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PROCEEDINGS OF THE NUTRITION SOCIETY

ABSTRACTS OF COMMUNICATIONS

A joint meeting of The Royal Society of Medicine Forum on Lipids in Clinical Nutrition, The Nutrition Society, and The Biochemical Society Lipid Group was held at The Royal Society of Medicine, London, on 15–16 October 1996, when the following papers were presented.

All Abstracts are prepared as camera-ready material by the authors.

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Comparison of the hepatic uptake and metabolism of chylomicron remnant triacylglycerol in rats fed on saturated and unsaturated fats. By MARC S. LAMBERT, MICHAEL AVELLA, KATHLEEN M. BOTHAM and PETER A. MAYES, *Department of Veterinary Basic Sciences, The Royal Veterinary College, Royal College St., London NW1 0TU*

We have shown previously that the fatty acid composition of chylomicron remnants varies, depending on the type of dietary fat from which they are derived (Lambert *et al.* 1996), and that this has a significant effect on the uptake and metabolism of their triacylglycerol by the perfused rat liver (Lambert *et al.* 1995). Livers from animals given a standard low-fat diet were used in all these studies, thus, the differences observed can be attributed to the variations in the fatty acid composition of the remnant particles. Chronic fat-feeding, however, may have additional effects on the metabolism of the different types of remnants, and this has been investigated in the present work.

Livers from rats fed on diets (21 d, fats providing 40% of the energy) rich in short- and long-chain saturated (butter fat), long-chain saturated (palm oil), monounsaturated (olive oil), *n* -6 polyunsaturated (maize oil) and *n* -3 polyunsaturated (fish oil) fatty acids were perfused with chylomicron remnants containing [^{14}C]oleate labelled triacylglycerol derived from the corresponding fat or oil (prepared *in vivo;* Lambert *et al.* 1995). The amounts of radioactivity removed from the perfusate after 1, 2 and 4 h (results not shown) and found in the liver after 4 h were similar for all five dietary groups. This finding contrasts markedly with the results obtained in similar experiments with rats given a standard low-fat diet, where remnants derived from butter fat and fish oil were taken up by the liver more rapidly than those from palm, olive or maize oils (Lambert *et al.* 1995). The oxidation of [^{14}C]oleate to $^{14}CO_2$ and its conversion to phospholipid after 4 h were measured as indices of remnant metabolism, and both were highest in livers from fish oil-fed rats (see Table). In comparison with the results obtained with rats given a low-fat diet

	Uptake by liver			Oxidation to $^{14}CO_2$			Conversion to phospholipid		
Diet	Mean	SE	*n*	Mean	SE	*n*	Mean	SE	*n*
Butter fat	32.3	3.7	6	1.65	0.50	6	6.35***	0.82	6
Palm oil	35.4	4.2	6	1.22*	0.33	6	6.95***	1.23	4
Olive oil	35.9	5.8	5	1.13**	0.21	5	5.73**	0.65	3
Maize oil	30.8	2.3	6	1.65	0.32	6	7.39**	0.87	6
Fish oil	34.7	1.0	4	2.48	0.26	4	14.23	0.65	4

Data are expressed as % of radioactivity added to the perfusions. Mean values were significantly different from the fish oil diet; * P <0.05, ** P <0.01, *** P <0.001 (unpaired t test).

(Lambert *et al.* 1995), the oxidation of palm and maize oil remnants was increased, while that of fish oil remnants remained unchanged. On the other hand, the conversion of [^{14}C]oleate to phospholipid was raised by feeding fish oil, but not the other fats tested. The results reported here indicate that the type of fat in the diet influences the hepatic chylomicron remnant metabolism by longer-term adaptive mechanisms which are different from the acute effects due to the fatty acid composition of the particles, and these are currently under investigation in our laboratory.

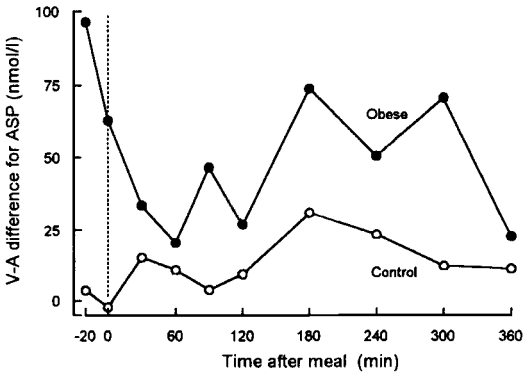
Lambert, M.S., Botham, K.M. & Mayes, P.A. (1995). *Biochemical Journal* **310**, 845-852.

Lambert, M.S., Botham, K.M. & Mayes, P.A. (1996). *British Journal of Nutrition* **76**, 435-445.

Postprandial generation of acylation stimulating protein by human adipose tissue *in vivo*. By KATHERINE CIANFLONE[1], ALLAN D. SNIDERMAN[1], LUCINDA K.M. SUMMERS[2], BARBARA A. FIELDING[2] and KEITH N. FRAYN[2], *[1]McGill Unit for the Prevention of Cardiovascular Disease, Royal Victoria Hospital, McGill University, Montreal, Canada H3A 1A1 and [2]Oxford Lipid Metabolism Group, Radcliffe Infirmary, Oxford OX2 6HE*

Acylation stimulating protein (ASP) is the most potent known stimulator of triacylglycerol (TAG) synthesis in human adipocytes (Cianflone *et al.* 1994). *In vitro* studies have shown that ASP is generated extracellularly by the interaction of three precursor proteins, all of which are secreted by human adipocytes, and that the ASP which is formed then acts on the adipocyte to increase the rate of TAG synthesis within it. *In vitro* studies have shown that the rate of ASP formation by adipocytes can be increased by insulin and by chylomicrons, but not by other factors such as fatty acids or VLDL. The present studies were designed to determine whether ASP is generated by human adipose tissue *in vivo* and what factors accelerate that process.

Paired samples of arterialized and venous blood draining the subcutaneous abdominal adipose tissue were obtained before and at intervals for 6 h after a mixed meal (60 g fat, 85 g carbohydrate) in nine lean (BMI 19.5-26.3 kg/m^2) and four obese (BMI 30-52.8 kg/m^2) subjects. Plasma ASP concentrations were measured by ELISA and adipose venous-arterial (V-A) differences calculated. The results for both groups are shown (Fig.). The principal findings were: (1) ASP was consistently liberated by adipose tissue in both groups; (2) in the lean group, there was an early increase which related temporally to increased insulin concentrations, with the major change occurring between 120 and 300 min postprandially; (3) in the obese subjects, the V-A difference was greater (mean V-A differences for ASP (nmol/l): lean, 12.1 (SE 6.1); obese, 51.8 (SE 20); $P<0.03$), with again the major differences concurrent with the postprandial increase in plasma TAG.

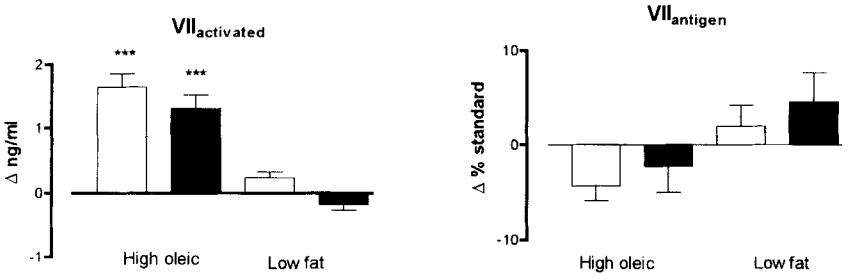


We conclude that ASP is liberated by human adipose tissue in vivo during the postprandial period, and that there may be differences between lean and obese subjects which warrant further investigation.

Cianflone, K., Roncari, D. A. K., Maslowska, M., Baldo, A., Forden, J. & Sniderman, A. D. (1994). *Biochemistry* **33**, 9489-9495.

Increased activation of clotting factor VII without apparent increase in clotting factor XII activation following a test meal enriched in oleic acid. By FRANCESCA OAKLEY[1], T.A.B. SANDERS[1] and G.J. MILLER[2], *[1]Nutrition, Food & Health Research Centre, King's College, University of London, Campden Hill Road, London W8 7AH and [2]MRC Epidemiology and Medical Care Unit, Wolfson Institute of Preventative Medicine, Medical College of St Bartholomew's Hospital, Charterhouse Square, London EC1M 6BQ*

Increased factor VII coagulant activity following a high fat meal is now well recognized. It has been argued that this may be a consequence of increased activation of the intrinsic pathway of blood coagulation via clotting factor XII and the contact system (Mitropoulos *et al.* 1995). We previously reported increased factor VII coagulant activity following a test meal enriched in oleic acid compared with a low-fat test meal (Oakley *et al.* 1996). Consequently, we have determined the concentration of factor VII circulating in the activated form ($VII_{activated}$), according to the method outlined by Morrissey *et al.* 1993. Total factor VII zymogen was measured as $VII_{antigen}$, by ELISA and activated factor XII ($XII_{activated}$) by the method described by Ford *et al.* 1996. All assays were carried out on blood samples taken fasting and at 3 h and 7 h postprandially following a high-oleic-acid test meal or a low-fat test meal. Subjects were twelve, healthy, male volunteers in the study previously described. The results are shown as the mean change from fasting values with their standard errors (open bars denote difference between 3 and 0 h, filled bars between 7 and 0 h).



*** values were significantly different from the low-fat test meal $P<0.001$ (paired t-test).

The high oleic test meal led to a significant increase in $VII_{activated}$ at both 3 and 7 h whereas the level of $VII_{antigen}$ remained constant. The low-fat meal did not influence the concentration of $VII_{activated}$ but led to a non-significant ($P=0.06$) increase in $VII_{antigen}$ at 3 h compared with the high oleic test meal. Factor $XII_{activated}$ remained unchanged from fasting values at 3 and 7 hours on both treatments (results not shown). These results demonstrate that the increase in factor VII coagulant activity previously reported with the high-oleic-acid test meal was a consequence of an increased proportion circulating in the activated form. Second, these findings suggest that factor XII activation may be not involved in the postprandial activation of factor VII by dietary fat.

T.A.B.S. acknowledges a grant from the Ministry of Agriculture, Fisheries and Food.

Mitropoulos, K.A., Martin, J.C., Stirling, Y., Morrisey, J.H. & Cooper, J.A. (1995). *Thrombosis Research* **78**,67-75.

Oakley, F., Sanders, T.A.B. & Miller, G.J. (1996). *Proceedings of the Nutrition Society* (In the Press).

Morrissey, J.H., Macik, B.G., Neuenschwander, P.F. & Comp, P.C. (1993). *Blood* **81**; 734-744.

Ford, R.P., Esnouf, M.P., Burgess, A.I. & Sarphie, A. (1996). *Journal of Immunoassay* (In the Press).

Treatment with statins reduces apoprotein B-48 in the Sf 20-400 fraction of plasma. By J. WRIGHT[1], J.D.R. RECKLESS[2], C.M. WILLIAMS[3], C.A. STIRLING[2], D. COLE[2], S. SETHI[1] and B.J. GOULD[1]. [1]*School of Biological Sciences, University of Surrey, Guildford GU2 5XU;* [2]*Bath University Postgraduate Medical School, Bath BA2 7AY;* [3]*Hugh Sinclair Unit of Human Nutrition, University of Reading, RG6 6AP.*

Previous studies showing a fall in plasma triacylglycerol (TAG) levels in response to treatment with statins have mostly used measurement of retinyl ester as an indirect marker of chylomicron metabolism. This method has limitations which have been overcome with the development of a specific assay for apolipoprotein B-48.

Postprandial lipoprotein metabolism was studied in a group of twenty subjects with primary hypercholesterolaemia on two occasions: 1. following 6 weeks placebo treatment, and 2. following 4 weeks treatment with either simvastatin or atorvastatin 10 mg daily. On each occasion blood samples were taken after an overnight fast and for 9 h following a test meal comprising 86 g carbohydrate, 97 g fat and 42 g protein. Subjects were eight males and twelve 12 females (age 54.7 (SD 11.7) years; BMI 27.2 (SD 5.7) kg/m2).

Plasma was subfractionated into a chylomicron (CM) fraction (Sf>400) and an infranatant (Sf 20-400, total VLDL). The infranatant fraction was further subfractionated into three flotation intervals, Sf 100-400 (VLDL1), Sf 60-100 (VLDL2) and Sf 20-60 (VLDL3). Measurements of TAG and apo B-48 were made on these subfractions, the latter using a specific ELISA method (Lovegrove *et al.* 1996).

Levels of fasting plasma cholesterol and TAG, and 9 h postprandial total area under the curve (TAUC) values for plasma TAG, total VLDL-TAG, total VLDL B-48 and VLDL1-3 B-48 following placebo and statin treatment are shown in the Table. Differences were calculated using paired Student's t test.

	Placebo		Statin		P
	Mean	SD	Mean	SD	
Plasma (fasting)					
TAG (mmol/L)	2.00	0.72	1.66	0.63	< 0.05
Cholesterol (mmol/L)	7.97	1.12	5.69	0.82	< 0.005
Postprandial TAUC					
Plasma TAG (mmol/L)	33.33	15.17	27.88	9.90	NS
Sf 20-400 TAG (mmol/L)	8.95	1.69	6.32	0.99	<0.01
Sf 20-400 B-48 (μg/ml.h)	6.30	1.67	4.85	1.55	<0.01
Sf 100-400 B-48 (μg/ml.h)	3.55	0.72	3.43	2.30	NS
Sf 60-100 B-48 (μg/ml.h)	3.17	0.44	2.69	0.38	<0.05
Sf 20-60 B-48 (μg/ml.h)	3.63	0.82	2.82	0.73	<0.05

In addition to the expected fall in plasma cholesterol in response to statin treatment, there was also a fall in fasting plasmaTAG. Postprandially, the reduction in VLDL TAG and B-48 was most marked in the later postprandial phase and thus probably represents an increase in clearance rather than decreased absorption at this time. The reduction in TAG and B-48 was largely accounted for by a reduction in smaller particles (Sf 20-100). These findings suggest that statin treatment increases the clearance of chylomicron remnants in the late postprandial phase. This may be due either to upregulation of the B/E receptor or reduced competition from B-100 particles for clearance by the receptor.

Enhanced clearance of atherogenic remnant particles may be partly responsible for the therapeutic effect of hydroxymethylglutaryl (HMG) CoA reductase inhibitors.

Lovegrove, J.A., Isherwood, G.A., Jackson, K.G., Williams, C.M. & Gould, B.J. (1996) *Biochimica et Biophysica Acta* (In the Press).

Effect of high– and low–fat meals on postprandial lipid metabolism in healthy adult volunteers.

By REBECCA MOORE, CHRISTOPHER J. SEAL and JOHN C. MATHERS. *Human Nutrition Research Centre, University of Newcastle, Wellcome Research Laboratories, Royal Victoria Infirmary, Queen Victoria Road, Newcastle upon Tyne NE1 4LP*

Obesity is an important aetiological factor in the major causes of premature mortality in the UK. Consumption of diets rich in fat is linked with the development of obesity and current guidelines advocate reducing total fat and saturated fat consumption. The short-term metabolic fate of dietary fat, especially the relationship between postprandial fat oxidation and storage is unclear. Alterations in the balance of these two variables may predispose to obesity and may be influenced by the composition of each meal. The present study aimed to quantify fat metabolism in the non–steady state after a meal using stable isotopes, and to investigate the effect of altering the dietary fat energy:total energy ratio in the meal.

Five healthy, weight stable, non–obese subjects (2 male) took part in the study (mean age 40 (SE 4.9) years; BMI 22.9 (SE 1.3) kg/m^2). After an overnight fast, blood and expired air samples were taken for background plasma [^{13}C]palmitate and $^{13}CO_2$ measurements. A prime of $NaH^{13}CO_3$ was given at 08.00 hours followed by a 6 h continuous intravenous infusion of [1–^{13}C]palmitate bound to albumin (50 μmol/kg body weight per min). After 1 h infusion each subject consumed either a high-fat (HF, 60% dietary energy from fat) or low–fat (LF, 20% dietary energy from fat) meal. Samples of blood and expired air were obtained at regular intervals during the infusion period and for a further 2 h after the infusion stopped. Indirect calorimetry was carried out before the meal and at regular intervals during the infusion period. Each subject completed the experiment twice, consuming the two meals in random order with at least 1 month between each measurement. Plasma [^{13}C]palmitate and breath $^{13}CO_2$ enrichments were determined by gas chromatography–mass spectroscopy and isotope ratio mass spectroscopy respectively. Data were analysed by paired *t* test.

	Time from meal (min)							
	50		110		170		230	
	HF	LF	HF	LF	HF	LF	HF	LF
% [1–^{13}C]palmitate label appearing as $^{13}CO_2$	13.9	17.5	10.8	15.2	10.6	17.2	11.8	16.9
P value (HF *v.* LF)	0.090		0.051		0.002		0.047	

Basal plasma palmitate flux rate was 1.64 (SE 0.13) μmol/min per kg body weight which is similar to values previously reported for non-obese subjects after a 12 h fast (Webber *et al.* 1995). The area under the curve for plasma palmitate enrichment *v.* time was higher for LF compared with HF (1671 *v.* 1177 (SE 10.2) atom%.min P=0.095) during the postprandial phase. Palmitate flux through the plasma pool reached a minimum value approximately 60 min after both meals but increased after the HF meal returning to pre-meal values after 240 min. In contrast, after the LF meal, palmitate flux through the plasma pool remained lower and approached pre–meal levels only after 300 min. The proportion of the palmitate flux which was oxidized was consistently higher with the LF meal throughout the postprandial phase. These results show that postprandial lipid metabolism is affected by meal composition and that the experimental approach described can be used to quantify these changes.

The authors are grateful to Henry Greathead for his help in plasma palmitate analyses.

Webber, J., Taylor, J., Greathead, H., Dawson, J., Buttery, P.J. & MacDonald, I.A. (1995). *Proceedings of the Nutrition Society* **54**, 51A.

Postprandial lipid partitioning and obesity. By ALEXANDER L. MACNAIR, *Cae'n y Bwlch, Talsarnau, Gwynedd LL47 6YB.*

In health, energy intake and expenditure are balanced over long periods of time but the mechanism remains obscure. Control of energy intake appears to lack any reference to energy reserves although the glucostatic mechanism for controlling energy intake may exist in the complex down-regulation of glycogen synthase (EC 2.4.1.21) by serial phosphorylation as the intracellular concentration of muscle glycogen approaches its ceiling. No matter how precisely carbohydrate intake is regulated in relation to depletion of its reserves, fat intake is unregulated in this way. In the non-obese, there is little conversion of fat to carbohydrate and the fat:carbohydrate ratio oxidized approaches closely the ratio in which they are ingested. Excess of energy intake over that expended is stored as fat and as the fat mass increases, there is an increase in the fat:carbohydrate ratio oxidized under the influence of the glucose-fatty acid cycle. Ultimately, a balance is struck and maintained at a level of adiposity determined by the fat:carbohydrate ratio of the diet. However, weight stabilizes only if energy expenditure equilibrates with intake. How then is the energy expenditure regulated in order to balance intake? Obese individuals expend more energy at rest than slim individuals with a similar lean body mass. Nevertheless, studies of total energy expenditure using doubly-labelled water show that there is a highly significant inverse relationship between body fatness and non-basal energy expenditure (Schulz & Schoeller, 1994).

An explanation for the ability of some individuals to dissipate excess energy and remain slim while others accumulate fat, derives from the arrangement for partitioning lipids entering the circulation in chylomicrons. The half-life of these particles in the circulation is a matter of minutes. Indicating that most of their triacylglycerol (TG) is removed during their first pass through the capillary networks of skeletal muscle (SM) and adipose tissue (AT), where they attach to lipoprotein lipase (EC 3.1.1.34; LpL) deployed on the glycocalyx embedded in the basement membrane of the endothelial cells of which these capillaries are formed. Normal-weight, active subjects have an AT mass of the order of 20% of total body mass whereas SM is about 40%. Moreover, metabolically active muscle tissue is considerably more densely supplied with capillaries than is AT. Thus, the primary determinant of whether fatty acids (FA) released from chylomicrons enter muscle cells and are oxidized rather than entering fat cells to be stored is the difference between the surface area of endothelium in muscle capillaries as compared with adipose tissue capillaries.

This system of partitioning of postprandial lipid disposition is further refined by the effects on LpL activity of the degree of training of the individual, the level of habitual activity and recent activity. Endurance training of locomotor muscles can double LpL activity as capillary density in muscle increases (Kiens & Lithell, 1989). The oxidative enzyme capacity of muscle mitochondria may be increased by up to threefold during such training. These are chronic effects with a timescale of days or weeks but in addition, not only does blood flow increase in response to oxygen demand by skeletal muscle but this tissue has the capacity to increase LpL activity acutely by up to 25 fold, after an hour or more of vigorous exercise (Lithell *et al.* 1981). It may remain elevated for up to 24 h following cessation of exercise (Bahr *et al.* 1987).

In sedentary subjects, the oxidative capacity and capillary density in skeletal muscle decline with the reduced demand for energy. There is a consequent diminution in LpL capacity in this tissue. Chylomicrons arriving postprandially in the systemic circulation in such subjects are more likely to be relieved of their TG within AT capillaries to be stored, than in SM capillaries for energy release. In consequence, AT mass tends to increase with a parallel increase in its capillary network and LpL activity which underlie an increasing propensity for FA released from the postprandial lipid load to be re-esterified and stored rather than metabolised. Thus prevention of obesity may be a matter simply of maintaining a threshold level of training of the major skeletal muscle groups.

Bahr, R., Ingnes, I., Vaage, O., Sejersted, O.M. & Newsholme, E.A. (1987) *Journal of Applied Physiology* **62**, 485-490.

Kiens, B. & Lithell, H. (1989). *Journal of Clinical Investigation* **83**, 558-564.

Lithell, H., Cedermark, M., Fröberg, J., Tesch, P. & Karlsson J. (1981) *Metabolism* **30**, 1130-1134.

Schulz, L.O. & Schoeller, D.A. (1994) *American Journal of Clinical Nutrition* **60**, 676-681.

The effect of apolipoprotein H (β_2 glycoprotein-I) on the rate of activation of factor XII on the surface of emulsions of Albumin with fatty acids. By A.F. SARPHIE, and M.P. ESNOUF, *Department of Clinical Biochemistry, University of Oxford, Radcliffe Infirmary, Oxford OX2 6HE*

It is well known that the contact-phase of coagulation is activated *in vitro* by the exposure of citrated plasma to an electronegative surface, such as kaolin, glass or sulphatide vesicles. It has been suggested that large lipoprotein particles in plasma such as chylomicrons, very-low-density and intermediate-density lipoprotein particles may also provide a suitable surface *in vivo* for the activation of factor XII. In this instance, the negative charge arises from the presence of fatty acids on the surface of the particles, released by the action of lipoprotein lipase (*EC* 3.1.1.34). To model this interaction and to study the potency of various fatty acids, the activation of factor XII was studied in a purified system on the surface of emulsions of a range of fatty acids with albumin (Mitropoulos & Esnouf, 1991). This work has now been extended to compare the potency of a number of saturated and unsaturated (*cis*- and *trans*-) fatty acids emulsified with albumin, and the effect of apolipoprotein H on the activity of these surfaces. The kinetics of the activation of factor XII on these surfaces suggests that this is an autocatalytic process but this has not been demonstrated unequivocally. We have studied the activation of factor XII using an ELISA specific for factor XIIa in the presence of a serine protease inhibitor (3,4 dichloroisocoumarin). The presence of the inhibitor has little effect on the recognition of factor XIIa by the ELISA. We have demonstrated that factor XII activation does not occur if the trace amounts of factor XIIa, which invariably contaminate factor XII preparations, are inhibited by preincubation with the inhibitor.

Emulsions prepared with albumin and saturated fatty acids were very potent activators of factor XII, while those made with *cis*-unsaturated fatty acids were less active and, in contrast, emulsions made with *trans*-unsaturated fatty acids were almost as active as those made with saturated fatty acids. The activation of factor XII was most rapid if the interaction was studied at a temperature below the melting point of the fatty acid concerned.

Apolipoprotein H is an inhibitor of the activation of factor XII on the surface of acidic phospholipids in plasma (Schousboe, 1988) and we have found, using purified reagents, that apolipoprotein H also inhibits the activation of factor XII by emulsions of saturated fatty acids and albumin. In contrast, apolipoprotein H stimulated the rate of activation of factor XII when it was added to emulsions prepared from unsaturated fatty acids. Because apolipoprotein H is present in normal plasma this might explain why diets rich in unsaturated fatty acids do not appear to reduce the flux of the coagulation system.

This work was funded in part by the Ministry of Agriculture, Fisheries and Food, UK.

Mitropoulos, K.A. & Esnouf, M.P. (1991). *Thrombosis and Haemostasis* **66**,446-452.
Schousboe, I. (1988). *International Journal of Biochemistry* **20**, 309-315.

Effect of platelet-activating factor on lipid oxidation in the isolated working rat heart. By XIN WANG and RHYS D. EVANS, *Nuffield Department of Anaesthetics, University of Oxford, Radcliffe Infirmary, Woodstock Road, Oxford OX2 6HE*

Platelet-activating factor (L-α-phosphatidylcholine, β-acetyl-γ-O-alkyl; PAF) is a phospholipid mediator of inflammation with widespread metabolic effects (Evans *et al.* 1991) and cardiovascular activity (Munoz *et al.* 1995). The present study examined the potential role of PAF in changes in myocardial lipid metabolism. Isolated working hearts obtained from postprandial rats were perfused with glucose (10 mM) and either [^{3}H]oleate (1.1 mM) or [^{3}H]triolein-chylomicrons (0.4 mM; prepared from rat thoracic duct cannulation) for 80 min. PAF or *lyso*-PAF (control) was administered after 40 min perfusion. Myocardial lipid oxidation rate was estimated by measuring ^3H_2O production; the heart was subsequently frozen in liquid N_2 and its lipoprotein lipase (*EC* 3.1.1.34; LPL) activity measured.

			Lipid oxidation rate (nmol/min per g wet wt)						Heart LPL activity (nmol FA/min per mg acetone-dried powder)	
			Baseline (0-40 min)		Early post-effector (40-50 min)		Late post-effector (50-80 min)			
Substrate	Effector	*n*	Mean	SE	Mean	SE	Mean	SE	Mean	SE
[^{3}H]Oleate	*lyso*-PAF	6	146.5	22.1	112.1	47.3	124.4	16.0	1.51	0.04
[^{3}H]Oleate	PAF 2 nM	5	150.3	18.7	171.9	51.4	140.3	26.3	2.21***	0.12
[^{3}H]Oleate	PAF 200 nM	6	163.6	10.3	294.1*††	37.3	143.1	17.7	1.23	0.10
[^{3}H]Triolein	*lyso*-PAF	6	17.0	3.5	16.1	2.7	20.2	3.1	1.53	0.12
[^{3}H]Triolein	PAF 200 nM	8	17.0	4.1	17.5	3.1	30.6†	9.0	1.96*	0.13

FA, fatty acid. Significant difference (paired *t* test/ANOVA) between PAF and *lyso*-PAF treatments are indicated: *P<0.05; ***P<0.001 and between baseline and post-effector are indicated: †P<0.05; ††P<0.01.

The oleate-perfused group demonstrated a gradual decrease in aortic flow and cardiac output, but PAF administration had no effect on coronary or aortic flow rates or rate-pressure product in either oleate- or chylomicron-perfused hearts (results not shown). Oxidation of triolein (requiring initial hydrolysis by LPL) was slower than oleate oxidation. PAF increased [^{3}H]oleate oxidation briefly (10 min) at high dosage, and caused a more prolonged increase in oxidation of [^{3}H]triolein; this was associated with an increased myocardial LPL activity (Table). These results suggest that PAF has an effect on cardiac lipid metabolism that is independent of mechanical performance.

Evans, R.D., Lund, P. & Williamson, D.H. (1991). *Prostaglandins, Leukotrienes and Essential Fatty Acids* **44**, 1-10.
Munoz, H.R., Evans, R.D, Marsch, S.C.U. & Foëx, P. (1995). *Cardiovascular Research* **30**, 1028-1032.

The gastrointestinal handling and postprandial metabolism of [1-^{13}C]palmitic and [1-^{13}C]oleic acids in healthy women. By A.E. JONES, R.D. SMITH, J.A. NURMI, P. HAMEEN-ANTTILA, J.L. MURPHY and S.A. WOOTTON, *Institute of Human Nutrition, University of Southampton, Southampton SO16 6YD*

Dietary guidelines recommending a decrease in saturated fatty acid intake whilst maintaining *cis*-monounsaturated fatty acid intake (Department of Health, 1991) assume that all fatty acids are handled equally by the body. However Jones *et al.* (1985) found that [1-^{13}C]stearic acid was both poorly absorbed and poorly oxidized when compared with [1-^{13}C]oleic acid. In contrast Murphy *et al.* (1995) found that whilst the absorption of [1-^{13}C]palmitic acid was comparable with that of [1-^{13}C]stearic acid, it was oxidized to a much greater extent. In both these studies the labelled fatty acids were presented as the free acid. The poor absorption of the saturated fatty acids may be directly attributable to differences in the physicochemical properties of the crystalline form of these fatty acids. The present study utilized stable-isotope tracer methodology to examine the gastrointestinal handling and postprandial metabolism of the predominant saturated (palmitic) and *cis*-monounsaturated (oleic) fatty acids in the UK diet presented in an emulsified form.

Following an overnight fast two groups of healthy, normal-weight women ingested either [1-^{13}C]palmitic acid or [1-^{13}C]oleic acid (10 mg/kg body weight) prepared as a casein-glucose-sucrose emulsion as part of a test meal (3 MJ; 30 g lipid). Breath samples were collected for measurement of ^{13}C enrichment before and at hourly intervals for 10 h following label administration and again at 15 and 24 h. Whole-body breath CO_2 excretion was measured by indirect calorimetry at the same time points until 10 h. A baseline stool and all stools passed over a 5 d period following label administration were collected. The ^{13}C enrichment was analysed by isotope ratio mass spectrometry. The results are shown in the Table for the excretion of ^{13}C in stool expressed as a percentage of administered dose and on breath as $^{13}CO_2$ as a percentage of absorbed dose which takes into account stool losses of ^{13}C.

	[1-^{13}C]palmitic acid (*n* 6)		[1-^{13}C]oleic acid (*n* 7)	
	Median	Range	Median	Range
Age (years)	25	21 - 28	25	20 - 31
BMI (kg/m^2)	22.6	18.6 - 24.0	23.3	19.5 - 27.0
^{13}C Stool (% administered dose)	1.1	0.2 - 2.4	0.7	0.0 - 5.5
$^{13}CO_2$ Breath (% absorbed dose)	24.8	20.9 - 32.0	25.9	23.0 - 32.4

There were no significant differences between trials in the time course and magnitude of excretion of ^{13}C within stool or breath. Emulsification of the labelled fatty acids resulted in an almost complete absorption of [1-^{13}C]palmitic acid (97.6-99.8%) and [1-^{13}C]oleic acid (94.5-100%). Compared with previously reported values for the absorption of the free acids (palmitic 66.3-92.7%; oleic 89.0-99.8%), prior emulsification improved the gastrointestinal handling of palmitic acid but that of oleic acid appeared unaltered. The excretion of $^{13}CO_2$ on breath following administration of emulsified [1-^{13}C]palmitic acid and [1-^{13}C]oleic acid was comparable with values previously reported when the fats were given as the free acid. These results suggest that the gastrointestinal handling and postprandial metabolism of [1-^{13}C]palmitic acid and [1-^{13}C]oleic acid are not different when presented in an emulsified form. Further studies are needed to compare directly palmitic and stearic acids using a similar approach, in order to determine whether the gastrointestinal handling and postprandial metabolism are influenced by fatty acid chain length.

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Increased proton leak in liver mitochondria from obese mice compared with lean controls. By RICHARD K. PORTER, SIOBHAN M. McBENNETT, ZOE I. MacDONALD and J.F. ANDREWS, Departments of Biochemistry and Physiology, Trinity College Dublin, Dublin 2, Republic of Ireland

It has long been known that mitochondrial O2 consumption is not perfectly coupled to ATP synthesis. In brown adipose tissue (BAT) there is imperfect coupling due to a specific uncoupler protein that catalyses the movement of protons across the mitochondrial inner membrane. In other tissues, the imperfect coupling has been shown to be due to a non-specific potential dependent diffusion process across the mitochondrial inner membrane, known as proton leak. Proton leak accounts for approximately 20% of the resting cellular O_2 consumption of all tissues thus far measured (Brand *et al.* 1994). In obese rodents, the thermogenic capacity of BAT is impaired as a result of triacylglycerol deposition and decreased H^+ conductance of the BAT mitochondria (Trayhurn & Mercer, 1986). In the present study we assessed whether liver mitochondrial proton leak differed between lean (L) and obese (Ob) mice under conditions where BAT activity in obese mice is known to be reduced. Five lean and three obese Aston mice were housed at a subthermoneutral temperature of 20°. After 11 weeks body mass (L, 41 (SD 1) and Ob, 51 (SD 1) g), whole-body metabolic rate at 20° (L, 1.68 (SD 0.03) and Ob, 2.0 (SD 0.02) ml O2/min), liver mass (L, 1.63 (SD 0.02) and Ob, 1.73 (SD 0.06) g) and liver mitochondrial yields (L, 2.60 (SD 0.03) and Ob, 2.50 (SD 0.02) g per 100 g) were measured. In addition, proton leak kinetics were determined for liver mitochondria from lean and obese mice (Fig. 1). The proton leak rate was approximately ten times greater in obese mice compared with lean at a reference membrane potential of 165 mV. A qualitative assessment of interscapular BAT activity using histology, confirmed a greater activity in lean compared with obese mice.

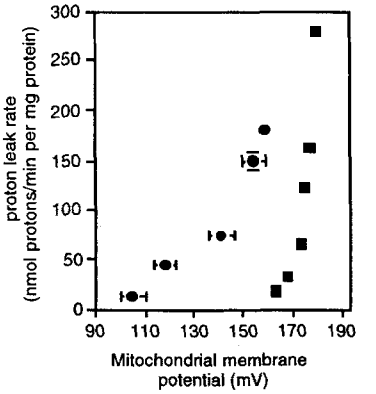

Fig. 1. Comparison of proton leak kinetics of liver mitochondria from lean (■) and obese (●) mice. Proton leak kinetics were measured according to Porter & Brand (1993). Rat liver mitochondrial proton leak kinetics were determined as an internal control of the system and gave results similar to those of Porter & Brand (1993).

Our results show that mitochondrial proton leak in liver is greater in obese compared with lean mice under conditions where BAT activity in obese mice is low.

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The measurement of emulsion particle hydrolysis by lipoprotein lipase (EC 3.1.1.34) using a fluorescence displacement assay: effect of cholesterol on activity. By L. ISABEL B. LOBO and DAVID C. WILTON, *Biochemistry Department, University of Southampton, Bassett Crescent East, Southampton SO16 7PX*

Lipases rely on interfacial binding for activation and subsequent hydrolysis of lipids to take place. The type of interface presented to the enzyme thus controls the rate of lipase catalysis. Coincidentally, the physical properties of the interface depend on the lipid components forming the substrate surface. The underlying mechanism for enzyme-substrate interaction remains uncharacterized. In an attempt to investigate the relationship between substrate lipid composition and lipoprotein lipase (LPL) activity, a continuous fluorescence displacement assay was developed to measure hydrolysis of emulsion particles, which resemble VLDL in structure (Wilton, 1989).

Results are presented that characterize the use of the fluorescence assay and to illustrate how emulsion particle hydrolysis is modulated by changing lipid composition. The fluorescence assay was shown to provide a flexible alternative to normal radiochemical assays and to give novel information on interfacial catalysis. Emulsion particles were made incorporating up to 12% (of total lipid weight) cholesterol which leads to an increase in LPL activity, contrary to previously published findings (Fielding, 1970). The stimulatory effect of apolipoprotein CII was a modest 2-4-fold and was not modulated by the presence of cholesterol.

	FLUORESCENCE ASSAY (μmol OA/mg per min)				RADIOCHEMICAL ASSAY (μmol OA/mg per min)			
Enzyme...	LPL		LPL & ApoCII		LPL		LPL & ApoCII	
Particle composition	Mean	se	Mean	se	Mean	se	Mean	se
PC only	2.72	1.51	4.29	2.70	3.26	1.66	4.91	1.30
4.5% Chol	4.66	0.51	14.92	1.08				
9% Chol	14.40	1.06	26.94	1.31				
12% Chol	13.15	0.63	22.10	5.39	15.43	3.90	22.01	2.79

OA = oleic acid ; PC = phosphatidylcholine; Chol = cholesterol.

Since high molar ratios of cholesterol exclude triacylglycerol from the monolayer surface in the emulsion particle system (Spooner & Small, 1987), these results suggest that the mechanism for LPL catalysis requires the enzyme to gain access to triacylglycerols in the core of the substrate rather than utilizing the small mole fraction of triolein that would partition into the surface monolayer.

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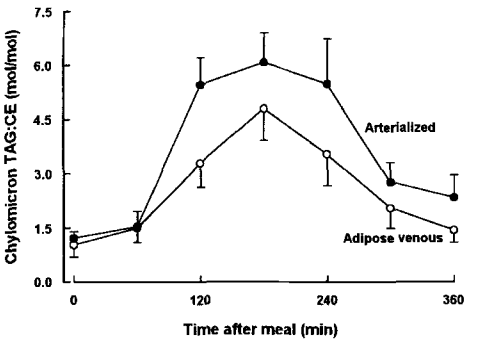
Characteristics of chylomicron clearance across human adipose tissue in healthy individuals. By BARBARA A. FIELDING, LUCINDA K. M. SUMMERS, VERA ILIC and KEITH N. FRAYN, *Oxford Lipid Metabolism Group, Radcliffe Infirmary, Oxford OX2 6HE*

Dietary triacylglycerol (TAG) enters the systemic circulation in chylomicron particles; their clearance from plasma by the enzyme lipoprotein lipase (*EC* 3.1.1.34; LPL) initiates the sequence of events that constitutes postprandial lipid metabolism. Impaired clearance of plasma TAG after a meal has been reported in obese subjects (Potts *et al.* 1995) and has also been linked to coronary artery disease (Patsch *et al.* 1992). It is therefore important to fully understand the normal metabolism of chylomicrons.

In the present study, we have used the arteriovenous difference technique (Frayn *et al.* 1989) to measure the chylomicron TAG: cholesteryl ester (CE) ratio as an index of particle delipidation during the passage through adipose tissue *in vivo*. Seven normal subjects (one male, six female) were studied; their ages ranged from 18 to 55 years and their BMI ranged from 19.5 to 30.0 kg/m^2. After an overnight fast, paired (arterialized and adipose-venous) blood samples were taken before and for 6 h after a high-fat meal consisting of 60 g fat, 85 g carbohydrate and 13 g protein in the form of breakfast cereal and a milk shake. Chylomicron-rich fractions were prepared from 0.75 ml plasma samples to which internal standards (triheptadecanoic acid and cholesteryl heptadecanoate) were added. Total lipid was extracted from the fractions and after TLC to separate the TAG and CE spots, the fatty acid components of the lipids were quantified using GC.



After the high-fat meal, there was significant extraction of chylomicron TAG across the adipose tissue ($P< 0.05$). There was a rapid increase in the chylomicron TAG:CE ratio in arterialized and adipose venous samples (Fig.), reflecting the rapid influx of dietary TAG and there was a significant arterio-venous difference ($P<0.001$). There was no significant arterio-venous difference for chylomicron CE concentration. This suggests that in normal individuals there is a rapid reduction of particle size during the process of chylomicron TAG hydrolysis by LPL, rather than complete hydrolysis of a proportion of the particles. The results argue against significant uptake of intact particles in adipose tissue. Further work is needed to study the factors influencing normal and abnormal chylomicron and chylomicron remnant clearance.

This work was supported by the Ministry of Agriculture, Fisheries and Food.

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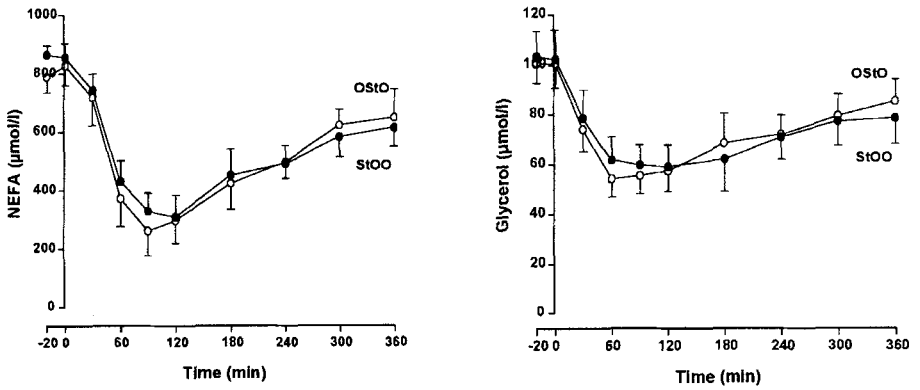
The effect of triacylglycerol fatty acid positional distribution on postprandial metabolism. By LUCINDA K.M. SUMMERS, BARBARA A. FIELDING, VERA ILIC and KEITH N. FRAYN, *Oxford Lipid Metabolism Group, Radcliffe Infirmary, Oxford OX2 6HE*

It has been suggested that triacylglycerol (TAG) enriched with saturated fatty acids at the sn-2 position may be absorbed more rapidly in the gut (Filer *et al.* 1969) and cleared from the circulation more slowly (Redgrave *et al.* 1988) than TAG containing saturated fatty acids at the sn-1 and sn-3 positions, resulting in a more pronounced postprandial lipaemia. It has been shown, using test meals containing dietary TAG in which palmitic acid was predominantly at the sn-1 or sn-2 position, that the positional distribution of palmitic acid on dietary TAG is not an important determinant of postprandial lipaemia (Zampelas *et al.* 1994). Palmitic acid is a common plasma fatty acid and has been used in most previous human studies using structured TAG ingestion. We therefore decided to perform a similar study using stearic acid in place of palmitic acid.

Nine postmenopausal female subjects median age 59 (range 40 - 70) years and median BMI 35 (range 22 - 53) kg/m² were studied after an overnight fast on two occasions. On each visit a meal consisting of 60 g fat, 85 g carbohydrate and 13 g protein was given at time zero. The fat was made up of a structured TAG either with stearic acid at the sn-1 position (StOO) or at the sn-2 position (OStO), with oleic acid at the remaining two positions. The structured TAG were given to the subjects in random order. Blood samples were taken from an arterialized hand vein at -20, 0, 30, 60, 90, 120, 180, 240, 300 and 360 min.

There were no significant differences between plasma total TAG, non-esterified fatty acid (NEFA) and glycerol concentrations in response to the two meals. Plasma glucose, insulin, lactate and 3-hydroxybutyrate concentrations were also very similar following the two meals.

NEFA StOO *v.* OStO (*n* 9) Glycerol StOO *v.* OStO (*n* 9)



These results confirm that the positional distribution of fatty acids on dietary TAG is not an important determinant of postprandial lipaemia. We are currently analysing the specific fatty acids present in the plasma TAG and NEFA following the different meals.

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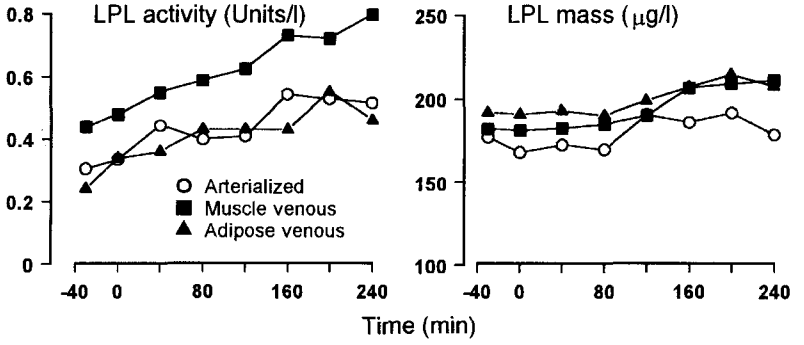
Lipoprotein lipase transport in plasma: role of muscle and adipose tissues in regulating plasma levels of lipoprotein lipase. By FREDRIK KARPE[1,2], KEITH N. FRAYN[2], SANDY M. HUMPHREYS[2], GUNILLA OLIVECRONA[3] and THOMAS OLIVECRONA[3], *[1]King Gustaf V Research Institute, Karolinska Institute, Stockholm, Sweden, [2]Oxford Lipid Metabolism Group, Radcliffe Infirmary, Oxford, OX2 6HE and [3]Department. of Biochemistry and Biophysics, University of Umeå, Umeå, Sweden*

The classical role of lipoprotein lipase (*EC* 3.1.1.34; LPL) is to hydrolyse triacylglycerols (TAG) from TAG-rich lipoproteins. More recently it has been demonstrated that LPL mediates binding of lipoproteins to proteoglycans (Eisenberg *et al.* 1992) and to some of the receptors in the LDL-receptor family (Beisiegel *et al.* 1991). There is a small amount of LPL in the circulating blood where it is bound to lipoproteins. Most of this LPL (>95%) is in a catalytically inactive form (Vilella *et al.* 1993). The aim of the present study was to investigate the role of muscle and adipose tissues in regulating the plasma level of LPL before and after a meal.

Seven healthy males fasted overnight. Cannulas were placed to obtain samples of blood representing muscle venous drainage (deep forearm), adipose tissue venous return (lower abdominal wall) and arterialized blood. After baseline samples subjects were given a fat-rich mixed meal (60 g fat, 85 g carbohydrate). Plasma levels of LPL activity, LPL mass and non-esterified fatty acids (NEFA) were measured before and in serial samples after meal intake. The arterio-venous difference was taken as a measure of the respective tissue uptake/release of LPL in response to the meal. Areas under curves were analysed by ANOVA.

Both muscle and adipose tissue tended to release inactive LPL (LPL mass) ($P<0.02$ for adipose tissue), whereas active enzyme was only released from muscle ($P<0.001$) (Fig.). Muscle extracted NEFA at all time-points, in contrast to adipose tissue, which released NEFA, more so in the fasting state and in the late postprandial phase. The total plasma level of active enzyme increased in response to the meal and the source of LPL was therefore apparently skeletal muscle.



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Differences in postprandial lipaemia in response to standard meals in Southern and Northern Europeans. By J.A. LOVEGROVE[1], K.G. JACKSON[2], A. ZAMPELAS[2], B.J. GOULD[2], M.J. GIBNEY[3], H. ROCHE[3], A. KAFATOS[4] and C.M. WILLIAMS[1], [1]*Hugh Sinclair Unit of Human Nutrition, University of Reading, Reading RG6 6AP,* [2]*Centre for Nutrition and Food Safety, School of Biological Sciences, University of Surrey, Guildford GU2 5XH,* [3]*Trinity College, Dublin 8, Ireland,* [4]*Department of Preventive Medicine, University of Heraklion, Crete-71409*

The incidence of CHD is lower in Southern (SE) than Northern Europe (NE). Differences in circulating levels of cholesterol do not explain these differences in susceptibility to CHD. Recent interest in the influence of postprandial triacylglycerol (TAG)-containing particles, chylomicrons (CM) and their remnants (CM-r), on CHD risk, suggested that a cross-cultural comparison of postprandial lipoprotein metabolism in these two European populations would be of value.

Sixteen NE and sixteen SE males matched for age and BMI and living in their country of origin (Greece for SE; UK and Ireland for NE) were studied. Subjects each received two mixed test meals of different monounsaturated fatty acid (MUFA) composition on separate occasions, with the meals given in random order and following an overnight fast. The meals were of identical nutrient composition (150 g carbohydrate, 24 g protein and 42 g fat), apart from the differences in fatty acid composition, and comprised a milk shake containing the test oil (12% MUFA or 24% MUFA) and a sandwich with preserve. Following collection of baseline fasting blood samples, nine hourly blood samples were collected after consumption of the meal and the TAG and apolipoprotein (apo) B-48 concentrations were measured (Lovegrove *et al.* 1996). The results are shown in the Table below:

MUFA		Fasting concentration		Area under curve		Time to peak (min)	
		Mean	sd	Mean	sd	Mean	sd
12% TAG (mmol/l)	NE	1.07	0.33	727	230	349	106
	SE	1.02	0.32	738	261	177 ***	66
Apo B-48 (μg/ml)	NE	3.57	0.69	2576	750	266	145
	SE	3.01 **	0.83	2159	526	180	103
24% TAG (mmol/l)	NE	1.12	0.38	777	79	283	139
	SE	1.17	0.39	786	234	165	83
Apo B-48 (μg/ml)	NE	3.84	1.04	2596	733	248	135
	SE	3.20	1.22	2330	695	180	76

Mean values were significantly different from those for NE: $^{**}P<0.02$, $^{***}P<0.001$

The postprandial TAG and apo B-48 responses, represented by the areas under the response curves, were similar after both meals and between the two populations. However the patterns of the postprandial TAG and apo B-48 responses for the SE compared with the NE differed, with the time to TAG peak occurring earlier after both meals in the SE group. This reached significance for the TAG concentrations after the 12% MUFA test meal ($P<0.001$). Repeated measures ANOVA showed a significant difference in the total pattern of the TAG response for the two populations for both the 12% and 24% MUFA meals ($P<0.01$, both cases). Fasting apo B-48 levels were also significantly lower in the SE group before the 12% MUFA meal ($P<0.02$) and a similar trend was evident for the 24% MUFA meal. The results show that the SE subjects had an earlier TAG peak and the TAG:apo B-48 ratios (results not shown) suggest that the SE group had larger CM particles in the earlier postprandial period. It is suggested that these larger particles are cleared at a faster rate when compared with the NE subjects and are associated with lower fasting apo B-48 concentrations. These differences may be of significance to the differences in CHD risk between the two populations.

Acknowledgments to EU for funding this work.

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Postprandial lipaemia in endurance- and sprint/strength-trained athletes. By J.E.M. LAWRENCE, S.L. HERD and A.E. HARDMAN, *Sports Nutrition and Exercise Biochemistry Research Group, Loughborough University, Leicestershire, LE11 3TU*

Postprandial lipaemia has been reported to be lower in endurance-trained individuals than in sedentary controls (Cohen *et al.* 1989). This is possibly because endurance training leads to an enhanced capillary network, and hence greater activity of lipoprotein lipase (*EC* 3.1.1.34; LPL), in skeletal muscle. Strength or sprint-training, however, would not confer such a high level of adaptation in the microcirculation. The purpose of the present study was to compare postprandial lipaemia in endurance-trained and sprint/strength-trained athletes. Athletes were studied after refraining from training for 2 d, i.e. in the absence of any acute effect of exercise.

The subjects were thirteen endurance-trained (ET) athletes (nine men, four women) aged 23 (SD 3.8) years and nine sprint/strength-trained (ST) athletes (six men, three women) aged 23 (SD 2.3) years. Maximal O_2 uptake values (ml/kg per min) were: ET - men 70.9 (range 58.3-82.0), women 56.4 (range 53.8-57.9); ST - men 63.8 (range 62.0-64.9), women 48.2 (range 45.1-54.5). Body fat values (%) were: ET - men 13.6 (range 4.5-18.5), women 21.1 (range 18.4-25.3); ST - men 14.8 (12.4-21.0), women 23.1 (range 20.6-26.4). Fat-free mass values (kg) were: ET - men 57.7 (range 48.0-70.1), women 45.4 (range 43.6-48.3); ST men 63.0 (56.9-68.5), ST women 49.1 (range 45.2-52.5).

Subjects reported to the laboratory in the morning after a 12 h fast for an oral fat tolerance test. Baseline venous blood samples were obtained. A test meal (1.2 g fat, 1.2 g carbohydrate/kg body mass, 67% energy from fat, 29% energy from carbohydrate) was then consumed. Further blood samples were obtained after 30 min and then at hourly intervals for 6 h. Plasma was analysed for triacylglycerol (TAG), total cholesterol (TC) and HDL cholesterol (HDL-C). Serum was analysed for insulin. Lipaemic and insulinaemic responses were determined as the areas under the TAG concentration *v.* time and insulin concentration *v.* time curves respectively. Comparisons between groups were made using a Mann-Whitney U test, adopting a 5% level of significance.

No differences were found between groups in the fasting concentrations of TAG, TC and HDL-C or in the lipaemic and insulinaemic responses (shown in table).

Group		Fasting TAG (mmol/l)		Fasting TC (mmol/l)		Fasting HDL-C (mmol/l)		Lipaemic response (mmol/l.h)		Insulinaemic response (μIU/ml.h)	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Endurance	Male	1.13	0.15	4.70	0.39	1.09	0.07	10.08	1.02	93.7	8.3
	Female	0.78	0.09	4.27	0.47	1.64	0.20	9.03	1.71	73.6	6.4
	All	1.02	0.11	4.57	0.30	1.26	0.10	9.76	0.85	87.5	6.5
Sprint / Strength	Male	1.09	0.11	4.59	0.35	1.06	0.04	10.94	1.13	98.9	13.1
	Female	1.11	0.14	5.20	0.62	1.19	0.01	9.98	0.43	135.7	20.4
	All	1.10	0.09	4.79	0.31	1.10	0.03	10.62	0.76	111.2	11.9

These results suggest that, in the absence of an acute effect of exercise, there is no difference in postprandial lipaemia between endurance-trained and sprint/strength-trained athletes.

This research was supported by the British Heart Foundation.

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Moderate intensity exercise, postprandial lipaemia and muscle lipoprotein lipase activity. By S.L. HERD[1], A.E. HARDMAN[1] and L.H. BOOBIS[2], [1]*Sports Nutrition and Exercise Biochemistry Research Group, Loughborough University, Leicestershire, LE11 3TU and* [2]*Deparment of Surgery, Sunderland District General Hospital, Tyne and Wear, SR4 7TP*

The rate of clearance of triacylglycerol (TAG)-rich lipoproteins is enhanced following a bout of exercise (Sady *et al.* 1986). The concentration of these lipoproteins is particularly high during the hours after eating a fatty meal. The purpose of the present study, therefore, was to examine the influence of a bout of moderate-intensity exercise on postprandial lipaemia, muscle lipoprotein lipase (*EC* 3.1.1.34; LPL) activity and muscle TAG concentration.

Eight physically active, normolipidaemic men, aged 27.0 (SD 4.2) years, BMI 24.5 (SD 1.3) kg/m^2, participated. Subjects undertook two trials, each over 2 d, in a balanced, crossover design. On the afternoon of day 1, subjects performed either activities of daily living only (control trial) or completed 90 min cycling at 62.3 (SD 1.7) % maximal O_2 uptake, representing an energy expenditure of 4.5 (SD 0.5) MJ (exercise trial). On day 2 of both trials, subjects reported to the laboratory after an overnight fast for an oral fat tolerance test (OFTT). In the fasted state, a blood sample was drawn from a venous cannula and a muscle sample was obtained by needle biopsy from vastus lateralis. A high-fat test meal, comprising whipping cream, fruit, cereal, nuts and chocolate (1.4 g fat, 1.2 g carbohydrate, 0.2 g protein and 73 kJ/kg body mass), was then ingested. Further blood samples were drawn after 30 min and then hourly for 6 h. No food or drink, except water, was consumed during the observation period. Food intake was standardized during the 2 d leading up to each OFTT. Subjects refrained from exercise for 2 d before each trial.

Muscle samples were analysed for TAG concentration and for LPL activity. Blood samples were analysed for TAG concentration in total plasma and in the chylomicron (chylo)-rich fraction. TAG in the non-chylo-rich fraction was the difference between total TAG and TAG in the chylo-rich fraction. Indices of lipaemia were the areas under the TAG concentration *v.* time curves. Comparisons between trials were made using a Wilcoxon matched pairs test, adopting a 5% level of significance. Results are expressed as means with their standard errors.

Indices of lipaemia for total plasma and for the chylo-rich fraction were lower in the exercise trial by 24% and 53% respectively compared with the control trial. Muscle TAG was 26% lower in the exercise trial compared with the control trial, but the difference was not statistically significant. There was no difference in muscle LPL activity between trials. TAG in the fasting and postprandial states and muscle TAG and LPL activity are presented in the Table.

	Fasting TAG (mmol/l)		Areas under TAG *v.* time curves (mmol/l.h)						Muscle TAG (mmol/kg dry wt)		Muscle LPL activity (mU/g wet wt)	
			Total plasma		Chylo-rich		Non-chylo-rich					
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Exercise trial	0.69	0.03	6.16*	0.46	0.92*	0.16	5.21	0.35	36.3	3.9	19.3	1.3
Control trial	0.78	0.07	8.15	1.07	1.98	0.51	6.13	0.59	48.9	4.9	20.6	4.9

* Significantly different from control trial, $P < 0.05$.

The findings suggest that moderate-intensity exercise decreases the magnitude of postprandial lipaemia in plasma, particularly in the chylo-rich fraction and that this response may be independent of an increase in the LPL activity of exercised skeletal muscle.

This research was supported by the British Heart Foundation.

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The relationship between birth weight and energy and macronutrient intakes, physical activity and body mass index in British teenagers aged 16-17 years. By H. DAVID McCARTHY[1] and HELEN F. CRAWLEY[2], *[1]School of Life Sciences and [2]Statistics, Operational Research and Probability Methods Research Centre, University of North London, Holloway Road, London N7 8DB*

A reduced growth in early life is associated with an increased risk for developing cardiovascular diseases (CVD) in adult life (Barker, 1992). Obesity, particularly intra-abdominal, is one risk factor for CVD which itself may be "programmed" *in utero* and/or early post-natally (Law *et al.* 1992). We have taken the opportunity to exploit data from the 1970 longitudinal birth cohort study to examine the relationships between birth weight and later variables which could contribute to obesity in adult life and thus influence the risk for CVD.

A total of 4040 individuals from the 1970 longitudinal birth cohort study (BCS70) (Chamberlain *et al.* 1973) whose birth weight was known, completed a 4 d unweighed dietary diary at age 16-17 years (Crawley, 1993), from which mean daily metabolizable energy (ME) and macronutrient intakes were calculated. Approximately half of these respondents (n 2305) also completed a 4 d activity diary from which physical activity levels (PAL) were estimated (Crawley, 1996), and a further sub-sample of 1094 teenagers had their height and weight measured by a community medical officer. The relationships between birth weight and the explanatory variables body mass index (BMI), PAL, ME and macronutrient intake (expressed as a percentage of energy) were investigated using generalized linear interactive modelling (GLIM) software.

A positive relationship between birth weight and ME intake at 16-17 years was observed ($P<0.001$) but the percentage of energy derived from each macronutrient did not vary with birth weight. Although total ME intake did not differ between low birth weight infants (LBW<2500 g, n 108) and optimum-birth-weight infants (OBW), those from the LBW group reported a significantly greater proportion of ME from carbohydrate (LBW 45.9%, OBW 44.2, $P<0.001$) and a significantly lower proportion of ME from fat (LBW 40.7%, OBW 41.5%, $P<0.05$). Such differences are unlikely to be of biological importance.

BMI at 16-17 years was positively associated with birth weight among females, but not males ($P<0.005$). It could be suggested that some males at 16-17 years have not completed the adolescent growth spurt, thus skewing the relationship between birth weight and BMI. No relationship between birth weight and PAL was observed.

These preliminary findings indicate that although early nutrition and growth may influence obesity and other risk factors for CVD in adulthood, differences in nutrient intakes, activity and BMI which may support a relationship between low birth weight and later CVD risk were not overtly observable in this cohort at age 16-17 years. Furthermore, birth weight may be too crude a measurement to predict these risk factors for CVD; birth dimensions such as ponderal index may be a more appropriate measure (Barker, 1992).

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GLP-1 secretion is reduced in obesity and levels are modulated by circulating non-esterified fatty acids. By J. WRIGHT, L. RANGANATH, L.M. MORGAN, F. NORRIS and V. MARKS, *School of Biological Sciences, University of Surrey, Guildford, GU2 5XH*

Glucagon-like peptide-1 (7-36) amide (GLP-1) is a hormone of the enteroinsular axis. In addition to enhancing the insulin response to food, it has been shown to influence peripheral metabolism of both fat and carbohydrate *in vitro*. It may also be involved in the control of satiety (Turton *et al.* 1996).

We have recently shown that postprandial GLP- 1 levels are lower in obesity, and that this may be due to the higher non-esterified fatty acid (NEFA) levels which characterise the postprandial phase in obesity (Ranganath *et al* 1996). The current study was undertaken to see whether modulation of NEFA levels results in changes in the GLP-1 response to carbohydrate administration. NEFA levels were modulated either by prior administration of acipimox (500 mg) which lowers NEFA by suppressing adipose tissue lipolysis, or by administration of heparin (10 000 units) which raises NEFA by activating lipoprotein lipase (EC 3.1.1.34).

Five lean (BMI 22.8 (SE 0.3) kg/m^2) and five obese (BMI 39.3 (SE 2.4) kg/m^2) women were studied on three occasions after an overnight fast. They were given, in random order, either glucose alone (100 g as Hycal®), glucose with heparin or glucose with acipimox.

Integrated postprandial glucose (mmol/min), insulin (nmol/min), NEFA (mmol/min) and GLP-1 pmol/min responses (total area under the curve, TAUC, 0-120 minutes) are shown in the Table.

	Glucose alone				Glucose + heparin				Glucose + acipimox			
	Lean		Obese		Lean		Obese		Lean		Obese	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Glucose	761	57	1005	69	728	52	1166	82	698	66	929	93
Insulin	31	3.5	86	17.5	30.9	4.0	85.7	18.6	30.4	5.0	66.9	9.2
NEFA	24.4	8.1	46.1	7.2	78.9	21.1	177	34.1	4.6	4.1	10.5	9.1
GLP-1	2569	421	2002	320	2194	437	1370	331	3623	309	2379	398

Postprandial plasma glucose levels were significantly higher in obese than lean subjects in all three studies. Plasma glucose was higher following Hycal plus heparin than Hycal alone in obese but not lean subjects. Fasting and postprandial insulin levels were higher in obese than lean subjects and were unaffected by either heparin or acipimox. Postprandial NEFA levels were significantly higher in obese than lean subjects; they were significantly increased by heparin and reduced by acipimox in both groups. GLP-1 levels were significantly lower in both lean and obese subjects after heparin and higher in both groups following acipimox. Overall, there was a negative inverse correlation between levels of NEFA and GLP- 1 ($r = -0.28$, $p < 0,02$).

Acute manipulation of plasma NEFA modulates GLP-1 secretion in both lean and obese subjects. Differences in levels of GLP- 1 secretion may be important not only in enhancing levels of insulin secretion but also in influencing peripheral substrate metabolism and, possibly, in affecting levels of satiety. The consistently lower GLP-1 levels in obese subjects may indicate either an intrinsic or acquired defect which may contribute to decreased statiety and, therefore, increased appetite in obesity.

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Isoenergetic exchange of monounsaturated for saturated fatty acids: effects on fasting triacylglycerol and total cholesterol levels. By J.M.E. KNAPPER[1], A. ZAMPELAS[1], D.H. WEBB[1], C.N. BROOKS[1], A. LAWRENCE[1], J.A. TREDGER[1], L.M. MORGAN[1], J.WRIGHT[1] and C.M. WILLIAMS[2], *[1]Centre for Nutrition and Food Safety, University of Surrey, Guildford GU2 5XH and [2]Hugh Sinclair Unit of Human Nutrition, University of Reading, Whiteknights, Reading RG6 6AP*

We have examined the effect of reducing the saturated fatty acid (SFA) intake by increasing the monounsaturated fatty acid (MUFA) intake (olive oil) over a 4-month period, within a free-living environment. Forty-three men received two diets in random order in a cross-over design. The exact nature of the diet and the method of intervention have been reported previously (Knapper *et al.* 1997). During the first 8- week experimental period fifteen healthy middle aged men (mean age 48.4 (SD 7.0) years) and seven healthy young men (mean age 30.4 (SD 5.9) years), with normal fasting lipid values (plasma triacylglycerol (TAG) <2.3 mmol/l, plasma cholesterol <6.5 mmol/l) and matched for lifestyle factors such as sports participation, received a control diet; and an equal number of middle-aged men (mean age 48.8 (SD 5.1) years) and six young men (mean age 35.7 (SD 2.5) years) with identical screening details received the experimental (high MUFA) diet. After a wash-out period of 4-6 weeks the regimens were crossed over. Analysis of the dietary intake for the first experimental period revealed that those subjects receiving the control diet consumed 11.3 MJ, with 38% of the dietary energy as fat: comprising 16% SFA; 13% MUFA and 7% PUFA. Subjects on the experimental diet consumed 11.4 MJ with 38% energy as fat comprising 10% SFA; 18% MUFA and 7% PUFA.

Body weights were monitored at 0, 2, 4 and 8 weeks in each experimental period. There was a small but significant increase in body weight in both arms of the study (mean 1.23 (SD 0.25) kg in the first arm, $P<0.01$, and mean 0.89 (SD 0.46) kg in the second arm, $P<0.01$). There were no differences in weight gain on the two diets. zFasting plasma TAG levels and total cholesterol levels were measured before each experimental period and at 2, 4 and 8 weeks on the diets. Data were analysed by diet, age group and experimental period, results for diet are shown in the Table.

	Duration of the diet							
	0 weeks		2 weeks		4 weeks		8 weeks	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
TAG (mmol/l)								
Control diet (*n* 43)	1.56	0.69	1.45	0.63	1.59	0.76	1.47	0.62
MUFA-enriched diet (*n* 43)	1.54	0.60	1.50	0.66	1.55	0.72	1.55	0.74
Cholesterol (mmol/l)								
Control diet (*n* 43)	5.40	1.00	5.17	0.98	5.33	1.07	5.50	1.01
MUFA-enriched diet (*n* 43)	5.54	0.94	4.99	0.92	5.00 **	0.95	5.09 **	0.77

** Mean values were significantly different from the control diet values, $P<0.01$.

There were no differences in fasting TAG levels between each diet group or experimental period. No significant differences were seen in fasting TAG levels at 0, 2, 4 or 8 weeks of the diets in either experimental period. Fasting cholesterol levels were also similar before the start of either experimental period by within- and between-subject analysis. Cholesterol levels differed significantly at 4 and 8 weeks according to diet group as revealed by repeated measures ANOVA ($P<0.01$). After 4 weeks on the diets mean cholesterol levels were significantly lower on the high-MUFA diet when compared with the control diet ($P<0.01$). This difference was maintained after 8 weeks on the diets ($P<0.01$). The percentage reduction in cholesterol levels on the MUFA enriched diet was 8.1% after 8 weeks on the diet.

These results, obtained through a dietary intervention in a free-living, healthy population, support the hypothesis that partial replacement of SFA with MUFA within the typical Western diet reduces total plasma cholesterol levels.

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Postprandial lipid metabolism in women after reproductive cycles. By MARIA de LOURDES C. F. RODRIGUES and TERESA H. M. DA COSTA, *Department of Nutrition, University of Brasilia, C.P. 04511, CEP 70919-070, Brasilia-DF, Brazil*

Some evidence points to the involvement of reproductive cycles in the accumulation and distribution of body adiposity, which may be one of the reasons why women are more susceptible to obesity than men. We compared short-term postprandial lipaemia in nulliparous (n 9) women and women who had had two or more complete pregnancies with lactation (n 10). All women were recruited at the University Hospital or among University students or staff. Women were healthy, without any known hypertension or diabetes mellitus. For multiparous women the youngest child was between 15 and 18 months of age. Subjects were instructed to keep a normal food intake during the day before examination and to fast overnight. On the day of the experiment before sampling began, subjects rested for 15-20 min. A sequential blood collection cannula was inserted in a forearm vein and a fasted blood sample obtained. Heparin solution (250 IU/ml in isotonic saline) was flushed into the cannula to keep it patent. The subjects then ate a mixed breakfast of bread (70 g), butter (10 g), scrambled egg (50 g) prepared with fried bacon (10 g), strawberry jam (20 g), pasteurized 20 g fat/l cows milk (200 g) with the addition of chocolate powder (10 g), refined sugar (10 g), double cream (6 g), and vegetable oil (6 g). The macronutrient content of the meal was estimated from food tables to be 23.5 g protein, 81.5 g carbohydrate and 34.6 g fat. This meal provided 3.0 MJ (730 Kcal) energy, of which 45% was from carbohydrate, 13% from protein and 42% from fat. The subjects ate the meal in 10-20 min. Further blood samples were taken at the following times from the start of eating: 30, 60, 90 and 120min. Plasma and serum were separated and measured for glucose, total triacylglycerols (TAG), total cholesterol and HDL-cholesterol.

	Nulliparous		Multiparous		
	Mean	Range	Mean	Range	*P* value (*t* test)
Age (years)	26	20-38	28	21-35	NS
Body mass index (kg/m^2)	20.9	17.9-23.6	27.4	21.1-35.1	0.001
Waist:hip ratio	0.71	0.67-0.78	0.82	0.76-0.92	0.001
Glucose (mmol/l)	4.5	3.9-5.1	4.7	4.0-5.3	NS
Total Cholesterol (mmol/l)	4.6	3.8-5.7	4.0	3.0-4.9	NS
HDL-Cholesterol (mmol/l)	1.5	1.0-2.1	1.0	0.7-1.1	0.007
Total TAG (mmol/l)					
min 0	0.7	0.4-1.0	0.8	0.3-2.1	NS
min 30	0.6	0.2-0.8	0.8	0.2-2.1	NS
min 60	0.8	0.3-1.3	0.9	0.3-2.4	NS
min 90	1.0	0.4-1.8	1.1	0.5-2.7	NS
min 120	1.3	0.5-2.1	1.4	0.7-3.2	NS

Multiparous women had significantly higher BMI and waist:hip ratios, indicating accumulation of total body fat and visceral adiposity. They had lower HDL-cholesterol which is a predictor of coronary heart disease. Mean values for total TAG were not different between nulliparous and multiparous women, but variability was higher in this latter group, suggesting a tendency towards lipaemia. These results indicate that reproductive cycles increase total mass of adipose tissue and favour adiposity around the abdominal region, which is accompanied by a decrease in HDL-cholesterol levels and indicative of maladaptation in terms of lipid metabolism. Further work is needed for a better examination of post-prandial lipaemia in women after reproductive cycles.

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The association of factor XIIa with lipoprotein particles in plasma. By A.F. SARPHIE[1], L.K.M. SUMMERS[2], and M.P. ESNOUF[1], *[1]Department of Clinical Biochemistry and [2]Oxford Lipid Metabolism Group, University of Oxford, Radcliffe Infirmary, Oxford OX2 6HE*

It has been suggested that factor XII is activated on the surface of lipoprotein particles in plasma (Mitropoulos *et al.* 1989) although it was not possible to demonstrate any association between the particles and activated factor XII (factor XIIa) at that time. In this communication we describe a procedure for investigating this association directly in plasma which is based on a combination ELISA in which the capture antibody is specific for factor XIIa and the secondary antibody is directed against a selected component of the lipoprotein particle. Using this technique we found that factor XIIa was associated with apolipoproteins B, CII, E and H (Table1; values derived from twenty-five subjects). Apolipoprotein A was not associated, suggesting that factor XIIa is probably present on the surface of VLDL remnants.

Table 1 *Apolipoproteins associated with factor XIIa.*

Units	Apo-A (relative absorbance)*	Apo-B (apparent nmol)	Apo-CII (relative absorbance)	Apo-E (apparent nmol)	Apo-H (nmol)
Mean value	0.0063	15.01	0.402	30.12	33.8
SD	0.0009	8.04	0.158	7.6	9.6

*Relative or apparent units are used where the assay could not be calibrated with a true standard.

The association with apolipoprotein CII was probably indirect since it was not detected in the presence of 0.05% Tween-20. In some experiments factor XIIa was found in preparations of chylomicrons isolated from subjects after a high-fat meal containing 60g fat,85g carbohydrate and 13g protein. To determine whether factor XII was also associated with the chylomicrons, they were incubated for 60 min at 37°C with a bacterial lipase to hydrolyse the triacylglercerol and subsequently activate the factor XII; in all cases the treatment resulted in a large increase in the amount of factor XIIa compared with control samples incubated under the same conditions without lipase (Table 2; study based on eight subjects).

Table 2 *The activation of factor XII on the surface of postprandial chylomicrons incubated with and without bacterial lipase.*

	Control		Lipase	
Time (min)*	XIIa (nM)	SD	XIIa (nM)	SD
0	0.0132	0.009	0.108	0.082
120	0.0081	0.0068	0.346	0.167
360	0.013	0.0154	0.301	0.081

*The plasma samples were taken at the times shown after the meal.

This experiment shows not only that factor XII associates with the chylomicrons, by an unknown mechanism, before the hydrolysis of the triacylglycerol but also that lipolysis led directly to the activation of factor XII.

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Surgical correction of postprandial dyslipidaemia. By D. J. OWEN, A. CARMICHAEL, R. F. G. J. KING, I. G. MARTIN, H. SUE-LING and D. JOHNSTON, *Academic Unit of Surgery, Leeds General Infirmary, Leeds LS1 3EX*

Obese people are at increased risk of developing both coronary heart disease (CHD) and non-insulin dependent diabetes mellitus (NIDDM). The pathogeneses of these two diseases in the obese may be interrelated (Elliott & Viberti, 1993). Certainly there is now much evidence for the existence of a metabolic syndrome ('Syndrome X') that is characterized by obesity, dyslipidaemia, hypertension and glucose intolerance, in which insulin resistance is the common link (Reaven, 1993).

Insulin resistance is a pathological condition in which the metabolic pathways regulated by insulin are rendered less sensitive to its effects. This results in compensatory hyperinsulinaemia, which leads in turn to hypertriacylglyceridaemia and reduced HDL-cholesterol and thus an increased risk of CHD. Weight loss is known to improve insulin sensitivity but it is unclear whether the dyslipidaemia of obesity is corrected by successful anti-obesity surgery such as the Magenstrasse & Mill procedure (Johnston & Sue-Ling, 1996).

To study the effect of surgically induced weight loss on postprandial triacylglycerol metabolism, three groups were studied: (1) twenty nine morbidly obese patients, with normal glucose tolerance; (2) twelve patients after the Magenstrasse & Mill procedure (Johnston & Sue-Ling, 1996), (weight loss >30 kg at 10 - 94 months); and (3) ten lean controls. Subjects fasted for 12 h and ate a test meal of fat (64 g), protein (14.7 g) and carbohydrate (56.2 g); (energy 1125 kJ). Glucose, insulin, incretins, non-esterified fatty acids (NEFA), triacylglycerols, total cholesterol, HDL-cholesterol and LDL-cholesterol were measured before and for eight hours after the meal.

	Morbidly obese		After surgery		Controls	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	39	8.3	42	9.1	37	11.6
BMI (kg/m^2)	41	(range 35-58)	33	(range 23-39)	23	(range 20-31)
Fasting glucose (mmol/l)	5.07	0.51	4.72	0.62	4.56	0.47
Peak glucose (mmol/l)	7.24	1.99	6.95	1.35	6.08	1.08
Fasting triaclyglcerol (mmol/l)	1.34*	0.9	0.98	0.33	0.79	0.32
Peak triaclyglcerol(mmol/l)	4.7**	1.3	1.89	0.67	1.68	0.34
Fasting insulin (μU/ml)	23.7*	7.8	13.7	4.7	12.5	3.6
Peak insulin (μU/ml)	143.3*	38	114.6*	9.8	74.2	10.1
Fasting NEFA (mmol/l)	0.61	0.2	0.79	0.2	0.75	0.5
Nadir NEFA (mmol/l)	0.16*	0.09	0.32	0.2	0.27	0.15
HDL-cholesterol (mmol/l)	1.00*	0.19	1.57	0.21	2.05	0.31
Total cholesterol (mmol/l)	5.63	1.2	5.09	1.3	5.25	1.1

Mean values were significantly different from those for controls: *$P<0.05$; **$P<0.01$.

Weight loss of >30 kg following anti-obesity surgery was characterised by a normal postprandial triacylglycerol response and a significantly higher HDL-cholesterol. Such differences in lipid and insulin metabolism reduce the risk that CHD and NIDDM will develop. However, we also found that unless the weight reduction resulted in a BMI < 30, postprandial secretion of insulin was elevated and some degree of insulin resistance was manifest.

There is an enhanced insulin-stimulated uptake of NEFA and a reduction of NEFA production postprandially, which suggests that loss of insulin sensitivity occurs initially in the liver resulting in a failure to suppress hepatic VLDL synthesis in the fed state. We propose that most of the postprandial lipaemia in morbidly obese patients can be explained by continuing hepatic VLDL synthesis.

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Transient triacylglycerolaemia in healthy normolipidaemic men alters particle composition and increases cellular processing of large very-low-density lipoproteins by the low-density lipoprotein receptor *in vitro.** By JOHAN BJÖRKEGREN, FREDRIK KARPE and ANDERS HAMSTEN, *Atherosclerosis Research Unit, King Gustaf V Research Institute, Department of Medicine, Karolinska Hospital, Karolinska Institute, S-171 76 Stockholm, Sweden.*

Very-low-density lipoproteins (VLDL) are a heterogeneous population of lipoprotein particles varying in structure and metabolism. VLDL are made in the liver and contain apolipoprotein (apo) B-100 and endogenous lipids (Gotto *et al.* 1986). Upon their entry into the bloodstream, VLDL achieve their normal particle composition after transfer of C apolipoproteins (apo) and apo E from circulating plasma lipoproteins, primarily from high-density lipoproteins (HDL) in normolipidaemic individuals (Havel *et al.* 1973) and also from other VLDL particles in hypertriacylglycerolaemic subjects (Tornoci *et al.* 1993). Exaggerated and prolonged postprandial triacylglycerolaemia is a characteristic of patients with premature coronary heart disease (Karpe *et al.* 1993). Although accumulation of large (Svedberg flotation rate (Sf) 60-400) VLDL particles is a major event during alimentary lipaemia, the biological properties of the postprandial VLDL remain unknown.

In the present study, an intravenous infusion of a chylomicron-like triacylglycerol emulsion (Intralipid) was given to eighteen healthy normolipidaemic men to examine the effects of transient triacylglycerolaemia *in vivo* on compositional and cell biological characteristics of VLDL. The postinfusion large VLDL was found to have increased binding affinity to the low-density lipoprotein (LDL) receptor (increased declination of the curve (k-value) from 31(25-38) to 41(35-46), $p<0.005$, $n=10$ (values are means and 95% confidence limits) and a greater ability to suppress the 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase activity (increase in k-value from 0.05(0.03-0.07 to 0.12(0.05-0.18), $p<0.05$, $n=8$) of cultured fibroblasts compared with large VLDL isolated from fasting plasma. The alterations of large VLDL particles cellular interactions in response to the infusion of Intralipid were accompanied by increases in the number of apo E (1.5(1.0-2.0) to 2.4(1.3-2.3), $p<0.0001$, $n=18$), C-I (19(14-24) to 36(27-44), $p<0.0001$, $n=18$), and C-III_1 (22(15-28) to 27(19-35), $p<0.05$, $n=18$), molecules per large VLDL particle and loss of apo C-II (27(22-32) to 18(13-23), $p<0.01$, $n=18$). In contrast, the composition of the small (Sf 20-60) VLDL particles did not change significantly, nor was the LDL receptor-mediated processing of these particles altered consistently. These observations indicate that large VLDL particles that accumulate during alimentary lipaemia undergo compositional changes which render them more prone to processing by the LDL receptor. These postprandial perturbations may have both atherogenic and thrombotic consequences.

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