

Lipid Composition of Rat's Serum in Relation to Fatty Diets

S. Gabr, A. AS. Ramadan, S.I. El-Hinnawi, A. Gergis and S.M.A. Kassem

Faculty of Agriculture, Zagazig University, Egypt and College of Science, University of Riyadh, Riyadh, Saudi Arabia.

Three diets containing 20% of either corn oil or butter fat or hydrogenated cottonseed oil were fed by rats for 30 and 50 days. The variation in fat in diets affected the lipid composition of rats at variable rates.

Both the total lipids and total cholesterol in serum of rats increased due to presence of butter fat in diet in both periods of nutrition. Also, the percentages of both phospholipids and triglycerides increased slightly due to presence of the butter fat in the diets.

Many investigators showed that the growth of young rats fed on butter-containing diets was comparatively better than the growth of rats fed other vegetable oils and fats. Albrink *et al.* (1963) showed that there is a relationship between the increase of serum triglycerides and the occurrence of heart disease.

On the baiss of food and caloric efficiency the groups of rats fed on diets containing cottonseed oil showed good food utilization value. As a role the higher the fat levels in diets, *i.e.* butter fat, the greater the body weights are as compared with corn oil diets (Nieman *et al.* 1952).

Hill *et al.* (1958) stated that fats, lard, corn oil, vegetable oil, and hydrogenated vegetable oil in diets are effective in reducing hepatic lipogenesis. Frantz and Carey (1961), added three ounces of corn oil to the daily diets of 6 men for a period of one month. Also three ounces of hydrogenated coconut oil were added daily to diets of a similar group of men as a control. The serum cholesterol concentration was found to increase 9% in men received diets containing corn oil but did not change significantly in the other control group. Serum cholesterol levels were studied also by Wilcox and Galloway (1961). Groups of four men and four women each were maintained for 15

days on diets containing butter margarine, cottonseed oil, lard and corn oil, and hydrogenated cottonseed oil. Each fat source in diet formed 35% of the total caloric diets. The results indicated that, there were significant decrease in serum cholesterol levels in the groups maintained on diets containing margarine, cottonseed oil, hydrogenated cottonseed oil, and corn oil. The decrease was found to be 22% in the groups who received diets containing the corn oil and 12% in the groups maintained on other diets.

Oyama *et al.* (1967) recorded that the dietary fat level and its nature affected the values of total cholesterol, phospholipids and triglycerides in plasma. The decreased values of total cholesterol and phospholipids of plasma were attributed to the high unsaturated fatty acid contents of the oil used in diets.

The normal concentration of serum cholesterol for children is about 220 mg/100 ml of serum but at the age of twenty its concentration is less than that. The most effective method for lowering the levels of cholesterol is by using controlled diet. Reduction of the amount of saturated fats and an increase in the amount of polyunsaturated fats in the diet can accomplish a significant reduction in serum cholesterol in most persons as stated by Fetcher *et al.* (1967). Also Connor *et al.* (1961) showed that reduction of dietary cholesterol will result in a decrease in serum cholesterol. Moreover, Antonis and Bersohn (1961) and Kuo (1965) illustrated that dietary regulation may affect the concentration of serum triglycerides.

The present work was carried out to study the effect of feeding three different fats on the changes in total lipids, total cholesterol, phospholipids and triglycerides in serum of rats during two nutrition periods, *i.e.* 30 and 50 days.

Materials and Methods

Male albino rats (50—70g) were divided into 3 groups. Each group was fed on one of these diets: A. containing 20% hydrogenated cottonseed oil (control). B. containing 20% of butter fat, and C. containing 20% corn oil. Rats were weighed every 48 hours throughout the experiment. All rats were sacrificed, blood samples were collected and livers were dissected out and weighed. Total lipids of the serum were extracted and determined according to Flectecher (1968) and phospholipids were determined colorimetrically by the method of Kaur *et al.* (1973). Total cholesterol in serum were determined according to Zlatkis *et al.* (1953).

Results and Discussion

Effect of dietary fats on the total lipids in serum of rats

The total lipids in the serum of rats after feeding for 30 and 50 days are illustrated in Table (1).

It could be noticed that the rats which received the Diet B have comparatively the highest content of total lipids in serum than those taking Diet A or C. The

difference is significant especially after extending the feeding for 50 days. However, diet A and C have nearly the same effect. The differences between the effect of diet A and B or between diet A and C or diet B and C are not significant after feeding for 30 and 50 days. When the feeding was extended to 50 days the percentage of total lipids in the serum of rats which received the control diet (diet A) was higher than the corresponding value in serum of rats which received the diet C. It is also clear that the effect of diet B (containing 20% butter fat) caused a higher increase in total lipids of serum than the increase caused by using diet C (containing 20% corn oil) after the same period of feeding, *i.e.* 30 days. It could be concluded therefore, that rats fed on corn oil diets showed the lowest percentages of total lipids in serum caused by using diets which contained similar amounts of either butter fat or hydrogenated oil (control).

Effect of fatty diets on total cholesterol content in serum of rats

The total cholesterol content in serum of rats is shown in Table 2.

It is found that the rats receiving the diet B have the highest concentration of total cholesterol in their serum than rats receiving either diet A or diet C. The value of total cholesterol in the serum of rats receiving the control diet (A) is significantly higher than the corresponding value in the serum of rats receiving diet C. Moreover the differences between the effects of diet B and C are highly significant. However, the difference between the effects of diets A and B is not significant. The high percentage of total cholesterol in rats receiving diet B which contain butter fat, may be attributed to the presence of high percentage of saturated fatty acids in this diet. The above mentioned results apply for the feeding experiments for either 30 or 50 days. It can be noticed that the increase in serum cholesterol is 20.37, 60.11 and 44.22 mg/100ml in the serum of rats fed on diet A, B and C respectively, during the last 20 days.

Effect of diets on phospholipids content in serum of rats

Phospholipids content in the serum of rats that received diets A, B and C are given in Table 3.

It is found that diet B has comparatively the highest effect on the phospholipids content of serum while the effect of diet A is comparatively lower than the effect produced by using diet C. The differences between the effect of diets A and B as well as between diets B and C are significant. Moreover, the average of phospholipids in the serum of rats received diet B is more than that in the serum of rats which received diet A or C in the 50 days feeding experiment. These results further substantiate the results of Oyama *et al.* (1967), who illustrated that the dietary fat level and its nature affect the phospholipid values of plasma. So butter fat diets induce an increase in the phospholipid contents more than that induced in diets which contained the hydrogenated oil or corn oil, especially after feeding for 50 days.

Effect of diets on serum triglycerides

The average amounts of triglycerides in serum of rats which received diet B were more than the average amounts of triglycerides in serum of rats that received either diets A or C, for 30 days (Table 4).

The differences between the effects of diet A and B or between diet A and C and between diet B and C are not significant especially in the feeding experiments for 30 days. However, feeding the rats on diets A, B and C for 50 days showed that the serum triglycerides of rats that received diet A or B are almost of the same level. The serum triglycerides in rats that received diet C are comparatively lower than the corresponding percentage in rats fed on diet A or B. The difference between the effects of diet B and C on the serum triglycerides is significant. The increase in the triglyceride content in the serum of the last 20 days is equal to 9.59% , 7.45%, and 5.89% in rats fed on diet A, B and C, respectively.

References

- Albrink, M.J., Lavietes, P.H. and Man, E.B.** (1963) Vascular disease and serum lipids diabetes. *Ann. Intern. Ed.*, **58**, 305.
- Antonis, A. and Bersohn, I.** (1961) The influence of diet on serum triglycerides in South Africa white and bantu prisoners. *Lancet*, **1**, 3.
- Connor, W.E., Hodges, R.E. and Bleiler, R.E.** (1961) The serum lipids of men receiving high cholesterol and cholesterol free diets. *J. Clin. Invest.*, **40**, 894.
- Fetcher, E.S., FASTER, N., Anderson, J.I., Grando, F. and Keys, A.** (1967) Quantitative estimation of diets in control serum. *Amer. J. Clin. Nutr.*, **20**, 475.
- Flectcher, M.J.** (1968) A colorimetric method for estimating serum triglycerides. *Clin. Chem. Acta.*, **22**, 393—397.
- Frantz, L.D. and Carey, J.B.** (1961) Cholesterol content of human liver after feeding of corn oil and hydrogenated coconut oil. *Proc. Soc. Exp. Biol. Med.*, **106**, 800—801.
- Hill, R.J. Linzasavo, Chevalier, F. and Chalkoff, L.L.** (1958). Regulation of hepatic lipogenesis: The influence of dietary fats., *J. Biol. Chem.*, **233**, 305.
- Karu, R.K., Singh, C.A. and Bhatia, T.S.** (1973) New colorimetric method for the quantitative estimation of phospholipids without acid digestion. *J. Lipid Res.*, **14**, 695.
- Kuo, P.T.** (1965) Extraction of cell lipids from blood cell and plasma. *Trans. Ass. Amer. Physicians*, **78**, 97.
- Nieman, C., Groor, E.H. and Jansen, R.C.P.** (1952) The nutritive value of butter fat compared with that of vegetable fats. *Proc. Kon. Ned. Akad. Wetensch., Ser.* **55**, 587—604.
- Oyama, K., Uzwa, H., Tage, I. and Imarchi, K.** (1967) Plasma lipids in Japanese subjects in relation to dietary fats. *J. Cira (Japan)*, **3** (2), 286.
- Wilcox, B. and Galloway, L.S.** (1961) serum cholesterol and different dietary fats. *J. Amer. Diabet. Assoc.*, **38**, 227—230.
- Zlatkis, A.Z., Boyd, B.A.J., and Misl, D.** (1953) A new method for the direct determination of serum cholesterol. *J. Lab. Clin. Med.*, **41**, 486.

Table 1. Total lipids in serum of rats fed the three diets.

Diet*	Total lipids after 30 days (mg/100 ml)**	Total lipids after 50 days (mg/100 ml)**
A	248.88 ± 14.04	363.81 ± 34.21
B	263.90 ± 72.82	420.08 ± 73.41
C	245.30 ± 14.84	301.33 ± 29.88

* Diet A: containing 20% hydrogenated oil (control), Diet B: containing 20% butter fat, Diet C: containing 20% corn oil.

** ± standard deviation of the mean.

Table 2. Total cholesterol in serum of rats as affected by the fatty content of diet.

Diets*	Total cholesterol after 30 days (mg/100 ml)**	Total cholesterol after 50 days (mg / 100 ml)**
A	161.01 ± 10.8	181.38 ± 18.51
B	180.15 ± 8.47	240.26 ± 5.44
C	108.29 ± 12.14	152.51 ± 10.94

* Diet A: containing 20% Hydrogenated oil (control), Diet B: containing 20% butter fat, Diet C: containing 20% corn oil.

** ± SD: standard deviation of the mean.

Table 3. Phospholipids content in serum of rats as affected by the diets used.

Diets*	Phospholipids after 30 days (mg/100 ml)**	Phospholipids after 50 days (mg/100 ml)**
A	27.85 ± 12.93	50.83 ± 2.79
B	45.63 ± 2.65	65.84 ± 4.09
C	35.48 ± 2.05	54.71 ± 2.71

* Diet A: containing 20% hydrogenated oil (control), Diet B: containing 20% butter fat, Diet C: containing 20% corn oil.

** ± SD: standard deviation of the mean.

Table 4. Triglyceride contents in serum of rats as affected by the three fatty diets.

Diet*	Triglycerides after feeding for 30 days (mg/100 ml)**	Triglycerides after feeding for 50 days (mg/100 ml)**
A	13.13 ± 1.39	23.72 ± 3.27
B	17.41 ± 1.56	24.86 ± 1.77
C	13.24 ± 0.85	19.13 ± 0.82

* Diet A: containing 20% hydrogenated oil (control); Diet B: containing 20% butter fat; Diet C: containing 20% corn oil.

** ± SD: standard deviation of the mean.

معدلات النمو ومكونات الليبيدات في مصّل دم الفيران وعلاقته بالأغذية الدهنية

سعيد جبر ، على أبو سريع رمضان ، سعد الحناوي ، عادل جرجس ،
وسهير محمد عبدالمجيد قاسم

كلية الزراعة ، جامعة الزقازيق ، مصر ، المركز القومي للبحوث ، مصر
وكلية العلوم ، جامعة الرياض ، الرياض ، المملكة العربية السعودية

أجرى هذا البحث بغرض دراسة تأثير أنواع الدهون الداخلية في علائق تغذية الفيران على المكونات الليبيدية في مصّل الدم . فقد وجد :

أ - أن أعلى نسبة من كمية الليبيدات الكلية في حالة التغذية على عليقة بها ٢٠٪ من دهن اللين ووجدت أقل نسبة لها في سيرم الفيران المغذاة على علائق بها زيت ذرة بنسبة ٢٠٪ . وأن هذه الزيادات تكون أكثر وضوحاً عند تغذية الفئران على هذه الوجبات لمدة ٥٠ يوماً عنها عند التغذية لمدة ٣٠ يوماً .

ب - ترتفع نسبة الفوسفوليبيدات في السيرم في حالة احتواء الغذاء على دهن اللين وأقلها في مصّل دم الفيران المغذاة على علائق بها ٢٠٪ من الزيوت المهدرجة .

ج - عند حساب كمية الكولوسترول بالمليجرام لكل ١٠٠ سم من مصّل الدم وجد أن مصّل الدم للفيران المغذاة على علائق بها ٢٠٪ دهن لين تعطى أعلى نسبة تليها العلائق المحتوية على نفس النسبة من زيت الذرة وأقلها تلك المحتوية على الزيوت المهدرجة وتزداد هذه الكميات بزيادة مدة التغذية من ٣٠ يوماً إلى ٥٠ يوماً .

د - الجليسيريدات الثلاثية الموجودة في سيرم الدم توضح أن استخدام دهن اللين في التغذية كان أكثر الدهون سبباً في ارتفاع نسبة الجليسيريدات الثلاثية الموجودة في سيرم الدم .