Changes in plasma lipid composition induced by coconut oil. Effects of dipyridamole

E. García-Fuentes, A. Gil-Villarino, M. F. Zafra and E. García-Peregrín

Department of Biochemistry and Molecular Biology, University of Granada, Avda. Fuentenueva s/n, 18071 Granada, Spain

(Received on February 19, 2002)

The comparative effects of 10-20% coconut oil feeding on fatty acid composition of the main lipid classes of chick plasma have been studied with and without simultaneous treatment with dipyridamole in order to clarify the hypolipidemic role of this drug. Coconut oil drastically increased the percentages of lauric and myristic acids in free fatty acid and triacylglycerol fractions, whereas these changes were less pronounced in phospholipids and cholesterol esters. The percentage of arachidonic acid was higher in plasma phospholipids than in the other fractions and was significantly decreased by coconut oil feeding. Linoleic acid, the main fatty acid of cholesterol esters, was drastically increased by coconut oil feeding. Changes induced by the simultaneous administration of dipyridamole were more pronounced in the phospholipids and cholesterol esters than in the other fractions. The fall observed in linoleic acid levels after dipyridamole treatment may be of interest for a lower production of its derived eicosanoids, especially in plasma phospholipids and cholesterol esters.

Keywords: Dipyridamole, Coconut oil, Free fatty acids, Triacylglycerols, Phospholipids, Cholesterol esters.

Several pharmacological studies show that atherogenesis results from the simultaneous occurrence of platelet-endothelial interaction and lipid accumulation. Dipyridamole, 2,6-bis(diethanolamino)-4,8-dipiperidinopyrimido-[5,4d]pyrimidine, seems to present different anti-thrombotic effects carried out by different mechanisms. It has been reported that dipyridamole stimulates prostacyclin pro-
duction (23), inhibits thromboxane generation (25) and suppresses the uptake of adenosine by red blood cells (19). Little is known, however, about its mechanism(s) of action on lipid metabolism. We have previously demonstrated that the activity of chick liver 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase (EC 1.1.1.34), the main regulatory enzyme of cholesterogenesis, was drastically reduced by dipyridamole (31). More recently, we have reported that plasma cholesterol content as well as total amounts of intermediate and very low density lipoproteins were reduced about 50% by dipyridamole treatment of normocholesterolemic chicks (10). Likewise, dipyridamole seems to prevent the hypercholesterolemic effects of saturated fat (11).

On the other hand, it has been widely accepted that dietary lipid modifications influence the membrane structural lipid composition and metabolic functions (29). The hypercholesterolemic effects of saturated fatty acids have been well established in humans and in several animal species (13, 20, 22). Saturated fatty acids also induce rapid changes (24 h) in fatty acid composition of chick liver and hepatic mitochondria and microsomes (12, 15). As a consequence, mitochondrial cytochrome oxidase and ATPase activities drastically changed after 24 h of dietary manipulation (14) as well as microsomal HMG-CoA reductase activity (7, 13). Fatty acid composition of the different lipoproteins from chick plasma were also affected by dietary saturated fat (3).

To gain a better understanding of the hypolipidemic role of dipyridamole while bearing in mind the relationship between platelet aggregation and changes in eicosanoid production from arachidonic acid, in this work we have studied the effects of this drug on the fatty acid composition of the main lipid classes of chick plasma (free fatty acids, triacylglycerols, phospholipids, and cholesterol esters). Young chicks were used as the experimental animals because they are highly sensitive to dietary modifications (2, 7, 8, 17) and different hypolipidemic products (4, 18, 32).

Materials and Methods

Animals and feeding procedures.—White Leghorn male chicks (Gallus domesticus) from a commercial hatchery (Granja Avícola Santa Isabel, Córdoba, Spain) were maintained in a chamber with a light cycle from 09.00 - 21.00 h and controlled temperature (28 °C). Control chicks were fed ad libitum on a cholesterol-free standard diet normally used for growing chicks (Sanders A-00, Granada, Spain) which contained (w/w) 42% carbohydrate (mainly starch), 6.6% fat, and 20.6% protein. A second group of newborn chicks were fed during the first 14 days on this standard diet and then fed during the next 14 days on the experimental diet prepared by supplementation of 10% (CO10 group) or 20% (CO20 group) coconut oil to the standard diet. The CO10 diet contained (w/w) 38.7% carbohydrate (mainly starch), 15.3% fat, and 18.6% protein. The CO20 diet contained (w/w) 35% carbohydrate (mainly starch), 24% fat, and 16.7% protein. Both experimental diets were enriched in saturated fatty acids, especially lauric and myristic acids, which were nearly absent in the standard diet (Table I). In parallel groups, dipyridamole (Boehringer Ingelheim, S.A.E., Barcelona, Spain) was added to the drinking water at a level of 4.5 mg/kg weigh per day for chicks 14 to 28 days old. The dosage of dipyridamole used in our experiments was similar to that employed in human studies (30) and