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Physicochemical and sensory characteristics of white soft cheese made from different levels of Cassava powder (*Manihot esculenta*)

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KEYWORDS

Sudanese white soft cheese; milk; physicochemical; storage; Cassava powder.

A B S T R A C T

This study was carried out in the milk processing unit at college of animal production Science and Technology, Sudan University of Science and Technology during January 2012 – September 2013.The physicochemical and sensory characteristics of Sudanese white soft was investigated as affected by different levels of cassava powder and storage period. One hundred twenty (120) liters of fresh cow's full cream milk were purchase from a private farm at Khartoum north. Four treatments were carried out as follows: First treatment is the control in which cow's cheese milk had no additive. In the second (Cw1) , third (Cw2) and fourth (Cw3) treatments 0.5 % , 0.75% and 1 % of cassava powder were added respectively to cheese milk before pasteurization then white cheese was made and stored at room temperature for 90 days. Physicochemical and sensory evaluation were done for the cheese samples at 0,30,60 and 90 days intervals. The cheese Statistical analysis showed that cassava powder significantly ($p<0.05$) affected the chemical composition of the cheese. The results also showed that total solids, fat, crude protein, titratable acidity, pH, and volatile fatty acids were significantly ($p<0.05$) affected by the storage period while there was no significance ($p<0.05$) on ash contents. The results showed that there was significance difference ($p<0.05$) effect by the Cassava levels on total solids , fat, crude protein, acidity and volatile fatty acids while there was no significance differences ($p<0.05$) of cassava levels on pH and ash content of the cheese. The results showed that there were significance differences($p<0.05$) between control cheese and the other with 0.5,0.75 and 1 percent respectively in total solids, fat , crude protein , and acidity , while there were no significance ($p<0.05$) in PH and

Introduction

According to Ramkant (2006) cheese is a product that made from the curd obtained from milk by coagulating the casein with the help of rennet or similar enzymes in the presence of lactic acid microorganism .Law (1999) and Fox *et al*., (2000) defined cheese as the fresh or ripened product obtained after coagulation and whey

separation of milk, cream or partly skimmed milk, buttermilk or a mixture of these products , it can also be made from the milk of cows, sheep, goats and camels or mixture of two of these (Herrington, 2000). The objectives of cheese making are to obtain the optimum cheese composition with respect to moisture, acidity, pH, fat, protein and minerals (Price, 1974).

Each type of milk imparts the characteristics quality of cheese made from it and the resulting cheese will diver in its proprieties, body texture, and flavor (Andrew, 2010). There are great varieties of cheese, some are perishable and must be consumed within few days while other can be stored for years (Herrington, 2000).

White cheese is the only type of cheese available to the public at large quantities on the markets of Sudan, the method of its making was introduced from Egypt, or through Egypt, from Mediterranean countries such as Syria or Greece (Dirar, 1993). Sudanese white cheese falls into the family of soft and semi-soft pickled cheese of east European countries, the East Mediterranean region and North Africa (Abdalla ,1992).

Warsama *et.al* (2006) reported that Sudanese white soft cheese contained 47.8% total solids, 14.0% fat, 15.9 % protein and 6.2% ash , and it is locally known in Sudan as (Gibna Bayda) or Gibbna which is the most famous name , and it is usually stored in containers filled with whey (Kur , 1992). Natural cheese should be stored at suitable temperatures to ensure good quality because a high temperature leads to evaporation of moisture and growth of unwanted bacteria and other faults (Ramakant ,2006).

Cassava **(***Manihot esculenta***)** crop is originated in the American tropics but it is now grown through the tropical world. It is an important food crop in many south and Central American Countries and part of West Africa (William, 1989). It was first grown for food by the American Indians, and then introduced to Africa in sixteenth centaury from Brazil; it was first introduced to east Africa and Congo in the eighteenth century (Michael, 1991). There are many varieties of cassava, and it is classified as sweet or bitter cassava (Ravindran, 1991).

Before it is utilized cassava tuber is almost peeled. The tuber flesh is composed of about 61 % water , 35 % carbohydrate , 1-2 % protein 0.3 % fat 1-2 Fiber , and 2 % minerals. Especially cassava roots are very rich in minerals and contain significant amounts of calcium, phosphorus, and vitamin C (Olsen, 1999).

For the making of cassava Powder (flour), the fresh roots are peeled, washed, and cut into large slabs. The slabs are then allowed to dry under the sun and then stored. When the flour is needed the dry slabs can be milled to produce grayish white flour which can be used for producing many type of food (John, 1978).

Materials and Methods

The present study was conducted during 2013 at the Laboratory of Dairy Science and Technology Department, College of Animal Production Sciences and Technology, Sudan University of Science and Technology. In this Study four treatments were carried out as follows: First treatment is a control in which fresh cow's full cream milk cheese had no additive. In the second (Cw1), third (Cw2) and fourth treatment (Cw3) 0.05, 0.75 and 1 % of cassava powder were added respectively to

the fresh cow's full cream milk cheese before pasteurization.

Material and Methods

One hundred twenty liters of fresh cow's full cream milk were purchase from a private farm at Khartoum north and then divided into four equal groups (15 liters each) . Cassava roots were brought from Konyo-Konyo market at Juba and then were cut into small pieces and dried under the sun light for 1-3 days, then grinded to a fine powder (flour) before added to the milk. A fine commercial Salt (Sodium Chloride NaCl) was purchased from the local market at Haj Yousif (Shigila).

Rennet powder of one gram per 50 liters of milk was obtained from Hassan El-said center for veterinary services at Hellat Kuku Khartoum North – Bahary . Calcium Chloride Powder was purchased from Lab line International Company. Khartoum – Sudan . Commercial starter (Streptococcus thermophillus and Lactobacillus bulgaricus) was purchase from local markets . Sterile plastic buckets of (500 gram) capacity were brought from Hala Plastic Factory – Omdurman.

Cheese manufacture

Cheese was manufacture according to the method described by Ibrahim (2003) with some modifications. One hundred twenty liters(120 liters) of fresh clean cow's full cream milk was divided into four equal parts (15 liters each) and kept into four separate tanks.

The first part was left free without any additive of cassava powder , while in the other three parts cassava powder was added at the levels of 0.5 , 0.75 , and 1 % to the milk respectively. The cheese milk in all treatments was pasteurized at 72^{o}c for 1 minute.

The milk was then cooled to 42 ^{o}c . Commercial starter culture *(Streptococcus thermophillus* and *Lactobacillus bulgaricus*) in the ratio of 1:1% was added at the level of 1 % (W/v) . The milk was stirred gently and left for 30 minutes. Rennet powder (1 gram/50 liters) was added to milk at 40 ^{o}c. Fine Calcium chloride was added at the levels of 0.02 % immediately. Milk was then stirred for 10 minutes and left until coagulation occurred. The curd was then cut into small cubes (5x5x5 cm) .After draining, salt at 2% (w/v) was mixed with the curds .The curd was poured into small clean wooden molds lined with cheese cloth and pressed overnight. The manufactured cheese samples were stored into triplicates sterile plastic containers (capacity 500ky) filled with whey closely sealed and stored at room temperature (38±C°) for 90n days. Physicochemical and Sensory evaluations of cheese samples were carried out at 0, 30, 60 and 90 days intervals.

Chemical analysis

Total solid, fat , crude protein , ash were determined according to AOAC (2009) and pH was determined according to Newlander *et al*. (1964).Volatile fatty acids was determined according to Kosikowski (1997).

Sensory Characteristics

The sensory characteristics of the cheese samples were judge by 10 untrained panelists for color, flavor, texture, taste, saltiness, and over all acceptances by using sensory evaluation sheet according to Larmond (1987).

Statistical analysis

Statistical analysis was done by using SPSS (1998) programme (version 17). General Linear models were used to estimate the effect of storage periods, Cassava powder and interactions between them on the chemical composition of the cow's milk white cheese. Least Significance Difference (LSD) was used for mean separation between the treatments. The level of Significance (α 0.05) was used in this Study.

Result and Discussion

A total of 100 fresh water samples were The average chemical composition of the milk used for cheese making in this study was as follow : 10.5 %, 0.85%, 3.78%, 3.8 %, 5.75 0.1 N mL NaoH/100 gms cheese, 0.21%, and 6.5% for total solid, ash, crude protein, fat, volatile fatty acid, titratable acidity and pH respectively, while the chemical composition of Cassava powder used was as follow: 92.75%, 5.2%, 16.75%, 3.0%, 3.02%, 65.13% and 6.75% for dry mater, ash, crude protein, ether extracts, crude fiber, nitrogen free extracts and pH respectively.

Effect of the storage period on the chemical composition of the white cheese

Results in Table (1) show the main effect of storage period on physicochemical characteristics of cow's cheese.

The results indicated that total solid content of the cheese was significantly ($p<0.05$) increased from 41.98±0.88 % at day zero to 65.65±1.35 % at day 90 (Table 1). The fat content of the cow's milk cheese was affected significantly ($p<0.05$) by the storage period. The highest fat content (23.29 ±0.26%) was at day 30 while the lowest one (18.57±0.62%) was at day 90. The crude protein content of white cheese was significantly increased ($p<0.05$) to 23.27±0.53% at day 30 as the storage progressed it decreased 11.23±1.39% at day 90 (Table 1). It was clear (Table 1) that the titratable acidity of the cheese increased significantly ($p<0.05$) with the storage period. It was increased from 0.41±0.01 at the day zero to 1.36±0.02% at the day 90.

The pH of the cheese was affected significantly ($p<0.05$) by the storage period . It was decreased from 4.21±0.08 at the day zero to 2.71±0.10 % at the day 90 (Table 1).

Data in Table 1 showed that the volatile fatty acid was increased significantly ($p<0.05$) with the storage period. It was increased from 6.33±1.58 0.1 N mL NaoH/100 gms cheese at the day zero to 15.15±0.71 0.1 N mL NaoH/100 gms cheese at the day 90.

The ash content of the cheese was not significantly ($p<0.05$) affected by the storage period it was increased from 3.74±0.09 % at the day zero to 5.36±0.19 % at the day 90 (Table 1).

Effect of different levels of cassava powder on the physicochemical characteristics of Cow's cheese

Results in table 2 illustrated the effects of different levels of Cassava on physicochemical characteristics of cow's milk cheese.

The results indicated that there were significance difference ($p<0.05$) in the total solids content between all the treatments. The results showed that the highest total solid 56.31±9.20 % was in the Cow's milk

cheese without Cassava (Control) while the lowest total solid 53.95±8.93 % was recorded in the cow's milk cheese with 1 % Cassava (Cw3) (Table 2).

The results obtained in table 2 raveled that there were significance difference ($p<0.05$) in the fat content of cow's milk cheese between all the treatments. The highest fat contents 21.28±1.57 % was recorded in the cow's milk cheese with 1 % Cassava (Cw3) , while the lowest protein contents 20.25±1.84% was found in the Cow's milk cheese without Cassava (Control) .

It was clear from the results in table 2 that there were significance difference ($p<0.05$) in the crude protein contents between all the treatments. The highest crude protein contents 18.54±4.38 % was found in the cow's milk cheese with 1 % Cassava (Cw3) while the lowest crude protein 16.90±5.08 % was found in the cow's milk cheese without Cassava .(Control).

From the results obtained the acidity of the cheese was affected significantly ($p<0.05$) by the different levels of Cassava between all the treatments. The highest acidity 0.94±0.37% was recorded in the Cow's milk cheese with 0.75 % of Cassava (Cw2) while the lowest acidity 0.91±0.37 % was found in the cow's cheese milk without Cassava (Control) (Table 2).

The results showed that there were significance difference ($p<0.05$) in the total volatile fatty acids between all the treatments. The highest total volatile fatty acids 11.05±2.92 0.1 N mL NaoH/100 gms cheese was in the cow's milk cheese with 1 % Cassava (Cw3), while the lowest volatile fatty acids 7.70±3.97 0.1 N mL NaoH/100 gms cheese was in the cow's milk cheese without cassava (control) (Table.2).

It was observed from the results obtained in table 2 that there were no significance difference ($p<0.05$) of different levels of Cassava on pH between all the treatments. The highest pH 3.48±.0.59 % was in the cow's milk cheese without Cassava (Control) and 0.75 % of Cassava (Cw2) , while the lowest pH 3.43±0.55 % was recorded in the cow's milk cheese with 1 % Cassava.(Cw3). The results indicates that there were no significance difference ($p<0.05$) in the ash contents between all the treatments. The highest ash 6.38±8.46 was in the Cow's milk cheese with 1 % cassava(Cw3) while the lowest ash 4.49±0.60 % was in the cow's milk cheese with 0.5 % Cassava (Cw1).(Table 2).

Effect of storage period on sensory characteristics

Results in table 3 showed the main effect of storage period on sensory characteristics of the cheese. The results showed that the best values for color, flavor, texture, taste and over all acceptance was obtained at the first day Zero, while the best value for Saltines was recorded at the day 30. The color of the cheese was affected significantly ($p<0.5$) by the storage period. The color decreased from day Zero to the end of the storage (day 90) . The highest value for the color 7.35±1.81 was recorded at the day zero while the lowest value 5.10±2.07 was recorded at day 90 (Table 3).

Based on the results obtained in table 3 the flavor of the chesses was significantly ($p<0.05$) affected by the storage period. The flavor reduced from the day zero up to day 60 and the increased again at the day 90. The highest value 7.10±1.69 for the flavor was recorded at the day zero and the lowest one 4.85±2.09 was recorded at the day 60.

Table.1 Effect of storage on physicochemical characteristics of Cow's cheese

Storage Period	Physicochemical characteristics						
	Total Solid %	**Fat %**	**Protein %**	**Acidity %**	**pH %**	**VFA 0.1 N mL NaoH/100 gms cheese**	**%Ash**
Day 0	41.98±0.88 [d]	21.00±0.54 [b]	21.36±0.49 [b]	0.41±0.01 [d]	4.21±0.08 [a]	6.33±1.58 [a]	3.74±0.09
Day 30	52.73±1.03 [c]	23.29±0.26 [a]	23.27±0.53 [a]	0.81±0.04 [c]	3.68±0.13 [b]	7.95±1.48 [b]	4.14±0.49
Day 60	59.89±0.66 [b]	20.39±0.35 [c]	15.36±0.49 [c]	1.14±0.02 [b]	3.26±0.10 [c]	9.77±1.54 [c]	4.75±0.11
Day 90	65.65±1.35 [a]	18.57±0.62 [d]	11.23±1.39 [d]	1.36±0.02 [a]	2.71±0.10 [d]	15.15±0.71 [d]	5.36±0.19
LS	***	***	***	***	***	***	NS

Mean values bearing different superscripts within columnss are significantly different (P<0.05)
LS= Levels of significance
Ns= Not Significance

Table.2 Effect of different levels of Cassava powder on physicochemical characteristics of cow's milk

Treatment	Physicochemical characteristics						
	Total Solid %	**Fat %**	**Crude Protein %**	**Acidity %**	**VFA 0.1 N mL NaoH/100 gms cheese**	**PH %**	**Ash %**
Control	56.31±9.20[a]	20.25±1.84 [d]	16.90±5.08 [d]	0.91±0.37 [d]	7.70±3.97 [d]	3.48±0.59	4.53±0.53
Cw1	55.26±8.90[b]	20.77±1.84 [c]	17.85±5.18 [c]	0.92±0.36 [c]	10.06±3.50 [c]	3.48±0.55	4.49±0.60
Cw2	54.73±9.11[c]	20.95±1.71 [b]	17.94±5.00 [b]	0.94±0.37 [a]	10.37±2.23 [b]	3.48±0.59	4.58±0.63
Cw3	53.95±8.93[d]	21.28±1.57 [a]	18.54±4.38 [a]	0.93±0.37 [b]	11.05±2.92 [a]	3.43±0.55	6.38±8.46
LS	***	***	***	***	***	NS	NS

Mean values bearing different superscripts within columns are significantly different (P<0.05)
LS= Levels of significance
Control = Cheese without Cassava powder
Cw1=Cheese with 0.5 % Cassava
Cw2= Cheese with 0.75 % Cassava
Cw3=Cheese with 1 % Cassava
NS: Not significance

The texture of the cheese was significantly (p<0.05) affected by the storage period. The best value for the texture 6.65±1.56 was recorded at the day zero while the lowest 5.50±2.06 value was recorded at the day 30 (Table 3).

According to the results presented in table 3 the taste of the cheese was significantly (p<0.05) affected by the storage period. The best value of the taste 6.85±1.78 was recorded at the day zero while the lowest value 5.10±2.48 was founded at the day 30. Saltines of the cheese was significantly (p<0.5) affected by the storage period .The saltines increased at the day 30 and then decreased up to the end of the storage period. The highest saltine 7.05±2.10 was

recorded at the day30 while the lowest saltines 5.20±1.96 were found at the day 90. There was significance ($p<0.05$) affect by the storage period on the over all acceptance of the cheese. The over all acceptances reduced by the storage period from the day zero up to the day 60 and then increased again at the day 90. The best over all acceptances 7.25±1.64 was found in the day zero while the lowest one 5.25±2.32 was found in the day 30.

Effect of the different levels of cassava on sensory characteristics of cow's cheese

Table 4 showed the main effect of different levels of Cassava on the Sensory characteristics of cow's milk cheese. There were significance difference ($p<0.05$) by the Cassava levels on the color, texture and saltines, while there were no significances differences ($p<0.05$) on the flavor, taste, and over all acceptance of the cheese. The results in table 4 showed that there was significance difference ($p<0.05$) in the color, the best value of the color 6.90 was recorded in the control cheese while the lowest one 5.05 was recorded in the cheese with 1 % cassava (Cw3). The best value for the texture 6.56 was in the control cheese while the lowest one 5.55 was in the cheese with 0.75 % cassava (Cw2). The cheese with 0.5 Cassavas (Cw2) recorded the highest saltines 6.85, while the control cheese recorded the lowest value 5.24. The control cheese obtained the highest acceptability than the other cheese with 0.5, 0.75, and 1 % Cassava respectively.

Effects of Storage period and different levels of Cassava powder on physicochemical characteristics of Cow's milk white soft cheese

The physicochemical characteristics of Cow's milk cheese was significantly ($p<0.05$) affected by the storage period (Table 1).

The total solid contents of the cheese samples significantly increased during the storage period. Similar results were obtained by El-Owni and Hamid (2008) , Babiker (1987) , Abdel-Razig (1996) and Hamid (2005) who found the total solid of Sudanese White Soft Cheese increased during the storage period . The increase in total solid contents could be due to continuous lost of moisture from the curd as a result of lactic acid developments which cause curd contraction. Aly and Galal (2002). Abdol-Elsalam *et al*.(1993) and Celik *et al* .(2002) stated that the increased in total solid could be due to salt absorption and / or water diffusion of some soluble components between brine and cheese mass .

The fat contents of the cheese decreased significantly with the storage period. The results were silmliar with that found by Abdel-Razig (1996) and Abdalla (1992). The decrease of fat contents could be explained by the degradation of total protein, dissolution of salt and fat into the pickling solution or absorption of why by curd, Dariani, 1980. Other results demonstrated that the decreased in fat content was probably due to the lipolytic activity of microorganisms on fat resulting in a leakage of some fat from crude into the pickling whey (Khalid (1991), Abbala (1992) Nofal *et al*. (1981) and (Nasur, 2001)).

The increase of the fat content in the day 30 during the pickling could be attributed to the diminution of solids non-fat content due to the partial degradation of proteins and loss by solubility in whey (Nofa *et al*. (1981). The protein contents decreased with the Storage period.

Table.3 Effect of Storage period on sensory characteristics of processed Sudanese white soft cheese

Storage Period	Sensory characteristics					
	Color	**Flavor**	**Texture**	**Taste**	**Saltines**	**Overall acceptance**
Day Zero	7.35±1.81 [a]	7.10±1.69 [a]	6.65±1.56 [a]	6.85±1.78 [a]	6.15±2.48 [b]	7.25±1.64 [a]
Day 30	6.45±1.81 [b]	6.00±2.31 [c]	5.50±2.06 [d]	5.10±2.48 [d]	7.05±2.10 [a]	5.25±2.32 [d]
Day 60	6.30±2.54 [c]	4.85±2.09 [d]	6.15±1.86 [b]	5.45±2.66 [c]	5.55±2.02 [c]	5.45±1.89 [c]
Day 90	5.10±2.07 [d]	6.35±1.78 [b]	5.70±1.84 [c]	6.05±1.50 [b]	5.20±1.96 [d]	6.03±2.02 [b]
LS	***	***	*	**	**	***

Mean values bearing different superscripts within column are significantly different (P<0.05)
LS= Levels of significance

Table.4 Effect of different levels of Cassava Powder on sensory characteristics of processed Sudanese white soft cheese

Treatments	Sensory characteristics					
	Color	**Flavor**	**Texture**	**Taste**	**Saltines**	**Overall acceptance**
Control	6.90±2.01 [a]	5.88±2.53	6.56±2.07 [a]	6.41±2.20	5.24±2.42 [d]	6.46±2.00
Cw1	6.65±1.86 [b]	6.30±2.15	5.85±1.63 [c]	6.05±2.35	6.85±1.66 [a]	6.15±2.26
Cw2	6.55±2.15 [c]	5.90±1.86	5.55±1.75 [d]	5.40±2.13	6.15±2.17 [b]	5.80±2.07
Cw3	5.05±2.41 [d]	6.23±1.93	6.03±1.94 [b]	5.56±2.20	5.72±2.41 [c]	5.54±2.09
LS	***	NS	*	NS	**	NS

Mean values bearing different superscripts within rows are significantly different (P<0.05)
LS= Levels of significance
Control = Cheese without Cassava powder
Cw1=Cheese with 0.5 % Cassava
Cw2= Cheese with 0.75 % Cassava
Cw3=Cheese with 1 % Cassava
NS: Not significance

These findings were in agreement with those reported by (Khaild , 1991 ; Abdalla 1992 ; Billial 2000 ; Kamal and Nagla,2009 and Nusuer 2001, who found that protein used to decrease during the storage . Hayalogolou *et al*. (2005) , Khalid (1991) , Abdlla (1992), Nofal *et al* .(1981) explained that the protein contents decreased during the storage period due to the degradation of protein and loss of pickling whey . Nusuer (2001) found that the decreased in protein contents during pickling was a direct results of protein degradation leading to the formation of water soluble compounds which were lost in the pickling solution leading to increase in the nitrogen contents of the whey . The total protein found in this study was higher than that obtained by Saria (2009). This may be due to the effect of Cassava powder and heat treatment which resulted in denaturation of whey protein and their

retention in the curd. The high crude protein could also be attributed to the high levels of crude protein in Cassava powder used for cheese manufacture. However the increase in protein contents that occurred in the day 30 of the storage period was due to loss of moisture Kamal and Nagla (2009).

The ash contents increased with the storage from the beginning till the end of the storage period. These results coincide the results that obtained by Elowni and Hamid (2008) and Kamal and Nagala (2009) who founded the ash contents of Sudanese white soft cheese increased during the storage period. The increase in ash content during pickling may be due to the decrease in moisture content, and absorption of salt by curd. Abdalla and Abdel Razig , 1997) and Abdel Razige, 1996.

The pH of the cheese decreased till the end of the storage period (Table 1). Similar findings were obtained by Wlstra *et al.* (1987) and Hamid , (2005) who reported that , the pH values progressively decreased during storage .The Increase in the cheese acidity might be due to the storage temperature, which activated the natural microflora of raw milk to develop acidity as the result of lactose fermentation which lead to decrease in pH-value (Babiker,1987).

The acidity increased in all cheese samples during storage period. This results were in agreements with the work of Tarakci and Kucukoner , 2006 , El-Owni and Hamid 2008, Hayalogu *et al*. 2008 who reported that the increase in the acidity is due to increase in lactic acid by the action of lactic acid bacteria Present in the raw milk . Similar findings were obtained by Wlstra *et al.* (1987).

The volatile fatty acid increased from the beginning of the storage to the end. These finding were in consistent with the result of Abdel-Razig, 1996 and El-Owni and Hamid 2008. The increase in volatile fatty acid probably could be attributed to lipolytic action of organisms on fat contents during ripening (Esponda *et al*.(1983) and Abdel Razig, 1996).

Effect of storage period and different levels of cassava on sensory characteristics of white cheese

Table 3 presented the effect of storage period on sensory characteristics of cheese samples. The results indicated that there were significance change ($p<0.05$) by the storage period on the characteristics under investigation (color, flavor, texture, taste, saltiness, and over all acceptance. These results was in agreement with that found by El-Owni and Haimd (2008) who found that there was significance change in color , flavor and texture of the cheese during the storage . However the color, flavor, texture, taste, saltiness, and over all acceptance decreased gradually with the storage period. These results were in disagreements with the work of Tarakci and Kucuknoer (2006) and Mohamed (2009) who reported that an increase for all these above values during the storage. The best color obtained for the control cheese in table 4 could be attributed to the consumer acceptability for the white color which is very clear in the control cheese. There were no significance differences in the flavor, taste and over all acceptances of the cheese samples with different levels of Cassava. This could be due to the low percentage of cassava used in the treatments. These results were in agreements with those of El- Tantawy *et al*. (2006).

Physicochemical characteristics of Cow's milk soft cheese were significantly ($p<0.05$) affected by the storage period and

Cassava levels. Total solid, fat, crude protein, titratable acidity, and volatile fatty acids were significantly ($p<0.05$) affected by the storage period and different levels of cassava. While there was no significance different by storage and different levels of cassava on ash and pH. It would be concluded that storage period significantly affected the physicochemical and sensory characteristics of the Sudanese white soft cheese.

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