Protective effects of soft ripened cheese (camembert) containing vegetable oil (rapeseed) compared to classical dairy fat cheese on the severity of atherogenic markers in hamsters fed hyperlipidemic diets

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Abstract

Milk fat is rich in saturated fatty acids (SFA) known to increase plasma cholesterol, but we previously showed that there was some benefit to cheese consumption compared to milkfat: at equal fat content, cheese was less atherogenic than milkfat*. In this study we evaluated the impact of diets including cheese prepared with different fat sources: Veg-cam cheese *"Primevere"* prepared with vegetable rapeseed oil (poor in SFA) compared to Dairy-cam cheese prepared with milkfat (camembert) rich in SFA and cholesterol.

Two groups of 9 hamsters were fed with equal fat and protein contents from cheese sources: Dairy-cam or Veg-cam. Diets were obtained by blending lyophilized whole cheese with the chow-based diet, to provide up to 10% or 20% (by weight) of fat. Animals were fed for 5wks with the 10% fat diets and then with the 20% fat diets till 17wks. The atherogenic impact was evaluated after both 10% and 20% fat diets on plasma lipids: total cholesterol (TC), LDLC, non-HDLC, atherogenic ratio non-HDLC/HDLC, and after the 20% fat diets by measuring the aorta lesions severity expressed by its cholesteryl esters (CE) content (by GLC).

Results showed that after the 10% fat diets, Veg-cam induced lower levels of plasma lipids than Dairy-cam (TC:- 29% $p<0.001$, non-HDL/HDLC:-45%$p<0.05$). Interestingly, the increase of fat intake from 10% to 20% induced opposite changes in plasma lipids: a decrease with Veg-cam (TC:-16% $p<0.001$), and an increase with Dairy-cam (TC:+20% $p<0.05$), resulting in much more prominent differences after the long term 20% fat diets (TC:- 51%$p<0.001$). However, the increase of fat intake from 10% to 20% did not modified the plasma atherogenic ratio non-HDLC/HDLC within each type of cheese diet: Veg-cam ratio (0.56vs0.56) and Dairy-cam ratio (1.06vs113). The atherosclerotic fatty streaks evaluated by the CE levels of the aortas were also dramatically reduced: four time less in Veg-cam group than in the Dairy-cam group.

At equal fat and protein content, cheese prepared with rapeseed vegetal oil is less atherogenic than the classical dairy cheese and may contribute to the recommended SFA reduction intake. **B. Delplanque, A. Thaminy, G. Agnani, JC. Martin, K. Bensharif, D Gripois. Comparison of the effects of cheese or butter on the severity of atherogenic markers in hamsters fed an hyperlipidemic diet. ISA 2006 Rome*

Key words: Rapeseed, oil, cheese, saturated, unsaturated, alphalinolenic fatty acids, plasma and aorta lipids.

Introduction

Milk fat is rich in saturated fatty acids (SFA) known to increase plasma cholesterol, but we previously showed that there was some benefit to cheese consumption compared to milkfat consumption: at equal fat content and quality, cheese was less atherogenic than milkfat. The plasma atherogenic ratio nonHDL-C/HDL-C was reduced by 42% ($p<0.01$) and was correlated to the reduction (-25% $p<0.05$) of the levels of Cholesteryl esters (CE) deposit in the hamsters aortas (**B. Delplanque, A. Thaminy, G. Agnani, JC. Martin, K. Bensharif, D Gripois. Comparison of the effects of cheese or butter on the severity of atherogenic markers in hamsters fed an hyperlipidemic diet. ISA 2006 Rome).*

In this study, the impact of hyperlipidemic diets including cheese prepared with different fat sources was evaluated on atherogenic parameters of hamsters plasma and aorta: Veg-cam cheese *"Primevere"* prepared with vegetable rapeseed oil (poor in SFA) was compared to classical Dairy-cam cheese prepared with milkfat (camembert) rich in SFA and cholesterol.

Methods

Diets **:** Two diets were carried out with cheese (camembert) sources. Veg-cam diet was obtained by blending lyophilized whole cheese prepared with rapeseed oil with the chow-based diet and the Dairy-cam was similarly prepared with the classical cheese prepared with milk fat, to provide up to 10% or 20% (by weight) of fat for both. *Experimental procedures:* Two groups of 9 hamsters were fed with Veg-cam or Dairy-cam respectively for 5 weeks with the 10% fat diets and then for 12 weeks with the 20% fat diets. At the end of these 5 and 12 week-periods, the hamsters were fasted overnight and blood was withdrawn under anaesthesia by intra-cardiac puncture (0.5mL and 3mL respectively). After the second period, aortas and other organs were removed, quickly frozen in liquid N2 and stored at -80°C until lipid analysis. Plasma lipids and lipoproteins were measured by enzymatic procedures (using commercial kits on automatic analyzer). The aorta lesions severity was evaluated by GLC as expressed by its cholesteryl ester (CE) content.

Statistical analysis were performed by student's t-test (α, $p<0.05$, γ, $p<0.001$).

Results

Lipids and lipoproteins After 5 weeks of 10% fat diets, Veg-cam induced lower levels of plasma lipids than Dairy-cam (TC:-29% $p<0.001$, non-HDL/HDLC:-45% $p<0.05$) (fig.1). The differences were more prominent after the 12 weeks of 20% fat diets (TC:-51% $p<0.001$) (fig.2).

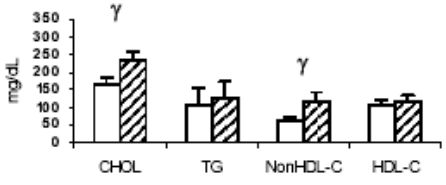

fig.1 Lipids and lipoproteins after 5 weeks of 10% fat diets

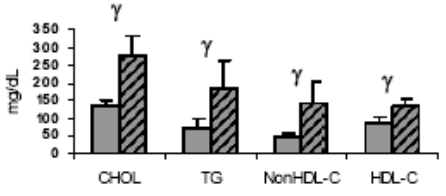

fig.2 Lipids and lipoproteins after 12 weeks of 20% fat diets

Interestingly, the increase of fat intake from 10% to 20% induced opposite changes in plasma lipids and lipoproteins: a decrease with Veg-cam (TC:-16% $p<0.01$), and an increase with Dairy-cam (TC:+20% $p<0.05$), resulting in much more prominent differences after these two long term 20% fat diets. The resulting plasma atherogenic ratio non-HDLC/HDLC was almost double with the Dairy-cam diet compared to the Veg-cam diet (1.06 vs 0.56 $p< 0.05$) (fig.3). However, the increase of fat intake from 10% to 20% did not modify this atherogenic ratio within each type of cheese diet: Veg-cam ratio (0.56 vs 0.56) and Dairy-cam ratio (1.06 vs 1.13).

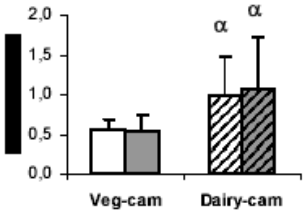

fig.3 Atherogenic ratios after 10%and 20% fat diets

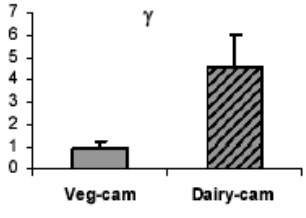

fig.4 Relative CE deposit in aorta

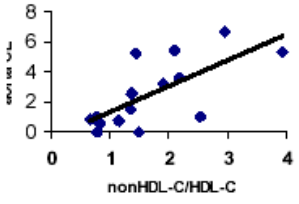

fig.5 Correlation between aorta CE and plasma nonHDL-C/HDL-C

Aorta lipids

At the end of the 20% fat diets, the aorta lesion severity (fatty streaks) evaluated by the measurement of the CE level was also dramatically reduced: four time less in Veg-cam group than in the Dairy-cam group (fig.4) and was correlated to the nonHDL-C/HDL-C ratio ($r_2 = 0{,}513$, $p<0.01$) (fig.5).

Conclusion

Within our hyperlipidemic protocole for hamsters and at equal fat and protein content, cheese prepared with rapeseed oil is less atherogenic than the classical dairy cheese and may contribute to the recommended SFA reduction intake.