

## Journal of Food and Dairy Sciences

Journal homepage & Available online at: [www.jfds.journals.ekb.eg](http://www.jfds.journals.ekb.eg)

### Impact of Variation in Protein / Fat Ratio on Soft White Tallaga Cheese Properties

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#### ABSTRACT

The effect of using different ratios of protein/fat ( p/F ) on the characteristics of soft white Tallaga cheese(SWTC) ,Two techniques of variations were used, the first was investigated by using constant percent of Fat with variation in Protein, the second was by using constant percent of Protein with variation in Fat percent to reach to three targeted Protein/ Fat ratios ( 0.3,0.4 and 0.5 ) in order to choose the most acceptable treatment with decreasing the economic costs for producing SWTC with good properties. Raw milk, fresh cream, skim milk powder(SMP), milk Protein concentrate(MPC), aroma, and preserving ingredients were used for (SWTC) making . the resultant (SWTC) kept at 4°C for 30 days was organoleptically, and microbiologically evaluated at variable throughout the storage period at different intervals period (zero – 15 , 21, 30 days) . Results indicated that all ( SWTC ) have an acceptable properties by all P/F ratios. Moreover, the ( SWTC ) made from p/F( 0.4 ) in two techniques gained the highest organoleptically scores among other treatments. In addition, the results for microbiological evaluation indicated that all (SWTC) Treatments were free from *E coli*, Molds and yeasts, either it were fresh or until the end of storage period. Also, the (SWTC) made by P/F ratio ( 0.3 ) in two techniques had The lowest total Bacterial counts among other treatments.

**Keywords:** Tallaga , cheese , protein , Fat , Ratio , Organoleptic , characteristics

#### INTRODUCTION

Scientific progress in nutrition, medical and food sciences is having an increasingly profound impact on consumer's approach to nutrition. There is a growing awareness that many chronic diseases are caused by an unbalanced diet. From this point of view milk and many dairy products belong to the family of functional food replete with bioactive peptides, probiotic bacteria, antioxidants, highly absorbable calcium, conjugated linoleic acid and other biologically active components IRENA,(2000)., Eda,( 2017) reported that, Milk and dairy products have long been recognized as an important component of a balanced diet. However, we cannot state that they are essential to the diet although it is quite difficult to sustain an appropriate balance of nutrients if they are removed from the diet. Nestel, (2008), decided that dietary advice all over Europe recommends that dairy products be consumed daily during all stages of life. On average it is recommended to consume 2-3 portions of dairy foods per day for adults and 3-4 portions for children. . A small portion of cheese (30g), or two pots of yoghurt (2 x 125g), or 250ml of milk all contain about 300mg of calcium which is the same amount provided by 3kg of fruits or 750g of vegetables. Calcium from dairy is in general better absorbed by the human body than calcium from plant origin.

Scientific studies show that as part of a healthy diet dairy is associated with many health effects, including bodyweight management and composition, lower blood pressure and reduced risk of type 2 diabetes. A cardio-protective effect of dairy products has been observed in some studies. Several studies have found no negative links

between intake of saturated fat in dairy foods and cardiovascular disease and diabetes. Cheese consumption has shown no adverse effects on cholesterol levels. Moreover, the production technique makes a great action on the economic value of dairy technology.

For this trend, the manufacturers and scientific researchers aimed to many institutions for milk components, especially milk fat. So, they searched for cheaper fat replacer's such as vegetative oils and fats or using any other raw material give the fatty effects and properties. In addition, the lowering of the economic production costs, by using cheaper sources of fat such as vegetative oil ,due to its cheaper price than milk fat which leads to reduce the total production costs (Abo-El-Naga et al., 1994),

So, the research work tends to define the more suitable protein/Fat ratio from the view of consumer's acceptability and expectation .

#### MATERIALS AND METHODS

Fresh skimmed milk was obtained from the Dairy department plant, Faculty of Agriculture, Mansoura University, Skim milk powder (SMP) made in Poland by "AARIMEX", milk protein concentrate powder (MPC) made in Poland by "AARIMEX", Microbial rennet powder (Formase TL2200) was obtained from Ch. Hansen's Laboratories, Copenhagen, Denmark, the addition ratio for pre-cheese mix was 7.5 gram /100 kg milk. Dry commercial food grade salt used during this investigation was obtained from El-Nasr Saline's Company, Egypt.

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DOI: 10.21608/jfds.2022.133200.1048

potassium sorbate as Fine grade (edible) obtained from CHAS-Pfizer Co. Inc. New York, USA. was used as preservative material by recommended ratios.

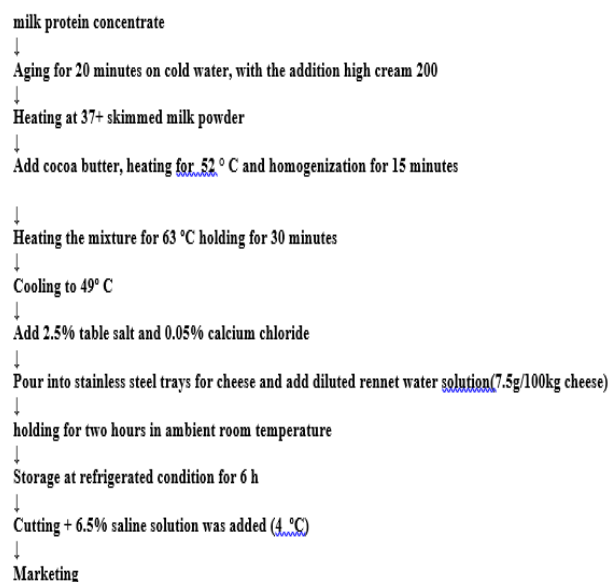
emulsifier blend named high cream 100 (consists of gelatin, carrageenan and diglycerides) was obtained from Misr Food Additives Co., Egypt. Was used with 0.1-0.2 % addition ratio.

Analytical grade calcium chloride obtained from El-Gomhouria Company, Egypt. has been used in this investigation by 0.05 % addition ratio.

#### Methods:

Fresh tallaga cheese was processed according to the method described by ( Baraka, (2015 ) with some differences. control treatment which have P/ f ratio 0.4 was processed from natural milk ingredients and by the same processing steps. Another six recombined cheese treatments carried out by replacing milk fat with cacao butter Oil and using a stabilizer high cream 200 (0.1% w/w).

#### The following is a flow sheet diagram for tallaga cheese processing steps:



Milk was analyzed for total solids (TS), fat, protein and lactose contents using a laboratory Milkoscan. pH was measured using a ML 1010 pH meter with a glass electrode according to the standard method described by ling (1963). Chemical composition and cheese mix ingredients quantity were calculated as the method recommended by (Baraka 2015).

Total solids ,Fat, and ash content were determined according to Ling (1963).

The evaluation of microbial quality of Tallaga cheese during the storage period at 4±1 °C was assessed by counting the following microbial groups (Total bacterial count (T. C) , Coliform bacteria (*E. coli*) , Moulds, and yeasts) according to the method described by the American public Health Association (A.P.H.A., 1992)

Trained Staff members of dairy department ,Faculty of Agriculture , Mansoura University determined the organoleptic properties of Soft White Tallaga cheese according to the International Dairy Federation methodology (IDF 1987).

## RESULTS AND DISSECTION

Soft White Tallaga cheese was processed from natural milk ingredients by using different Protein / fat ratios. soft white Tallaga cheese was processed and calculated according to ( Baraka , 2015) the resultant cheese samples were organoleptically and microbiologically evaluated either it was fresh or throughout 30 days of storage period.

The chemical composition and the amount of the different ingredients used for the manufacturing of tallaga cheese were illustrated in Table(1-5) /100kg of Soft white Tallaga Cheese.

For producing Soft White Tallaga Cheese containing 35 % Total Solids, data presented in Table (1) indicate the quantities of raw materials (Raw Skim milk , Skim Milk Powder , Milk Protein Concentrate , Cream70%Fat , Salt, Stabilizer (high cream 200), Calcium Chloride (CaCl<sub>2</sub>), Water )by kilograms (50, 5, 7.820, 25.700, 2.5, 0.001,0.005, 14.1 ) respectively. Resultant cheese by using this formula have ( 18% fat, 6%lactose, 9%protein, 2.5% salt, 0.1%stabilizer) .

**Table 1. The chemical composition and the amount of ingredients for (0.5)P(9)/F(18) ratio.**

components	Quantity(Kg)	fat	Lactose	P	T.s
Raw Skim milk	50	....	2.25	1.6	3.850
Skim Milk Powder	5.00		2.75	1.7	4.450
Milk Protein Concentrate	7.820	....	1.09	5.48	7.38
Cream70%Fat	25.700	18.00	0.38	0.22	18.6
Salt	2.5				2.5
Stabilizer( high cream 200)	0.001				0.100
Calcium Chloride (CaCl <sub>2</sub> )	0.005				0.005
Total	91.1				36.8
Water	14.1				

Data presented in Table (2) indicate the ingredients of raw materials (Raw Skim milk , Skim Milk Powder , Milk Protein Concentrate , Cream70%Fat , Salt, Stabilizer (high cream 200), Calcium Chloride (CaCl<sub>2</sub>), Water )quantities by kilograms (50, 5, 5.26, 25.700, 2.5, 0.001,0.005, 8.1 ) respectively. to produce Soft White Tallaga Cheese containing 35 % Total Solids, Cheese resultant description ( 18% fat, 6%lactose, 7.2%protein, 2.5% salt, 0.1%stabilizer)

**Table 2. The chemical composition and the amount of ingredients for (0.4)P(7.2)/F(18) ratio.**

components	Quantity in kg	fat	Lactose	P	T.s
Raw Skim milk	50	....	2.25	1.6	3.85
Skim Milk Powder	5.00		2.75	1.7	4.45
Milk Protein Concentrate	5.26	....	0.74	3.86	4.6
Cream70%Fat	25.700	18	0.38	0.22	18.4
Salt	2.5				2.5
Stabilizer( high cream 200)	0.001				0.001
Calcium Chloride (CaCl <sub>2</sub> )	0.005				0.005
Total	88.500				33.8
Water	8.1				

Table(3) showed The data to produce Soft White Tallaga Cheese containing 35 % Total Solids, by using raw materials (Raw Skim milk , Skim Milk Powder , Milk Protein Concentrate , Cream70%Fat , Salt, Stabilizer (high cream 200), Calcium Chloride (CaCl<sub>2</sub>), Water )quantities by kilograms (50, 5, 7.740, 32.14, 2.5, 0.001,0.005, 8.1 ) respectively. Resultant cheese by using this formula have ( 22.5% fat, 6%lactose, 9%protein, 2.5% salt, 0.1%stabilizer)

**Table 3. The chemical composition and the amount of ingredients for (0.4)P(9)/F(22.5) ratio.**

components	Quantity in kg	fat	Lactose	P	T.s
Raw Skim milk	50.0	....	2.25	1.6	3.85
Skim Milk Powder	5.0		2.75	1.7	4.450
Milk Protein Concentrate	7.740	....	1.000	5.420	6.420
Cream70%Fat	32.14	22.5	0.48	0.28	23.26
Salt	2.5				2.5
Stabilizer( high cream 200)	0.001				0.001
Calcium Chloride (CaCl <sub>2</sub> )	0.005				0.005
Total	97.386				40.486
Water	18.289				

Table (4) showed the ingredients of raw materials (Raw Skim milk , Skim Milk Powder , Milk Protein Concentrate , Cream70%Fat , Salt, Stabilizer (high cream 200), Calcium Chloride (CaCl<sub>2</sub>), Water )For producing Soft White Tallaga Cheese containing 35 % Total Solids, data presented in by kilograms (50, 5.500, 2.440, 25.700, 2.5, 0.001,0.005, 4.97 ) respectively. Resultant cheese by using this formula have ( 18% fat, 6%lactose,5.4%protein, 2.5% salt, 0.1%stabilizer) .

**Table 4. The chemical composition and the amount of ingredients for (0.3)P(5.4)/F(18) ratio.**

components	Quantity in kg	fat	Lactose	P	T.s
Raw Skim milk	50.0	....	2.25	1.6	3.85
Skim Milk Powder	5.500		3.0	1.870	4.870
Milk Protein Concentrate	2.440		0.340	1.710	2.05
Cream70%Fat	25.700	18	0.38	0.22	18.6
Salt	2.5				2.5
Stabilizer( high cream 200)	0.001				0.001
Calcium Chloride (CaCl <sub>2</sub> )	0.005				0.005
Total	86.12				31.88
Water	4.97				

Data presented in Table (5) indicate the ingredients of raw materials (Raw Skim milk , Skim Milk Powder , Milk Protein Concentrate , Cream70%Fat , Salt, Stabilizer (high cream 200), Calcium Chloride (CaCl<sub>2</sub>), Water )by kilograms (50, 5, 7.820, 25.700, 2.5, 0.001,0.005, 14.1 ) respectively For producing Soft White Tallaga Cheese containing 35 % Total Solids,. Resultant cheese by using this formula have ( 30% fat, 6%lactose, 9%protein, 2.5% salt, 0.1%stabilizer) .

Data Illustrated in the table (6) show the microbial quality for cheese treatments(T1) which have constantan fat ratio and variable protein ratio, whereas (T2) have constantans on the cheese protein ratio and changing the fat ratio to reach the different protein / fat ratios, and these data showed that, all cheese samples are free from a coliform group bacteria from the beginning of production or

throughout the storage period. Moreover, It was noted that the microbial counts of all treatments increased with the progress at the storage period. These results are in agreement with (Katsiari ,*et al.*, 2002) . Also, it was shown from the results in the same Table that the rate of increasing in the total bacterial counts (TC) were decreased among all treatments in general. In addition, the rate of increasing was less with the decrease in the proportion of protein content.

**Table 5. The chemical composition and the amount of ingredients for (0.3)P(9)/F(30) ratio.**

components	Quantity in kg	fat	Lactose	P	T.s
Raw Skim milk	50.0	....	2.25	1.6	3.85
Skim Milk Powder	4.55		2.500	1.55	4.05
Milk Protein Concentrate	7.83		1.1	5.48	6.58
Cream70%Fat	42.850	30	0.64	0.37	31.0
Salt	2.5				2.5
Stabilizer( high cream 200)	0.001				0.001
Calcium Chloride (CaCl <sub>2</sub> )	0.005				0.005
Total	108.00				48.00
Water	29.2				

These results may be due to the rising in the fat to dry matter (F/DM), as well as the decrease in the percentage of added protein and this might be explained the effect of fat content on delaying the development of microbial growth . There were increases in TC counts with increasing storage periods at refrigerator temperature up to 28 days and with increasing levels of protein in all treatments. There were no detected coliform group counts in all treatments. Yeast and molds were not detected in fresh cheese or after one week of storage, but they were detected and increased gradually with the progress of storage at 28 days in most treatments ,these results are in agreement with (ElAlfy,*et al.*,2010) showed that , Molds and yeasts appeared after the 4th week and increased up to the end of storage period. The same Table noted that S3(T1) gained The highest value in( Tc, MY) and in a reverse trend S1 in the two type of treatments have the lowest TBC and bacterial increasing rate among all other treatments. These mentioned results might be due to the increased moisture content , which made a suitable environment for rising growth number of ( TC ,MY)

**Table 6. Effect of p /f ratio variation on microbial properties of fresh and stored SWTC (21 days/4°c)**

Treatments	Storage period	T.C* 106	M,Y *105
T1			
S1	7	1	1
	21	30	2
S2	7	1	1
	21	33	2
S3	7	2	2
	21	36	4
T2			
S2	7	1	1
	21	28	2
S3	7	1	1
	21	25	2

**T1: Different protein ratios with constant fat ratio**

**S1,: p/f : 9/18 = 0.5 S2,: p/f : 7.2/18 = 0.4 S3 : p/f: 5.4/18 = 0.3**

**T2: Different fat ratios with constant protein ratio**

**S1,: p/f : 9/18 = 0.5 S2,: p/f : 9/22.5 =0.4 S3 : p/f: 9/30 = 0.3**

Table (7) reveals the data for the sensory evaluation of treatments these data show that the S2(T2,T1) gained the highest total organoleptic scores when compared with other treatments (93.1) and (84) followed by S1(T2,T1) (91.5) (79.5) moreover S3(T2,T1) had the lowest total organoleptic scores (74) and (68) even at the end of storage period although decreasing of its quality level, but in general, all treatments were acceptable for flavor, these results incomputable with the mentioned data by (lobato-calleros, et al; 2007) however, they reported that, fat replacer has a major effect on flavor of soft white fresh cheese. Also the previous data are in agreement with (Khalifa, et al; 2017) whose carried out an investigation to determine the effect peanut oil, on the oxidative stability and organoleptic properties of white soft cheese, , On the other hand, body and texture were differed, S3(T2,T1) (p/f=0.3) had the lowest scores among other treatments that might be due to the decreasing in the total solids content also, The highest value for fat/dry matter which leads to more smooth texture which were un favorable for the panelist commit member. The mentioned data were incomputable by (Dinkci, et al; 2011) as they showed the influence of a vegetable fat blend on the texture of kashar cheese, and (Koca, and Metin, 2004) they reported that the high content of cheese total solids and the percent of fat to total solid have asignificant effect on the soft cheese properties. On the other hand, S2(T2,T1) treatment gained the highest scores for flavour, body, and texture when compared with other cheese treatment. From the data for appearance, all treatments were good but a treatment was very acceptable for panelist staff member S2(T1), which has  $P/F = 7.2/18 = 0.4$ , and these results came in harmony with those reported by (kavas, et al., 2004) however, they decided that the differentiation in the main cheese component such as protein and fat have a great effect in its sensory evaluation especially the appearance scores. Moreover the obtained data are equal to the findings by (Marcus Hjammarsson, 2015) whereas who decided that the differences in fatty acid composition between different vegetable fats and that of milk fat, give rise to different functional properties of the final cheeses.

**Table 7. Effect of protein fat ratios on the sensory properties of fresh and stored SWTC (21 days/4°C)**

Treatemnts	Storage period	Flavour (40)	Body and texture (40)	Appearance (20)	Total score (100)
T1(f)					
S1	7	36	37	17.5	91.5
	21	33	32	13.5	79.5
S2	7	37.5	37.8	17.8	93.1
	21	35	34	14	84
S3	7	38	28	12	83
	21	35	25	10	70
T2(p)					
S2	7	37	30	12	79
	21	35	28	10	73
S3	7	38	25	11	74
	21	37	22	9	68

**T1: Different protein ratios with constant fat ratio**

**S1: p/f: 9/18 = 0.5 S2: p/f: 7.2/18 = 0.4 S3 : p/f: 5.4/18 = 0.3**

**T2: Different fat ratios with constant protein ratio**

**S1: p/f: 9/18 = 0.5 S2: p/f: 9/22.5 = 0.4 S3 : p/f: 9/30 = 0.3**

## CONCLUSION

In general from maintained results we recommended the use of the P/F ratio (0.4) which were preferable for the organoleptic evaluation staff members and gained the best results for other evaluation methods used for determining the (SWTC) quality.

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**تأثير تباین نسبة البروتين الى الدهن على خصائص الجبن الابيض الطري ( الثلجة )**  
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تم استخدام ثلاث نسب من البروتين الى الدهن ( 0.3,0.4,0.5 ) وذلك لدراسة تأثير اختلاف نسبة البروتين الى الدهن على خصائص جبن الثلجة الابيض الطري . تم تنفيذ هذه الدراسة على مرحلتين الاولى تثبيت الدهن وتغيير نسبة البروتين و الثانية تثبيت البروتين وتغيير نسبة الدهن من اجل الوصول الى افضل نسبة من حيث الخواص الحسية والميكروبيولوجية للجبن الناتج باستخدام اللبن الخام والقشدة الطبيعية مدعما باللبن الفرز المجفف ومركز بروتين اللبن ومثبت ومواد حافظه مصرح استخدامها في تصنيع الجبن الابيض الطري . تم حفظ الجبن الناتج على درجة حرارة 4 درجة مئوية لمدة 30 يوم وخلال هذه الفترة تم اجراء الاختبارات الحسية والميكروبيولوجية على فترات متباعدة ( بداية التصنيع – 7 ايام – 14 يوم – 21 يوم – 30 يوم ) وقد أظهرت النتائج المتحصل عليها ان الجبن المصنع والمحتوي على نسبة بروتين الى دهن  $0.4 = 7.2/18$  في كلتا المعاملتين حققت اعلى قيم للتقييم الحسي خلال جميع فترات الحفظ في حين نالت جميع المعاملات قبولاً من المحكمين فيما يتعلق بالخواص الحسية كذلك أظهرت النتائج خلو جميع المعاملات من بكتيريا القولون خلال جميع فترات التقييم. وفيما يتعلق بالخمائر والفطريات أظهرت النتائج خلو جميع المعاملات منها خلال فترات التقييم الاولى في حين ظهرت بعض نموات من الخمائر والفطريات في نهاية فترة التقييم في جميع المعاملات وكان اكثرها المعاملة ( 0.3 ) في كلتا المرحلتين ويمكن من خلال النتائج الاقرار باستخدام نسبة بروتين الى الدهن ( 0.4 ) كأفضل نسبة من حيث الخواص الحسية والميكروبيولوجية .