

Use of Hydrocolloids for Enhancing Egyptian Style Low Fat White Soft Cheese Attributes

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ABSTRACT

The yield, composition, organoleptic, textural and microbiological properties of Egyptian style low-fat white soft cheeses made of skim buffalo's milk (0.1%F) by adding fat replacers (hydrocolloids); 0.07 & 0.1% w/w Xanthan gum (XG), 0.5 & 0.75% w/w Tragacanth gum (TG) and 0.5 & 1% w/w Maltodextrin (MD) were evaluated and compared with their counterpart low & full fat control cheeses (LFC & FFC). All of the low-fat products reduced the yield, F/DM, Ash/DM, M:P and MNFS, whereas the moisture content, P/DM, and pH significantly increased. However, the cheeses containing hydrocolloids had higher moisture and yield values than their control LFC with respect to the type and concentration. The mean values of TPA (texture profile analysis) improved the cheese texture parameters, when the hydrocolloids were included. This was clearly evident by sensory evaluation. The replacement of fat by these hydrocolloids caused a significant increase of the total, proteolytic and lipolytic bacteria counts and moulds & yeasts of cheese. The fresh full-fat white soft cheese was perceived as more elastic, less salty and had higher flavor and odor scores than all low fat variants. It could be concluded that by using hydrocolloids significantly enhanced all organoleptic parameters to gain higher total scores, as compared with control LFC, and to be more close to their corresponding control for XG cheeses (91.04 & 89.06 vs. 91.80).

Keywords: Low fat white soft cheese - Hydrocolloids – Yield - Chemical composition - Microbiological analysis – Texture profile properties - organoleptic attributes.

INTRODUCTION

Because of that Domiati cheese is delicious and rich source in nutritive components, it is the most consumptive, wide productive, and popular cheese in Egypt. It makes up about 75% of the cheese produced (El-Baradie *et al.* 2007). Full fat Domiati cheese has high fat content (40/45 – 60% F/TS) ES; 1008-3/ (2005), which is one of the most components that the desired typical characteristics depend on. However, the presence of saturated fatty acids and cholesterol in butter milk fat, particularly, in high content renders that cheese less desirable for health of conscious consumers and people suffering from coronary heart diseases, obesity, diabetes and several other diseases Potel *et al.* (2010).

On the other hand, cheese fat has a critical role sense it is not only of nutritional significance, but also contributes to sensory, texture and functional properties. Because of that, removing or reduction of cheese milk fat adversely affects both cheese texture and flavor Koca and Metin (2004). Thus, low fat cheeses usually have rubbery body and flavor that are atypical of corresponding full fat varieties. With increasing levels of consumer health awareness, there is more interest in the development of low fat cheese Rahimi *et al.* (2013). Formulating low fat cheeses with the quality and acceptability matching their full fat counterparts has been an issue for cheese processors. To obtain attributes similar to full-fat cheeses, low fat cheese are making by technological changing of the manufacturing protocol or by using fat substitutes and additives Mistry (2001). Among the most useful strategy proposed to increase the acceptability of that cheese is the use of fat replacers such as hydrocolloids (carbohydrate based fat replacers) that commonly implied in food processing industry to counter the effects of fat reduction and improvement of its functional properties Totosa and Guemes-Vera (2008). In fact, hydrocolloids compensate for the low

level of fat by their ability to absorb and band water and texturizing characteristics Bench (2007). They include many polysaccharides extruded from plants (*e.g.* Gum tragacanth) or of microbial source (*e.g.* Xanthan gum) or modified starch products (*e.g.* Maltodextrin). Consequently, such hydrocolloids might be able to change the composition of cheese and modify the rheology and the organoleptic quality of low fat white soft cheese.

The objective of this study was to enhance the quality of Egyptian style low fat white soft cheese by using three hydrocolloids ((xanthan & tragacanth gums and maltodextrin), comparing between their performance as compensating to milk fat reduction and evaluating an improving scores of low fat cheese attributes against their respective LF & FF control cheeses.

MATERIALS AND METHODS

The whole buffaloes' milk (7% fat) and its skim milk (0.1%) were obtained from Dairy Technology Unit at Faculty of Agriculture, Cairo University, Egypt. The three hydrocolloids, Xanthan gum, Gum Tragacanth & Maltodextrin, were, respectively obtained from Gumix International, Inc. New Jersey, USA, El-Neel medicine Co., Cairo, Egypt and Misr Food Additives (MIFAD) Company, Giza, Egypt. Calf rennet powder was purchased from Chr. Hansen's Laboratories, Denmark.

White soft cheese (Egyptian style) was made according to the traditional method described by Fahmi and Sharara (1950), with some modifications regarding to the addition of the gums and Maltodextrin to the cheese milk as shown in Fig.1.

Full-fat and low-fat control cheeses (FFC & LFC) were, respectively, made from fresh full-fat buffalos' milk (7% F) and its skim milk (0.1% F). Six treatment cheeses were made from the same skim milk

with 0.5 & 1.0% maltodextrin (MD1 & MD2), 0.5, 0.75% gum tragacanth (TG1 & TG2) and 0.07 & 0.1% xanthan gum (XG1 & XG2). These hydrocolloids were added to cheese milk according to Zammar (2000), Rahimi *et al.* (2007) and Shendi *et al.* (2010), respectively.

Moisture, ash, & salt contents and acidity were determined according to AOAC (1990), while fat and

protein contents were determined according to IDF (1986). The pH value was measured by using pH meter (JENWAY Series 3510). Specific gravity was measured by Quevenne's lactometer type, whereas lactose was calculated by subscription of milk fat, protein & ash from milk total solids.

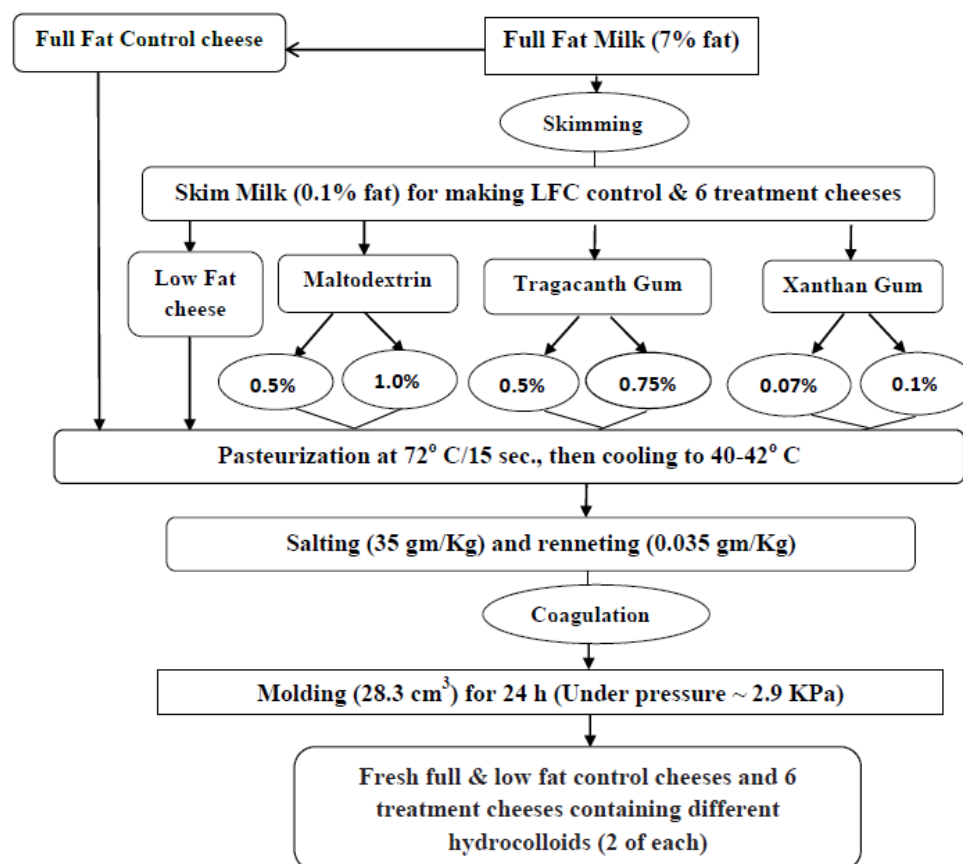


Fig.1. Flow diagram of making Egyptian style low fat white soft cheese with tragacanth gum, Xanthan gum and Maltodextrin and their corresponding full and low fat control cheeses

For examining rheological properties Fresh cheese samples were cut into cubes 4×4×4 cm, kept at 12°C for 30 min and measured immediately using texture analyzer (Cometech, B type, Taiwan). The probe used in a “Texture profile Analysis “(TPA) was 25 mm diameter, double compression test to penetrate 50% depth, at speed of 1 mm/s and 20 mm was the distance of penetration using cycle or hold programs. Data were collected on computer and the texture profile parameters were calculated from LFRA texture analyzer and computer interface. Calculation processes described by Bourne (2003) were followed.

Total viable bacteria counts were determined using standard plate count agar medium according to Houghtby *et al.* (1992). Coliforms and Moulds & yeasts counts were determined according to Marshall (1992). Lipolytic bacteria count was estimated by El-Sadek and Mahmoud (1967). Proteolytic bacteria count was carried out as described by Chalmers (1962).

Organoleptic properties of cheese samples were assessed by 12 panel members of both Dairy Science Departments at Faculty of Agriculture, Cairo University

and at Food Technology Institute, Agriculture Research Center. Samples were evaluated for appearance (15 points), body and texture (50 points) and flavor (35 points) to be 100 points for the total scores.

All data were statistically analyzed for analysis of variance and Duncan's test as well as average and standard error following M stat program.

Three replicates of each treatment and control were manufactured and subjected to varieties analysis.

RESULTS AND DISCUSSION

Data in Table 1 illustrate that full & low cheese milk composition are in accordance with EOS (2005a). Reduction of cheese milk fat used for making low fat white soft cheese (LFC) manufacturing to 0.1% caused insignificant increase ($P>0.05$) in all of milk components, except fat and TS contents, which had significant decrease. These results are similar to those obtained by Shendi *et al.* (2010) and Romeih *et al.* (2002)

Table1. Composition of milk used for the manufacture of FF and LF white soft cheese

Milk type	Fat (%)	Protein (%)	Lactose (%)	Ash (%)	Solid Non Fat (SNF)	Total Solids	Specific gravity
Whole milk	7.00 ^a	3.80 ^a	5.00 ^a	0.7 ^a	9.50 ^a	16.50 ^a	1.030 ^b
Low-fat milk	0.10 ^b	3.90 ^a	5.10 ^a	0.7 ^a	9.70 ^a	9.80 ^b	1.036 ^a

Means with unlike superscript letters were significantly different ($\alpha=0.05$).

As shown in Table 2, Low fat control cheese resulted in the lowest yield, which might be related to the decrease in sum of the casein and fat contents of the cheese milk, which are the principle ingredients of cheese yield (Banks *et al.* 1989). On contrast, as the hydrocolloid concentration increased, the cheese yield increased with respect to the hydrocolloid type and concentration because of the water-binding property of the hydrocolloid and the increased moisture content (Mahmoud 1995). Xanthan cheeses (XG1 & XG2) was of the highest yield in all treatments, which followed behind FFC, while MD1 cheese was of the lowest yield. The effect of hydrocolloids is mainly due to the effective carbohydrate-based fat replacers having the ability to control the rheology of water based system and syneresis inhibition which ultimately increase the cheese yield (McMahon *et al.* 1996). This finding is in agreement with the results of Rahimi *et al.* (2007) for low fat Iranian white cheese and Kebary *et al.* (2006) for low fat Domiati cheese.

The composition of the all cheese samples are presented in Table 2. Moisture content was inversely related to the fat content of cheese milk. The FFC had the lowest moisture content, compared to the cheeses made from low-fat milk with or without hydrocolloids (as fat replacers). Because of the MNFS in cheese is related to milk fat, Ryhanen *et al.* (2001), reduced fat in milk, and thus in cheese, significantly reduced the level of MNFS and the ratio of moisture to protein (M:P).

Table 2 Yield and chemical composition of fresh LFC containing hydrocolloids compared with their corresponding FF & LF control cheeses

Components	Controls*				Treatments*				L.S.D
	FFC	LFC	MD1	MD2	TG1	TG2	XG1	XG2	
Yield (%)	31.30 ^a	14.48 ^a	16.08 ^g	17.42 ^f	18.00 ^e	19.40 ^d	23.60 ^c	25.40 ^b	0.1896
Moisture (%)	60.46 ^f	70.50 ^e	71.69 ^d	72.50 ^c	71.82 ^d	72.47 ^c	73.53 ^b	75.18 ^a	0.1896
M:P ratio	4.93 ^e	4.20 ^f	5.03 ^d	5.39 ^c	5.03 ^d	5.37 ^c	5.57 ^b	6.07 ^a	0.05474
MNFS (%)	74.91 ^b	70.85 ^f	71.96 ^e	72.76 ^d	72.08 ^e	72.74 ^d	73.78 ^c	75.41 ^a	0.1896
Fat / DM (%)	48.81 ^a	1.69 ^b	1.34 ^c	1.31 ^c	1.35 ^c	1.31 ^c	1.28 ^c	1.22 ^c	0.2448
Protein (%)	12.27 ^f	16.78 ^a	14.25 ^b	13.45 ^c	14.28 ^b	13.50 ^c	13.20 ^d	12.38 ^e	0.07741
Salt (%)	2.66 ^d	3.00 ^c	3.03 ^{bc}	3.05 ^{bc}	3.03 ^{bc}	3.05 ^{bc}	3.08 ^{ab}	3.12 ^a	0.05474
Ash/DM (%)	11.73 ^f	23.22 ^e	23.98 ^d	24.29 ^{cd}	23.95 ^{cd}	24.41 ^c	25.12 ^b	26.19 ^a	0.46120
Acidity (%)	0.18 ^a	0.19 ^a	0.18 ^a	0.19 ^a	0.18 ^a	0.19 ^a	0.20 ^a	0.20 ^a	0.05474
pH	6.56 ^a	6.48 ^b	6.45 ^{bc}	6.40 ^{bc}	6.42 ^{bc}	6.38 ^c	6.30 ^d	6.25 ^d	0.07741

Means with unlike superscript letters were significantly different ($\alpha=0.05$). *FFC= Full fat control cheese, *LFC= Low fat control cheese, *MD1= Low fat cheese with 0.5% (w/v) Maltodextrin, *MD2= Low fat cheese with 1.0% (w/v) Maltodextrin, *TG1= Low fat cheese with 0.5% (w/v) Gum Tragacanth, *TG2= Low fat cheese with 0.75% (w/v) Gum Tragacanth, *XG1= Low fat cheese with 0.07% (w/v) Xanthan Gum, *XG2= Low fat cheese with 0.1% (w/v) Xanthan Gum, M:P = Moisture : Protein Ratio MNFS= Moisture non-fat substances.

Supplementation of the low fat milk used in cheese making with hydrocolloids increased the amount of MNFS as well as the M:P ratio in low fat cheese to a point greater than that in FFC. The difference in moisture content between the FFC and the LFC could be attributed to their protein content; that is, the higher protein content of reduced-fat cheeses may have contributed to an increase of water-binding capacity of the cheese matrix (Romeih *et al.* 2002), leading to the increased moisture content.

Changes in F/DM as affected by reducing of fat content of LFC are shown in the same Table. Sample of FFC had the highest significantly ($P<0.001$) F/DM % compared to LFC. The F/DM decreased in all hydrocolloids cheese samples ($P<0.001$) in respect to LFC. The F/DM of low-fat cheeses with TG1 was insignificantly higher than those of all other hydrocolloid cheeses. Fat and moisture act as fillers in the CN matrix of cheese texture. When fat content decreased, the moisture did not replace the fat on an equal basis (Mistry, 2001). The increased moisture

content of low-fat cheeses induced a decrease in the fat content, leading to decrease fat/DM. Furthermore, supplementation of the low-fat milk used in cheese making with hydrocolloids increased the amount of MNFS in low fat cheese, which was proportional to hydrocolloid concentration. thus resulted in more decrease in F/DM of cheese supplemented with that hydrocolloid. These results of F/DM are in harmony with those of Shendi, *et al.* (2010) and Kebary, *et al.* (2006).

Cheese with reduced fat had much more protein ($P<0.001$) as reported in Table 2. Moreover, adding different hydrocolloids to low fat cheese milk markedly decreased ($P<0.001$) the TP/DM contents in their low fat cheeses (data are not shown). However, not only the increase of hydrocolloids concentration, but also the interaction of hydrocolloid type and concentration resulted in significant decrease of the contents of both protein and TP/DM of cheeses. This occurred because of an increase in moisture content caused by the hydrophilic properties of added hydrocolloids, and the

decrease in syneresis. Increasing the concentration of XG from 0.07 to 0.1% resulted in insignificant ($P>0.05$) effect on TP/DM. These results are in harmony with those reported by Koca and Metin (2004).

FFC had the lowest salt (data are not shown) and highest S/M content, compared to LFC, while XG, TG and MD cheeses had the highest salt values and the lowest S/M values (Table 2). Data indicated that the changes in the S/M contents depended significantly ($P<0.001$) on the moisture content of cheese matrix. This finding is in agreement with Romeih *et al.* (2002).

Significant increase in ash content (data are not shown) and ash/DM% of LFC was observed, compared with FFC. Likewise, cheeses containing hydrocolloids had different lower values than the respective LFC depending on the hydrocolloid type and concentration (Table 2). Similar results were reported for and Kebary *et al.* (2006). This might be due to the higher protein content of LFC than FFC and higher moisture content of hydrocolloid cheeses than LFC.

Regarding the acidity and pH, there were a slight variations with no significant ($P>0.05$) differences in acidity values between full-fat and low-fat cheeses, as well as LFC with hydrocolloids (Table 2). Value of pH of FFC was higher than that of LFC with or without hydrocolloids (Table 2). It could be seen that pH values were inversely related to moisture content of cheese, which explained the lower pH values of low fat cheese particularly, that made with Xanthan, compared to FFC. These results agreed with those reported by Kavas *et al.* (2004).

Texture profile parameters

As shown in Table 3, hardness (N) of cheese samples were significantly ($P<0.001$) increased by fat reduction. LFC was the hardest among all the tested cheeses, thus recorded the highest value. Hydrocolloids caused variable reduction in hardness, compared to LFC depending on their moisture content. Hardness of XG2 was decreased by more than 50% of that of the LFC.

Table 3 Texture profile parameters of LFC containing hydrocolloids compared with their corresponding FF & LF control cheeses

Items	Controls*				Treatments*				L.S.D
	FFC	LFC	MD1	MD2	TG1	TG2	XG1	XG2	
Hardness (N)	6.170 ^f	15.290 ^a	13.630 ^b	10.650 ^c	10.320 ^c	9.390 ^d	8.590 ^e	6.230 ^f	0.47720
Cohesiveness (Ratio)	0.600 ^{bc}	0.740 ^a	0.670 ^{ab}	0.650 ^{bc}	0.660 ^{bc}	0.640 ^{bc}	0.620 ^{bc}	0.590 ^c	0.07741
Gumminess (N)	3.700 ^f	11.310 ^a	9.130 ^b	6.920 ^c	6.810 ^{cd}	6.000 ^{de}	5.320 ^e	3.670 ^f	0.88600
Springiness (mm)	3.330 ^e	8.480 ^a	7.300 ^b	5.740 ^c	5.510 ^{cd}	5.040 ^{cd}	4.580 ^d	3.270 ^e	1.12300
Chewiness (N.mm)	0.900 ^a	0.750 ^b	0.800 ^{ab}	0.830 ^{ab}	0.810 ^{ab}	0.840 ^{ab}	0.860 ^a	0.890 ^a	0.10950
Resilience (Ratio)	0.578 ^d	0.679 ^a	0.660 ^{ab}	0.595 ^{cd}	0.650 ^{abc}	0.610 ^{bcd}	0.612 ^{bcd}	0.607 ^{bcd}	0.05474

Means with unlike superscript letters were significantly different ($\alpha=0.05$). *See Table 2.

Results in Table 3 show that the highest chewiness (N.mm) was in LFC. Cheese contained higher level of XG was of lower chewiness level than FFC. Hydrocolloids showed ability to lose the structure of the protein matrix of cheese containing them. Therefore, less energy is needed for chewing of the cheese in the mouth. Type of hydrocolloid and interaction between it and its concentration showed significant effect on chewiness, which might be

Thus, no significant difference ($P>0.05$) was observed between FFC and XG2 cheese. It was probably due to changes in protein matrix compactness since the addition of that hydrocolloid increased water binding capacity of protein matrix (Sipahioğlu *et al.* 1999 and Koca and Metin 2004).

Cheese Cohesiveness (Ratio) had similar hardness values trend, which increased by reduction of fat content to be the maximum for LFC and decreased by the presence of hydrocolloids in the cheese matrix (Table 3). Cohesiveness of LFC containing hydrocolloids might be attributed to the water-binding property of hydrocolloids that provides cheese matrix with more water. This finding agreed with El-Zeini *et al.* (2007).

Significant differences in gumminess (N) were observed within hydrocolloids treatments (Table 3), the concentration of hydrocolloids and the interaction between hydrocolloids and their concentrations significantly ($P<0.001$) affected it. Negative correlation was found between hydrocolloid and gumminess, while positive one was found between hydrocolloid concentration and gumminess. Similar observations were found by Rashidi *et al.* (2015) and Romeih *et al.* (2002). Differences in moisture and protein contents of various cheeses might be the reasons of the differences obtained in the gumminess values.

All of low fat cheeses characterized by lower springiness (mm) than FFC. This might be due to the increase of the hardness of cheese. Using hydrocolloids insignificantly ($P>0.05$) increased springiness of LFC, based on their type and concentration. It could be also observed that treatment containing 0.1% XG showed close value to FFC springiness (Table 3). This might be due to the relationship between moisture and hardness and their effects on the protein microstructure existed for springiness and are responsible for losing the ability of the cheese to recover its original state. Similar findings were reported by Zisu and Shah (2005).

attributed to the water retention property of hydrocolloids which caused less hardness and in turn less chewiness. These results are in accordance with previous reported by El-Mahdy 2011 Zisu and Shah 2005 and Koca and Metin 2004).

Resilience showed insignificant decreased ratio indicating less visco-elastic properties in fresh cheese. FFC had the maximum reduction in resilience value than all LFC. While LF control cheese had the highest

value, LFC made with hydrocolloids improved their resilience texture parameters particularly XG2 followed by XG1.

Results in Table (4) showed that LFC and cheeses of different hydrocolloids treatments were of significantly higher total counts (TVBC), proteolytic (PBC), and lipolytic (LBC) bacteria as well as molds and yeasts than that of FFC (LSD value = 0.3462 at $\alpha = 0.050$). This might be ascribed to the increase of moisture content (water activity of cheese "a_w" participates in chemical / biochemical reactions and growth of micro-organisms (Beuchat 1983), as a result of fat reduction and water retention property of hydrocolloid. Meanwhile, the hydrocolloids are prebiotics that may promote support the stability, growth and activities of the cheese microflora (Karlton-Senaye 2013). The physical retention of micro-organisms in the curd, when whey is expels off, allows for the 1 log increase in the count, the remaining being due to microbial multiplication Tatini *et al.* (1971). It was confirmed that bacteria in dairy foods invariably locate on or in close proximity to the fat-protein interface or in contact with whey pockets Hickey *et al.* (2015). Proteolytic bacteria

counts of control and experimental cheeses were higher than the lipolytic bacterial count; which might be attributed to their initial counts in cheese milk and the resistance for cheese process and conditions. This trend of microbial groups count confronted with that of Fayed (2006). Significant differences were found between hydrocolloids and their concentrations with proteolytic and lipolytic bacteria counts. While they had the same trend as TVBC for hydrocolloids cheese, the maximum load was found with XG2 and the minimum with FF control cheese. Proportional relationships were found between hydrocolloids and proteolytic and lipolytic bacteria counts (0.871 and 0.715, respectively). Counts of molds & yeasts of all cheese samples had also similar trend of the other groups and were lower than previously mentioned by Metry (2010), and also lower than the permitted count (400 cfu/g) in the Egyptian Standards ES, (2005), and exhibited similar order with that of Fayed *et al.* (2006). No colonies of coliform group were detected in any treatment or control samples which agreed with that of Metry (2010) and confirms that the examined cheeses were made from pasteurized milk and under hygienic condition.

Table 4 Microbial groups count (cfu/g) of fresh LFC containing hydrocolloids compared with their corresponding FF & LF control cheeses.

Microbial Group	Controls*				Treatments*				L.S.D
	FFC	LFC	MD1	MD2	TG1	TG2	XG1	XG2	
TVB x10 ⁶	5.2 ⁱ	7.5 ^e	8.2 ^d	8.6 ^{bc}	8.4 ^{cd}	8.5 ^{bcd}	8.8 ^b	9.2 ^a	0.3462
PB x 10 ³	20.2 ^h	27.8 ^g	31.9 ^f	36.3 ^c	33.4 ^e	35.6 ^d	39.6 ^b	48.5 ^a	0.3462
LB x 10 ³	1.64 ^h	2.87 ^g	4.55 ^e	4.89 ^b	4.62 ^d	4.71 ^c	4.16 ^f	5.23 ^a	0.3462
M & Y x10	0.25 ⁱ	0.48 ^e	0.72 ^d	0.86 ^b	0.77 ^{cd}	0.81 ^{bc}	0.79 ^c	0.93 ^a	0.05474

Means with unlike superscript letters were significantly different ($\alpha = 0.05$). *See table 2.

From the data in Table (5), it could be observed that the score of the three sensory parameters (appearance, body & texture and flavor), as well as the total scores of control FFC were the highest, as compared to control LFC and that containing hydrocolloids. FFC received the highest total score, and the best perception for the all sensory attributes, while LFC had the lowest total score, and the worst perception for the same attributes.

The reduction in fat content significantly affected the appearance, texture, flavor and the overall acceptability of the cheese. Adding hydrocolloids to low fat cheese milk significantly improved all sensory parameters to gain higher total scores. Fresh low-fat cheeses also had pronounced saltiness, compared with FFC. It could also be noted that no off-flavor or bitterness was detectable by any member of the panel for the fresh low fat white soft cheese. By hydrocolloids added, appearance of treatment cheeses was developed and scored higher points than that of their LF control

cheese. FFC had also clean appearance and typical whiteness color of standard Egyptian white soft cheese while LFC had translucent appearance and less whiteness color tend to slight blueness, which showed less blueness by hydrocolloids added. Fat reduction caused mainly changes in color and appearance of cheese because the lack of fat gives opacity to cheese. The flavor lack of LFC might be ascribed to the lower sensory threshold of hydrophobic flavor components in water than they do in oil and their less amount when fat molecules are extracted from milk before it is made Mohamed, A. G. (2015). It possibly resulted from flavor dilution because of excessive moisture retention Sipahioglu *et al.* (1999). The significant role of fat in cheese is to impart the discontinuity of the protein matrix Rogers, *et al.* (2010), improve the texture, flavor and cheese yield Sipahioglu *et al.* (1999). The current results are in agreement with those of Rashidi *et al.* (2015), Rahimi *et al.*, (2007), Fayed *et al.* (2006); Koca and Metin (2004).

Table 5 .Organoleptic properties of fresh LFC containing hydrocolloids compared with their corresponding FF & LF control cheeses.

property	Controls*				Treatments*				L.S.D
	FFC	LFC	MD1	MD2	TG1	TG2	XG1	XG2	
App. (15)	13.09 ^a	10.18 ^g	11.82 ^f	12.06 ^e	12.23 ^d	12.87 ^b	12.36 ^c	13.07 ^a	0.05474
B & T (50)	46.17 ^a	34.45 ^h	43.93 ^g	44.17 ^f	45.33 ^e	45.87 ^c	45.81 ^d	46.05 ^b	0.05474
Flavor (35)	32.54 ^a	25.64 ^h	29.52 ^g	31.18 ^d	30.61 ^f	31.74 ^c	30.89 ^e	31.92 ^b	0.05474
Total (100)	91.80 ^a	70.27 ^h	85.27 ^g	87.41 ^f	88.17 ^e	90.48 ^c	89.06 ^d	91.04 ^b	0.05474

Means with unlike superscript letters were significantly different ($\alpha = 0.05$). *See table 2.

From the previous results of organoleptic attributes, it can be noticed that the appearance, body & texture and flavor as well as total scores of treatment cheeses samples were significantly affected by using hydrocolloids as fat replacer in Egyptian style LF white soft cheese making.

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إستخدام الغرويات المائية لتحسين صفات الجبن المصري الأبيض الطرى منخفض الدهن
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تم دراسة التركيب الكيميائي والخواص الحسية والريولوجية والميكروبيولوجية للجبن الأبيض الطرى منخفض الدهن (الطازج) المصنع من لبن فرز جاموسى يحتوى على غرويات مائية كبدائل دهنية ٠.٠٧ ، ٠.١ ، ٠.٥ % صمغ زانثان و ٠.٧٥ ، ٠.٥ % صمغ كثيرىاء و ١ ، ٥ % ملتودكسترين مع المقارنة بجبن الكنترول الخالى من تلك البدائل والمصنع من لبن فرز وأيضاً من لبن كامل الدسم . أظهر جبن الكنترول منخفض الدهن إنخفاضاً واضحاً فى نسبة التصافى وقيم الـ F/DM و M:P و MNFS بينما حدثت زيادة معنوية فى المحتوى الرطوبى و الـ P/DM و Ash/DM و الـ pH على الرغم من أن الجبن المحتوى على بدائل دهنية (غرويات مائية) أظهر إرتفاعاً فى قيم الرطوبة والتصافى حسب النوع والتركيز مقارنة بجبن الكنترول منخفض الدهن . كما أظهرت متوسطات قيم التحليل الريولوجى تحسن جيد فى قوام الجبن عند إضافة هذه الغرويات و كان هذا واضحاً أيضاً فى تحكيم وتقييم الجبن حسية حيث حصلت على درجات أعلى فى جميع الخواص الحسية متفوقة على مثيلتها بدون الغرويات . وعلى نفس المنوال أدى إستبدال دهن اللبن بالبدائل الدهنية إلى زيادة كلا من العدد الكلى للبكتريا والبكتريا المحللة للدهن والبكتريا المحللة للبروتين وكذلك أعداد الفطر والخميرة . مجملاً لوحظ أن جبن الكنترول كامل الدسم أكثر مرونة وأقل ملوحة وأعطى درجات طعم ورائحة أعلى من جميع المعاملات قليلة الدسم . كما أوضحت النتائج تحسن ملحوظ فى جميع الخواص الحسية للجبن منخفض الدهن بعد إضافة تلك الغرويات والتي ارتبطت بالتحسن فى خواصها الريولوجية وكذلك مكونات التركيب الكيميائى المؤثرة فى تلك الخواص ، وأدى ذلك إلى حصول الجبن المحتوى على الزانثان إلى درجات تحكيم قريبة من مثيلتها المصنعة من اللبن كامل الدسم ، ويشير ذلك إلى إمكانية تصنيع الجبن الطرى منخفض الدهن مع التحسن الواضح فى درجة قبوله بنجاح فى وجود صمغ الزانثان