MEDWIN PUBLISHERS
Committed to Create Value for Researchers

Vaccines & Vaccination Open Access
ISSN: 2578-5044

Study on the Characteristics of Cheddar Cheese Prepared from Different Blends of Buffalo and Goat Milk

Jabeen H[1], Imran M[3], Akbar A[3], Salam MU[3], Manzoor S[1]*, Qamar MF[2] and Hussain Z[3]

[1]Livestock & Dairy Development Department, Pakistan

[2]Department of Zoology, GC University, Pakistan

[3]Poultry Production, Livestock & Dairy Development Department, Pakistan

Review Article

Volume 8 Issue 1

Received Date: February 02, 2023

Published Date: March 23, 2023

DOI: 10.23880/vvoa-16000155

***Corresponding author:** Sohail Manzoor, Additional Principal Veterinary Officer, L&DD, Punjab, Pakistan, Tel: +92-333-6503982; Email: manzoorsohail76@gmail.com

Abstract

Cheese is a good food while traveling. It is valuable for its portability, long life, and high content of fat, protein, calcium, and phosphorus. Cheese is a more compact form of nutrition and has a longer shelf life than milk from which it is made. Goat cheese is known as Chevre, after the French word for goat. Goat cheese is often higher in protein and lower in fat than cheese from cow's milk. Regardless of excellent nutritional profile goat milk has been an ignored commodity; researchers and manufacturers have paid very little attention for its direct consumption and use in product value addition. In our current study Cheese was prepared from goat and buffalo milk and their blends 75:25, 50:50, 25:75, respectively. Samples thus prepared were packed in air-tight polyethylene bags and stored at 4±1ºC. Samples were evaluated for different physicochemical analysis i.e. fat, protein, lactose, ash, total solids, pH, acidity and organoleptic qualities on monthly basis up to 120 days of storage period. All the analysis was conducted in the Laboratories of Department of Animal Products Technology (DAPT) and Department of Food & Nutrition, University of Veterinary and Animal Sciences Lahore and Ravi Campus Pattoki. The data thus obtained from all the parameters was analyzed using analysis of variance technique to determine the level of significance. Statistical analysis showed that the storage and treatments had the non-significant effect on pH, acidity, moisture, protein, lactose of cheddar cheese. The sensory evaluation of different treatments of goat and buffalo milk in cheddar cheese varied non-significantly among each other. However, evaluation during storage varied significantly with respect to color and taste. Furthermore, the interaction between treatments and storage was found non-significant in smell, texture and overall acceptance.

Keywords: Milk Cheese Analyzed; Proteolysis; Lipolysis; Glycolysis; Adventitious Microflora

Abbreviations: SNF: Solid Not Fat; DAPT: Department of Animal Products Technology; UVAS: University Of Veterinary; Animal Sciences; TS: Total Solids.

Introduction

Goat population (56.7 million) contributes approximately two percent of the world's total annual milk and ranks third after cow and buffaloes [1]. Milk is a complete food and provides most of the nutrients required for growth in sufficient quantity [2]. Goat milk is both nutritious and delicious; hence adequate processing of raw goat milk followed by value addition results in doubling of return apart from increased shelf life and reduced volume of the product resulting in lower transportation cost [3].

Cheese has served as a hedge against famine and is a good food while traveling. It is valuable for its portability, long life, and high content of fat, protein, calcium, and phosphorus. Cheese is a more compact form of nutrition and has a longer shelf life than the milk from which it is made. The substantial storage life of cheese lets a cheese maker to control the material and get the better return or the product. Due to the widely appreciated organoleptic characteristics, the production of goat's milk cheese has attracted growing interest over recent years. It has been reported that the goat milk has more digestible fat and protein content than cow milk. In addition, goat milk has increased content of vitamin A, thiamine and niacin in comparison to cow's milk [4].

Cheddar cheese is a food made from the milk of mammals, by coagulating the milk acidifying it with a bacterial culture and then employing the rennet enzyme (or rennet substitutes) to coagulate the milk to "curds and whey" Fermented milk and yoghurt are the most popular means of delivering probiotic bacteria in food. Cheese volatile fraction and consequently sensory characteristics are affected by climatic conditions and raw milk quality, which depends on the animal species, raw, breed, feed and farming. The adventitious microflora of the raw milk will also play a relevant role [5]. Due to its importance as an alternate vehicle for delivering probiotic bacteria the popularity of cheese, especially Cheddar cheese has been increased [6].

The biochemistry of cheese ripening is a complex process which involves three primary events, i.e. proteolysis, lipolysis and glycolysis, which are catalyzed by enzymes indigenous to milk, from the coagulant, starter bacteria, and the adventitious non-starter microflora [7,8]. The goat's milk cheese is a soft white cheese with pleasant flavor made from pure heat-treated goat's milk by the addition of rennet and without the addition of any starter culture. In general, artisanal cheeses with unique characteristics such as goat's milk cheese analyzed in this study are manufactured for the first time in Pakistan. The goat and sheep milk in Pakistan is not usually processed and the value of goat milk in human nutrition has so far received very little factual attention from researchers and manufacturers. The present study was conducted to assess the feasibility of buffalo milk replacement with goat milk for Cheddar cheese manufacturing. Furthermore, the best possible combination of goat and buffalo milk for cheese manufacturing through chemical and organoleptic evaluation of cheese was also investigated.

Materials and Methods

Procurement of Raw Materials

Goat milk was procured from the flock maintained at Small Ruminants Training and Research Centre, Pattoki, University of Veterinary and Animal Sciences, Lahore while, buffalo milk was obtained from Buffalo Research Institute, Pattoki. For the preparation of Cheddar cheese, starter culture was obtained from Nestle Pakistan Limited, Lahore.

Analysis of Milk

Goat and buffalo milk was analyzed for chemical composition, like fat, crude protein, lactose, ash, total solids, solid not fat (SNF), pH and acidity according to their respective methods as described in Horwitz W, et al. [10].

Treatment Plan

Goat milk was blended with buffalo milk at various levels and was used in Cheddar cheese manufacturing as described in (Table 1).

Treatments	Buffalo milk (%)	Goat milk (%)
T0 (control)	100	-
T1	75	25
T2	50	50
T3	25	75
T4	0	100

Table 1: Composition of Milk Blend in Different Treatment Groups.

Preparation of Cheese

Indigenous goat and buffalo milk (25 lit) and their blends were used for the preparation of cheddar cheese (Table 1). Treatment milk blends were pasteurized at 65ºC for 30 minutes and were cooled down to 31ºC. Then starter culture was added at the rate of 1% and was allowed to acidify till acidity reached to 0.31%. Then rennet at the rate of 0.02 % was added and milk was allowed to coagulate. Whey was drained and curd was heated at 38ºC followed by pressing. Milling and sealing and ripening were performed as per procedure described by Potter NN, et al. [9]. The Cheddar cheese was packed in air-tight polyethylene bags and stored at 4±1ºC for further analysis in laboratories of Department of Animal Products Technology (DAPT) Department of Food and Nutrition, University of Veterinary and Animal Sciences (UVAS).

Physico-Chemical Analysis of Cheddar Cheese

Cheddar cheese was subjected to different physicochemical analysis i.e. fat, Protein, lactose, ash, total solids, pH and acidity on monthly basis for a period of 120 days as per their standard procedure as discussed in Horwitz W, et al. [10].

pH

Glass electrode was immersed in cheese for 2 minutes. The detecting unit was washed well with water, and the access water was blotted gently with a piece of filter paper. Immerse the detecting unit in the samples taken from all the treatment groups and read the pH value.

Acidity

Burette was filled with N/10 NaOH and placed 9ml of cheese in conical flask. 3 to 5drops of phenolphthalein indicator were added to the flask. Reading of the NaOH was taken in the burette at the lowest point of the meniscus. Allowed the NaOH drop wise into the flask containing the sample and stirred continuously. Pink color indicated the end-point. Subtracted the first reading from the second to determine the number of milliliters of alkali (NaOH) required neutralizing the acid in the sample. Acidity was calculated by using following formula and correction factor 0.0009 was used as described by Atherton HV, et al. [11].

$$\text{Acidity \%} = \frac{\text{No. of ml N/10 alkali} \times 0.0009 \times 10}{\text{Wt. of cheese in grams}}$$

Fat

Cheese samples (500–800 gm) were collected, for the analysis of fat in a Beaker. Samples were heated at 40-45°C and then cooled down to 20°C by continuously agitating. 10ml sulphuric acid was taken in butyrometer with the help of auto-measure. Pipette was filled with butyrometer; 1ml iso-amyl alcohol was added with the help of auto measuring pipette. The contents were mixed well by inverting butyrometer 3- 4 times then centrifuged in Gerber Machine for 3 min at 1100 rpm. Butyrometer was removed from the Gerber machine and recorded the reading at lower meniscus of fat column in butyrometer. Fat percentage of sample directly corresponded to the reading in butyrometer column [12].

Protein

15g K_2SO_4 was added in 1 mL CuSO4. $5H_2O$ catalyst solution and heated with 5gm of cheese sample in flask. 25mL H_2SO_4 was added in flask and was held for digestion. Flask was placed in inclined position with fume ejection system on. Digested within 20 minutes when white fumes appeared in flask. When digested, light blue-green color was observed, continued to boil for 1-1.5 hrs. At the end, 300gm of cheese was added to flask and swirled to mix. Some crystals may form when water was added. H_3BO_3 solution (50 ml) was added with indicator to graduated 500mL Erlenmeyer titration flask and placed flask under condenser tip so that tip is well below H_3BO_3 solution surface. Lighted stir plate was recorded at the end point [13].

Lactose

2.5gm sample was taken in centrifuge tube and 0.2 ml Zinc sulfate (5%) was added followed by 0.2 ml of 4.5% barium hydroxide. It was centrifuged for 15 to 30 seconds at 2500 rpm. 1.0 ml of the clear supernatant was transferred to test tube, 2.5 ml of Teles' reagent, was added and dry rubber stopper was closed tightly. Immersed the bottom of the tube in a boiling water bath for 6 minutes then put the volume to 25 ml with distilled water in the sample. After mixing contents read the absorbance at 520 nm against a similarly treated reagent blank in which 2.5 ml water was used as a substitutes for the sample. Results were compared with a standard solution of dry lactose in distilled water. Reading was recorded and lactose quantity was measured by using formula [14].

$$\text{Lactose (mg/ml)} = \frac{\text{absorbance of sample X 50}}{\text{absorbance of standard or use a standard Curve.}}$$

Total Solids (TS)

5gm of cheese sample was taken into a petri dish and transferred to oven for evaporation at 100°C. Dish was weighed, placed in oven for 30 min for evaporation again. Petri dishes were cooled in desiccators before weighing. Last weight minus weight of dish, gave the weight of TS in the amount of cheese taken. Percentage of TS was calculated as per formula below.

$$\text{\% of TS} = \text{CLR}/4 + (1.22 \times \text{fat \%})$$

$$\text{SNF} = \text{TS} - \text{fat \%}$$

$$\text{CLR} = (\text{corrected lactometer reading})$$

Sensory Evaluation

Cheddar cheese prepared from goat-buffalo milk blends was subjected to organoleptic evaluation by a trained taste panel of 10 judges. The panelists was selected from faculty and postgraduate students of Department of Animal Products Technology (DAPT), University of Veterinary and Animal Sciences (UVAS), Lahore, who have experience in evaluating such products and were trained to evaluate the cheese samples. Evaluation was carried out by the panelists using 15-cm unstructured line on a sensory evaluation Performa. The samples were presented in random order and all the evaluations for color, taste, smell, texture and overall acceptability were conducted at room temperature on the same day in the Sensory Laboratory of Department of Animal Products Technology (DAPT) University of Veterinary and Animal Sciences, Ravi Campus Pattoki. Evaluations were made by placing the cheese samples in transparent cups, labeled with 3-digit random codes and the panelists were asked to rate their acceptance by marking a cross on the line for all the parameters. Panelists were also provided with

distilled water and unsalted crackers to clean their mouths between the samples. The data thus obtained was converted to numerical scores using metric scale.

Components	Buffalo	Goat
pH	6.68+0.36	6.65+0.31
Acidity	0.1+0.41	0.1+0.29
Protein	4.0+0.28	4.29+0.28
Fat	6.71+0.35	4.78+0.27
Lactose	4.88+0.31	4.70+0.25
Total Solid	17.24+0.41	13.50+0.36
Moisture	82.76+0.39	86.50+0.37

Table 2: Chemical composition of goat and buffalo milk Used in our Experiment.

Statistical Analysis

The data thus obtained from all the parameters were analyzed through analysis of variance technique using Cohort version 6.1 to determine the level of significance. The separations of means or significant difference comparisons were done using DMR. The statistical significance was defined as $P \leq 0.05$. Correlation analysis was also carried out in order to explicit interactions between various physico-chemicals and organoleptic attributes of finished products.

Results and Discussion

Cheese was manufactured by different levels of goat and buffalo milk. The samples were stored in refrigerator and were evaluated for chemical composition, like fat, crude protein, lactose, ash, total solids, SNF, pH and acidity according to their respective methods as described in AOAC, et al. (2006) [10], at 0, 30, 60, 90 and 120 days of storage.

Composition of Milk

Fresh goat, and buffalo milk was analyzed for pH, acidity, protein, lactose, fat, and total solid by following the methods of Horwitz W, et al. [10] as shown in (Table 1).

pH

pH is of cheddar cheese is an indication of acidity and basicity. Statistically storage had non-significant effect on the pH of cheddar cheese, whereas treatment and their interaction effect were found to be non-significant (Table 2).

The range of mean values of pH (5.61) at 0 day and 5.53 at 120 day was observed during storage. During treatment 5.48 in to and 5.59 in T4 was observed (Table 3). pH also decreases gradually in all mean samples throughout the storage period of 120 days (Table 3). Treatment and storage had non-significant effect on pH of cheddar cheese in close agreement with the finding of Paquet J, et al. [14] who reported that pH 5.8 and 5.4 are the most suitable for cheddar cheese Mazahreh AS, et al. [15] also reported that suitable pH values for cheddar cheese after the first week and throughout the four weeks of storage were 5.8 Hassan AN [16] reported that the pH of cheese made from buffalo milk is 5.9 and it had no effect on the yield acidity and total nitrogen content of the cheddar cheese. In cheeses like Cheddar 35-96% of dicalcium paracasein is transformed to monocalcium paracesinate with increasing lactic acid with a pH drop to 5.3, which affects cheese texture [17].

Acidity

During the preparation of cheddar cheese the development of acidity is one of the basic operations. Statistical analysis exposed a non-significant effect of treatments and storage on acidity of cheddar cheese while their interaction was found to be non- important (Table 4). The mean acidity values of the five treatments ranged from 1.11 % to 1.19% having. These results showed that by adding goat milk, acidity of the cheese samples not increased which is also obvious from results for pH values. The results also showed a minor increase in the acidity of all treatments with storage intervals. Acidity of cheddar cheese is 1.15 % at the start of the study which significantly up to 1.19 at 120 days of storage period (Table 5). The results of this study are in close agreement with the finding of Selwa AA, et al. [18] who reported an increase in the acidity of cheese during storage. Cheese is an acidic dairy product with natural keeping quality. Acidity has an inverse relation to the pH. This relationship of acidity and pH was quite obvious from data of the present study collected from goat and buffalo milk cheddar cheese during 120 days of storage.

Moisture

The moisture contents are of great importance for many scientific, technical and economic reasons. Lower the moisture, the better its storage ability. The statistical analysis

shows a non-significant effect of treatments and storage on moisture of cheddar cheese (Table 5). The mean values for moisture contents of various cheddar cheese treatments are given in (Table 5) minimum moisture content at 0 day is 43.40%. There was slightly increase 43.40%, 43.47%, 43.94% and 43.95% at 30, 60, 90 and 120 days respectively. It shows a non-significant change and during the treatments is slightly increase in mean values from 42.36% to 44.57% with non-significant change.

Fat

The fat in milk is regarded as milk fat, butter fat or simply fat. Fat gives the end product or rich flavor and improved food perception including appearance, texture, and mouth feel. The fat is a rich source of calories and contributes energy values of products [9]. Analysis of variance on fat content of the cheddar cheese is shown in (Table 7). The results indicate non-significant effect of treatments and non-significant of storage on fat contents of cheddar cheese. The mean values for the fat contents of cheddar cheese of different treatments ranged from 32.39% to 33.73%. The fat content of treatments slightly increased during storage. At 0 day the mean fat of treatments was 33.04% which decreased to 33.04%, 32.86%, 32.93% and 32.93% at 30, 60, 90 and 120 days of storage respectively. The results of this study are in close agreement with the findings of Bonczar G, et al. [19] who reported that fat contents in cheddar cheese were (6.5%). The results concerning fat content in the present study are also closely associated with the earlier findings of Ahmad NL, et al. [20] who observed a slightly decreasing trend in fat content of cheddar cheese during storage.

Protein

The statistical results for protein content of cheddar cheese showed that the treatments and storage intervals had a non-significant. The mean values for protein content of cheddar cheese samples from all the five treatments ranged from 28.23 % to 28.52%. It is obvious from the results that the protein content of cheddar cheese samples was increased or decrease non significantly.

A slightly increasing receptiveness in the mean protein value was observed with storage period of 120 days. At 0 day of storage, the mean protein value of the treatments was 28% which increased non-significantly to 28.00%, 28.28%, 28.55% and 28.55 % after 30, 60, 90 and 120 days of storage respectively. The results are also in line with the findings of Wedholm A [21] who found a significant increase in the protein content of cheese during storage. Hydrolysis of protein relatively higher free moisture available during storage period favor the hydration and hydrolysis of protein and this may be the reason for decreased in protein during storage [22].

Lactose

Analysis of variance for lactose content of various cheddar cheese treatments with 120 day storage intervals has been represented in (Table 8). The statistical analysis showed a non-significant effect of storage but significant effect of treatments. Slightly increase with in treatments on lactose contents of cheddar cheese. The range of mean of lactose (1.57%) was found on 0 day, which increased to 1.57%, 1.58%, 1.59% and 1.59% after 30, 60, 90 and 120 days of storage respectively (Table 8) but significant changes observed during different treatments.

Total Solids

The mean values regarding the total solids of different treatments of goat and buffalo milk cheddar cheese are given in (Table 9). While analysis of variance revealed that all the treatments varied non-significantly among each other. The range of total solids was observed 63.69% at 120 day and non-significantly the lowest value was recorded 62.62% at 0 day. The highest total solids were observed at 120 day (63.69%) and non-significantly the lowest value was recorded (62.62%) at 0day. Total solids not significantly decreased throughout the storage period of 120 days. The interaction of treatment and storage was also found non-significant.

Color

The results regarding Analysis of variance for appearance of different treatments of goat and buffalo milk cheddar cheese revealed that all the treatments varied non-significantly among each other but they had significantly varied effect during storage. The range for appearance was observed in mean values (11.09-11.92). Statistical analysis of the data indicated that storage had significant influence on treatments the interaction between treatments and storage were also found significant. The results are in line with the findings of Lucey JA, et al. [22,23] who reported that the storage had a negative effect on color and appearance of cheddar cheese.

Texture

The results according to the analysis of variance for texture of different treatments of cheddar cheese revealed that all the treatments varied non-significantly among each other. The decrease in texture score may be due to the development of non-significantly the highest range (12.05-11.60) was noted during storage. Texture score non-significantly decreased during storage period 120 days. The interaction between treatments and storage was found non-significant.

Taste

The taste is a sensation perceived by the tongue and influenced by the texture, flavor and composition of the foods. The results regarding analysis of variance for taste of different treatments of goat and buffalo milk cheddar cheese showed that all the treatments varied non significantly among each other. On 0 day analysis significantly the highest score was observed in T1 (12.71) and the lowest score was noted in T4 (12.59) at 120 day. Taste score significantly increased throughout the storage period (120 days) this may be due to increased acidity of cheese samples. The interaction between treatments and storage also found significant. The results are in close agreement with the finding of Rowney et al. 2003 who also reported an increased in taste of cheese during storage.

Smell

The mean scores pertaining to smell of different treatments of goat and buffalo milk cheddar cheese were analyzed that indicated that all the treatments varied non-significantly among each other. Significantly the highest score for smell was recorded in T3 (11.22-13.08) during storage study and significantly the lowest score were noted in T4 (11.43). Smell score non-significantly decreased between treatments. The interaction between treatment and storage was also found non-significantly. The results are in close agreement with the finding of Diana MAB, et al. [24] they add skim milk powder and whey protein concentrate in and increase of the protein content. As a consequence the product receives a high score for appearance, taste, smell and overall acceptance.

Overall Acceptance

Statistical analysis disclosed that the treatments and days had non-significant effect on the overall acceptability of protein concentrations but their interaction effect was found to be non-significant (Table 10). All the five treatments showed non-significant results of protein for overall acceptance. The mean scores for overall acceptance of treatments showed that T1 having 28.52% got the highest scores for the overall acceptance by sensory panelists.

Storage also affected the overall acceptability of treatments. The highest mean score for overall acceptability was observed at 0 day of storage which decreases to 28.39, 28.34, 28.32 and 28.23% between treatments (Table 10).

Treatments	Storage Intervals					
	0- Day	30- Days	60-Days	90-Days	120-Days	Mean
To	5.55+0.15	5.43+0.15	5.43+0.15	5.47+0.35	5.50 +0.46	5.48 a
T1	5.63+0.13	5.62+0.12	5.59+0.10	5.58+0.40	5.53+ 0.16	5.59 a
T2	5.61+0.10	5.6+0.11	5.58+0.12	5.57+0.10	5.55+ 0.12	5.58 a
T3	5.62+0.11	5.62+0.12	5.6+0.13	5.57+0.13	5.53+0.10	5.59 a
T4	5.62+0.13	5.61+0.13	5.6+0.12	5.59+0.13	5.55+ 0.14	5.59 a
Mean	5.61 a	5.58 a	5.56 a	5.53 a	5.53 a	

Means sharing the same letters in a row or column are not significantly different

Table 3: pH of cheese prepared from various goat- buffalo milk blends.

Treatment	Storage Intervals					
	0- Day	30-Days	60-Days	90-Days	120-Days	Mean
To	1.13+0.15	1.1+0.17	1.1+0.17	1.07+0.25	1.17+0.25	1.11 a
T1	1.15+0.09	1.18+0.07	1.19+0.05	1.2+0.04	1.21+0.03	1.19 a
T2	1.18+0.04	1.19+0.06	1.19+0.03	1.2+0.04	1.21+0.03	1.19 a
T3	1.15+0.03	1.17+0.02	1.19+0.02	1.2+0.04	1.2+0.02	1.18 a
T4	1.16+0.02	1.16+0.02	1.18+0.02	1.18+0.01	1.18+0.01	1.17 a
Mean	1.15 a	1.15 a	1.16 a	1.17 a	1.19 a	

Means sharing the same letters in a row or column are not significantly different.

Table 4: Acidity of cheese prepared from various goat- buffalo milk blends.

Treatment	Storage Intervals					
	0 Day	30-Days	60-Days	90-Days	120-Days	Mean
To	41.62+2.70	41.86+2.47	41.88+2.49	43.21+2.07	43.22+2.07	42.36 a
T1	43.28+2.17	43.31+1.63	43.21+1.59	43.88+1.56	43.88+1.57	43.51 a
T2	43.66+1.81	43.67+1.84	43.68+1.82	43.68+1.81	43.69+1.81	43.68 a
T3	44.05+1.73	44.08+1.67	44.1+1.67	44.14+1.64	44.14+1.65	44.10 a
T4	44.38+1.36	44.41+1.66	44.44+1.29	44.8+1.04	44.81+1.03	44.57 a
Mean	43.40 a	43.40 a	43.47 a	43.94 a	43.95 a	

Means sharing the same letters in a row or column are not significantly different
Table 5: Moisture of cheese prepared from various goat- buffalo milk blends.

Treatment	Storage Intervals					
	0 Day	**30-Days**	**60-Days**	**90-Days**	**120-Days**	**Mean**
To	32.17+2.53	32.52+2.65	32.5+2.43	32.37+2.04	32.37+2.03	32.39 a
T1	33.17+2.53	32.53+2.65	32.5+2.43	32.35+2.04	32.37+2.04	32.58 a
T2	33.16+2.53	32.53+2.65	32.5+2.43	32.37+2.04	32.37+2.04	32.59 b
T3	33.19+2.52	33.2+2.52	33.21+2.54	33.43+2.38	33.43+2.37	33.29 b
T4	33.52+2.11	33.52+2.12	33.37+2.01	34.12+1.36	34.13+1.38	33.73 b
Mean	33.04 a	33.04 a	32.86 a	32.93 a	32.93 a	

Means sharing the same letters in a row or column are not significantly different
Table 6: Fat content of cheese prepared from various goat- buffalo milk blends**.**

Treatment	**Storage Intervals**					
	0-Day	**30-Days**	**60-Days**	**90-Days**	**120-Days**	**Mean**
To	27.43+ 1.00	28.45+0.98	28.47+1.00	28.79+1.51	28.79+1.51	28.39 a
T1	28.1+1.13	28.45+0.98	28.47+1.00	28.79+1.51	28.8+1.52	28.52 a
T2	28.13+1.00	28.14+1.00	28.44+0.97	28.45+1.00	28.45+1.00	28.32 a
T3	28.16+1.04	28.16+1.07	28.44+1.00	28.46+1.03	28.46+1.03	28.34 a
T4	28.2+1.00	28.2+1.01	28.23+1.03	28.25+1.05	28.25+1.05	28.23 a
Mean	28.00 a	28.00 a	28.28 a	28.55 a	28.55 a	

Means sharing the same letters in a row or column are not significantly different.
Table 7 Protein content of cheese prepared from various goat- buffalo milk blend.

Lactose	**Storage Intervals**					
	0-Day	**30-Days**	**60-Days**	**90-Days**	**120-Days**	**Mean**
To	1.57+0.50	1.59+0.49	1.59+0.49	1.57+0.48	1.57+0.48	1.58 a
T1	1.63+0.55	1.76+0.32	1.72+0.51	1.62+0.45	1.62+0.45	1.67 a
T2	1.61+0.49	1.77+0.32	1.69+0.50	1.63+0.46	1.63+0.46	1.67 a
T3	1.65+0.50	1.34+0.32	1.63+0.43	1.66+0.18	1.66+0.18	1.59 a
T4	1.38+0.28	1.46+0.24	1.38+0.28	1.46+0.24	1.46+0.24	1.43 a
Mean	1.57 a	1.57 a	1.58 a	1.59 a	1.59 a	

Means sharing the same letters in a row or column are not significantly different
Table 8: Lactose of cheese prepared from various goat- buffalo milk blends.

Treatment	Storage Intervals					
	0-Day	30-Days	60-Days	90-Days	120-Days	Mean
To	61.16+3.03	62.57+3.14	62.56+2.89	62.73+2.07	62.73+2.03	62.35 a
T1	62.9+2.17	62.74+1.63	62.68+1.59	62.78+1.56	62.79+1.57	62.78 b
T2	62.91+1.81	62.44+1.84	62.63+1.82	62.44+1.81	62.44+1.81	62.57 b
T3	63.01+1.73	62.7+1.67	62.38+1.67	63.5+1.64	66.65+1.65	63.65 c
T4	63.1+1.36	63.22+1.65	66.43+1.29	66.13+1.04	63.84+1.03	64.54 d
Mean	62.62 a	62.62 a	62.73 c	63.52 b	63.69 d	

Table 9: Total solid of cheese prepared from various goat- buffalo milk blends.
Means sharing the same letters in a row or column are not significantly different

Treatment	Storage Intervals					
	0-Day	30-Days	60-Days	90-Days	120-Days	Mean
To	13.29+1.11	13.21+0.98	13.14+1.21	12.75+1.67	11.72+2.10	12.82 a
T1	13.05+1.03	12.62+1.21	11.75+1.67	11.73+1.92	12.87+1.27	12.40 a
T2	13.06+0.92	12.77+0.93	12.37+1.20	11.88+1.71	10.6+0.79	12.14 a
T3	12.64+0.98	12.58+1.44	12.48+0.99	12.39+1.29	12.39+1.29	12.50 a
T4	12.79+1.43	12.06+1.07	11.66+1.21	11.36+1.43	10.17+1.74	11.61 a
Mean	12.97 a	12.97 a	12.65 a	12.02 a	11.55 a	

Table 10: Overall acceptance of cheese prepared from various goat- buffalo milk blends.
Means sharing letter "a" in a row or column are not significantly different
To = Cheddar cheese prepared from 100% buffalo milk
T_1 = Cheddar cheese prepared from 75% buffalo and 25% goat milk
T2 = Cheddar cheese prepared from 50% buffalo and 50% goat milk
T_3 = Cheddar cheese prepared from 25% buffalo and 75% goat milk
T_4 = Cheddar cheese prepared from 100% goat milk

Conclusion

Sensory evaluation is a scientific discipline used to measure, analyze and deduce reaction to characteristics of food and materials supposed by the senses of sight, smell, taste, touch. It is a very important quality criterion in food industry. So the sensory evaluations for appearance, texture taste/flavor, odor/smell, of cheddar cheese were studied. The sensory evaluation of different treatments of goat and buffalo milk in cheddar cheese varied non-significantly among each other. However, evaluation during storage varied significantly with respect to color and taste. Furthermore, the interaction between treatments and storage was found non-significant in smell, texture and overall acceptance.

References

1. Anonymous (2008) Economic Survey of Pakistan. Finance Division Govt of Pakistan, Economic Advisors Wing, Islamabad.

2. Mathur MP, Datta P, Dinakar P (2005) Text Book of Dairy Chemistry. In: Mathur MP (Ed.), Directorate of Information and Publication of Agriculture, New Delhi, India, pp: 456.

3. Domagala J (2008) Sensory Evaluation and Rheological Properties of Yoghurts Prepared from Goat, Cow and Sheep Milk. EJPAU 11(3): 04.

4. Haenlein GF (2001) Past, Present, and Future perspectives of small ruminant Dairy research. J D Sci 84(9): 2097-2115.

5. Carbonell M, Nunes M, Fernandez-Garcia E (2002) Seasonal variation of volatile compounds in ewe raw milk La Serena cheese. Lait 82: 699-711.

6. Tserovska L, Stefanova S, Yordanova T (2002) Identification of lactic acid bacteria isolated from Katyk, goat's milk and cheese. J Culture Collection 3: 48-52.

7. Fox PF, Mcsweeney PLH (1996) Proteolysis in cheese

during ripening. Food Review Int 12(4): 457-509.

8. Fox PF (1998) Developments in the biochemistry of cheese ripening. In Proceedings 25th International Dairy Congress (11-37), Aarhus, Denmark.

9. Potter NN, Hotchkiss JH (1995) Food Science. In: Potter NN, et al. (Eds.), Food Science. 5th(Edn.), Springer, New York, USA, pp: 608.

10. Horwitz W, Latimer GW (2006) The official methods of analysis of AOAC international 18th(Edn.), AOAC International, Arlington, Virginia, USA.

11. Atherton HV, Newlander JA (1987) Chemistry and testing of dairy products. AVI publishing Co, Westport, USA, pp: 250.

12. Davis JG (1951) The Laboratory Control of Milk. Dairy Ind Ltd, London, UK, pp: 59.

13. Barbano DM, Lynch JM, Fleming JR (1991) Direct and Indirect Determination of True Protein Content of Milk by Kjeldahl Analysis: Collaborative Study. Journal of Association of Official Analytical Chemists 74(2): 281-288.

14. Paquet J, Lacroix C, Thibault J (2000) Modeling of pH and Acidity for Industria Cheese Production. Journal of Dairy Science 83(11): 2393-2409.

15. Mazahreh AS, Jihad MQ, Ali Faleh AS, Ibrahim AA (2009) The Effect of adjusting PH on Stretchability and Meltability to White Brined Nabulsi Cheese. Am J Appl Sci 6(4): 543-550.

16. Hassan AN (2007) Structure development in cheese. Proceeding of the 10th Egyptian Dairy Science and Technology Conference, Cairo, Egypt.

17. Park J, Rosenan JR, Peleg M (1984) Comparison of four procedures of cheese meltability evaluation. J Food Sci 56: 1158-1170.

18. Selwa AA, Galal EA, Neimat EA (2004) Carrot Yoghurt: Sensory, Chemical, Microbiological properties and consumer acceptance. Pakistan Journal of Nutrition 3(6): 322-330.

19. Bonczar G, Domagała J, Walczycka M (2002) The influence of ultrafiltration of ewe's milk on soft cheeses properties. Food Sci Technol 5(1): 123-128.

20. Ahmad NL, Li L, Yang XQ, Ning ZX, Randhawa MA (2008) Improvements in the Flavour of Soy Cheese. Food Technol Biotechnol 46(3): 252-261.

21. Wedholm A (2008) Variation in Milk Protein Composition and its Importance for the Quality of Cheese Milk. Acta Universitatis Agriculturae Sueciae 13.

22. Lucey JA (2004) Formation, structural properties and rheology of acid-coagulated milk gels. In: Fox PF, et al. (Eds.), Cheese: Chemistry, Physics and Microbiology. 3rd(Edn.), Elsevier Academic Press, London, UK, pp: 105-122.

23. Mian AM (2008) Influence of Indigenous Cultures and Ripening Temperature on Cheddar Cheese Quality. PhD thesis, University of Agriculture, Faisalabad, Pakistan.

24. Diana MAB, Peláez C, Requena T (2004) Rheological and structural properties of fermented goat's milk supplemented with caseinomacropeptide and whey protein concentrate. Milchwissenschaft 59(7-8): 383-386.