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Full Length Research Paper

The effects of fat sources on lipid profile in New Zealand rabbits

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The main objective of this study was to assess the effects of different sources of fat (plant versus animal) on selected antioxidant profile in New Zealand rabbits. Eighteen male and female White New Zealand Rabbit Breed, weighing 1800-2700 gm and of average age 2.5 months were used in the second experiment. Rabbits were divided into three groups (each of six). They were kept in closed rooms in separate and individual cages; they were allowed to have free access to food and water. Three groups of rabbits were used in this experiment. One group was fed plain conventional rabbit feed, the second group was fed modulated feed by adding extra 7% fat from animal source (fresh butter extracted from raw milk of Egyptian cattle), and the third group was fed modulated feed of extra 7% fat from plant source origin (Sunflower oil); mixing and processing of the feed was done manually. The study showed significant increase in the plasma level of cholesterol, phospholipids and triglyceride in both fat fed groups compared to the control group, the difference is significant between the plant fed and animal fat fed groups with the latter showing great increase. Future studies should emphasize on using different concentrations of either plant or animal fat.

Key words: Animal, lipid profile, rabbits.

INTRODUCTION

Dietary factors contribute to the development of oxidative damage and atherosclerosis in human and laboratory animals, especially diet with high saturated fats. High amounts of fat in diets apparently accelerate the development of atherosclerosis (Waqar et al., 2009; Swefy et al., 2002). Cow Ghee is one of the most important dietary fats in Arabian countries; it is of paramount importance to relate its consumption on lipid profile, and we are interested here to see its effect on lipid profile compared to sunflower oil. The importance of dietary intervention in ameliorating disease, in general and cardiovascular ones, in particular has increase in recent years. Therefore, the main objective of this study was to assess the effects of high-fat diet from plant and animal sources on lipid profile in New Zealand rabbits.

MATERIALS AND METHODS

Eighteen male and female White New Zealand Rabbit Breed, weighing 1800-2700 gm and of average age 2.5 months were used in the second experiment. Rabbits were divided into three groups (each of six). They were kept in closed rooms in separate and individual cages; and allowed to have free access to food and water. The room temperature was 20 ± 2°C and the humidity was 40-65%. They were also allowed for 12 h dark and 12 h daylight. All groups were fed modified and non-modified Standard Conventional Rabbit Chow, manufactured by the Grain Silos and Flour Mills Organization, Jeddah, Saudi Arabia.

Three groups of rabbits were used in this experiment. One group was fed plain conventional rabbit feed, the second group was fed modulated feed by adding extra 7% fat from animal source (fresh butter extracted from

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Table 1. Experimental diet formulation.

Ingredients/ 300 g	Ration 1	Ration 2	Ration 3
Crude protein	55.5 g	55.5 g	55.5 g
Crude fat	9.0 g	9.0 g	9.0 g
Sun flower oil	-	21 g	-
Cow butter fat	-	-	21 g
Crude fiber	30 g	30 g	30 g
Ash	19.5 g	19.5 g	19.5 g

Table 2. Effects of sunflower and cow butter-fed New Zealand rabbits on the plasma cholesterol concentration (mmol/L).

Week of sampling	Control diet	Sunflower diet	Butter diet
Week 0	3.11^{a}±0.47	10.60^{b}±2.8	11.78^{c}±2.9
Week 3	3.50^{a}±0.40	21.56^{b}±3.4	34.60^{c}±3.4
Week 5	3.12^{a}±0.29	26.99^{b}±4.0	37.54^{c}±3.3
Week 8	3.00^{a}±0.35	30.17^{b}±5.4	42.51^{c}±2.3
Week 12	3.22^{a}±0.45	36.70^{b}±6.0	44.61^{c}±3.1

Values are expressed as means ± standard deviation (n = 6). Means with different letters within a row are significantly different ($p < 0.05$).

Table 3. Effects of sunflower and cow butter-fed New Zealand rabbits on phospholipid plasma concentrations (mmol/L).

Week of sampling	Control diet	Sunflower diet	Cow butter diet
Week 0	1.44^{a}±0.27	2.01^{b}±0.31	2.42^{c}+0.40
Week 3	1.51^{a}+0.31	8.45^{b}+0.42	11.34^{c}+0.63
Week 5	1.58^{a}+0.32	11.11^{b}+0.50	14.23^{c}+0.65
Week 8	1.42^{a}+0.29	13.11^{b}+0.42	17.34^{c}+0.91
Week 12	1.41^{a}+0.22	14.12^{b}+0.34	22.02^{c}+1.00

Values are expressed as means ± standard deviation (n = 6). Means with different letters within a row are significantly different ($p < 0.05$).

raw milk of Egyptian cattle), and the third group was fed modulated feed of extra 7% fat from plant source origin (Sunflower oil); mixing and processing of the feed was done manually (Table 1).

Blood sampling

Blood samples were collected prior to the start of the treatment, and on week 3, week 5, week 8, and week 12. Plasma was separated and stored till analysis for phospholipid, triglyceride and total cholesterol. Cholesterol was measured using kits (Spectrum, Cairo, Egypt). The method used was a spectrophotometeric method described by Ellefson et al. (1976). Phospholipid plasma concentrations were determined using the protocol of Bartlet (1959). The data were presented as means±standard deviations (SD). For the analysis of variance, a one-way ANOVA was carried out using SPSS version 15.0 for Windows. This analysis was used to compare the differences between two or more means.

RESULTS AND DISCUSSION

The main objective of this study is to assess the effects of fat from either plant or animal sources on selected plasma lipid profile in New Zealand rabbits. The central idea for the current study is the relation between fat intake and the risk of predisposing factors to cardiovascular disease and atherosclerosis. Recent investigations suggest that oxidative stress markers are useful in the evaluation of some types of abdominal pathology. There was significant increase in the plasma level of cholesterol in both fat fed groups compared to the control group, the difference is significant between the plant fed and animal fat fed groups with the latter showing great increase (Table 2).

Table 3 illustrates a significant difference in the plasma phospholipids concentration between the butter fat fed

Table 4. Effects of sunflower and cow butter-fed New Zealand rabbits on triglyceride plasma concentrations (mmol/L).

Week of sampling	Control diet	Sunflower diet	Cow butter diet
Week 0	0.76^{a}±0.12	0.80^{a}+0.08	0.91^{b}+0.09
Week 3	0.82^{a}+0.10	1.38^{b}+0.18	2.45^{c}+0.15
Week 5	0.87^{a}+0.11	1.66^{b}+0.23	3.24^{c}+0.34
Week 8	0.92^{a}+0.14	1.74^{b}+0.28	4.02^{c}+0.22
Week 12	0.88^{a}+0.11	1.90^{b}+0.26	4.23^{c}+0.11

Values are expressed as means ± standard deviation (n = 6). Means with different letters within a row are significantly different ($p < 0.05$).

group and the control group and also a significant difference in plasma phospholipids concentration was seen between plant fat fed group and the control group. The difference in plasma phospholipids concentration is also significant in cow butter fed group compared to plant fed group rabbits. Table 4 shows the results of feeding experimental rabbits with different sources of fat on triglyceride plasma concentration. Both fat diets resulted in a significant increase in the concentration of plasma triglycerides.

The current study indicated that both sunflower and butter diet caused an increase in all lipid profiles examined. However, Fekete et al. (1990) found no effects of supplemental oil on lipid profile.

It is well known that the amount and the type of fats in the diet can have important effects on plasma lipid profile in human and different species of animals. Cholesterol feeding to rabbit dramatically reduced fluidity in very low density lipoprotein (VLDL) and low density lipoprotein (LDL) (Berlin et al., 1991). There are accumulating body of evidences that the dietary intake of vegetable oils is more beneficial than animal fats (butter and beef fat) and hydrogenated oils (margarine). Supplementation of hypercholesterolemic diet with ghee significantly increased high density lipoprotein in comparison with hydrogenated oil (Hosseini and Asgary, 2012).

In rabbits, the structured lipids beneficially lowered serum cholesterol and triglycerides (Kanjilal et al., 2013). High fat diet caused atherosclerosis at least through anti-hyperlipidemic activity (Lai et al., 2011; Ekor et al., 2010). Serum cholesterol was increased by 46, 52 and 15%, respectively (Dhungel et al., 2009). In another study, high fat-fed rabbits showed an increase in plasma levels of total cholesterol and triglycerides as well as visceral adipose tissue accumulation (Zheng et al., 2009; Tuncer et al., 2009). Different levels of cholesterol (2, 4, and 8 g/ diet for three months resulted in an increase in the contents of total lipid and unsaturated fatty acids in plasma of rabbits (Byungrok et al., 2013). In the present study, the level of fat used was 7%.

In rabbits, compared with the standard butter, the trans-10-C18: 1-rich butter (T10) had detrimental effects on plasma lipid and lipoprotein metabolism in rabbits (Roy et al., 2007). The additional dietary fat, whatever its nature, had no effect on plasma cholesterol concentration in the absence of dietary cholesterol in a study conducted in hamsters (Sessions and Salter, 1994). In line with our current findings, Al-Othman found higher total cholesterol and triglyceride in animals fed diets containing ghee. The addition of dietary fat from animal and vegetable sources in the diet of rats increased total cholesterol and triglyceride (Pandev and Kumar, 2012).

In conclusion, cow ghee produced a significant increase in lipid profile compared to sunflower oil. Such effects may be due to the levels of unsaturated fatty acids (not the scope of this study). Future studies should emphasize on using different concentrations of either plant or animal fat.

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