

Insulin sensitivity during acute elevation of NEFA: influence of fat composition and gender

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Conditions associated with impairments in insulin sensitivity (SI), such as obesity and type-II diabetes (T2D), often present with elevated NEFA. While lipid infusion studies have shown that increasing NEFA can impair glucose metabolism⁽¹⁾, there are relatively few studies investigating the effect of NEFA elevation following fat loads of differing composition.

Sixty healthy volunteers participated in a single-blind crossover trial. Subjects were randomly assigned to either 0.75 g/kg bodyweight (bw) of palm stearin (SFA) or 0.65 g/kg bw of palm stearin and 0.1 g/kg bw of DHA-rich fish oil (*n*-3 PUFA) on separate occasions; study visits for females were conducted at 4-week intervals to control for the menstrual cycle. The oils were emulsified into chocolate drinks and given as a bolus at baseline (0 min), followed by smaller drinks every 30 min. At 60 min, an infusion of heparin (500 IU bolus + 0.4 IU/kg bw/min) was administered to activate lipoprotein lipase⁽²⁾. At 240 min, a hyperinsulinaemic (HI)–euglycaemic clamp (1 mU/kg/min) was initiated. SI was calculated as the mean glucose infusion rate for the last 30 min of the 150 min clamp, either adjusted for bw or fat-free mass (ffm).

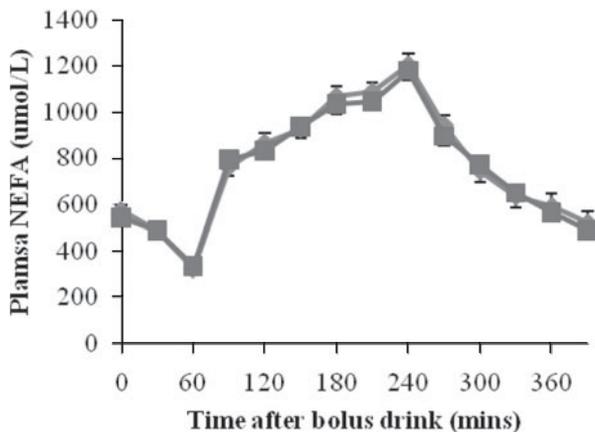


Fig. 1. Mean plasma NEFA during consumption of SFA (◆) or SFA + *n*-3 PUFA (■), *n* 48. Error bars represent SEM.

	SFA	<i>n</i> -3 PUFA	<i>P</i> value
Males (<i>n</i> 30)			
SI (mg/kg bw/min)	7.2(0.4)	7.8(0.4)	0.05*
SI (mg/kg ffm/min)	8.5(0.4)	9.3(0.4)	0.04*
Females (<i>n</i> 30)			
SI (mg/kg bw/min)	5.6(0.4)	5.3(0.3)	0.24
SI (mg/kg ffm/min)	7.9(0.6)	7.6(0.5)	0.28
Total (<i>n</i> 60)			
SI (mg/kg bw/min)	6.4(0.3)	6.6(0.3)	0.35
SI (mg/kg ffm/min)	8.2(0.4)	8.4(0.3)	

Mean (SEM). *Paired *t* tests; statistically significant at *P* ≤ 0.05.

Plasma NEFA increased with the heparin infusion and subsequently declined during the HI clamp (Fig. 1); NEFA did not differ between the two study days. Insulin sensitivity was significantly greater during the consumption of *n*-3 PUFA than SFA for males but not females (Table).

Our data suggest that the substitution of a relatively small amount of SFA for *n*-3 PUFA during oral fat feeding with heparin infusion acutely increases SI in males. The reasons for the gender-specific effect are unclear, but there is some evidence to indicate that men may be more sensitive to the effects of lipid-induced impairments in SI^(3,4). Long-term trials are needed to investigate whether these acute study results could infer any benefit of dietary fish oil supplementation in improving SI in males.

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1. Belfort R *et al.* (2005) *Diabetes* **54**, 1640–1648.
2. Beysen C *et al.* (2003) *Am J Physiol Endocrinol Metab* **284**, E18–E24.
3. Frias JP *et al.* (2001) *Diabetes* **50**, 1344–1350.
4. Masharani U, Goldfine ID & Youngren JF (2009) *Metabolism* **58**, 1602–1608.