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ADA	:	American Dietetic Association
EU	:	Europe united
USA	:	united States American
A. O. A. C.	:	Association of official analytical chemists
A. P. H. A.	:	American public health association
C F U	:	Cell forming unit
FIL-IDF	:	Fédération internationale de laiterie- International dairy federation
D.M	:	Dry Matter
W S N	:	Water Soluble Nitrogen
T S	:	Total Solids
T A	:	Titratable Acidity
TPC	:	Total Plate Count
LAB	:	Lactic Acid Bacteria

Table (27): Effect of mucilage ratios on organoleptic properties of low fat yoghurt during storage period at 5-7ºC.

Treatment	Storage period (days)	Properties			
		Flavor (50)	Body& texture (40)	Appearance (10)	Total (100)
C	0	47.2	39.1	9.3	95.6
	15	47.43	38.57	9.14	95.14
	30	47.2	39.1	9.3	95.60
	60	47.75	38.25	8.88	94.88
T_1	0	44.8	37.7	9.2	91.7
	15	46.71	73.57	9.29	93.57
	30	47.22	38.11	9.11	94.44
	60	46.63	37.75	8.88	93.25
T_2	0	43.57	35.14	8.29	87
	15	46.9	35.1	8	90
	30	45.63	37.13	9.00	91.75
	60	45.38	35.88	8.29	89.55
T_3	0	45.6	35.4	7.9	88.9
	15	45.57	35.71	8.43	89.71
	30	45.45	38.19	8.64	92.28
	60	45.55	36.19	8.04	89.78

5- SUMMARY AND CONCLUSIONS

This work was carried out to investigate the possibility of using of certain fat replacers (e.g., Inulin, whey protein concentrate and Okra mucilage) in manufacture some low-fat dairy products(e.g., Yoghurt and white soft cheese) , and study the effect of addition of fat replacers on chemical, microbiological and sensory properties of dairy products during storage at refrigerator temperature.

The results obtained could be summarized as follows:

❖ Inulin as a fat replacer:

I. Yoghurt:

1- The total solids and titratable acidity % of yoghurt were increased with increasing of inulin and with progressing the storage period at 5-7ºC up to the 7 days in all treatments.

2- Total protein content decreased by increasing the levels of inulin. On the other hand, the total protein contents increased in all treatments as the storage period progressed.

3- The water soluble nitrogen contents of inulin yoghurt were increased in all treatments with increasing the storage period.

4- The fortification of low fat yoghurt with inulin as fat replacers did not affect the fat content of the resultant yoghurt.

5- Replacement of milk fat with inulin caused a significant decrease of whey syneresis from curd and this reduction was proportional to the rate of replacement of inulin.

6- The total plate and lactic acid bacteria counts increased as storage period progressed up to the third day, and then decreased up to the end of storage period. However, the count of total plate counts and

lactic acid bacteria increased by increasing the rate of adding inulin.

7- The coliform bacteria were not detected in fresh and at the end of the storage period in all treatments.

8- The yeasts and moulds were not detected during the first three days of storage, but they increased slightly thereafter till the end of storage period.

9- The Fortification of skim milk with inulin improved the organoleptic properties of yoghurt. Treatment that made from skim milk fortified with 1.2% was not different from yoghurt that made from whole milk (C_1).

II. White soft cheese:

1- The titratable acidity % content of all resultant cheese treatments increased sharply during the first 30 days of the storage period and then increased gradually up to the end of the storage period. Also, results show that cheese treatments which made by adding inulin had higher titratable acidity than those of corresponding cheese treatments made without adding inulin.

2- The cheese made from whole milk had higher total solids (TS) when fresh and during storage, compared with other cheese samples.

3- The ash content of all cheese treatments increased as the storage period progress. However, replacement milk fat by adding inulin did not affect the ash content of cheese.

4- The fat contents and the fat/ dry matter content of all cheese treatments gradually increased as storage period advanced**.** Also,

the fortification of low fat cheese with inulin as fat replacers did not affect the fat content of the resultant cheese.

5- The total protein contents increased in all treatments as the storage period progressed. On the other hand, the total protein content increased by increasing inulin levels.

7- The water soluble nitrogen content of all resultant cheese treatments increased sharply during the first 30 days of the storage period and then increased gradually up to the end of the storage period (60 days). Addition of inulin as fat replacers caused a pronounced increase in the water soluble nitrogen content.

8- The salt content and salt/serum contents increased in all treatments as the storage period progressed. On the other hand, the salt content and salt / serum contents decreased by increasing inulin levels.

9- The total plate and lactic acid bacteria counts increased as storage period progressed up to the 30^{th} day, and then decreased up to the end of storage period and increased by increasing the rate of adding inulin.

10- The all treatments were free from yeasts and moulds during the first 30^{th} days of storage, but they detected at the end of storage period. Also, the results showed that all samples were free of coliform bacteria during storage period.

11- The fortification of skim milk with inulin improved the organoleptic properties of cheese. Treatment that made from skim milk fortified with 1.2% was not different from cheese that made from whole milk (C).

❖ Whey protein concentrate as a fat replacer

I. Yoghurt:

1- The total solids and titratable acidity % of yoghurt were increased with increasing of whey protein concentrate and with progressing the storage period at 5-7ºC up to the 7 days in all treatments.

2- The total protein content increased by increasing the levels of whey protein concentrate. On the other hand, the total protein contents increased in all treatments as the storage period progressed.

3- The water soluble nitrogen contents of whey protein concentrate yoghurt were increased in all treatments with increasing the percentage of whey protein concentrate added and during the storage period.

4- The fat content of all yoghurt treatments gradually increased as storage period advanced. In addition, the fortification of low fat yoghurt with whey protein concentrate as fat replacers did not affect the fat content of the resultant yoghurt.

5- Replacement of milk fat with whey protein concentrate caused a significant decrease of whey syneresis from curd and this reduction was proportional to the rate of replacement of whey protein concentrate.

6- The total plate and lactic acid bacteria counts increased as storage period progressed up to the third day, and then decreased up to the end of storage period. However, the count of total plate counts and lactic acid bacteria increased by increasing the rate of adding whey protein concentrate.

7- The coliform bacteria were not detected in fresh and at the end of the storage period in all treatments.

8- The yeasts and moulds were not detected during the first three days of storage, but they detected at the end of storage period.

9- The yoghurt made from skim milk without adding whey protein concentrate (C_2) gained the lowest scores for organoleptic properties and was different from other yoghurt treatments. Fortification of skim milk with whey protein concentrate improved the organoleptic properties of yoghurt. Treatment that made from skim milk fortified with 4.5% of whey protein concentrate was not different from yoghurt that made from whole milk (C_1).

II. White soft cheese:

1- Titratable acidity % content of all resultant cheese treatments increased sharply during the first 30 days of the storage period and then increased gradually up to the end of the storage period. Also, results show that cheese treatments which made by adding whey protein concentrate had higher titratable acidity % than those of corresponding cheese treatments made without adding whey protein concentrate.

2- The TS content of cheese in all treatments slightly increased during the storage period. The cheese made from whole milk had higher total solids (TS) when fresh and during storage, compared with other cheese samples. In addition, replacement of milk fat with whey protein concentrate caused a decrease in total solids content.

3- The ash content of all cheese treatments increased as the storage period progress. However, replacement milk fat by adding whey protein concentrate did not affect the ash content of cheese**.**

4- The fat contents and the fat/ dry matter content of all cheese treatments gradually increased as storage period advanced**.** Also, the fortification of low fat cheese with whey protein concentrate as fat replacers did not affect the fat content of the resultant cheese.

5- The total protein contents increased in all treatments as the storage period progressed. On the other hand, the total protein content increased by increasing whey protein concentrate levels.

6- The water soluble nitrogen content of all resultant cheese treatments increased sharply during the first 30 days of the storage period and then increased gradually up to the end of the storage period (60 days). Addition of whey protein concentrate as fat replacers caused a pronounced increase in the water soluble nitrogen content.

7- The salt content and salt / serum contents increased in all treatments as the storage period progressed. On the other hand, the salt content and salt / serum contents decreased by increasing whey protein concentrate levels.

8- The total plate and lactic acid bacteria counts increased as storage period progressed up to the 30^{th} day, and then decreased up to the end of storage period and increased by increasing the rate of adding whey protein concentrate.

9- All treatments were free of count of yeast and moulds and coliform bacteria during storage period.

10- The fortification of skim milk with whey protein concentrate improved the organoleptic properties of cheese. Treatment that made from skim milk fortified with 4.5% was not different from cheese that made from whole milk (C).

❖ Mucilage as a fat replacer:

I. Yoghurt:

1- The replacement of milk fat with mucilage caused a significant increase in titratable acidity %. And the TS content of yoghurt fortified with mucilage decrease gradually by increasing the concentration of added mucilage. Also, the TS content of yoghurt in all of treatments slightly increased during the storage period.

2- The total protein content decreased by increasing the levels of mucilage. On the other hand, the total protein contents increased in all treatments as the storage period progressed.

3- The water soluble nitrogen contents of mucilage yoghurt were increased in all treatments with increasing the percentage of mucilage added and during the storage period.

4- The fat content of all yoghurt treatments gradually increased as storage period advanced. In addition, the fortification of low fat yoghurt with mucilage as fat replacers did not affect the fat content of the resultant yoghurt.

5- Replacement of milk fat with mucilage caused a significant decrease of whey syneresis from curd and this reduction was proportional to the rate of replacement of mucilage.

6- The total plate and lactic acid bacteria counts increased as storage period progressed up to the third day, and then decreased up to the end of storage period. However, the count of total plate counts and

lactic acid bacteria increased by increasing the rate of adding mucilage**.**

7- All treatments were free of count of yeast and moulds and coliform bacteria during storage period.

8- The fortification of skim milk with mucilage improved the organoleptic properties of yoghurt. Treatment that made from skim milk fortified with 0.01% was not different from yoghurt that made from whole milk (C_1).

II. White soft cheese:

1- Titratable acidity % content of all resultant cheese treatments increased sharply during the first 30 days of the storage period and then increased gradually up to the end of the storage period. Also, results show that cheese treatments which made by adding mucilage had higher titratable acidity % than those of corresponding cheese treatments made without adding mucilage.

2- The TS content of cheese in all treatments slightly increased during the storage period**.** The cheese made from whole milk had higher total solids (TS) when fresh and during storage, compared with other cheese samples.

3- The ash content of all cheese treatments increased as the storage period progress. However, replacement milk fat by adding mucilage did not affect the ash content of cheese**.**

4- The fat contents and the fat/ dry matter content of all cheese treatments gradually increased as storage period advanced**.** Also, the fortification of low fat cheese with mucilage as fat replacers did not affect the fat content of the resultant cheese.

5- The total protein contents increased in all treatments as the storage period progressed. On the other hand, the total protein content increased by increasing mucilage levels.

6- The water soluble nitrogen content of all resultant cheese treatments increased sharply during the first 30 days of the storage period and then increased gradually up to the end of the storage period (60 days). Addition of mucilage as fat replacers caused a pronounced increase in the soluble nitrogen content.

7- The salt content and salt / serum contents increased in all treatments as the storage period progressed. On the other hand, the salt content and salt / serum contents decreased by increasing mucilage levels.

8- The total plate and lactic acid bacteria counts increased as storage period progressed up to the 30^{th} day, and then decreased up to the end of storage period and increased by increasing the rate of adding mucilage.

9- All treatments were free of count of yeast and moulds and coliform bacteria during storage period.

10- The fortification of skim milk with mucilage improved the organoleptic properties of cheese. Treatment that made from skim milk fortified with 0.01% was not different from cheese that made from whole milk (C).

From the obtained results, it could be recommended that using fat replacers in manufacturing low-fat dairy products with additional nutritional benefits without affecting the physico-chemical properties of dairy products. The results revealed that Inulin, Whey protein concentrate and Okra mucilage led to improve the physico-chemical

characteristics of low-fat dairy products as well as improving sensory properties of dairy products during storage at refrigerator temperature using inulin at rate 1.2% to skim milk resulted in produce yoghurt and White soft cheese with comparable results to full fat cow's milk, Whey protein concentrate at rate 4.5% to skim milk resulted in produce yoghurt and White soft cheese with comparable results to full fat cow's milk and Okra mucilage at rate 0.01% to skim milk resulted in produce yoghurt with comparable results to full fat cow's milk and added at rate 0.01% to cow's milk standardized to1.9% fat resulted in produce White soft cheese with comparable results to full fat cow's milk. In conclusion, it could be recommended to use fat replacers in manufacturing low-fat dairy products.