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EFFECT OF SUPPLEMENTING DIETS OF ZARAIBI GOATS WITH CORN STEEP LIQUOR ON MILK PRODUCTION AND QUALITY PROPERTIES OF SOFT WHITE CHEESE.

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ABSTRACT

The objective of this study was to investigate the effect of partial substitution of protein in the ration by corn steep liquor (CSL) on milk production of Zaraibi goats and the manufactured white soft cheese**.** Twenty four Zaraibi does, at the beginning of pollination season weighing 37.5 kg and aged < 30 months, were selected and divided into four similar groups (n=6). The groups were assigned at random to receive four experimental rations. All goats offered treatment diets 30 days before the breeding season at flushing period then through pregnancy and lactation periods where the concentrate feed mixtures (CFM) was partially substituted by CSL at different levels**:** Zero, control diet (T1)**,** 10% (T2)**,** 20% (T3) and 30% (T4). The rice straw (RS) used as a roughage portion in all treatments and offered ***ad lib***. The feeding experiment was extended for 34 weeks.

Results showed that supplementation of CSL at 20 and 30% of the CFM significantly improved both milk yield and composition. Total milk yield was significantly increased by 13.0**,** 21.0 and 37.8%, respectively for T2, T3 and T4 than control diet. Also daily milk yield was significantly increased with T2 (1.13 Kg/h), T3(1.21 kg/h) and T4(1.38 Kg/h) than control diet. Milk fat, protein and lactose percentages were significantly increased while milk total solid (TS) and ash content had insignificant increase by the tested treatments. The lowest values ($P \leq 0.05$) of fat, protein and lactose were recorded with control ration (3.02, 2.68 and 4.63%, respectively). The data of milk quality indicated that pH value was higher (6.77) with control group compared with the three levels of CSL. Soft white cheese had increased ($P \leq 0.05$) with all treatments during storing period in ash, salt contents, acidity and ripening indices while increase was insignificant with fat content**.** On the other hand, moisture content**,** yield and pH value were significantly decreased with increasing storage period**.** The texture characteristics revealed that cheese made from treated groups, T3 and T4 recorded higher values ($P > 0.05$) for hardness**,** cohesiveness, gumminess and chewiness and the lowest values of springiness compared to other milk treated cheese at the beginning or end of storing. Sensory evaluation of cheese from animals fed 30% CSL (T4) gained significantly ($P \leq 0.05$) the highest total scores followed by T3 then T2 and T1 throughout the storage of ripening**.** The specific "goat flavor" taste was significantly improved in T4 and T3. Therefore**,** partial replacement of protein of concentrate feed mixtures (CFM) by CSL, especially at rates 30 or 20% could led to improve milk quality and yield and gain the best composition and texture properties of soft white cheese during ripening time**.**

Key words: Milk production, feed, Soft cheese, Zaraibi goats, corn steep liquor.

INTRODUCTION

Feed is the most important cost item for livestock production which represent 50-75% of total production costs **(Safari et al., 2012).** Since proteins is the principal constituent of the animal body and has to continuously present in feeds for repair and synthesis process, it is vital for animal life, reproduction and milk production **(Harmeyer and Martetens, 1980).** Corn steep liquor (CSL) is a by-product of wet milling process of maize-starch industry**.** It is viscous, slurry, with light to dark brown color**,** having ensiled odor and acidic pH**.** It reported to be a good source of protein**,** energy and minerals for animals **(Filipovic et al., 2002).** This product particularly is free from fat**,** fiber and silica and contains 20-25% lactic acid as determined by **Wagner et al., (1983) and Gupta et al., (1990).**

Corn steep liquor fed to beef and dairy cattle as a liquid source of protein **improved productive performance (Gill, 1997,** while did not affect when fed to finishing steers **(Trenkle, 2002).**

The type of milk exerts a pronounced effect on quality of the resultant cheese**.** Goat milk ranks first in this respect**.** A good dairy goat can produce up to 10% of its body weight milk **(Peterson, 2005).** In Egypt, increased attention focused towards goat milk production because its lower cost compared with cow milk and its chemical similarity to cow milk**.** Both fat globules and casein micelles are of small sizes compared to cow and buffalo milk**,** thus it commonly referred to goat milk as "naturally homogenized milk". In the meantime**,** the fat of that milk is known to possess high ratio of volatile fatty acids namely caproic**,** caprylic and caprice**.** Accordingly, cheese made from goat milk characterized by a smooth texture and a more piquant flavor in comparison with cheese of cow and buffalo milk **(Kosikowski, 1978).**

Goat milk products are not highly accepted in Egypt due to its flavor, though it has special nutritional value that makes it attractive to some consumers**.** It is easily digested than cow milk and may have certain therapeutic value **(Haenlien, 2004).**

The objective of this study was to investigate the partial substitution of protein in goats' ration by CSL at different levels and its effect on milk production performance and the processed white soft cheese. The effect of these different levels of CSL on yield, chemical composition, textural properties and sensory characteristics of the resultant cheese were measured during cold storage.

MATERIALS AND METHODS

Animals and experimental design:

This study was conducted in El-Serw Experimental Research Station belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture, Egypt. Twenty four Zaraibi does at the beginning of pollination season, weighed 37.5± kg and aged < 30 months were selected and divided into four equal groups, six does each, according to their body weight (BW) and pervious milk yield records. The does received four dietary treatments in-group feeding using a randomized complete block design. Animals were weighed at the beginning then every two weeks. Treatments started one month before flushing period and continued along pregnancy (5 months) and milking (60 days) until the next breeding season.

Feeding and Management

Corn Steep Liquor (CSL) obtained from Starch and Glucose Factory, Mostord, Cairo as a liquid by-product of wet milling process of maize-starch. It is viscous, slurry with light to dark brown color, having ensiled odor and acidic pH **(Filipovic et al., 2002**). It also contains high levels of soluble protein, glucose and minerals that make it useful to compensate the poor value of low quality forages by increasing the energy and protein levels without more fiber intake.

All animals of the four experimental groups were fed on restricted amount of concentrate feed mixture (CFM) in order to cover 100, 90, 80 or 70 % of total crude protein of control ration (T1), and the rest of crude protein requirement was completed by CSL for the three tested rations, T2, T3 and T4, respectively**.** Rice straw (RS) offered ***ad libitum*** for all experimental rations. The first 10 days considered as adaptation period for the experimental diets and the prevailing condition of the experiment as well**.** Feed residuals were weighed throughout the experiment for dry matter intake determination. Samples of feeds (CFM or RS) were collected and analyzed according to **A.O.A.C. (2007).**

Concentrate feed mixture contained un-decorticated cotton seed meal (23%), yellow corn (43%), wheat bran (22%), soybean meal (5%), molasses (3.5%), limestone (2%) and common salt (1%). CSL replaced 2.5, 5.0 and 7.5% of CFM till the end of experimental period **(Table 2)** that ranged 12.3 to 13.7% as crude protein and 1.573 to 1.659 MJ/Kg DM as metabolisable energy (ME).

Water was available all times. Diets were offered twice daily at 8:0 am and 3:0 pm. Daily milk yield was recorded individually.

Experimental parameters measured:

Representative milk samples (about 0.5% of total milk produced) were collected from both milking during lactation season for analysis from each doe. Samples immediately cooled to 6±1ºC and kept until analysis. Samples were analyzed for total solids, fat, protein, and ash as well as pH and acidity (Ling, 1963) while lactose content was determined by method of **Nickerson et al., (1976).** pH value was measured using digital pH meter. The biggest amount of milk samples ware used for processing white soft cheese.

Table,(1): Formulas of the experimental total mixed rations (%).

Ingredient	Experimental total mixed rations			
	T1	**T2**	**T3**	**T4**
CFM	**67.0**	**59.9**	**53.1**	**45.9**
CSL	**0.0**	**2.5**	**5.0**	**7.5**
R.S.	**30.0**	**34.6**	**38.9**	**43.6**
Agrivate*	**0.5**	**0.5**	**0.5**	**0.5**
Sodium chloride	**1.0**	**1.0**	**1.0**	**1.0**
Limestone	**1.5**	**1.5**	**1.5**	**1.5**
Total	**100**	**100**	**100**	**100**

*Agrivate contains (per 3kg) Vit. A 1000000 IU; Vit.D3 200000 IU; Vit.E. 10000 mg; Vit.B1, 1000 mg; Vit.B2 5000 mg; B6, 1500mg; Vit.B12, 10 mg; Biotin, 50mg; Colin chloride, 250000 mg; Pentothenic, 10000 mg; Niacin, 30000 mg; Folic acid,1000 mg; Manganese; 60000 mg; Zink, 50000 mg; Iron, 3000 mg; Copper, 4000 mg; Iodine, 300 mg; Selenium, 100 mg and, Cobalt, 100 mg.

ºCSL=corn steep liquor.

Processing white soft cheese:

White soft cheese was made from Zaraibi goat milk as described by **Fahmi and Sharara, (1950).** Four pilot-scale batches of cheese were made from milk samples of the four dietary treatments, each of 10 kg, heated at 63ºC for 30 min then cooled to 37ºC. The activated starter culture added to milk at rate (1% w/w) and kept for 45 min prior addition of sodium chloride (4% w/w), calcium chloride (0.02%,w/w) then an amount of chymosin (3g/100 kg of milk), respectively, stirred well and milk set for 2.5 - 4 hr . The cheese curd was scooped into small perforated cheese moulds and left to drain whey at room temperature for 24 hr. Resultant cheese were pickled in previously pasteurized brine solution 4% sodium Chloride (Nacl). Cheeses were analyzed during storing at 6 ± 1ºC for 45 days. Cheese samples were taken fresh and after 15, 30 and 45 days for physical and chemical analysis and sensory evaluation. All experiments performed in triplicates and analysis also done for all replicates.

Chemical and physiochemical analysis:

Goats bulk milk and cheese samples were analyzed for moisture and salt contents as described by **Bradley et al., (1992).** The Gerber method used for fat determination in milk and cheese as described by **Ling (1963).** Titratable acidity (TA%) of milk and cheese samples were determined as described **in A.O.A.C. (1990).** pH values of milk and cheese were determined using a digital pH meter (540-GLp, Multical, Germany). The total nitrogen (TN), water-soluble nitrogen (WSN) and non-protein nitrogen (NPN) contents were determined using macro-kjeldahl method. Ash content was determined using (The rmolyne, type 1500 Muffle furnace) according to **AOAC (2000).** Total carbohydrates were calculated by the difference. Total volatile fatty acids (TVFA) were determined by the direct distillation methods as described by **Kosikowski (1978),** and values are expressed as 0.1 ml NaOH/100 g cheese. The yield of cheese calculated as Kg/100 Kg milk.

Textural properties of cheese (Texture determination):

The objective tests of processed white cheeses were carried out by Texture analyzer (**TA 1195, Instron Corportion, Canton, M.A., U. S. A.)** as method described by **Yang and Toranto (1983).** Cheese samples were cut into 3 cm^3 cubes and kept at 12 ºC for 1 hr before analysis. The probe TA 15 (45º and 30 mm diameter) was used at speed 1 mm/ $second^{-1}$ and 10 mm distance using cycle and hold programs.

Texture profile analysis (TPA):

The rate and extent of texture development and thereby, the quality of cheese can be determined by measuring the rheological properties of cheese in terms of hardness, springiness, gumminess and cohesiveness which determined by the deformation Gpaph, while the characteristic of Chewiness was calculated. The changes in these properties of cheese are influenced by milk types, addition of the corn steep liquor and physico-chemical compositions of cheese.

Sensory analysis of cheese:

Goats cheese samples were judged by 15 panelists from the staff members of Dairy Science and Technology Department, Animal Production Research Institute (APRI) using the following scales; 15 points for Appearance and color, 35 points for body and texture and 50 points for flavor and taste according to the method described by **Nelson and Tourut, (1981).** All cheese samples were evaluated at fresh (one day) and during storage 15, 30 and 45 days at 6±1ºc.

Statistical analysis:

Data were statistically analyzed by using **SAS (2009**). The significant differences among means were assigned according to **Duncan (1955).**

The used model was,

$$X_{ij}=M + T_i + P_j + E_{ij}$$

Where: M is the overall mean.

T_i is the effect of i (treatment).

P_j is the effect of j (Storage period).

E_{ij} is the experimental error.

RESULTS AND DISCUSSION

1-Chemical composition of feed ingredients

Chemical composition of feed ingredients presented in **Table (2).** The obtained results showed that CSL contained 43.0 % DM, 33.5% CP, and 55.50% NFE. Similar results were recorded by **Khalifa et al., (2013)** on CSL. In another study of **MIRZA et al., (2006)** the proximate analysis of CSL was higher for crude protein (40%), ash and minerals and virtually free from crude fiber. CSL is practically free from fat, fiber and silica **(Wagner et al., 1983 and Gupta et al., 1990).** It contains about 40% crude protein on dry matter basis, out of which more than 90% is in form of amino acids and peptide **(Trenkle, 2002)**

Daily feed intake:

Data related to feed intake of goats fed the experimental rations are presented in **Table (3).** Results showed that the daily intake of CP gradually increased (138, 143 and 150 g/h) with increasing levels of CSL in T2, T3 and T4, respectively. While total DM intake slightly affected by dietary treatments despite there was relatively large differences among treatments respecting roughage concentrate ratio being 24:76, 31:69, 37:63 and 42:58 for T1, T2, T3 and T4, respectively. The positive effect of CSL on CP intake might be due to its high contents of nitrogen, vitamins, amino acids, peptides and soluble nutrients as reported by **Nisa, et al., (2004).**.

Table (2): Chemical analysis (% DM) of feed ingredients and calculated composition of the experimental rations.

Item	DM%	Chemical composition of DM (%)						M.E.*MJ/Kg
		OM	CP	EE	CF	NFE	Ash	
T1	87.31	80.09	12.31	3.40	11.08	53.30	19.91	1.573
T2	87.36	80.41	12.85	3.01	12.64	51.91	19.59	1.574
T3	86.17	80.55	13.25	2.30	14.25	50.75	19.45	1.565
T4	87.02	84.88	13.70	2.90	14.98	53.30	15.12	1.659
CFM	87.85	89.25	14.42	3.45	12.6	59.22	10.75	1.7632
CSL	43.00	90.00	33.50	1.00	----	55.50	10.00	----
RS	92.83	80.23	3.08	1.49	36.88	38.78	19.77	2.256

Metabolisable energy (ME) calculated according to MAFF (1975) using the following equation: ME, MG/Kg DM= 0.0226 CP + 0.0407 CF + 0.0177 NFE.

In addition, the improvement in RS intake in tested rations might attributed to improving the rumen function and digestion due to CSL addition.

Milk yield and feed conversion efficiency:

Data of daily and total milk yields and feed conversion efficiency are presented in **Table (4).** Results revealed that animals fed 7.5% CSL gave the highest (**P≤0.05**) total milk yield followed by those fed 2.5 and 5% then the lowest yield was occurred with control. The daily milk yield showed the same trend as the highest value with T4 (1.380 kg) followed by T3 (1.210 kg) then T2 (1.130kg) compared with the T1 (1.00 kg).

The positive effect of CSL on milk yield was observed also by **Khalifa et al., (2013)** who found that including CSL at level 5% in lactating Zaraibi goats' ration improved milk yield by22.88%. The FCR calculated as DM was better with the three tested treatments being 0.860 kg DM/kg 4% FCM for T4, then 0.958 and 1.041 for T3 and T2, while the least for control (1.369).

Table (3): Treatment effect on feed intake by lactating Zaraibi does.

Items	T1	T2	T3	T4
Body weight, (kg)	42.5	43.0	42.0	41.0
Metabolic body size, $w^{0.75}$	16.65	16.79	16.50	16.20
<u>Daily intake during lactation</u>				
CFM (g/h)	889.2	834.6	788.8	774.2
RS (g/h)	278.5	321.11	361.10	404.08
Total DM intake , g/h	1167.7	1155.71	1149.90	1178.28
DM intake, g/kg $w^{0.75}$	70.09	68.83	69.69	72.73
DM intake, (% BW)	2.75	2.69	2.74	2.88
R/C ratio*	24:76	31:69	37:63	42:58
CP intake, g/h	137	138	143	150

*R/C : Roughage to Concentrate ratio.

Table (4): Daily milk yield and feed utilization efficiency of lactating goats fed the experimental rations.

Items	T1	T2	T3	T4
Total-milk yield(kg/h)(34week)	**238[c]±7.54**	**269[b]±6.62**	**288[b]±6.16**	**328[a]±5.51**
Daily milk yield, (kg/h/d)	**1.00[c]±0.02**	**1.13[b]±0.02**	**1.21[b]±0.02**	**1.38[a]±0.02**
Daily milk yield 4%FCM*(kg/h/d)	**0.853**	**1.11**	**1.2**	**1.37**
Feed utilization efficiency:				
Kg DM/kg milk 4% FCM	**0.86**	**0.958**	**1.041**	**1.369**
Kg CP/kg milk 4% FCM	**0.118**	**0.127**	**0.134**	**0.169**

[a,b,c] means within the same row with different superscripts are significantly different at (P<0.05).
*****T1= control diet containing 30% rise straw, 67% concentrate feed mixture (CFU), 0.5 Agrivate ,1% sodium chloride and 1.5% Limestone.
T2= control diet plus 10% CSL.
T3= control diet plus 20% CSL.
T4= control diet plus 30% CSL.
4%FCM = M * 0.4+15(M*F%) where FCM =Fat corrected milk and M= milk yield

In the same time, FCR as CP intake/kg 4%--FCM, was markedly better with tested treatments(being 0.118 kg CP/kg 4% FCM for T4, then 0.127 and 0.134 for T3 and T2 and least with control (0.169). The positive effect of CSL on feed conversion ratio probably attributed to an improvement in rumen function and digestion of diets as reported by **Nasir, et al., (2012).** Generally CSL is rich source for many active nutrients like nitrogen, vitamins, amino acids, peptides and soluble nutrient **(Nisa, et al., (2004).**

Milk composition:

The effect of experimental treatments on milk composition present in **Table (5).** The percentages of milk fat, protein and lactose were significantly increased by inclusion of CSL in the tested rations. However, milk total solids (TS) was insignificantly increased in tested rations compared to control one. The lowest values ($P \leq 0.05$) of fat, protein and lactose were recorded with control ration (3.02, 2.68 and 4.63%, respectively) while the highest one was associated with 20% and 30% CSL levels (T3, T4). On the other side, the differences in ash among all treatments were not significant as shown in **Table (5).** In this respect, **Khalifa et al., (2013)** reported that most measured components especially total solids, milk fat and protein were significantly higher with 5% CSL in Zaraibi goat ration.

Table (5): Chemical composition of milk (%) of Zaraibi goat fed the experimental rations.

Items	T1	T2	T3	T4	± S.E
Total solids	11.83	12.31	12.59	12.61	0.020
Fat	3.02[b]	3.90[a]	3.97[a]	3.97[a]	0.146
Total protein	2.68[c]	2.99[b]	3.10[a]	3.12[a]	0.149
Lactose	4.63[c]	4.68[b]	4.75[a]	4.75[a]	0.120
Ash	0.72	0.74	0.77	0.77	0.019
pH value	6.77[a]	6.61[b]	6.67[b]	6.67[b]	0.021

[a,b,c] Means with different superscripts in the same row are significantly different at (P≤0.05).

Generally, milk chemical composition showed nearly similar values to those obtained by **Abd El-Hamed, et al., (2011), Ahmed, et al., (2011) and El-Emam, et al ., (2014).** Regarding quality of milk, the data indicated that pH value was significantly higher with control group (6.77) compared with the three levels of CSL (6.61, 6.67 and 6.67 for T2, T3 and T4**,** respectively**).**

Yield of soft white cheeses

Results revealed that cheese yield was significantly increased with T3 and T4 which had the highest levels of CSL), compared with that of control (T1) **(Table 6).** The cheese yield of all treatments were significantly decreased during storage period, and cheese made from T4, T3 and T2 retained significantly higher yield than the control (T1). This may be referred to the high total solids, fat and protein in the milk of these treatments. The trend of these results agree with those reported by **Abd El-Salam et al., (1976)** who attributed the losses in cheese weight during pickling to expulsion of whey and to the escape of a certain amount of cheese solids which become soluble as a result of bacterial action. On the other hand, **Khalifa et al., (2013)** found that using CSL at level 5% in lactating Zaraibi goats ration improved soft white cheese yield by 22.88% while, **Galal et al., (2013)** found that Domaiti cheese made from milk produced by cow fed diets including cassava root meal as a source of energy gained higher cheese yield and lower weight loss of cheese.

Chemical properties of soft white cheese:

The changes in chemical properties of soft white cheese due to the experimental treatments during storing at 6±1°C for 45 days are presented in **Table (6).** The moisture content of white cheese was decreased with increasing CSL level in the experimental rations and these decreases were only significant with T3 and T4 compared with control (T1). This confirms that the increase in cheese yield seemed to be due to the increases in fat and protein contents and dry matter, but not due to the moisture content (**Table 5).** During storing period, the moisture contents were significantly changed due to differences in periods of storing, being significantly decrease with the longer periods of storage (30 or 45-d) than those with the shorter periods (0 or 15-d) of storage. The significant decrease during the storage period might attributed to the counter act of this effect inducing curd contraction, expulsion of whey and exudation of moisture from cheese curd as the result of acid production. The trend of these results agree with those reported by **Hamed and Ismail (2012)** and **Galal et al., (2013)** who confirmed that adding cassava root meal as a source of energy to goats feed had clear effect on actual yield of fresh and stored white cheese as a result of moisture decrease.

Fat percentages, on DM base of white cheese were not significantly affected by adding different levels of CSL to the experimental rations **(Table 6).** The differences among all treatments were not significant during storing period. Fat percentages of all treated cheeses were not significantly increased as storing period progress. Values for T4, T3 and T2 had higher percents of fat over the storage period compared with control (T1).

This is due to the decrease in solids not fat content as a result of protein degradation and its partial loss in whey during storing period. The trend of the present study resulted from adding CSL as sources of protein and energy is in agreement with **that found by Galal et al., (2013)** who used cassava root meal as a source of energy which developed the rumen environment and consequently affected the rumen bacteria that change the balance of developed short chain fatty acids in favor of increased fat (%) in milk and improved the cheese quality.

The data of other chemical properties as salt and ash contents, acidity and pH, of fresh and stored cheese are presented in **Table (6).** Obviously, results showed that salt content in cheese greatly associated with moisture content. Respecting the salt content, the experimental treatments T4 and T3 were higher significantly than those of T2 and control. On the same time, with progressing in storage period (45-d), the salt content was significantly increased, compared with fresh cheese. Similar trend among dietary treatments could be observed with ash contents of cheeses. It could be attributed to the changes in moisture content among treatments which greatly affected the concentration of salt and ash in stored cheese. These results are in agreement with **Korish and Abd-El Hamid, (2012)** who reported that the increase in fat, protein and salt contents during storing period may be attributed to the corresponding decrease in moisture content.

From the above results, it could be concluded that supplementing concentrate feed mixture (CFM) with 10, 20 and 30% CSL caused significant increase ($P \leq 0.05$) in salt, content. Whereas, ash content was increased ($P \geq 0.05$) due to treatments, while it was significantly increased during the storage period 45 –d comparable to the fresh cheese.

Titratable acidity (%) in tested ration (T4) was higher significantly ($P \leq 0.05$) compared with the other treatments. It developed with progress of storage period ($P \leq 0.05$). In contrast, pH values were insignificantly decreased with increasing CSL supplement to rations. However, the values were decreased ($P \leq 0.05$) especially at 45-d of storing **(Table 6).** This may contributed to the microbial growth, acidity progress and peptidase activity of lactic acid bacteria in goat milk. Meanwhile, some metabolite substances of chemical constituents fed as dietary supplement with CSL which can passed to the milk as esters. In this respect**, Ayyad (2003)** and **Galal et al., (2013)** reported that pleasant flavor was found in goat milk as a result of adding cassava root meal as a source of energy to goat rations, which may be attributed to pass of some substances (menthene, nerolidol,….etc) to milk without change.

Table (6) : Effect of the experimental treatments and storing period on yield and chemical properties of soft white cheese.

Items	Treatments			
	T1	T2	T3	T4
Yield(Kg)	1.73±0.15^{c}	1.78±0.15b^{c}	1.84± 0.13^{ab}	1.91±0.16^{a}
Moisture (%)	63.21±2.12^{a}	62.43±2.08^{ab}	62.10±35^{bc}	61.32±2.30^{C}
Fat(%of DM)	37.98±0.79	38.21±0.84	38.45±1.26	38.61±1.43
Salt (%)	3.09±0.29^{b}	3.11±0.25^{b}	3.40±0.44^{a}	3.41±0.42^{a}
Ash	5.55±0.87	5.64±0.45	5.78±0.81	5.82±0.52
Titratable Acidity%	0.53±0.24^{b}	0.55±0.25^{b}	0.60±0.27^{b}	0.74±0.41^{a}
pH Value	6.30±0.21	6.29±0.19	6.23±0.25	6.20±0.37
	Storage periods (days)			
	0	15	30	45
Yield(Kg)	1.97±0.13^{a}	1.87±0.10^{b}	1.76±0.11^{c}	1.66±0.11^{d}
Moisture (%)	64.97±1.10^{a}	62.65±1.19^{b}	61.33±1.45^{c}	60.11±1.63^{d}
Fat(%of DM)	37.71±1.42	38.08±1.18	38.71±1.48	38.76±1.16
Salt (%)	2.71±0.14^{c}	3.35±0.27^{b}	3.39±0.25^{b}	3.53±0.20^{a}
Ash	5.20±0.48^{c}	5.49±0.50^{bc}	5.92±0.85^{ab}	6.17±0.36^{a}
Titratable Acidity%	0.22±0.04^{d}	0.50±0.07 ^{c}	0.77±0.17^{b}	0.94± 0.17^{a}
pH Value	6.40±0.19^{a}	6.36±0.12^{a}	6.25±0.16^{a}	6.02±0.34^{b}

^{abcd} Means with different superscripts in the same row are significantly different at ($P \leq 0.05$).

Data in **Table (7)** present the concentrations of TN, WSN, NPN and TVFA in soft white cheeses. The results showed that TN content was closely similar, while the contents of WSN and NPN were significantly higher with T3 and T4 than with T2 and control (T1). TN was increased (P≤0.05) with storing for 45 and 30 days followed by 15 and 0 d of storing. WSN and NPN values

improved significantly by excess the storing period (P≤0.05). This might due to the progressive proteolysis of cheese proteins leading to increasing effect of paracasein. The trend of these results agree with those reported by **Abo Ayana and Gamal El- Deen (2011)** who studied the effect of adding some vegetable oils as non-conventional energy sources to rations on properties of Labneh from goats milk and they found increases in WSN, NPN (%), soluble tyrosine and tryptophan and degradation of **α_s** and **ß-** caseins in all cheese batches during ripening period**.**

Regarding to total volatile fatty acids (TVFA), no significant difference**s** **(P≥0.05)** were found among all treatments. While progress of storage period, increased values of TVFA, being insignificant after zero and 15 d and thereafter the values improved (P≤0.05) at days 30 and 45, respectively. The present results might be due to the higher proteolytic and libolytic microbial enzymes which are involved in transformation of casein into free amino acids and further degraded to volatile aroma compound to release free amino acids and fatty acids during ripening as quoted by **Nakae and Elliott, (1965).** The trend of these result agree with those reported by **El-Shafie (1979)** who studied the effect of adding milk and vegetable protein hydrolysates to goats feed on some flavor components on soft cheese since he found decrease in fat and lactose contents and increase in TVFA and carbonyl compound in all treatments.

Table (7) : Effect of the experimental treatments and storing period on total nitrogen, water soluble nitrogen, non protein nitrogen (%) and total volatile fatty acids of soft white cheese .

Item	Treatments			
	T1	**T2**	**T3**	**T4**
Total nitrogen (TN)	**2.43±0.22**	**2.44±0.18**	**2.45±0.23**	**2.49±0.26**
Water soluble nitrogen (WSN)	**0.410±0.18[b]**	**0.420±0.22[b]**	**0.470±0.22[a]**	**0.490±0.10[a]**
Non protein nitrogen (NPN)	**0. 145± 0.05[b]**	**0.151± 0.06[b]**	**0.194±0.08[a]**	**0.210±0.10[a]**
Total volatile fatty acids (TVFA)	**13.00±6.65**	**14.00±7.22**	**15.25±7.51**	**15.25±7.72**
	Storage periods			
	0	**15**	**30**	**45**
Total nitrogen (TN)	**2.23±0.07[c]**	**2.31±0.08[c]**	**2.54± 0.14[b]**	**2.73± 0.09[a]**
Water soluble nitrogen (WSN)	**0.20±0.08[d]**	**0.40± 0.10[c]**	**0.48±0.08[b]**	**0.71±0.15[a]**
Non protein nitrogen (NPN)	**0.08±0.01[d]**	**0.17±0.05[c]**	**0.20±0.03[b]**	**0.26±0.06[a]**
Total volatile fatty acids (TVFA)	**8.50±2.07[c]**	**10.50±2.43[c]**	**13.00±2.56[b]**	**25.50±4.36[a]**

[Abcd] Means with different superscripts in the same row are significantly different at (P≤0.05).

** Expressed as ml NaOH 0.1 N/100gm cheese samples.

Cheese texture parameters:

Cheese texture is quite important as one of the principal difficulties for physical measuring of the rheological properties of cheese **(Fox et al., 2000).** The changes in texture primary parameters (Hardness, Springiness and Cohesiveness) and texture secondary parameters (Gumminess and Chewiness) during ripening period present in **Table (8).** The hardness values of white cheese not significantly affected by adding the different levels of CSL to the experimental rations**.** Hardness values of all treated cheeses not significantly increased as storing period progress. The early hydrolysis of α_{s1}-CN at the Phe_{23}-Phe_{24} peptide bond by residual chamoisn would result in a marked weakening of Para-casein matrix and a decrease in fracture stress and hardness. The hardness of cheese increased as the amount of protein increased **(Awad et al., 2001). Tunick, (2000)** also reported that the relative amounts of water, protein and fat could considered as dominant factors electing cheese hardness. The same findings was reported by **Hassan et al., (2004) , Korish and Abd- El Hamid (2012),** who found that fat and moisture contents act as filler in the casein matrix of cheese texture.

The harder cheese is the lower in springiness values. Therefore, the maximum values of springiness were found in fresh cheese, after that, these values, insignificantly **(P≥0.05)** decreased until the end of ripening period**.** This may be due to the continuous breakdown of protein matrix and its strength and as a result increasing the hardness. The springiness of T4 was insignificantly lower than that of T1, T2, and T3, respectively. The untreated goat milk cheese (T1) tended to have higher springiness values than treated goat milk cheese because of different moisture contents. The obtained data agreed with those found by **Ahmed and Abd El Razig (1998)** and **Lobato-Calleros et al., (1997 and 1998)** who stated that moisture in the cheese acts as a plasticizer of the protein matrix, thereby making it less elastic and more susceptible to facture up on compression.

Extending the storage period had insignificant **(P≥0.05)** effects on cohesiveness of soft white cheese **(Table 8).** The maximum values of cohesiveness were found in fresh cheese. After that, these values gradually decreased until the end of storing period. These results are confirmed with those of **Volikakis et al., (2004), Ozer et al., (2003)** and **El Zany (1991)** who found that corresponding cohesiveness of cheese with higher dry matter (%), increased as a result of increasing casein matrix interaction.

The gumminess (energy required to disintegrate a semi-solid food to a state) and Chewiness (energy required to masticate a solid food to a state ready for swallowing) values of all experimental cheeses insignificantly **(P≥0.05)** increased with extending the storing period **(Table 8).**

Treatment T4 was slightly higher in gumminess and chewiness values than the other treatments which may attributed to its lower moisture and higher protein contents **(Table 5)** and the alteration in cheese matrix. These results agree with those reported by **Awed et al., (2001)** that moisture, fat, protein and pH were the major factors affected the rheological properties of Domiati cheese, whereas **El Zeine et al., (2007)** revealed that as the moisture of UF-white soft cheese increased, hardness, cohesiveness, gumminess and chewiness were decreased. **Fox et al., (2000)** also found that water molecules are bound with the three dimensional protein matrixes that weaken the structure of the network. In this respect, **Lucey et al., (2003)** reported that increased moisture content contributed to softer texture, while lower moisture contributed to increase brittleness. From the present results, it could be concluded that changes in these texture properties of cheese are influenced by milk types, addition of corn steep liquor, physico-chemical compositions of cheese as well as storing time.

Organoleptic properties of cheese:

Summary of the sensory scores of soft white cheese made from milk of Zaraibi goat fed diets supplemented with different levels of CSL are shown in **Table (9)**. Results indicated improvement of appearance & color, body & texture and flavor, & taste, of all treatments by advance of storing period up to 45 days..

Table (8): Effect of the experimental treatments and storing period on texture characteristics of soft white cheese.

Items	Treatments			
	T1	T2	T3	T4
Hardness value (Newton)	6.41±0.40	6.55±0.46	6.64±0.24	6.75±0.78
Springiness (mm)	0.67±0.02	0.66±0.02	0.65±0.05	0.63±0.06
Cohesiveness (mm)	0.74±0.03	0.75±0.04	0.77±0.05	0.78±0.08
Gumminess (Newton)	3.50±0.29	3.52±0.09	3.57±0.12	3.60±0.16
Chewiness (Newton)	3.17±0.08	3.18±0.08	3.22±0.17	3.23±0.17
	Storage periods			
	0	15	30	45
Hardness value (Newton)	6.48±0.52	6.61±0.67	6.61±0.37	6.65±0.50
Springiness (mm)	1.19±1.80	0.66±0.05	0.65±0.05	0.63±0.6
Cohesiveness (mm)	0.78±0.03	0.77±0.05	0.76±0.05	0.74±0.08
Gumminess (Newton)	3.49±0.25	3.52±0.15	3.52±0.13	3.61±0.16
Chewiness (Newton)	3.17±0.12	3.19±0.10	3.21±0.15	3.23±0.16

Abcd Means with different superscripts in the same row are significantly different at ($P \leq 0.05$)

This may contributed to the high content of soluble nitrogen that serves as a precursor of certain flavor compounds Significant differences ($P \leq 0.05$) were found among treated cheeses, where the type of food (CSL), physico-chemical composition of cheese as well as time of the storage were the principle factors influencing the organoleptic properties.

It is clear that significant differences occurred in appearance, color, body & texture among cheeses tested either fresh or after storing period**.** Furthermore, the flavor of all treatments showed significant differences and characterized with specific taste "goat flavor" which could be attributed to the high ratio of short chain fatty acids especially caproic, caprylic and capric that represent up to 15% of goat milk fat (**El-Almy et al., 1990).**

Cheese from treatments T4 (30% CSL) followed by T3 (20% CSL) significantly **($P \leq 0.05$)** recorded the highest point for whiteness appearance & color, body & texture and flavor & taste as well as the total score points. On the other side, the cheese manufactured from treatments T2 and T1 had lowest scores throughout the storing period. In this respect, **Abou Ayana and Gamal El-Deen (2011)** indicated improvement in organoleptic properties of labneh from goat milk by using vegetable oils as non- conventional energy sources in rations.

Conclusion

It could be concluded that partial replacment of CFM with CSL at rates 30, and 20% on the basis of crude protein content in the diets led to an improvement in feed utilization efficiency, milk yield, composition and quality of the obtained soft white cheese processed and stored at 6±1°C for 45 days.

Table(9) : Effect of the experimental treatments and storage period on organoleptic properties of soft white cheese .

Items	Treatments			
	T1	T2	T3	T4
Appearance and Color (15)	8.25±1.44^{b}	9.13±2.66^{b}	10.63±1.65^{ab}	13.13±0.75^{a}
Body and Texture (35)	27.13±1.89^{b}	28.50±3.14^{b}	30.38±$^{1.80ab}$	33.13±0.75^{a}
Flavor and Taste (50)	36.63±2.56^{b}	37.63±3.90^{b}	40.00±2.48^{ab}	42.88±1.38^{a}
Total (100)	72.13±5.96^{b}	75.25±9.67^{b}	80.88±6.02^{ab}	89.13±2.87^{a}
	Storage periods			
	0	15	30	45
Appearance and Color (15)	9.00±2.61^{b}	9.00±2.61 ^{b}	10.88±1.80^{ab}	12.25±1.94^{a}
Body and Texture (35)	28.38±3.28b	28.25±3.23^{b}	30.38±2.17^{ab}	32.13±2.17^{a}
Flavor and Taste (50)	37.00±3.49^{b}	37.63±3.35^{b}	39.88±2.59^{ab}	42.63±2.17^{a}
Total (100)	74.25±9.32^{c}	74.88±9.19^{c}	81.25±6.40^{b}	87.00±6.28a

^{abcd} Means with different superscripts in the same row are significantly different at ($P \leq 0.05$)

REFERENCES

A.O.A.C. (2000). Official methods of Analysis. Association of Official Analytical Chemists. A.O.A.C. International.17th Ed Horwitz H. (ED) Gaithersburg, MDUSA.

Abd El-Hamed,A. M. ; E. I. Shehata and G. A. Maged (2011). Effect of some medical herbs on production of lactating Zaraibi goats. J. Animal and Poultry Prod. ,Mansoura, Univ.,Vol.2(11):493 – 513.

Abd El-Salam, M. H.; El-Shibiny, S. and Fahmy, A.H. (1976). Domiati cheese. Areview N.Z.J. Dairy Sci. Technol. 11:57.

Abou Ayana, I. A.A. and Gamal El Deen, A. A. (2011). Improvement of the properties of Goats Milk Labneh using some Aromatic and Vegetable oil. Int. J. Dairy Science, 6:112**.**

Ahmed, T. K. and Abd El-Razig K. A. (1998). Manufacture of Gibna Beida (white soft cheese) from cows and goats milk. Egyptian J. dairy Sci. 26:167-174.

Ahmed, M.E.; O. A. EL- Zelaky, K. M. Aiad and E.I. Shehata (2011). Response of small ruminants to diets containing red forage either as fresh, silage or hay versus berseem hay. Egypt, J. of Sheep and Goat Sciences;6 (1).

Awad, S.A.; Abd El-Azim, S. and El-Soda, M. (2001). Texture profile analysis of Egyptian Conf. Dairy Sci. & technol. P.44 Cairo, 3-5 Nov. (2001).

Ayyad, K.M.K. (2003). Studies on some dairy products, ph. D. Thesis, Fac. Of Agric. Mansoura Univ. Egypt.

Bradley, R.L.; J. E. Arnold; J.D. M. Barbano; R. G. Semerad; D. E. Smith and B.K. Vines (1992). Chemical and Physical methods, Chapter 15. In"Standard Methods for Examination of Dairy products 16th Ed. American Public Health Association, Washington, DC.

Duncan, D.B. (1955). Multiple range and multiple F test. Biometrics, 11: 1-**42.**

El-Almy, H.A.; M.B. Mahfouz; L.F. Hamzawi, and M.M. El-Loly (1990). Studies on the chemical composition of Egyptian goats milk 1- Gross chemical composition and mineral contents. Egyptian J. Dairy Sci.18;195-206.

EL-Emam G. I.; M. E. EL-Kholany, Hoda M. EL-Hosseiny; S. B. Mehany (2014). Milk production , some rumen parameters and feed utilization efficiency of lactating goats fed rations containing berseem silage and their mixture with barely or millet x Napier grass hybrid. . Animal and poultry prod. Mansoura, Univ.,Vol. 5(1):15 -26.

El-Shafei, N.M. (1979). Studies on the effect of adding milk and vegetable protein hydrolysates on some flavour components in soft cheese. M. Sc. thesis, Zagazig Univ., Egypt.

El-Zeini, H. M.; El-Asser, M.A.; Anis, S.M.K. and Romeih, E.A.H. (2007). Influence of some processing treatments on chemical composition, rheological Properties and microstructure of cast UF-white soft cheese. Egyptian J. Dairy Sci. 35:57.

El-Zeny, H.M. (1991). Rennet coagulation of salted milk and rheology of soft white cheese produced from it. Ph. D Thesis, Michigan state Yniv., East lansing, 28824 MI, USA.

Fahmi, A. H. and Sharara, H. A. (1950). Studies on Egyptian Domiati cheese .J. Dairy Res., 17: 312.

Fayed, E. Q. (1982). Studies on the use of some natural flavor agents on the ripening of pickled domiati cheese. Ph.D. Thesis. Ain-Shams Univ. Egypt.

Filipovic, S. S.; M.D. Ristic and M.B. Sakac, (2002). Technology of corn steep a application in animal mashes and their quality. Roum. Biotechnol. Lett., 7**:** 705-710.

Fox, P.F.; Guinee, T. P.; Cogan, T.M. and Mc Weeney, P.L.H. (2000). Cheese reology and texture, In Fundamental of Cheese Science, Aspen Pub., USA. 305-324.

Galal, HF.; E.S. Soliman and M.R. Shahein (2013). Effect of partial replacement of yellow corn by cassava root meal enriched with corn glutin or brewers residues in lactating cow rations on milk yield, composition and quality of resultant Domiati cheese Egyptian J. Nutrition and feeds (2013),16(3):449- 459**.**

Gill, C., (1997). More value from imported maize. Feed international, August, 23-26.

Gupta, R.S.; M.C. Desai; P.M. Talpada and P.C. Shukala (1990). Effect of corn steep liquor feeding on growth of crossbred calves. Indian J. Animal Nutr. 7**:** 279-282.

Haenlein, G.F.W. (2004). Goat milk in human nutrition. Small Ruminant Res., 51;155.

Hamad M.N. and Ismail, M.M.(2012). Quality of soft cheese made with Goats Milk as Affected with the addition of Certain Essences. J. Anim. Prod. Adv. 2:121.

Hassan, A. N.; M. Corrending; J.F. Frank and; M. El-soda (2004). Microstructure and rheology of an acid-coagulated cheese (Karish) made with an exopolysaccharide producing Strepococcus thermophilus strain and its exopolysaccharide non producing genetic vriant. J. Dairy Res. 71:116.

International Dairy Federation (IDF) (1993). Milk determination of nitrogen content**.** IDF standard 20B.

Kearl, L.C. (1982). Nutrient requirements of ruminants in developing countries. International Feed staffs Institute, Utah, U.S.A.

Khalifa, E. I., Behery, H. R., Hafez, Y. H. , Mahrous, A. A., Fayed, Amal, A. and Hassanien, Hanan, A. M. (2013). Supplementing non-conventional energy sources to rations for improving production and reproduction performance of dairy Zaraibinanny Goats. Egyptian Journal of Sheep &Goat Sciences, Vol.8(2),P:69-83

Korish, M. and Abd El-hamid, A.M. (2012). Improving the textural properties of Egyptian Kareish cheese by addition of hydrocollioids. Int. J. Dairy Technol., 65:237.

Kosikowski, F.v. (1978). Cheese and Fermented Milk Foods. 2nd Ed. Cornell. Univ., Ithhaca, New York.

Ling, E. R. (1963). A textbook of dairy chemistry, Vol. 2 practical 3**rd**ed. Chapman & Hall, Ltd., London.

Lobato- Calleros, C.; Vernon-Carter, E.J.; Guerrerolergarreta, I.; Soriano- Santos, J. and Escalona-Buendia, H. (1997). Use of fat blends in cheese analogs: influence on the sensory and instrumental textural the sensory and instrumental textural characteristics. J. Texture of cheese analogs containing different types of fat. J. Texture Studies, 28:619.

Lopato-Calleros, C.; Vernon-Carter, E.J. and H.E. Scalona-Buendia (1998) Micro-structure and texture of cheese analogs containing different types of fat J. Texture Studies, 29:569**.**

Lucey, j. M.; Johnson, M. E. and horn, D.S. (2003). Perspectives on the basis of the reheology and texture properties of cheese. J. Dairy Sci. 86:2725.

MAFF (1975). Ministry of Agriculture, Fisheries and Food. Energy allowance and feeding system for ruminants. Technical bulletin 33, Ministry of Agriculture, Fisheries and Food, HMSO, London, pp: 63-67.

MIRZA M. A.; AND T. MUSHTAQ (2006). Effect of supplementing different levels of corn steep liquor on the post-weaning growth performance of pak-Karalul lambs. Pakistan Vet. J., 26 (3): 135-137.

Nakae, J. and Elliott, J.A. (1965). Production of volatile fatty acids by some lactic acid bacterial. II-Selective formation of volatile fatty acids by degradation of amino acids J. Dairy Sci. 48: 273.

Nasir, T. A., M. Sarwar, and M. A. Khan. (2012). Influence of urea treated wheat straw with or without corn steep liquor on feed consumption, digestibility and milk yield and its composition in lactating Nili-Ravi buffaloes. Asian-Aust. J. Anim. Sci. 6: 825.

Nelson, J.A. and G. Torut (1981). Judging of Dairy Products, 4^{th} Ed. Revised . The AVC. Westport, Connecticut.

Nickerson, T.A., I.F. vujicie and A.Y. Lin (1976). Colorimetric estimation of lactose and its hydrolytic products. J. Dairy Sci., 59: 386-390.

Nisa, M., M. Sarwar, and M.A. Khan, (2004). Influence of ad libitum feeding of urea treated wheat straw with or without corn steep liquor on intake, in situ digestion kinetics, nitrogen metabolism, and nutrient digestion in Nili-Ravi buffalo bulls. Austr. J. Agric. Res., 55: 235-239.

Ozer, B.H.; Robinson, R.K. and Grandison, A.S. (2003). Textural and micro- structure properties of Urfa cheese (a white brined Turkish cheese). Int. J. dairy Tech., 56: 171.

Peterson, D. (2005). Goat milk. The other white milk. Dairy Goat J. 4: 1-10.

rations for improving production and reproduction performance of dairy Zaraibi Goats. Egyptian Journal of Sheep &Goat Sciences, Vol. 8(2),P:69-83

Trenkle, A., (2002). Beef Research Report, lowa State University, Lowa, USA.

Tunick, M. H. (2000). Symposium: Dairy products rheology. Rheology of dairy foods that gel, stretch, and fracture. J. Dairy Sci. 83: 1892.

Volikakis P.; Billiaderis C. G.; Vamvakas C. and Zerfiridis G.K. (2004). Effect of commercial oat-β-glucan concentrate on the chemical, physic-chemical and s sensory attributes of low-fat white-brined cheese product. Food Res. Int., 37: 83.

Wagner, J.J., K.S. Lusby and G. W. Horn, (1983). Condensed molasses, soluble corn steep liquor, fermented ammoniated condensed whey as protein sources for beef cattle grazing dormant native range. J. Anim. Sci. 57: 542-552.

Yang, C. S.T. and Toranto, M.W. (1983). Textural properties of Mozzerella cheese analogue manufactured from soybeans. J. Food Sci., 47:906

تأثير إضافة مركز مياه نقع الأذرة لعلائق الماعز الزاريبى على إنتاج اللبن وخواص وجودة الجبن الابيض الطرى

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أجريت هذة الدراسة لمعرفة تأثيرالاستبدال الجزئى لبروتين مخاليط الأعلاف المركزة بمركز مياة نقع الاذرة الناتج عند صناعة النشا (CSL) بنسبة 10و20 و30% من البروتين على الاداء الإنتاجى (إنتاج اللبن وتركيبه) للماعز الزاريبى ودراسة خصائص الجبن الأبيض الطرى الناتج من تصنيع اللبن.

تم استخدام 24 عنزة زاريبى(6 لكل مجموعة) قسمت عشوائيا الى 4 مجاميع . غذيت المجاميع لمدة 30 يوم قبل موسم التربية كفترة دفع غذائى ثم خلال فترتى الحمل والرضاعة حيث تم الإحلال الجزئى بالعليقة لـ 10 و20 و30% من البروتين بمركز مياه نقع الأذرة وتم أستخدام قش الارز كماة مالئة لحد الشبع حتى نهاية فترة التجربة (34 أسبوع). تم تقدير إنتاج وتركيب ومعدل التحويل الغذائى وخصائص ومواصفات الجبن الناتج من اللبن.

<u>وكانت أهم النتائج المتحصل عليها:-</u>

- زاد إنتاج اللبن معنويا فى جميع المعاملات التى استخدمت مركز مياة نقع الاذرة عن عليقة المقارنة حيث زاد إنتاج اللبن الكلى معنويا بمقدار 13.0 ، 21.0 ، 37.8% للمجموعة الثانية والثالثة والرابعة على التوالى مقارنة بالمجموعة الاولى. ووصل لأعلى إنتاج يومى من اللبن (1.38 كجم/رأس) مع المعاملة الرابعة ثم (1.21 كجم/رأس) مع المعاملة الثالثة ثم (1.13 كجم/رأس) مع المعاملة الثانية مقارنة بالمعاملة الإولى التى سجلت أقل محصول لبن يومى (1.00 كجم/رأس).

- كذلك كان هناك تأثير ايجابى وملحوظ من أضافة مركز مياه نقع الإذرة على معظم مكونات اللبن خصوصا الدهن والبروتين واللاكتوز وبصورة غير معنوية على المكونات الصلبة الكلية ومحتوى الرماد.

- سجلت مجموعة الكنترول أقل قيمة للدهن والبروتين والاكتوز (3.02 ، 2.68 ، 4.63% على التوالى) مقارنة بالمعاملات المختبرة

<u>وفيما يتعلق بخصائص الجبن كانت أهم النتائج المتحصل عليها كما يلى:</u>

- أرتفع محتوى الجبن الأبيض الطرى بصورة معنوية من الرماد والملح ونسبة الحموضة ودلائل التسوية والأحماض الدهنية الطيارة الكلية وغير معنوى مع نسبة الدهن بينما انخفض محتوى الرطوبة والتصافى ودرجة pH بصورة معنوية بزيادة فترة التخزين.

- أظهرت الخصائص التركيبية للجبن الابيض الطرى أن الجبنة المصنعة من المجاميع التى غذيت على المعاملة الثالثة والرابعة سجلت أعلى قيم فى الصلابة والتماسك واللزوجة والقابلية للمضغ ، وتحصل على أقل قيم للمرونة مقارنة بالجبن المصنعة من المعاملات الاخرى وذلك فى بداية ونهاية فترة التخزين بصورة غير معنوية .

- حصلت الجبنة المصنعة من المعاملة الرابعة على أعلى قيم معنوية من الخواص الحسية تليها المعاملة الثالثة ثم المعاملة الثانية والأولى خلال فترة التسوية.

- <u>ومن هذة النتائج:</u>

يتضح ان الأستبدال الجزئى بمركز مياة نقع الأذرة بنسبة 30% و 20% من البروتين بمخلوط العلف المركز بعلائق الماعز الزاريبى الحلاب يحسن من إنتاج وتركيب اللبن وأنتاج جبن أبيض طرى بخواص جودة تركيبية وحسية مرتفعة خلال فترة التخزين.