasing IL-10-secreting cells, promoting apoptosis, and decreasing procarcinogenic enzymes (**García-Burgos *et al.*, 2020**).

Buffalo, camel, and cow milk are widely dispersed in Arab countries and North Africa. Despite its similarities, milk from these animals has unique qualities and different components (**Khalifa & Zakaria, 2019**). Although cow milk is extensively used (83%) in dairy production, people tend to consume alternative milk for health and function. Camel milk, reported to be superior to cow milk, releases bioactive peptides during digestion, offering hypocholesterolemic, hypoglycemic, hypoallergic, immune-stimulating, antimicrobial, and anti-carcinogenic effects (**Mudgil *et al*., 2018**). Buffalo milk, with its higher lactose, protein, vitamin, and mineral content, is distinguished by its white color, high fat-lactose percentage, and suitability for diverse product manufacturing. Buffalo milk is widespread in Egypt and is known for its palatability and wide availability **(Khan *et al*., 2017**).

Therefore, the present study aimed to evaluate the impact of consuming three types of milk (buffalo, cow, and camel) on yogurt production, compare their physicochemical properties at various storage times at 4 ºC, and assess their potential effects in treating cancer.

Materials and methods

Raw materials

Cow and skimmed buffalo milk were supplied by the Faculty of Agriculture at Cairo University, Egypt, and camel milk was collected from the Cairo Desert Research Center during the winter of 2022. Sigma-Aldrich Chime, Steinheim, Germany, supplied all the chemicals and reagents. Abreast adenocarcinoma cell lines (MCF-7, ATCC® HTB-22™) were obtained from the American Type Culture Collection (ATCC, Manassas, VA, USA).

The ABT-5 lyophilized starter culture containing *S. thermophilus* (CH-1), *Lactobacillus acidophilus* (CH-2), and *Bifidobacterium bifidum* (NRRL B-41410) were acquired from the National Research Center in Egypt.

Preparation of yoghurt

Fresh milk from various sources (skimmed buffalo, whole cow, and camel) was pasteurized at 80°C for 5 minutes with stirring, cooled to 42°C, and inoculated with 3% ABT-5 culture. Incubated at 41±1°C until curd formed and pH reached 4.6 (**Zoidou *et al.*, 2017**).

Physicochemical properties analysis

Moisture, ash, protein, fat, and dry matter were assessed based on the methods of (**AOAC International, 2016**). Fat by Gerber method (**Ling, 1956**). pH was measured with a digital pH meter (Boeco, Hamburg, Germany). Viscosity was measured using a Brookfield viscometer (model DV-II, Brookfield Engineering Laboratories Inc., Middleboro, MA, USA). Total carbohydrates were calculated by differences according to **(Maclean *et al*., 2003**)

Total phenol content (TPC) and Total flavonoids (TFC)

The total phenol content was determined using a modified method (**Wolfe *et al*., 2003**). Results expressed as mg GAE/100 g extract utilized a gallic acid standard curve. Flavonoids were assayed according to the method (**Zhishen *et al*., 1999**), and the results were expressed as mg QC/100 g extract utilizing the Quercetin standard curve

Antioxidant activity by DPPH

The antioxidant activity of all samples was measured using the 2, 2'-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity (**Baliyan *et al*., 2022**).

Microbiological examination

Total count, yeast & mold

Total bacterial count, yeast, and mold were estimated according to (**Wehr & Frank, 2004**).

Enumeration of *L. acidophilus*, *S. thermophiles*, and *B. bifidum* strains

The pour plate method was used with PBS dilutions to count bacteria. *B. bifidum* on Bifidobacterium agar, 37°C, 72 hr anaerobic. *L. acidophilus* on MRS-sorbitol agar, 37°C, 72 hr anaerobic. *S. thermophilus* on M17 agar, 37°C, 48-hour aerobic **(Najgebauer-Lejko, 2014**). The results were expressed as a log number of colony-forming units per g (log CFU/g).

In vitro cytotoxicity activity using MTT cell viability assay

In vitro MTT evaluated MCF-7 cell cytotoxicity. Milk, kefir, and yoghurt formulations (25-500 µg/mL) were administered to cells over 24-72 hours. Cell viability at 48 hours was used to calculate the IC_{50} for 50% growth inhibition from the dose-response curve **(Fani *et al*., 2016**).

Statistical analysis

The data were presented as means standard deviations (SD) of three replicates. At p0.05, mean values were separated using an analysis of variance (ANOVA) (SPSS Inc., Chicago, IL, USA; SPSS software version 13.0).

Results and discussion

Physicochemical properties of yoghurt products during storage periods at 4 °C

Physicochemical properties of yoghurt from skimmed buffalo, whole cow, and camel milk were assessed initially (zero time) and during storage at 4±1°C for 7 and 14 days. The results are presented in Table (1). The use of different animal milks in yoghurt production had a very significant effect ($p \leq 0.01$) on all physicochemical analyses (total solids, fat, protein, pH values, and viscosity).

Concomitantly, over 14 days of storage, the physicochemical properties of the yoghurts changed significantly ($P < 0.01$). Moisture content increased in whole cow and skimmed buffalo yoghurt, while no significant change was found in camel yoghurt. Meanwhile, total solid content declined after 14 days of cold storage. Additionally, protein, fat, and pH decreased over storage time in all three yoghurt types. Whole cow yoghurt declined from 3.36 to 3.01% protein, 3.55 to 3.21% fat, and 4.81 to 4.31 pH. Skimmed buffalo yoghurt reduced from 4.94 to 4.45 pH, 0.15 to 0.003% fat, and 4.69 to 4.01% protein. Whole camel yoghurt decreased from 3.05 to 2.89% protein, 3.26 to 2.99% fat, and 4.61 to 3.95 pH. Initial viscosity was highest in cow yoghurt (369) and lowest in whole camel yoghurt (63.85), with storage time reducing viscosity in all samples after 14 days. Moreover, whole camel yoghurt had the lowest reduction in physicochemical properties. These results agreed with (**Terzioğlu *et al*., 2023)**, who reported that physicochemical properties (total solids, protein, fat contents, and pH values) of buffalo, camel, cow, goat, and sheep, skimmed milk powder yoghurt decreased during storage time at 4±1°C till 14 days.

Changes in moisture content across all treatments result from factors like temperature, humidity, and packaging material, affecting water loss or absorption. The decrease in total solids can be attributed to moisture loss or changes in the yoghurt matrix composition **(Sanusi et al., 2022).** Reduction in protein content may be attributed to enzymatic and microbial activities, leading to protein breakdown through proteolysis by lactic acid bacteria. Fat breakdown processes like lipolysis during prolonged storage can cause a decline in fat content **(Bakirci et al., 2017).** Also, yoghurt fermentation by S. thermophilus and L. bulgaricus continues during storage, accumulating lactic acid and lowering pH, in addition to the effect of yoghurt microflora on its nutrient composition. Changes in viscosity are associated with elevated syneresis, impacting creaminess and mouthfeel **(Nagaoka, 2019).**

Table 1. Physicochemical properties of yoghurt products during storage periods at 4 °C

Components \ Samples	Yoghurt products		
	Whole cow yoghurt	Skimmed buffalo yoghurt	Whole camel yoghurt
Yoghurt products in zero time			
Moisture (g)	82.55±0.01[c]	85.34±0.01[b]	89.11±0.22[a]
Protein (g)	3.36±0.01[b]	4.69±0.01[a]	3.05±0.01[c]
Fat (g)	3.55±0.02[a]	0.15±0.05[c]	3.26±0.23[b]
Ash (g)	0.78±0.01[b]	0.83±001[a]	0.80±0.00[b]
Carbohydrate (g)	4.53±0.03[b]	4.95±0.06[a]	3.74±0.02[c]
Total solid (g)	12.25±0.06[a]	10.64±0.10[b]	10.89±0.22[b]
pH	4.81±0.01[b]	4.94±0.05[a]	4.61±0.01[c]
Viscosity	369.00±1.00[a]	237.50±6.5[b]	63.85±0.35[c]
Yoghurt products after 7 days			
Moisture (g)	83.95±0.04[c]	85.98±0.01[b]	88.35±0.05[a]
Protein (g)	3.18±0.03[b]	4.56±0.03[a]	3.01±0.01[c]
Fat (g)	3.32±0.01[a]	0.03±0.02[c]	3.07±0.06[b]
Ash (g)	0.80±0.01[a]	0.85±0.003[a]	0.86±0.004[a]
Carbohydrate (g)	4.01±0.01[a]	3.94±0.06[b]	3.49±0.04[c]
Total solid (g)	11.37±0.04[a]	9.38±0.02[c]	10.43±0.12[b]
pH	4.53±0.30[b]	4.64±0.01[a]	4.34±0.04[c]
Viscosity	219.00±1.00[a]	192.50±2.50[b]	49.75±0.75[c]
Yoghurt products after 14 days			
Moisture (g)	85.29±0.06[c]	87.25±0.25[b]	88.95±0.05[a]
Protein (g)	3.01±0.01[b]	4.01±0.01[a]	2.89±0.01[c]
Fat (g)	3.21±0.01[a]	0.003±0.01[c]	2.99±0.01[b]
Ash (g)	0.87±0.003[c]	0.86±0.00[bc]	0.87±0.00[b]
Carbohydrate (g)	3.74±0.03[a]	3.57±0.12[b]	3.01±0.01[c]
Total solid (g)	10.83±0.02[a]	8.44±0.13[c]	9.76±0.03[b]
PH	4.31±0.01[b]	4.45±0.05[a]	3.95±0.05[c]
Viscosity	190.50±0.50[a]	178.50±0.50[b]	33.50±0.50[c]

Phytochemicals of different yoghurt products

Yoghurt has antioxidant properties. Fermentation produces amino acids and peptides with antioxidant qualities. Yoghurt also contains reducing sugars, fatty acids, oligosaccharides, and lactic acid bacteria that act as reducing agents and antioxidants **(Silva *et al.*, 2022**). The phytochemical contents of skimmed buffalo, whole cow, and camel yoghurt are analyzed at initial production (zero time) and storage time at 4±1°C for 14 days. The results are presented in Table (2); Whole camel yogurt has the highest total phenols and antioxidant activity (DPPH) compared to cow and skimmed buffalo. Meanwhile, skimmed buffalo yoghurts had the highest total flavonoid content compared to the other yoghurt types.

Interestingly, these phytochemical attributes changed during storage, reducing their content. Notably, whole camel yoghurt exhibited the lowest percentage loss in total phenols and flavonoid content, decreasing from 81.75 to 65.78 mg GAE/100g and 19.95 to 12.60 mg QC/100g, respectively. Additionally, the antioxidant activity showed a decrease from 50.55% to 40.50%, with a loss percentage of 19.53, 36.84, and 19.88%, respectively, compared to skimmed buffalo and whole cow yoghurt after 14 days of all parameters. These results align with those **(Shori & Baba, 2014)**, who mentioned that camel yoghurt's total phenolic content was about 1.0–1.2-fold higher than cow yoghurt's.

The total phenolic content in milk may be clarified by the formation and/or further degradation of polymeric phenolics by the yoghurt bacteria during fermentation (**Zeb & Zeb, 2021**). Furthermore, the observed decrease in total phenols and flavonoid content indicates a potential degradation or alteration of these compounds during storage. Factors such as exposure to light, temperature variations, and oxidative processes may contribute to the breakdown of these phytochemicals over time (**Camargo-Herrera *et al*., 2023**).

Table 2. Phytochemical compounds of different yoghurt products during storage periods at 4 °C

Sample / Phytochemicals	Yoghurt products		
	Whole cow yoghurt	**Skimmed buffalo yoghurt**	**Whole camel yoghurt**
Yoghurt products in zero time			
Total phenols (mg/100g)	71.00±1.00c	74.60±0.60b	81.75±0.25a
Total flavonoid (mg/100g)	15.20±0.60c	20.28±0.40a	19.95±0.05b
Antioxidant activity (DPPH) %	37.34±1.35c	40.01±0.11b	50.55±0.27a
Yoghurt products after 7 days			
Total phenols (mg/100g)	65.50±0.50c	70.50±0.50b	78.75±0.75a
Total flavonoid (mg/100g)	8.90±0.10c	9.50±0.50c	16.59±0.61b
Antioxidant activity (DPPH) %	35.61±0.40c	38.22±033b	47.52±0.37a
Yoghurt products after 14 days			
Total phenols (mg/100g)	48.60±0.40c	52.70±1.50c	65.78±0.65b
Total flavonoid (mg/100g)	7.10±0.10c	8.95±0.050b	12.60±0.30a

Antioxidant activity (DPPH) %	25.40±0.50c	29.25±0.75b	40.50±0.50a

Effect of different storage time on microbiological counts (log cfu/g) of experimental yoghurts during refrigerated storage

The yoghurt samples were analyzed for their microbiological properties at initial production (zero time), after 7 and 14 days of storage at 4±1°C. The counts of total bacterial count, *S. thermophilus*. *L. acidophilus* and *B. bifidum*, as well as yeast and mold in all samples, were determined. The results indicated low variation between reliable counts for the probiotic and yoghurt strains and acceptable viability of the species throughout the shelf life of the yoghurt products (Table 3). Whole camel yoghurt displayed the highest content of *B. bifidum* and *L. acidophilus* (8.95 and 8.12 log CFU/g, respectively), while *S. thermophilus* recorded the highest level in whole cow yoghurt. However, the counting of *S. thermophilus*. *L. acidophilus*, *B. bifidum*, and the total count plate showed lower counts after 14 days of cold storage.

Table 3. Effect of different storage time on microbiological counts (log cfu/g) of experimental yoghurts during refrigerated storage

Samples	Yeast Mold	S. thermophilus	L. acidophilus	B. bifidum	TCP
	Microbiological characteristics of yoghurt on zero time				
Whole cow yoghurt	ND*	7.96±0.02a	7.53±0.03b	7.23±0.03c	8.95±0.03c
Skimmed buffalo yoghurt	ND*	7.82±0.02b	7.08±0.09c	7.46±0.04b	8.91±0.01c
Whole camel yoghurt	ND*	7.34±0.02c	8.12±0.01a	8.95±0.06a	9.95±0.01b
	Microbiological characteristics of yoghurt after 7 days				
Whole cow yoghurt	ND*	7.02±0.01b	6.0233±0.01c	6.41±0.13c	7.88±0.02c
Skimmed buffalo yoghurt	ND*	7.10±0.01a	6.9667±0.03b	7.05±0.04b	8.03±0.01b
Whole camel yoghurt	ND*	6.98±0.01c	7.7350±0.13a	8.06±0.12a	8.54±0.03a
	Microbiological characteristics of yoghurt after 14 days				
Whole cow yoghurt	ND*	6.09±0.01b	5.67±0.02c	5.32±0.03c	7.01±0.01c
Skimmed buffalo yoghurt	ND*	6.57±0.03a	6.02±0.01b	6.32±0.02b	7.94±0.06b
Whole camel yoghurt	ND*	6.02±0.01c	6.87±0.07a	6.90±0.01a	8.00±0.01a

***ND (Not detected)**

Concomitantly, it was observed that skimmed buffalo yoghurt exhibited the lowest reduction of all microbiological counts compared to whole camel and cow yoghurts, which reduced from 7.82 to 6.57 log CFU/g for *S. thermophiles*, 7.08 to 6.02 log CFU/g for *L. acidophilus*, 7.46 to 7.94 CFU/g for *B. bifidum* and 8.91 to 7.94 for the total viable count with losing percentages15.28, 14.97, 15.98 and 10.89 % after cold storage. On the other hand, the yoghurt showed no microbial growth of yeasts or molds, either initially after production or after 7 and 14 days of cold storage. These results are close to those of **(Hamdy *et al*., 2021**), who stated that *S. thermophilus* and *Lactobacillus*. spp counts in full-fat yoghurt and skimmed yoghurts decreased slightly (0.5–1 log cycle) during refrigerated storage. In general, the low temperature caused a decrease in the metabolic activities of bacterial cells, thereby causing a reduction in their death rate (**Sengupta & Chattopadhyay, 2013**).

Sensory evaluation of skimmed buffalo, whole cow, and camel yoghurt

The results of sensory parameters, including flavour, texture, acidity, appearance, and overall acceptability of skimmed buffalo, whole cow, and camel yoghurt, are presented in Table 4. Skimmed buffalo yoghurt scored the highest preference in most parameters, including flavour, acidity, appearance, and over-acceptable, with a rating of 44.20, 9.10, 9.60, and 96.60, respectively, followed by whole cow and camel yoghurts. On the other hand, whole cow yoghurt recorded the highest score in texture (32.50), followed by skimmed buffalo and whole camel yoghurts. These differences in texture could be due to the highest fat content in whole cow yoghurt compared to other yoghurt types. These results are in line with those of **Boukria *et al*., (2020**), who discovered that the color, smell, taste, and consistency of yoghurts made from goat, ewe, and cow milk, as well as blended cow and goat milk, cow and ewe milk, and ewe and goat milk, differed. Regarding flavour, respondents chose three samples as the most preferred, including yoghurt produced with an equal proportion of cow and goat milk and sheep and cow milk.

Table 4. Sensory evaluation of skimmed buffalo, whole cow, and camel yoghurt

Samples	Flavour (45)	Texture (35)	Acidity (10)	Appearance (10)	Over acceptable (100)
Whole cow yoghurt	42.50±0.53b	32.50±0.53a	7.80±0.42b	8.60±0.52b	92.40±0.84b
Skimmed buffalo yoghurt	44.20±0.87a	32.00±0.47b	9.10±0.57a	9.60±0.51a	96.60±1.71a
Whole camel yoghurt	39.10±0.74c	28.30±0.48c	6.80±0.42c	7.70±0.48c	84.60±1.26c

Anticancer activity of skimmed buffalo, whole cow, and camel milk yoghurt against MCF-7 cells during the storage period

Yoghurts are a source of probiotic bacteria, and their regular consumption may be a strong point in preventing various diseases, including civilization diseases and cancer (**Karwowska *et al*., 2019**). Different yoghurt products from skimmed buffalo, whole cow, and camel milk were used to assess the inhibitory effects against MCF-7 cells at initial production and during the storage period at 4 C for 7 and 14 days (Table 5). Initially, skimmed buffalo yoghurt recorded the highest inhibitory activity (445 µg/ml), followed by whole camel and cow milk yoghurt (552 and 902 µg/ml, respectively).

Conversely, it was revealed that the growth inhibition rate of MCF-7 cells increased significantly during prolonged cold storage for 7 days, followed by a reduction after 14 days of cold storage. Whole camel milk yoghurt exhibited the highest inhibitory activity (IC_{50}) against MCF-7 cells with a value of 273 µg/ml, followed by skimmed buffalo yoghurt (307 µg/ml) compared to whole cow yoghurt (687 µg/ml). These results are close to those of **Ayyash *et al*., (2018)**, who reported that camel milk fermented with *L. acidophilus* K782 demonstrated more potent anticancer activity than bovine milk fermented with the same strain against Caco-2, MCF-7, and HELA cell lines. As well as, these data are consistent with (**Sah *et al*., 2016**), who mentioned the increasing antiproliferative activity of probiotic yogurt with PPP against HT29 colon cancer cells during a cold storage period of 14 days and gradually declined after 28 days of storage.

Interestingly, the inhibitory activity against MCF-7 cells increased significantly during storage, particularly after 7 days of cold storage. This rise in inhibitory action over time could be attributed to several factors, including that yoghurt ferments slightly even when refrigerated, which could increase the concentration or potency of bioactive peptides and other anticancer chemicals. In addition, continuing enzymatic activity may break down proteins and other milk components into smaller, more bioactive fragments that limit cancer cell development better during storage (**Rashwan *et al*., 2023**).

Additionally, after prolonged cold storage, fermented camel milk yoghurt may accumulate low molecular mass peptides formed during lactobacillus-mediated milk protein hydrolysis, improving its antiproliferative effects. Oligopeptides from milk proteins are carried into cells and digested by intracellular peptidases into tiny peptides and amino acids **(Gonzalez-Gonzalez et al., 2011).** These milk peptides may induce apoptosis in cancer cells or compete with cancer growth agents for cell-membrane receptors. The heightened antiproliferation in fermented camel milk yoghurt could be attributed to the superior competition capability of peptides compared to those from other milk types **(Pessione and Cirrincione, 2016).**

Table: (5) Anticancer activity of skimmed buffalo, whole cow, and camel milk yoghurt against MCF-7 cells during storage periods

Samples / Conc.	Conc. µg/ml						
	0	25	50	100	250	500	IC_{50}
(MCF-7) cells treatment on zero							
Whole cow yoghurt	1.01±1.03	7.59±2.07	12.42±1.12	18.32±2.11	33.06±1.11	54.75±2.12	902
Skimmed buffalo yoghurt	1.56±0.34	12.43±1.9	19.34±1.26	28.43±1.97	47.23±1.94	59.34±2.06	445
Whole camel yoghurt	1.78±0.47	11.45±1.1	14.76±2.13	18.23±3.11	26.23±3.11	34.67±2.11	552
(MCF-7) cells treatment after 7 days							
Whole cow yoghurt	3.78±0.44	12.43±1.3	17.23±1.43	23.4±1.34	29.44±2.34	41.45±1.34	678
Skimmed buffalo yoghurt	2.67±0.32	4.89±0.79	9.57±1.13	17.56±0.45	21.89±1.43	32.67±1.35	307
Whole camel yoghurt	1.77±0.55	15.68±1.3	21.65±1.43	35.89±2.34	47.98±1.34	69.35±2.43	273
(MCF-7) cells treatment after 14 days							
Whole cow yoghurt	1.32±0.67	4.21±0.16	9.34±0.45	16.31±1.43	21.76±2.43	34.65±0.46	797
Skimmed buffalo yoghurt	1.68±0.35	2.54±0.43	6.34±1.56	9.45±1.43	12.46±0.47	16.53±2.56	633
Whole camel yoghurt	1.25±0.15	16.12±1.3	23.54±1.43	31.45±2.45	42.54±1.32	56.34±3.54	385

IC50: Half-maximal inhibitory concentration

Conclusion

This study examined the physicochemical, phytochemical, microbiological, sensory, and anticancer activities of cow, skimmed buffalo, and camel milk yoghurts over a 14-day cold storage. Skimmed buffalo milk yoghurt exhibited the highest protein, ash content, and pH, with the lowest fat content. Protein, fat, and pH values decreased in all yoghurts over storage. On the other hand, camel milk yoghurt had the highest total phenolic and flavonoid content and antioxidant activity and the lowest storage decrease. It had the most *B. bifidum* and *L. acidophilus*. Skimmed buffalo milk yoghurt inhibited MCF-7 cells best and earned the highest acceptance score. Camel milk yoghurt originally inhibited MCF-7 cells less but increased significantly over storage. These findings suggest that camel milk yoghurt exhibits the potential for enhanced anticancer effects over extended storage despite the initial lower inhibitory activity.

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