

EFFECTS OF ACETYLATION AND SUCCINYLATION ON FUNCTIONAL PROPERTIES OF WHEY PROTEIN CONCENTRATES

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Summary

Three types of whey protein concentrates were prepared, one was prepared from sweet salted whey by heat precipitation (SWPC) and the other two were prepared from acid whey, one of them was obtained by heat precipitation (AWPC) and the third one was prepared by ultrafiltration (FWPC). The three types of whey protein concentrates were acylated to various degrees by acetic and succinic anhydrides. Functional properties were assessed. Increasing the concentration of acetic and succinic anhydrides increased the extent of chemical modification of whey protein concentrates. All the types of whey protein concentrates behaved similarly. Acylation of whey protein concentrates increased protein solubility in different solutions, fat absorption, water absorption, emulsification capacity and foam capacity, while decrease the foam stability. Water and fat absorption increased by increasing the levels of acetic or succinic anhydride, while emulsification capacity increased with increasing the level of acid anhydrides up to 0.6 gm acid anhydride / gm protein, then decreased. Acetylated whey protein concentrate exhibited higher modification rate, water and fat absorption, protein solubility index, emulsification and foam capacity than those of corresponding succinylated whey protein concentrates. FWPC showed the best functional properties. Acetylated FWPC at 0.6 gm acetic acid anhydride / gm protein was the best treatment.

Key words: Whey protein concentrate, Chemical modification, Acetylation, Succinylation, Functional properties.

EFFECTS OF FORTIFICATION OF COWS MILK WITH ACETYLATED WHEY PROTEIN CONCENTRATES ON THE QUALITY OF SET YOGHURT

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Summary

Two types of acetylated whey protein concentrates (WPC) were prepared, one by heat precipitation from salted sweet whey (ASWPC) and the another one by ultrafiltration of sweet whey (AUFWPC). Nine treatments of yoghurt were made to study the effect of fortification of cow's milk with acetylated WPC on the quality of yoghurt at a ratios between 1 and 4%. Total solids, total protein, ash, non protein nitrogen and diacetyl (DA) and acetyl methyl carbinol (AMC) contents, curd tension and scores of organoleptic properties increased, while whey syneresis decreased by fortification of cow's milk with acetylated whey protein concentrates (AUFWPC and ASWPC). Yoghurt treatments fortified with AUFWPC contained higher total solids, non protein nitrogen, DA, AMC, lower total protein and whey syneresis than those of the corresponding treatments fortified with ASWPC. Titratable acidity was not affected either type of WPC used to fortify the milk. Total solids, total protein, non protein nitrogen and ash content did not change significantly during the storage period at 6°C; however, the acidity increased as storage period proceeded. DA and AMC increased, while whey syneresis decreased up to the 6th day of the storage period, thereafter DA and AMC decreased, whilst whey syneresis increased up to the end of storage period. Organoleptic scores of yoghurts fortified with ASWPC up to 2.0% or AUFWPC up to 3% were not significantly different from those of the control yoghurt. The yoghurt fortified with 2.0% AUFWPC gained the highest scores of organoleptic properties and was the most acceptable product.

Key words: Whey protein concentrate, Acetylation, Whey syneresis, Fortification.

INFLUENCE OF SOME NUTRIENTS AND BILE SALT ON THE PRODUCTION OF ANTIMICROBIAL AGENTS BY BIFIDOBACTERIA

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SUMMARY

Seven strains of bifidobacteria were screened for their inhibitory activity. *Bif. bifidum* ATCC29521, *Bif. bifidum* ATCC15696, *Bif. longum* NCFB2299, *Bif. longum* BL-04, *Bif. infantis* ATCC15567, *Bif. catenulateum* ATCC18371 and *Bif. lactis* BL-01 produced antimicrobial substances with a wide spectrum of antimicrobial activity. Cell free culture of all bifidobacteria strains inhibited strongly the growth of *E. coli* ATCC69337, *Staphylococcus aureus* ATCC20231, *Bacillus cereus* ATCC33018, *Pseudomonas aeruginosa* ATCC9027, *E. coli* 0157-H7, *Staph. aureus*, *Bacillus cereus*, *Salmonella typhi* and *Salmonella enteritidis* and slightly the growth of lactic acid bacteria. Supplementation of media with cysteine + glycine, inulin, hydrolyzed whey protein, whey protein hydrolysate, tomato juice and carrot juice increased the production of antimicrobial agents by all bifidobacteria strains, while bile salt decreased their production. The increase or decrease of antimicrobial agents production was proportional to the rate of supplementation. *Bif. longum* BL-04 and *Bif. bifidum* ATCC 29521 exhibited the highest inhibitory activity. It seems that the production of antimicrobial agents by bifidobacteria is species and strain dependent.

Key words: Antimicrobial agents, bifidobacteria, nutrients, fortification, bile salt.

MANUFACTURE OF LOW FAT DOMIATI CHEESE USING NOVAGEL®

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SUMMARY

Seven batches of low fat Domiati cheese were made to study the effect of adding Novagel® (a carbohydrate-based fat replacer) on the quality of Domiati cheese. Control cheese was made from buffaloes' milk standardized to 4% fat, Another three batches were made from the same milk which was standardized to 3% and Novagel® was added at the rate of 0.0, 0.5 and 1.0% respectively. The other three batches from milk containing 2.0% fat and Novagel® was added at the rate of 0.0, 1.0 and 1.5% respectively. Cheeses were pickled for 90 days in refrigerator (6 – 8°C). The data were analyzed statistically. Reduction of fat in cheese milk caused a significant decrease in cheese yield, moisture, fat, acidity, water soluble nitrogen, total volatile fatty acids (TVFA) total calories and scores of organoleptic properties, while increased total nitrogen and ash content. Incorporation of Novagel® into cheese increased cheese yield, moisture, acidity, soluble nitrogen, TVFA and scores of organoleptic properties, while decreased the total calories, but did not affect the total nitrogen, fat and ash contents of cheese. Fat, ash, acidity, soluble nitrogen and TVFA contents and scores of organoleptic properties increased as pickling period progressed, while cheese yield, moisture and total nitrogen contents decreased. Control cheese and cheese treatments that made from milk standardized to 3.0 and 2.0% fat with adding 1.0 and 1.5% Novagel® respectively gained the highest scores for organoleptic properties and were not significantly different from each other. That means it is possible to make a good quality low fat Domiati cheese from 2.0% fat milk, which means reducing the fat to 50% and reducing the total calories by 18.5%.

Key words: low fat, Domiati cheese, Novagel®, fat replacer, calories.

IMPACT OF ADDING AVICEL ON THE QUALITY OF LOW FAT DOMIATI CHEESE

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SUMMARY

The effect of incorporating a carbohydrate-based fat replacer on the quality of low fat Domiati cheese was studied. Control cheese treatment was made from milk standardized to 4.0% fat and salted with 7.0% other three batches were made from milk standardized to 3.0% fat with adding Avicel[®] at the rate of 0.0, 0.5 and 1.0%, respectively, while the other three batches were made from milk standardized to 2.0% with adding Avicel[®] at the rate of 0.0, 1.0 and 1.5%, respectively. Cheeses were pickled for 90 days in refrigerator ($6 \pm 2^{\circ}\text{C}$) and were sampled every 15 days for some chemical analysis and sensory evaluation. Incorporation of Avicel[®] caused a significant increase of yield %, moisture %, acidity %, water soluble nitrogen (SN) %, total volatile fatty acids (TVFA) contents and total scores of organoleptic properties, while decreased the total energy and did not affect the fat, total nitrogen and ash contents of cheese. Reducing of milk fat caused a significant decrease in yield, moisture, fat, acidity, SN, TVFA, total energy and total scores of organoleptic properties, while increased in both total nitrogen and ash contents. Yield, moisture and total nitrogen content decreased as pickling period proceeded while fat, ash, acidity, SN, TVFA, total energy and total scores of sensory evaluation increased. Cheese treatment made from milk containing 3.0% fat with adding 1.0% Avicel[®] and control cheese gained the highest scores and were not significantly different from each other, also cheese made from milk containing 2.0% fat with adding 1.5% Avicel[®] was accepted.

Key words: fat replacer, Avicel[®], low fat Domiati cheese.

INCORPORATING BIFIDOBACTERIA IN LOW FAT LABNEH

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Abstract

Preparation of low fat labneh containing inulin and bifidobacteria of acceptable quality was investigated. Labneh was made from buffalo's milk (4% fat), buffalo skim milk and buffalo milk 1, 2 and 3% fat supplemented with 4, 3, 2 and 1% inulin as carbohydrate fat replacer, respectively. Labneh from different treatments was stored at 8°C for 12 days. Addition of inulin increased the yield of labneh. Development of acidity and changes in the sensory properties and chemical composition of labneh were followed during storage. Addition of inulin up to 3% did not affect the acceptability of low-fat labneh. The use of bifidobacteria in low-fat labneh (1% fat and 3% inulin) was then investigated. *Bifidobacterium bifidum* ATCC 29521 and *Bifidobacterium infantis* ATCC 15567 were used in the ratio of 1.0 and 1.5% to replace 33.3 and 50.0% of the yoghurt starter (3%) used in the manufacture of labneh. The use of bifidobacteria in labneh did not affect significantly the gross composition of labneh, but decreased the developed acidity and total bacterial count. Labneh made with the use of bifidobacteria ranked high scores for sensory attributes during storage particularly that made with *B. infantis*. Low fat symbiotic labneh of acceptable quality can be made using buffalo milk (1% fat) and addition of 3% inulin and use of up to 50% replacement of yoghurt starter with *B. infantis*.

Key words: low fat Labneh, inulin, probiotic, prebiotic, symbiotic.

Manufacture of probiotic yoghurt from cow's milk fortified with butter milk

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Abstract

Effect of partial (50, 67%) replacement of the yoghurt starter with *Bifidobacteria bifidum* and *Bifidobacteria infantis* on the quality of yoghurt and viability of bifidobacteria were studied. The gross composition of yoghurt was not affected significantly ($p > 0.05$) with changing the starter used, but the titratable acidity, whey syneresis, viscosity, curd tension, total bacterial, lactobacilli and streptococci counts decreased, and while, diacetyl and acetyl methyl carbinol (DA + AMC) content, sensory scores and counts of bifidobacteria increased being proportional to the ratio of added bifidobacteria. Fresh control yoghurt gained the highest scores for sensory properties as compared to yoghurt made with the use of bifidobacteria and decreased thereafter while the scores of yoghurts treatments made by adding bifidobacteria increased up to the 6th day then decreased as storage period progressed. Stored yoghurts made by adding 67% bifidobacteria were the most acceptable yoghurt treatments, with no significant differences between yoghurt made with *Bif. bifidum* or *Bif. infantis*.

Key words: butter milk, cow's milk, probiotic, yoghurt, bifidobacteria.

Preparation and properties of novel functional yoghurt from buffalo milk

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Abstract

Effects of hydrolyzing lactose and addition of bifidobacteria on the quality of yoghurt that made from 2% fat buffaloe's milk supplemented with 1.0% inulin were studied. The total solids (TS), total protein (TP), fat and ash contents were not changed significantly either by hydrolyzing lactose or addition of bifidobacteria. Adding bifidobacteria increased total volatile fatty acids (TVFA), diacetyl (DC) and acetyl methyl carbinol (AMC) and improved the acceptability of yoghurt, while it decreased syneresis, developed acidity and total bacterial (TBC), lactobacilli (LC) and streptococci counts (SC). Hydrolysis of lactose caused a significant increase in bifidobacterial and TBC, acidity, syneresis, TVFA, DC and AMC contents and scores of sensory attributes. Yoghurt made by adding *Bif. bifidum* on *Bif. longum* were not significantly different. The TS, TP, fat and ash contents were almost unchanged during storage at $6 \pm 1^{\circ}\text{C}$ for 12 days, while the titratable acidity and TVFA increased. Whey syneresis in all yoghurts decreased while the DC and AMC contents increased up to the 6th day and the reverse was found up to the end of storage period. Scores of sensory attributes were almost unchanged during the first 6 days of storage, then decreased with advanced storage. Yoghurts made from hydrolyzed lactose milk with replacing 67.0% of normal yoghurt starter with either *Bif. bifidum* or *Bif. longum* gained the highest total scores as compared to other treatments.

Key words: Inulin, bifidobacteria, prebiotic, probiotic, symbiotic, low fat, low lactose.

Manufacture of replacing skim milk with dried butter milk on ice milk quality

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Abstract

Effect of substituting skim milk powder was used as source at milk solid not fat in the manufacture of ice milk with butter milk powder on the quality of ice milk was studied. Five ice milk batches were made. Skim milk powder was replaced in these batches with dried butter milk at the rate of 0.0 (C), 25% (T₁), 50% (T₂), 75% (T₃) milk powder with butter milk powder did not affect significantly ($p \leq 0.05$) the weight per gallon, specific gravity, titratable acidity and viscosity of ice milk mixes. Also, total solids, total protein, ash, fat contents, titratable acidity and pH values of ice milk did not affect with replacement of skim milk with butter milk. Overrun, melting resistance increased, while specific gravity and weight per gallon of ice milk decreased by increasing the rate of replacement. Replacement of skim milk up to 75% with butter milk improved the acceptability of ice milk. Ice milk treatment that made with replacing 75% of skim milk with butter milk gained the highest score for organoleptic properties.

Key words: Ice milk, dried butter milk, skim milk powder.

Manufacture of low fat Domiati cheese using fat mimetics

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Abstract

Seven Domiati cheese treatments were made to study the effect of fat replacers on cheese quality. Control cheese was made from buffaloe's milk standardized to 5.0% fat. Another six cheese treatments were made by replacing 20, 40 and 60% of milk fat by either Dairy-Lo[®] (a protein based fat replacer) or Litesse[®] (a carbohydrate based fat replacer) individually. Replacement of milk fat with fat replacers caused a pronounced increase in moisture content and decrease in total calorific values of cheese treatments. Using Dairy-Lo[®] increased the protein content, while using Litesse increased the total carbohydrate content of cheese treatments. Cheese treatments those made by replacing milk fat with Dairy-Lo[®] contained higher total volatile fatty acids (TVFA), water soluble nitrogen (WSN) and were more acceptable than corresponding cheese treatments those made by adding Litesse[®]. Cheese treatment that made by replacing 40% milk fat with Dairy Lo[®] contained the highest TVFA, WSN and was the most acceptable cheese. Moisture and total nitrogen contents decreased during pickling period, while fat, ash, TVFA, WSN, calorific value, titratable acidity and scores of organoleptic properties increased of all cheese treatments.

Key words: Low fat, Domiati cheese, fat replacers, Dairy-Lo[®], Litesse[®].

Ice milk quality attributes as affected by trypsinized whey proteins

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SUMMARY

Two types of trypsin modified whey protein concentrates were prepared, one from whey protein precipitated by heat treatment of salted sweet whey (mSWPC) and the another one by ultrafiltration of acid whey (mFWPC). Nine treatments of vanilla ice milk were made to study the effect of replacing non-fat dry milk with enzyme modified WPC on the quality of ice milk. Replacement of non-fat dry milk with trypsin modified WPC caused a significant increase in moisture, total protein, non protein, nitrogen, viscosity, specific gravity and weight per gallon of ice milk mixes and melting resistance and pH values of ice milk and this increase was proportional to the rate of replacement. Ice milk mixes made by adding mFWPC were not significantly different from those made by adding mSWPC. Substitution of non-fat dry milk with trypsin modified whey protein concentrates up to the rate of 50% increased the overrun, while increasing the substitution rate above that, caused a significant decrease in the overrun of ice milk. Specific gravity and weight per gallon of ice milk decreased by replacing non-fat dry milk with trypsin MWPC up to the rate of 50% then increased by increasing the replacing rate above that. Replacing up to 50% increased the scores of organoleptic evaluation, while increasing the replacing rate to 75 or 100% decreased the scores of organoleptic evaluation of ice milk. Scores of organoleptic properties did not changed significantly during storage, while pH values decreased during the first four weeks of storage, then were unchanged.

Key words: Ice milk, modified whey proteins, trypsin, salted whey, acid whey.

Manufacture of yoghurt from cow's milk fortified with butter milk

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ABSTRACT

The effect of replacing skim milk powder that used to fortify cow's milk with spray dried butter milk on the quality of yoghurt was studied. Control yoghurt was made from 3.0% fat cow's milk fortified with 3% skim milk powder. Four treatments were made from that milk, but skim milk powder was replaced by butter milk at the rate of 25, 50, 75 and 100%.

Replacement of skim milk powder with butter milk did not affect significantly total solids, total protein, ash contents, titratable acidity, viscosity and curd tension of the resultant yoghurt treatments. Whey syneresis decreased, while diacetyl and acetyl methyl carbinol (DA + AMC) increased by replacing skim milk powder with butter milk and this increase or decrease was proportional to the rate of replacement. Replacement of skim milk powder with butter milk up to 50% did not affect the scores of organoleptic properties, while increasing the replacement rate above that decreased those scores. Scores of organoleptic properties did not change significantly during the first 6 days of storage, then decreased slightly up to the end of storage period. Total solids, total protein, fat, ash contents did not change significantly during storage, while titratable acidity increased. Diacetyl and acetyl methyl carbinol increased as storage period proceeded and reach their maximum values at the sixth day then decreased up to the end of storage period. Whey syneresis decreased during the first 6 days of storage period, then increased up to the end of storage period. Total bacterial, lactobacilli and streptococci counts increased during the first 3 days of storage period, then decreased up to the end of storage period.

Key words: Yoghurt, cow's milk, skim milk powder, butter milk.

UF “Tallaga” cheese quality made by incorporating bifidobacteria and different salting rates

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SUMMARY

Nine UF “Tallaga” cheese treatments were made, to three of them salt was added at the rate of 3%, one of them was served as control and to the other two *Bif. bifidum* ATCC 29521 and *Bif. longum* BL-04 were added individually. Another three treatments were made as described above except salt was added at the rate of 4%. The other 3 cheese treatments were made as above except salt was added at the rate of 5.0%. Obtained results showed that, increasing salting rate from 3 to 5 caused a significant decrease in ripening indices [water soluble nitrogen (WSN), Shilovich number and total volatile fatty acids (TVFA)], also total scores of sensory evaluation, bifidobacterial counts while increased the salt, ash content and pH value. Moreover, cheese treatments made by adding 3% salt were not significantly different from corresponding cheese treatments made by adding 4% salt. Incorporation of bifidobacteria increased the ripening indices, total score of organoleptic evaluation, acidity, but did not affect significantly fat, total protein, ash and salt contents of cheese. Cheese treatments made by incorporating *Bif. longum* were not significantly different from corresponding cheese treatments made by incorporating *Bif. bifidum*. Total counts of bifidobacteria increased up to the 1st week then decreased till to the end of storage period. Cheese treatments those made by adding 4% salt and incorporating bifidobacteria were the most acceptable cheese and even after storage for 4 weeks contained bifidobacterial counts higher than that should be present to achieve their health benefits.

Key words: UF “Tallaga” cheese, bifidobacteria, probiotic bacteria, salting rate.

IMPROVING QUALITY OF KAREISH CHEESE BY GAMMA IRRADIATION.

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Abstract

This investigation aims to study the possibility to utilize gamma irradiation to prolong the shelf-life of Kareish cheese. Kareish cheese was made from Fresh buffalo's skim milk, and subjected to γ -irradiation with 1.5, 2.5 and 3.5 kGy, and stored at refrigerator. During cold storage, the sensory, microbial and chemical properties of control Kareish cheese and treated one were evaluated. The obtained results indicated that, the total counts of bacteria, molds and yeasts were decreased by applied treatments in zero time which reached to 74%, 76% and 80% for 1.5, 2.5 and 3.5 kGy in total counts of bacteria respectively and 66.67, 77.78 and 88.89% for 1.5, 2.5 and 3.5 kGy respectively in molds and yeasts. During storage, the overall acceptability scores of each treatment were gradually decreased by increasing the storage periods, while a gradually increase in acidity, total nitrogen and soluble nitrogen of all treatments and observed decreased in moisture content and pH value. In addition 1.5, 2.5 and 3.5 kGy prolonged the shelf-life of Kareish cheese to 42, 48 and 54 days compared to 12 days for control sample.

Effect of fortification ingredients on the quality of yoghurt made from cow's milk

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ABSTRACT

Effect of replacing non-fat dry milk that used to fortify cow's milk in making yoghurt with either milk protein concentrate or whey protein concentrate or inulin were studied. Control yoghurt treatment was made from 3.0% fat cow's milk that was fortified with 3.0% non-fat dry milk. Another 12 yoghurt treatments were made by replacing 25, 50, 75 and 100% of non-fat dry with either milk protein concentrate or whey protein concentrate or inulin respectively. Replacement of non-fat dry milk with other ingredients did not affect significantly (0.05) the total solids and fat contents of yoghurt treatments. Protein and ash content increased by replacing non-fat dry milk with milk protein concentrates, while using inulin to replace non-fat dry milk caused a significant decrease in total protein and this increase or decrease was proportional to the rate of replacement. Replacing of non-fat dry milk with milk protein concentrate caused a significant increase in titratable acidity of yoghurt treatments, while replacing of non-fat dry milk with inulin up to 50% increased yoghurt acidity. Increasing the rate of replacing non-fat dry milk with inulin up to 50% increased total volatile fatty acids, while treatments those made using milk protein concentrate and whey protein concentrate were not significantly different from control yoghurt treatments. Replacement of non-fat dry milk with either inulin or whey protein concentrate caused a significant reduction in whey syneresis. On the other hand, curd tension of yoghurt increased by replacing non-fat dry milk with either milk protein concentrate or inulin. Yoghurt treatment that made by replacing 50% of non-fat dry milk was the most acceptable yoghurt treatments and were not significantly different from yoghurt treatments those made by replacing 25 and 50% of non-fat dry milk with milk protein concentrate.

Key words: Inulin, non-fat dry milk, milk protein concentrate, whey syneresis, prebiotic.

MANUFACTURE OF LOW FAT PREBIOTIC YOGHURT

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ABSTRACT

Effect of replacing milk fat with inulin on the chemical, rheological, microbiological and sensory properties of probiotic yoghurt was studied. Control yoghurt was made from buffalo's milk that standardized to 4.0% fat. Two treatments were made from buffalo's milk standardized to 3.0% fat and inulin was added to them at the rate of 1.0 and 0.5%, respectively. Another two treatments were made from buffalo's milk standardized to 2.0% fat and inulin was added to them at the rate of 2.0 and 1.0% in the same order. The other two treatments were made from buffalo's milk standardized to 1.0% fat and inulin was added to them at the rate of 3.0 and 1.5% successively. Replacement of milk fat with the same amount of inulin did not affect significantly ($p > 0.05$) the total solids, total protein and ash content of low fat prebiotic yoghurt, while total solids content decreased when the amount of inulin was decreased. Replacement of milk fat with inulin caused a significant ($p \leq 0.05$) increase in total carbohydrate content, diacetyl, acetyl methyl carbinol, curd tension and acidity, while total energy and whey syneresis decreased of the resultant yoghurt treatments. Those yoghurt treatments made from 3.0 and 2.0% fat milk with adding 1.0% inulin were the most acceptable samples. Also, adding inulin stimulate the growth of total bacterial lactobacilli and streptococci. On the other hand, total solids, total protein, fat, ash and carbohydrate contents and calorific values did not change in yoghurt samples during storage, at $6 \pm 1^\circ\text{C}$ for 12 days, while titratable acidity and total volatile fatty acids increased at the same conditions. Whey syneresis of all yoghurt treatments decreased until the 6th day of storage then increased later on. Diacetyl and acetyl methyl carbinol increased up to the 6th day of storage then decreased as storage period progressed. Scores of sensory evaluation were almost stable during the first 6 days of storage period then decreased slightly until the end of storage period. Total bacterial, lactobacilli and streptococci counts of all yoghurt treatments increased up to the 3rd day of storage period then decreased until the end of storage period.

Key words: Low fat, yoghurt, prebiotic, inulin, fat replacers.