The potential effect of feeding white soft cheese containing vegetable oils on blood lipid profile and some enzymes of rats

By

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Abstract

The present study aimed to investigate the impact of feeding soft white cheese containing vegetable oils and made with the use of some starter cultures on some cardiovascular parameters of rats. The experimental procedure included 36 female albino rats fed on basal diet for one week and then divided into 6 groups; two of them were positive and negative controls. The other four groups were fed for 6 weeks on the above mentioned cheese. The results indicated that the non-traditional white soft cheeses were more effective in lowering serum total cholesterol especially T3 (3% starter culture). The serum triglycerides level, serum VLDL + LDL level, The TC/HDL and LDL/HDL ratios were decreased. All the blood serum HDL cholesterol were also, gradually decreased. Serum glutamic oxaloacetic transaminase (GOT) level, showed a significantly low activity whereas, T3 was the lowest. On the other hand, the serum glutamic pyrovic transaminase (GPT) levels were observed to have a significant decrease in the serum levels of this enzyme relative to the negative control treated group. Hence, the non-traditional white soft cheese made with vegetable oils and starter culture could be better protecting against coronary heart disease.

Keywords: Non-traditional Soft cheese, Starter culture, lipid profile GOT, GPT

Introduction

Although cheeses are among the fat rich products their impact on the cardiovascular diseases is controversial. Recently, a study based on conventional and metabonomic approaches showed that the lowest atherogenicity was obtained with canola cheese diet followed by the dairy fat cheese diet, while the greatest atherogenicity was observed with the butter diet (***P < 0.05)*** in hyperlipidemic hamsters (Matin *et al.*, 2009). Therefore, it seems that the cheese matrix and the cheese fat play an in important role in determining the potential risk on human health. Recently, different sources of vegetable oils have been used in the production of

recombined cheeses on industrial scale in Egypt due to the shortage of fresh milk supply, to satisfy the growing demand of cheese and for economic reasons. Recently (El-Alfy *et al.,* 2010) described a standardized method for the production soft cheese containing different commercial sources of vegetable oils. They (El-Alfy *et al.,* 2010) concluded that the cheese made with cocoa butter substitute exhibited the best sensory quality, and chemical composition. It was thought desirable to evaluate the atherogenic effect of of this newly developed cheese.

Cheese consumption has been steadily increasing over the past 20 years **(Putnam & Allshouse 1999).** In addition, cheese considers being the main sources of animal fat and dietary cholesterol, since over 60% of the dairy fat is saturated. The dietary cholesterol is essential for membrane structure, hormones and steroid biosynthesis **(Adanyi & Varadi, 2003; Rozner & Garti, 2006).** It has been recognized that its elevated levels in plasma are directly correlated to increase cardiovascular heart diseases **(Okazaki *et al.*, 2006).** Dietary milk fats, on account of their higher content of saturated fatty acids, have long been associated with a variety of human diseases; however, recent studies have focused on the healthy components of milk fats, a decline in consumption of dairy-derived products (rich in saturated fat increases serum total and LDL–cholesterol concentrations) has occurred during the last decade because of their negative health image , as well as, an increase of vegetable fats which consider to be rich in phytosterols and unsaturated fatty acids in the daily food intake. This may give new opportunities to control elevated serum cholesterol concentration, which is known to be one of the most important risk factor for atherosclerotic vascular diseases **(Assmann *et al.*, 1999).** So, this research was planned to explain the effect of the improved non–traditional white soft cheese made with using vegetable oils and different ratios of starter culture on rats fed on cholesterol–enriched diet *via* biochemical examinations *i.e.* (total cholesterol, triglycerides, HDL–cholesterol, VLDL, LDL, GOT and GPT).

Materials and Methods

1. Materials:

Fresh mixed milk (cows and buffaloes′s, 1:1) used in this study was obtained from the herd of Faculty of Agriculture, Moshtohor, Benha University, Egypt. Low heat skimmed milk powder was purchased from local market, which imported from California Dairies, Inc, Fresno, California, USA. Super "ERCOAT CBS" cocoa butter substitute was obtained from local market which imported by International Egyptian Food Company (IEFCO Egypt), Attaqa, Suez, Egypt. Lacta–815 was obtained from Misr Food Additives (MIFAD) Company, Giza, Egypt. Commercial pure fine grade

salt (NaCl) was obtained from the Egyptian Salt & Minerals Company (EMISAL), Egypt. Microbial rennet powder (Formase TL2200) was obtained from Chr. Hansen's Laboratories, Copenhagen, Denmark. Calcium chloride ($CaCl_2$) was obtained from El-Nasr Pharmaceutical Chemicals Co., Cairo, Egypt. The diagnostic kits were obtained from Sentinel CH. Millan, Italy and purchased from Technogene Company, Egypt.

1.2. Starter cultures:

Pure strain of *Lactobacillus casei* NCAIM B01137 was obtained from National Collection Agricultural Institute of Microbiology. Starter culture contains *Lactococcus lactis* ssp. *lactis* and *Lb. delbrueckii* ssp. *bulgaricus* was obtained from Chr. Hansen's Laboratories, Horsholm, Denmark.

1.3. Experimental rats:

Experimental design was carried out as described **by Roupas *et al* (2006)**. Thirty sex female albino rats (90–100 g) were obtained from animal house of Crops Tech. Depart., Food Technology Research Institute, Agriculture Research Center. All rats were fed on basal diet Table 2 (20g per day/ rat) for one week (adaptation period) and then divided randomly into 6 groups (6 rats/each) to carry the experiment of biological evaluation. The first group was fed on basal diet (cholesterol free diet) throughout the experimental period (7 weeks) and was considered to be as negative control. The second group was fed on basal diet contained 0.5% cholesterol (cholesterol–enriched diet) and considered as positive control. The other four groups were fed on a basal diet contained 0.5% cholesterol (cholesterol–enriched diet) to create hypercholesterolemic rats for one week, then they were fed for six weeks on a cholesterol–enriched diet supplemented with different cheese treatments according to the chemical composition from T1 to T4 as described in Table (2).

The weight of each rat was recorded weekly and blood samples were collected by withdrawing each two weeks from vein plexus eye, centrifuged at 3000 rpm to obtain the blood serum, which stored at (–20ºC) for biochemical assay. On the other hand, by the end of the experiment (7 weeks), rats were sacrificed and the blood was collected in clean test tubes and centrifuged to obtain the serum.

2. Methods:

2.1. Cheese manufacture:

Recombined white soft cheese was made as described by **El-Alfy *et al,* (2010)** from mixed buffalo and cow milks 1:1 supplemented with skim milk powder and cocoa butter substitute with the use of 1% (T1), 2% (T2) and 3% (T3) of the mixed culture of *Lactobacillus casei* NCAIM B01137, *Lactococcus lactis* ssp. *lactis* and *Lb. delbrueckii* ssp. *bulgaricus*.(1:1:1), respectively. In addition white soft cheese was made from mixed buffalo and cow milk by the traditional method and used as control.The cheese was mixed thoroughly with the basal diet before it was offered to rats

Table (1): The composition of the basal diet, the minerals and vitamins formula added to the basal diet.

Minerals mixture		**Vitamins mixture**	
Minerals	**Concentration**	**Vitamins**	**Concentration**
$CaCO_3$	600g	Vit A	2000 IU
K_2HPO4	645g	Vit D	200 IU
$CaHPO_4.2H_2O$	150g	Vit E	10 IU
$MgSO_4.2H_2O$	204g	Vit K	10 mg
NaCl	334g	Thiamin	0.5 mg
$Fe(C_6H_5O_7).6H_2O$	55g	Pyrodoxine	0.5 mg
KI	1.6g	Panthothenic acid	4.0 mg
$MnSO_4.4H_2O$	10g	Riboflavin	0.8 mg
$ZnCl_2$	0.5g	Niacin	4.0 mg
$CuSO_4.5H_2O$	0.6g	Choline chloride	200 mg
		Inositol	10 g
		P amino benzoic acid	10 mg
		$VitB_{12}$	0.03 mg
		Biotin	0.02 mg
		Folic acid	0.02 mg

●According to **AOAC (1998).**

Table (2): The experimental rat groups and their diets.

	Group	Experimental diets (per 6 rats)
Cholesterol free diet	Negative control	120g basal diet•
Cholesterol-enriched diet	Positive control	119.4g basal diet• + 0.6g cholesterol
	Treatment C	96.8g basal diet* + 0.6g cholesterol + 22.6g (Control cheese)
	Treatment 1	101.7 basal diet* + 0.6g cholesterol + 17.8g (cheese T_1)
	Treatment 2	101.7 basal diet* + 0.6g cholesterol + 17.8g (cheese T_2)
	Treatment 3	101.7 basal diet* + 0.6g cholesterol + 17.8g (cheese T_3)

Basal diet•: as mentioned in Table (1) - Basal diet*: free from casein and fat

C control cheese traditional cheese, T_1 , T_2 and T_3 cheese made with 1, 2 and 3 % of starter culture containing (*Lactobacillus casei* NCAIM B01137, *Lactococcus lactis* ssp. *lactis* and *Lb. delbrueckii* ssp. *bulgaricus* 1:1:1), respectively.

2.2. Methods of analysis:-

2.2.1. Biological analysis:

Blood serum total cholesterol was determined according to the method of **Richmond (1973)**, Triglycerides were determined according to the method of **Fassati and Principe (1982)**

Serum high density lipoprotein cholesterol (HDL) was determined according to the method of **Gordon (1977)**, **Low density lipoprotein cholesterol (LDL-cholesterol)** was calculated using the method of **Hatch and Lees (1968)** as the follows:

LDL-cholesterol (mg/dL) = Total cholesterol – (HDL-cholesterol + VLDL-cholesterol).

Glutamate oxaloacetate amino transferase GOT (AST) and glutamate pyruvate amino transferase GPT (ALT) were determined according to the method described by **Reitman and Frankel (1957).**

2.2.2. Statistical analysis:

Statistical analysis was performed according to the user's guide given by **SAS Institute (1998).**

Results and Discussion

Table (3) show the hypercholesterolemic effect of rats feed on cholesterol–enriched diets containing improved non–traditional white soft cheeses with different ratios of starter culture. At the commencement there were differences appeared in the total cholesterol level between the positive control group and all other groups.

Blood serum total cholesterol level:

The serum total cholesterol concentration of positive control treated group was 98.14 mg/dl in the first week followed by increasing the feeding period to be 146.43 mg/dl at the end of feeding period (6 weeks).

In contrast, the total cholesterol concentration increased in the rats fed on cholesterol–enriched diet containing supplementation of cheese treatment, whereas, it was 101.14, 99.71 and 97.29 mg/dl and increased to be 115.43, 116.00 and 108.00 mg/dl for T1 to T3 after 2 weeks of feeding, respectively. By increasing the feeding period these values start to decrease after 4 weeks to be 104.86, 101.43 and 86.86 mg/dl in the same order. The decrease of total cholesterol was continued to be 97.14, 92.00 and 81.14 mg/dl at the end of feeding period for T1, T2 and T3, respectively. On the other hand, the serum total cholesterol in group C was increased periodically then decreased by the end of feeding period and recorded 102.86, 131.29, 124.71 and 109.57 mg/dl at 0, 2, 4 and 6 weeks of feeding, respectively. Also, from the obtained results it could be noticed that improved non–traditional white soft cheeses supplemented with vegetable oils and starter cultures were more effective for lowering blood serum total cholesterol levels. However, T3 had the lowest level of total cholesterol of all the treatments and recorded 81.14 mg/dl by the end of feeding period. These results are in accordance with the results reported by **El-Alfy *et al.*, (2004).**

The results of blood serum total cholesterol levels indicated that different feeding periods causing significant difference in serum total cholesterol level. Also, significant differences were recorded as a result of applying different feeding types (different cheese treatments).

Blood serum triglycerides level:

At the beginning of the feeding period there was no pronounced difference between negative control group, positive control group and the supplementary groups in blood serum triglycerides. These values were 69.35, 71.98, 73.03, 71.28, 71.11 and 72.68 mg/dl for negative control, positive control, C, T1, T2 and T3, respectively. The results are in agreement with **During *et al.*, (2000)** who stated that the unsaturated fat enriched cheese induced a slight decrease (16%) of serum triglycerides concentrations compared with the traditional cheese.

Serum triglycerides level of both negative and positive control groups increased gradually by increasing the feeding period to be 77.41and 91.30 mg/dl, respectively by the end of the experiment (6 weeks). On the other hand, the serum triglycerides level decreased for all treatments during the interval feeding period and

recorded 70.41, 66.90, 62.97 and 60.42 mg/dl for supplementary groups C, T1, T2 and T3 in order, by the end of the feeding period.

Also, from the obtained results it could be noticed that the lowest triglycerides value was recorded for T3 followed by T2; this is due to the effect of the different ratios of starter culture, whereas, T3 used 3% and T2 used 2% starter culture. The obtained results are in agreement with **El-Alfy *et al.*, (2004) and Gafour (2005)** who reported that rats fed on probiotic UF Feta-like cheese decreased the triglycerides level after 2 weeks of feeding. There were significant differences among treated groups and all over the experimental period.

Blood serum HDL–cholesterol level:

The blood serum HDL–cholesterol recorded 38.05, 38.29, 39.17, 37.63, 37.44 and 38.8 mg/dl for negative control, positive control, C, T1, T2 and T3, respectively. All the blood serum HDL–cholesterol values decreased gradually in all the experimental groups by progressing of feeding time. By the end of the feeding period (6 weeks) the serum HDL–cholesterol level was 36.42, 36.14, 36.02, 33.85, 34.46 and 36.58 mg/dl for negative group, positive group, C, T1, T2 and T3, respectively. From such results it could be concluded that HDL–cholesterol level of treatment 3 was slightly higher than other treated groups. This reflects the effect of either vegetable oils or starter cultures of improved non–traditional white soft cheese (T3) as it contains 3% of starter. The obtained results indicated also that the high decrease of blood serum HDL–cholesterol was in all groups fed on diet contains cheeses. Similar results were also, obtained by **Ibrahim (2002) & Jaarsveld and Benade (2002).**

The statistical analysis showed that there were insignificant differences for blood serum HDL–cholesterol level among all treated groups.

Blood serum VLDL+LDL–cholesterol level:

The values started to increase during the interval feeding period; this increase was more noticeable in positive group. However, the serum VLDL + LDL cholesterol values of groups fed on cheeses using starter culture cleared pronounced decrease especially that group fed on cheese using 3% of starter culture which recorded a decrease from 58.49 mg/dl in zero time to 44.56 mg/dl at the end of feeding period, followed by T2 , T1 then C group. This gives an indicator about starter culture effect on lowering such parameter. These results are in agreement with **During *et al.*, (2000),** who mentioned that, the partial substitution of milk fat by vegetable oils in soft-ripened cheese resulted decrease of blood serum LDL–cholesterol. Also. **Nestel *et al*., (2005).** Stated that dairy fat in cheese raises LDL cholesterol less than that in butter in mildly hypercholesterolaemic subjects.

Total cholesterol/HDL and LDL/HDL ratios:

A significant increase in TC/HDL and LDL/HDL ratios was observed in positive control fed group and treatment C, which has an effect on cardiovascular diseases. The cholesterol–enriched diet supplemented with improved non–traditional white soft cheeses. It could be noticed that the negative control was lower in VLDL + LDL than the positive control and the other supplemented dietary groups at the beginning of feeding period and recorded 54.81, 59.85, 63.69, 63.51, 62.27 and 58.49 mg/dl for negative group, positive group, C, T1, T2 and T3, soft cheese with different ratios of starter culture groups resulted in the decrease of a number of proatherogenic factors, such as TC/HDL and LDL/HDL **(Morise *et al.*, 2004) and (Ladeia,** *et al.*, **2008). During *et al.*, (2000)** reported a significant decrease of the LDL/HDL ratio of rats fed experimental cheeses, considered as an index of CVD risk. Moreover, TC/HDL and LDL/HDL ratios are also predictors of coronary risk **(National Cholesterol Education Program Expert Panel, 1994).**

Liver functions:

Liver functions can be measured through the liver enzymes; these enzymes are groups of clinical biochemistry laboratory blood assays to give information about the state of liver. Hepatic liver involvement in some diseases can be of crucial importance.

Glutamic oxaloacetic transaminase (GOT) is a pyridoxal phosphate dependent enzyme which exists in cytoplasmic and mitochondrial forms. GOT plays a role in amino acids metabolism, urea and tricarboxylic acid cycles, while glutamic pyruvic transaminase (GPT) catalyzes the two parts of the alanine cycle, it catalyzes the transfer of an amino group from alanine to ά-ketoglutarate. The products of this reversible transamination reaction being pyruvate and glutamate. So, this part was to measure the GOT and GPT of hypercholesteremic rats fed on improved non–traditional white soft cheeses.

Table (4) show the changes in serum (GOT) and GPT levels (U/ml) of rats as a results of feeding on cholesterol–enriched diets containing improved non–traditional white soft cheese with different ratios of starter culture.

Serum glutamic oxaloacetic transaminase (GOT) level:

From such results it could be observed that serum GOT level for all rat groups increased allover the feeding period to be 61.11, 74.05, 65.83, 66.03, 70.00 and 54.76 U/ml for negative group, positive group, C, T1, T2 and T3, respectively at the 4th week of feeding period.

By the end of the feeding period (6 weeks), the (GOT) level recorded 60.24, 82.22, 73.05, 63.81, 50.95 and 45.08 U/ml for negative group, positive group, C, T1, T2 and T3, respectively. These results showed that positive group, negative group and control (C) treatments increased GOT activities, while the supplemented dietary groups indicated a decrease in activity of these enzymes. T3 showed low activity of this enzyme compared to other groups, followed by T2 and T1 compared with the control.

These observations indicate that fatty infiltration and degeneration of liver cells caused by cholesterol feeding were significantly reduced by cholesterol–enriched diet supplemented with improved cheese with vegetable oils and starter cultures**,** similar results were recorded by **Sandhya and Rajamohan (2008).**

Significant differences were recorded for serum (GOT) level because of different treatments. Different feeding periods caused significant difference in GOT level and this was clear from the analysis of variance at level of 5% with LSD 0.017 and 0.014 for the treated groups and feeding period, respectively.

Table (3): The hypercholesterolemic effect of rats fed on cholesterol–enriched diet containing improved non–traditional white soft cheeses.

Feeding period (week)	Treated groups					
	Negative Control	Positive Control	C	T1	T2	T3
	Blood serum total cholesterol (mg/dl)					
0	92.86^{EFG}	98.14^{EFG}	102.86^{D-G}	101.14^{D-G}	99.71^{F-G}	97.29^{EFG}
2	93.86^{EFG}	135.43^{ABC}	131.29^{BCD}	115.43^{C-F}	116.00^{C-F}	108.00^{C-G}
4	93.57^{EFG}	142.86^{AB}	124.71^{B-E}	104.86^{D-G}	101.43^{D-G}	86.86^{FG}
6	96.71^{EFG}	146.43^{A}	109.57^{C-G}	97.14^{F-G}	92.00^{EFG}	81.14^{G}
Mean	**94.25**	**130.72**	**117.11**	**104.64**	**102.29**	**93.32**
L.S.D at 5%: Treated groups = 13.092 Feeding period = 10.621 Treated groups × Feeding period = 26.017						
	Blood serum triglycerides (mg/dl)					
0	69.35^{B}	71.98^{B}	73.03^{B}	71.28^{B}	71.11^{B}	72.68^{A}

2	74.96^{A}	83.01^{A}	71.10^{B}	70.05^{B}	70.75^{B}	69.35^{B}
4	75.48^{A}	88.62^{A}	70.64^{B}	68.31^{D}	70.05^{B}	67.95^{D}
6	77.41^{A}	91.30^{A}	70.41^{B}	66.90^{E}	62.97^{D}	60.42^{E}
Mean	**74.30**	**83.73**	**71.30**	**69.14**	**68.72**	**67.60**

L.S.D at 5%: Treated groups = 0.016
Feeding period = N.S (Non Significant)
Treated groups × Feeding period = N.S (Non Significant)

	Blood serum HDL–cholesterol (mg/dl)					
0	38.05^{A}	38.29^{A}	39.17^{A}	37.63^{A}	37.44^{A}	38.80^{A}
2	37.66^{A}	37.63^{A}	38.47^{A}	36.60^{A}	36.04^{A}	38.38^{A}
4	37.19^{A}	36.98^{A}	36.23^{A}	35.67^{A}	35.86^{A}	37.16^{A}
6	36.42^{A}	36.14^{A}	36.02^{A}	33.85^{A}	34.46^{A}	36.58^{A}
Mean	**37.33**	**37.26**	**37.47**	**35.94**	**35.95**	**37.73**

L.S.D at 5%: Treated groups = N.S (Non Significant)
Feeding period = N.S (Non Significant)
Treated groups × Feeding period = N.S (Non Significant)

	Blood serum VLDL + LDL–cholesterol (mg/dl)					
0	54.81	59.85	63.69	63.51	62.27	58.49
2	56.20	97.80	92.82	78.83	79.96	69.62
4	56.38	105.88	88.48	69.19	65.57	49.70
6	60.29	110.29	73.55	63.29	57.54	44.56
Mean	**56.92**	**93.46**	**79.64**	**68.71**	**66.34**	**55.59**

Table (3): Continued.

Feeding period (week)	Treated groups					
	Negative Control	**Positive Control**	**C**	**T1**	**T2**	**T3**
	Total cholesterol/HDL ratio					
0	2.44	2.56	2.63	2.69	2.66	2.51
2	2.49	3.60	3.41	3.15	3.22	2.81
4	2.52	3.86	3.44	2.94	2.83	2.34
6	2.66	4.05	3.04	2.87	2.67	2.22
Mean	**2.53**	**3.52**	**3.13**	**2.91**	**2.85**	**2.47**
	LDL/HDL ratio					
0	1.44	1.56	1.63	1.69	1.66	1.51
2	1.49	2.60	2.41	2.15	2.22	1.81
4	1.52	2.86	2.44	1.94	1.83	1.34
6	1.66	3.05	2.04	1.87	1.67	1.22
Mean	**1.53**	**2.52**	**2.13**	**1.91**	**1.85**	**1.47**

(-ve): basal diet (cholesterol free diet)
(+ve): cholesterol–enriched diet
C: cholesterol–enriched diet supplemented with control cheese without vegetable oil or starter culture
T1: cholesterol–enriched diet supplemented with cheese with vegetable oil and 1% starter culture
T2: cholesterol–enriched diet supplemented with cheese with vegetable oil and 2% starter culture
T3: cholesterol–enriched diet supplemented with cheese with vegetable oil and 3% starter culture
Values with the same letters are not significant different.

Serum glutamic pyruvic transaminase (GPT) level:

The results obtained for serum (GPT) level show that serum GPT enzyme level was almost the same for all rat groups at the beginning of feeding period. The GPT level of different groups was slightly increased during feeding period as it was 29.47, 44.75, 41.61, 30.79, 36.92 and 34.38 U/ml for negative group, positive group, C, T1, T2 and T3, respectively, at the end of feeding period. From these results, it could be noticed that the negative group had low activity of this enzyme compared with other groups. The cholesterol–enriched diet supplemented with different vegetable oils and starter cultures fed groups were also have a significant decrease in the serum levels of this enzyme relative to the negative control treated group. **Oluba *et al.,* (2008)** stated that the palm oil–fed group; was also have a significant decrease in the serum levels of these enzymes relative to the soybean oil–treated group.

Analysis of variance at level of 5% for GPT indicated that there were highly significant differences between either positive, negative groups and all the treated groups during the intervals feeding period with LSD 0.012 and 0.009 for the treated groups and feeding period, respectively.

Conclusion

In conclusion, the data generated in this study showed clearly that the non–traditional cheese made with different vegetable oils and starter cultures consumption could be better protection against coronary heart disease risk compared with cheese without vegetable oils or starter cultures. Therefore, not all dietary fats generally classified as saturated raise serum cholesterol concentration thus such foods have a place in our daily diets**.**

Table (4): Liver functions of rats fed on cholesterol–enriched diet containing improved non–traditional white soft cheeses.

Feeding period (week)	Treated groups					
	Negative Control	**Positive Control**	**C**	**T1**	**T2**	**T3**
	Serum gluatamic oxaloacetic transaminase (GOT) level (U/ml)					
0	50.71^{E}	51.67^{E}	51.67^{E}	51.43^{E}	51.19^{E}	51.67^{E}
2	61.90^{D}	72.86^{A}	64.05^{B}	68.25^{B}	61.90^{D}	60.95^{D}
4	61.11^{D}	74.05^{A}	65.83^{B}	66.03^{B}	70.00^{B}	54.76^{E}
6	60.24^{D}	82.22^{A}	73.05^{B}	63.81^{B}	50.95^{E}	45.08^{E}
Mean	**58.49**	**70.20**	**63.65**	**62.38**	**58.51**	**53.12**
L.S.D at 5%: **Treated groups = 0.017** **Feeding period = 0.014** **Treated groups × Feeding period = N.S (Non Significant)**						
	Serum gluatamic pyruvic transaminase (GPT) level (U/ml)					
0	27.11^{R}	27.96^{OP}	28.81^{M}	28.15^{O}	28.15^{O}	27.68^{PQ}

2	27.77^{FQ}	28.53^{N}	28.91^{M}	31.55^{I}	31.17^{J}	33.62^{G}
4	28.95^{Q}	39.85^{D}	40.16^{C}	33.06^{H}	41.36^{B}	40.42^{C}
6	29.47^{L}	44.75^{A}	41.61^{B}	30.79^{K}	36.92^{E}	34.38^{F}
Mean	**28.33**	**35.27**	**34.87**	**30.89**	**34.40**	**34.03**

L.S.D at 5%:
Treated groups = 0.012
Feeding period = 0.009
Treated groups × Feeding period = 0.024

(-ve): basal diet (cholesterol free diet)
(+ve): cholesterol–enriched diet
C: cholesterol–enriched diet supplemented with control cheese without vegetable oil or starter culture
T1: cholesterol–enriched diet supplemented with cheese with vegetable oil and 1% starter culture
T2: cholesterol–enriched diet supplemented with cheese with vegetable oil and 2% starter culture
T3: cholesterol–enriched diet supplemented with cheese with vegetable oil and 3% starter culture
Values with the same letters are not significant different.

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تأثير الجبن الأبيض المحسن الغير تقليدي المدعم ببعض الزيوت النباتية وبعض مزارع البادئات على خفض نسبة الكوليسترول في الفئران

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ركزت الدراسة الحالية على خفض نسبة الكولسترول في دم الفئران التي تم تغذيتها بالجبن البيضاء الطرية غير التقليدية المحسنة و المدعمة ببعض الزيوت النباتية المختلفة،و كذلك بعض مزارع البادئات . وشمل إجراء التجربة استخدام ٣٦ من إناث فئران الالبينو والتي تغذت على عليقة أساسية لمدة أسبوع ومن ثم تقسيمها إلى ٦ مجموعات. منها مجموعتان استخدمت ككنترول إيجابي و الأخرى ككنترول سلبي. غذيت المجموعات الأربع الأخرى لمدة ٦ أسابيع على الجبن المذكورة أعلاه. وأشارت النتائج إلى أن الأجبان الطرية البيضاء غير التقليدية كانت أكثر فعالية في خفض الكوليسترول في الدم وخاصة المعاملة T3 (٣% بادئ). وقد انخفض مستوى الدهون الثلاثية في الدم، وكذلك انخفض مستوى VLDL +LDL في المصل وأيضا نسب TC/HDL و LDL/HDL ومن الجدير بالذكر أيضا ان مستوى الكولسترول HDL في الدم قد انخفضت تدريجيا. وقد انخفض نشاط انزيم الجلوتامك اوكسالواسيتك ترانس أمينيز GOT في السيرم انخفاضا معنويا و كانت المعاملة T3 هي الأكثر انخفاضا. و من ناحية أخرى فقد انخفض أيضا نشاط انزيم الجلوتامك بيروفك ترانس أمينيز GPT في السيرم انخفاضا معنويا مقارنة بالمجموعة الكنترول. ومن ثم فإن استخدام الجبن الأبيض الطري الغير تقليدي المصنع باستخدام الزيوت النباتية و مزارع البادئات يمكن ان يكون وسيلة جيدة للحماية من امراض القلب