

Table S1. Circulating fatty acid analysis.

Fatty acids	Genotype	Sex	Diet			
			Con	CFlax	HFHS	HFlax
C14:0 (Myristic acid)	Lean	Male	0.08±0.01 ^a	0.10±0.01 ^a	0.12±0.02 ^a	0.12±0.02 ^a
		Female	0.09±0.01 ^a	0.08±0.01 ^a	0.10±0.00 ^a	0.08±0.01 ^a
	Obese	Male	0.24±0.03 ^{a****}	0.20±0.02 ^{a*}	0.21±0.03 ^a	0.17±0.02 ^a
		Female	0.20±0.02 ^{a***}	0.15±0.02 ^{a,b}	0.12±0.01 ^{b†}	0.13±0.01 ^b
C15:0 (Pentadecylic acid)	Lean	Male	0.13±0.01 ^a	0.15±0.01 ^a	0.06±0.01 ^b	0.07±0.00 ^b
		Female	0.09±0.01 ^{a†}	0.09±0.00 ^{a†}	0.05±0.00 ^b	0.05±0.00 ^b
	Obese	Male	0.13±0.01 ^a	0.11±0.01 ^{a*}	0.07±0.00 ^b	0.06±0.00 ^b
		Female	0.09±0.00 ^{a†}	0.09±0.01 ^a	0.05±0.00 ^b	0.05±0.00 ^b
C16:0	Lean	Male	11.25±0.47 ^a	10.35±0.39 ^a	11.66±0.48 ^a	11.35±0.41 ^a

(Palmitic acid)		Female	10.28±0.38 ^a	8.82±0.15 ^b	9.65±0.19 ^{a,b}	9.47±0.33 ^{a,b}
	Obese	Male	17.69±0.63 ^{a****}	15.65±0.18 ^{b,c****}	15.90±0.33 ^{b****}	14.20±0.14 ^{c**}
		Female	13.42±0.79 ^{a*†}	11.81±1.33 ^{a†}	10.73±0.26 ^{a†}	10.91±0.83 ^{a†}
C16:1 (Palmitoleic acid)	Lean	Male	0.09±0.01 ^a	0.11±0.01 ^a	0.13±0.01 ^a	0.09±0.01 ^a
		Female	0.18±0.01 ^{a,c}	0.24±0.02 ^b	0.24±0.01 ^{b,c}	0.22±0.01 ^{b,c}
	Obese	Male	1.06±0.12 ^{a****}	1.18±0.14 ^{a****}	0.75±0.09 ^{a***}	0.66±0.12 ^{a**}
		Female	1.12±0.13 ^{a****}	0.97±0.19 ^{a,b***}	0.49±0.05 ^b	0.45±0.10 ^b
C17:0 (Heptadecanoic acid)	Lean	Male	0.34±0.03 ^a	0.34±0.01 ^a	0.16±0.01 ^b	0.14±0.01 ^b
		Female	0.32±0.03 ^a	0.34±0.03 ^a	0.14±0.01 ^b	0.14±0.01 ^b
	Obese	Male	0.24±0.02 ^{a**}	0.22±0.02 ^{a,b***}	0.17±0.01 ^b	0.18±0.01 ^b
		Female	0.22±0.01 ^{a**}	0.22±0.02 ^{a**}	0.13±0.00 ^b	0.14±0.01 ^b
C17:1	Lean	Male	48.19±3.20 ^a	49.22±1.94 ^a	44.89±1.89 ^a	47.72±2.16 ^a

(cis-10-Heptadecanoic acid)		Female	40.77±2.28 ^a	47.33±1.45 ^a	46.23±0.78 ^a	44.80±2.35 ^a
	Obese	Male	24.91±1.99 ^{a****}	33.50±1.69 ^{b***}	31.93±1.50 ^{b**}	34.23±1.01 ^{b**}
		Female	30.64±3.53 ^a	33.82±5.73 ^a	44.11±1.75 ^a	40.25±4.34 ^a
C18:0 (Stearic acid)	Lean	Male	9.52±0.68 ^a	9.52±0.37 ^a	12.31±0.63 ^b	11.62±0.35 ^b
		Female	15.56±0.69 ^{a†}	13.35±0.38 ^{b†}	14.79±0.31 ^{a,b}	15.21±0.56 ^{a,b†}
	Obese	Male	12.57±0.21 ^{a**}	11.55±0.37 ^a	13.40±0.69 ^a	13.70±0.22 ^a
		Female	15.04±0.54 ^a	15.20±0.64 ^{a†}	14.43±0.44 ^a	15.55±1.23 ^a
C18:1 (Oleic acid)	Lean	Male	3.22±0.19 ^a	3.28±0.19 ^a	6.21±0.11 ^b	5.90±0.31 ^b
		Female	2.72±0.10 ^a	2.43±0.05 ^a	4.91±0.11 ^b	4.55±0.24 ^b
	Obese	Male	7.55±0.69 ^{a****}	5.73±0.28 ^{b***}	8.38±0.29 ^{a**}	7.07±0.23 ^{a,b}
		Female	8.22±0.98 ^{a****}	6.38±1.32 ^{a**}	5.62±0.35 ^{a†}	5.75±0.25 ^a
	Lean	Male	0.89±0.06 ^{a,b}	0.95±0.04 ^a	0.77±0.01 ^b	0.74±0.03 ^b

C18:1n7 (<i>cis</i> - Vaccenic acid)		Female	0.70±0.08 ^a	0.83±0.11 ^a	0.61±0.01 ^a	0.68±0.10 ^a
	Obese	Male	1.39±0.02 ^a	1.18±0.05 ^{a,b}	0.90±0.02 ^b	1.07±0.24 ^{a,b}
		Female	0.88±0.06 ^{a†}	0.84±0.10 ^{a†}	0.69±0.03 ^a	0.70±0.04 ^a
C18:2 n-6 (Linoleic acid)	Lean	Male	9.87±0.40 ^a	12.26±0.51 ^b	7.26±0.22 ^c	7.92±0.28 ^c
		Female	8.73±0.43 ^a	9.09±0.33 ^{a†}	5.71±0.53 ^b	5.87±0.24 ^b
	Obese	Male	13.56±1.00 ^{a***}	11.33±0.53 ^{a,b}	9.35±0.31 ^{b,c}	8.51±0.23 ^c
		Female	9.99±0.76 ^{a†}	8.70±0.79 ^{a†}	4.36±0.19 ^{b†}	5.48±0.56 ^{b†}
C18:3 n-6 (Gamma- linolenic acid)	Lean	Male	0.03±0.01 ^a	0.03±0.00 ^a	0.03±0.01 ^a	0.02±0.01 ^a
		Female	0.05±0.01 ^a	0.04±0.00 ^a	0.05±0.01 ^a	0.05±0.02 ^a
	Obese	Male	0.07±0.00 ^{a**}	0.05±0.01 ^b	0.04±0.00 ^b	0.04±0.01 ^b
		Female	0.09±0.02 ^a	0.06±0.01 ^{a,b}	0.04±0.00 ^b	0.03±0.00 ^b
C20:0	Lean	Male	0.05±0.02 ^a	0.05±0.00 ^a	0.07±0.01 ^a	0.07±0.01 ^a

(Arachidic acid)		Female	0.05±0.00 ^a	0.06±0.01 ^a	0.08±0.01 ^a	0.07±0.01 ^a
	Obese	Male	0.05±0.00 ^a	0.05±0.01 ^a	0.06±0.01 ^a	0.06±0.00 ^a
		Female	0.04±0.00 ^a	0.03±0.00 ^a	0.04±0.00 ^{a**}	0.04±0.00 ^{a*}
C20:1 (Eicosenoic acid)	Lean	Male	0.19±0.05 ^a	0.19±0.02 ^a	0.19±0.02 ^a	0.18±0.01 ^a
		Female	0.19±0.07 ^a	0.25±0.13 ^a	0.14±0.00 ^a	0.28±0.13 ^a
	Obese	Male	0.14±0.02 ^a	0.11±0.03 ^a	0.16±0.01 ^a	0.09±0.03 ^a
		Female	0.11±0.01 ^a	0.09±0.01 ^a	0.12±0.01 ^a	0.21±0.11 ^a
C20:2 n-6 (Eicosadienoic acid)	Lean	Male	0.22±0.01 ^a	0.14±0.01 ^b	0.08±0.00 ^c	0.07±0.01 ^c
		Female	0.13±0.01 ^{a†}	0.09±0.01 ^{a,b†}	0.08±0.01 ^b	0.08±0.01 ^b
	Obese	Male	0.25±0.01 ^a	0.17±0.01 ^b	0.20±0.01 ^c	0.17±0.01 ^b
		Female	0.13±0.02 ^{a†}	0.10±0.01 ^{a,b†}	0.08±0.00 ^{b†}	0.10±0.01 ^{a,b†}
C20:3 n-6	Lean	Male	0.15±0.01 ^{a,c}	0.33±0.01 ^b	0.20±0.01 ^c	0.20±0.02 ^c

(Dihomo-gamma-linolenic acid)		Female	0.20±0.02 ^a	0.31±0.02 ^a	0.26±0.03 ^a	0.26±0.04 ^a
	Obese	Male	1.56±0.05 ^{a****}	1.13±0.05 ^{b,c****}	1.38±0.09 ^{a,b****}	1.00±0.06 ^{c****}
		Female	0.74±0.08 ^{a****†}	0.66±0.03 ^{a****†}	0.34±0.03 ^{b†}	0.51±0.05 ^{a,b**†}
C20:4 n-6 (Arachidonic acid)	Lean	Male	12.68±1.30 ^a	6.74±0.44 ^b	13.23±0.57 ^a	10.14±0.53 ^a
		Female	14.37±0.84 ^a	8.31±0.36 ^b	13.17±0.65 ^a	12.39±1.20 ^a
	Obese	Male	11.95±0.47 ^a	7.73±0.29 ^b	12.75±0.73 ^a	12.88±0.37 ^a
		Female	11.95±0.33 ^a	8.90±0.72 ^b	13.37±0.52 ^c	12.56±1.30 ^a
C20:3 n-3 (Eicosatrienoic acid)	Lean	Male	0.09±0.07 ^a	0.07±0.01 ^a	0.15±0.03 ^a	0.20±0.05 ^a
		Female	0.02±0.01 ^a	0.06±0.01 ^a	0.12±0.01 ^b	0.17±0.02 ^b
	Obese	Male	0.02±0.00 ^a	0.08±0.01 ^a	0.37±0.05 ^{b**}	0.32±0.05 ^b
		Female	0.01±0.00 ^a	0.08±0.01 ^b	0.11±0.01 ^{b,c†}	0.14±0.01 ^c
C22:0	Lean	Male	0.10±0.02 ^a	0.09±0.01 ^a	0.13±0.02 ^a	0.14±0.01 ^a

(Behenic acid)		Female	0.16±0.01 ^a	0.13±0.00 ^a	0.16±0.01 ^a	0.21±0.02 ^{b†}
	Obese	Male	0.10±0.00 ^a	0.12±0.00 ^{a,b}	0.13±0.01 ^{a,b}	0.16±0.02 ^b
		Female	0.08±0.00 ^{a*}	0.08±0.01 ^a	0.12±0.00 ^a	0.12±0.03 ^{a***}
C22:4 (Adrenic acid)	Lean	Male	0.13±0.02 ^a	0.05±0.00 ^b	0.20±0.01 ^c	0.08±0.02 ^{a,b}
		Female	0.14±0.01 ^a	0.04±0.01 ^b	0.30±0.02 ^{c†}	0.10±0.02 ^{a,b}
	Obese	Male	0.15±0.01 ^a	0.07±0.01 ^b	0.14±0.02 ^a	0.15±0.02 ^a
		Female	0.17±0.02 ^a	0.06±0.01 ^b	0.32±0.02 ^{c†}	0.14±0.02 ^a
C22:5 n-6 (Osbond acid)	Lean	Male	0.03±0.01 ^a	0.03±0.00 ^a	0.19±0.02 ^a	0.03±0.01 ^a
		Female	0.06±0.00 ^a	0.01±0.00 ^a	0.82±0.05 ^{c†}	0.06±0.02 ^a
	Obese	Male	0.07±0.01 ^a	0.06±0.01 ^a	0.09±0.02 ^{a***}	0.04±0.00 ^a
		Female	0.06±0.01 ^a	0.02±0.00 ^a	0.67±0.09 ^{b†}	0.06±0.02 ^a
C22:5 n-3	Lean	Male	0.29±0.01 ^a	0.87±0.09 ^b	0.23±0.02 ^a	0.58±0.04 ^c

(Docosapentaenoic acid)		Female	0.34±0.03 ^a	0.73±0.06 ^b	0.20±0.02 ^a	0.82±0.05 ^{b,c}
	Obese	Male	0.78±0.05 ^{a***}	1.57±0.02 ^{b****}	0.34±0.10 ^c	0.81±0.02 ^a
		Female	0.68±0.07 ^a	1.42±0.23 ^{a***}	0.25±0.01 ^b	0.86±0.06 ^a
C24:0 (Lignoceric acid)	Lean	Male	0.16±0.06 ^a	0.21±0.03 ^a	0.17±0.02 ^a	0.16±0.02 ^a
		Female	0.32±0.04 ^{a†}	0.34±0.03 ^{a†}	0.16±0.01 ^b	0.24±0.03 ^{a,b}
	Obese	Male	0.18±0.02 ^{a,b}	0.21±0.02 ^a	0.13±0.01 ^b	0.21±0.03 ^a
		Female	0.12±0.02 ^{a***}	0.12±0.01 ^{a****}	0.08±0.01 ^a	0.12±0.02 ^{a*}
C24:1 (Nervonic acid)	Lean	Male	0.17±0.06 ^a	0.16±0.03 ^a	0.21±0.03 ^a	0.24±0.02 ^a
		Female	0.35±0.01 ^{a†}	0.30±0.01 ^a	0.29±0.02 ^a	0.30±0.04 ^a
	Obese	Male	0.20±0.01 ^a	0.20±0.02 ^a	0.33±0.02 ^{b*}	0.31±0.00 ^b
		Female	0.13±0.01 ^{a***}	0.13±0.01 ^{a*}	0.26±0.00 ^a	0.24±0.07 ^a
ΣSFA	Lean	Male	21.60±1.21 ^a	20.77±0.76 ^a	24.68±1.17 ^a	23.61±0.80 ^a

		Female	26.86±1.00 ^a	23.21±0.54 ^b	25.12±0.45 ^{a,b}	25.47±0.93 ^{a,b}
	Obese	Male	31.19±0.63 ^{a****}	28.10±0.54 ^{b****}	30.08±0.66 ^{a,b**}	28.74±0.36 ^{a,b**}
		Female	29.22±1.29 ^a	27.70±1.87 ^a	25.70±0.68 ^a	27.05±2.07 ^a
ΣMUFA	Lean	Male	52.70±3.00 ^a	53.88±1.57 ^a	52.70±1.76 ^a	54.93±1.71 ^a
		Female	44.79±2.28 ^a	51.22±1.33 ^{a,b}	52.56±0.81 ^b	50.71±2.30 ^{a,b}
	Obese	Male	35.10±1.57 ^{a****}	41.75±1.12 ^{b**}	42.61±1.71 ^{b**}	43.58±0.76 ^{b**}
		Female	41.07±2.67 ^a	42.18±4.44 ^a	51.41±1.40 ^a	47.56±4.45 ^a
Σn-6	Lean	Male	23.13±1.66 ^a	19.66±0.48 ^{a,b}	21.18±0.54 ^{a,b}	18.42±0.81 ^b
		Female	23.66±1.19 ^a	17.87±0.59 ^b	20.39±0.32 ^{a,b}	18.75±1.07 ^b
	Obese	Male	27.62±0.79 ^a	20.52±0.28 ^b	23.95±0.78 ^c	22.77±0.30 ^{b,c}
		Female	23.14±1.04 ^a	18.48±1.09 ^a	19.18±0.68 ^{a‡}	18.86±1.83 ^a
Σn-3	Lean	Male	2.60±0.18 ^{a,c}	5.67±0.43 ^b	1.41±0.07 ^a	3.01±0.18 ^c

		Female	4.67±0.20 [‡]	7.70±0.31 ^{b‡}	1.91±0.14 ^c	5.05±0.31 [‡]
	Obese	Male	6.07±0.19 ^{a****}	9.62±0.32 ^{b****}	3.34±0.47 ^{c**}	4.90±0.12 ^{a**}
		Female	6.56±0.40 ^a	11.62±1.63 ^{b**}	3.69±0.17 ^a	6.53±0.55 ^a
ΣPUFA	Lean	Male	25.72±1.84 ^a	25.33±0.85 ^a	22.59±0.58 ^a	21.43±0.96 ^a
		Female	28.33±1.30 ^a	25.56±0.83 ^{a,b}	22.30±0.39 ^b	23.80±1.38 ^b
	Obese	Male	33.69±0.95 ^{a***}	30.14±0.59 ^{a,b}	27.29±1.07 ^b	27.67±0.40 ^{b*}
		Female	29.70±1.41 ^a	30.10±2.59 ^a	22.88±0.73 ^a	25.38±2.38 ^a

Values are presented as mean ± SE. Row means without a common superscript letter (a, b, and c) differ significantly, $P < 0.05$.

**** $P < 0.0001$ *** $P < 0.001$ ** $P < 0.01$ * $P < 0.05$ versus respective lean JCR rats on the same diet, 2-way ANOVA.

‡ $P < 0.05$ versus respective male JCR rats on the same diet, 2-way ANOVA.

N=8. Con, control diet; CFlax, 10% ground flaxseed supplemented control diet; HFHS, high-fat high sucrose diet; HFlax, 10% ground flaxseed supplemented high-fat high sucrose diet.

Figure Legends

Figure S1. Composition of liver saturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

Figure S2. Composition of liver monounsaturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

Figure S3. Composition of liver polyunsaturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

Figure S4. Composition of liver n-3 polyunsaturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

Figure S5. Logarithmic correlation between polyunsaturated fatty acids and ALT and AST release into the plasma. C18:3n3 (A); C22:6n3 (B); C22:5n3 (C).

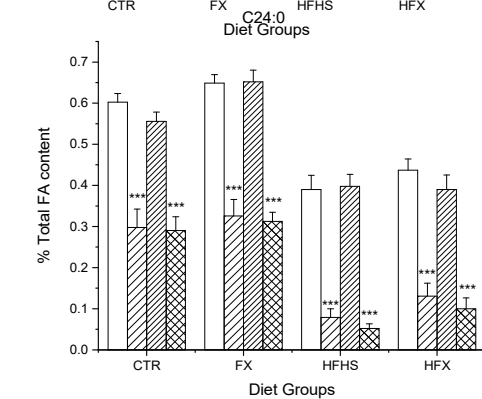
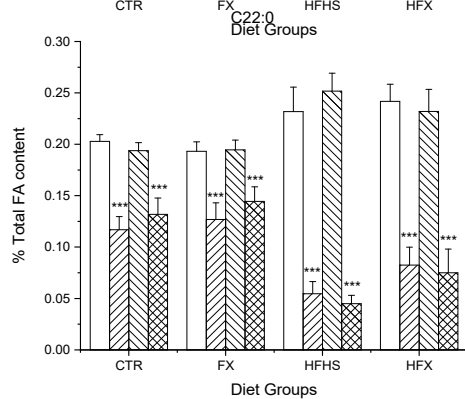
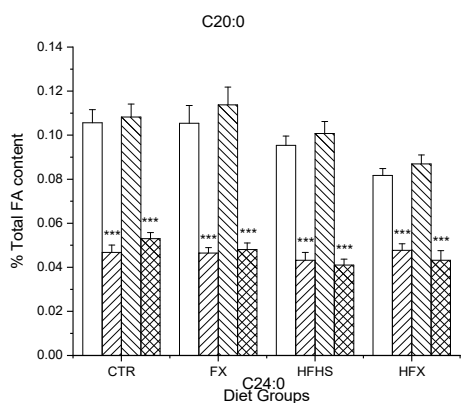
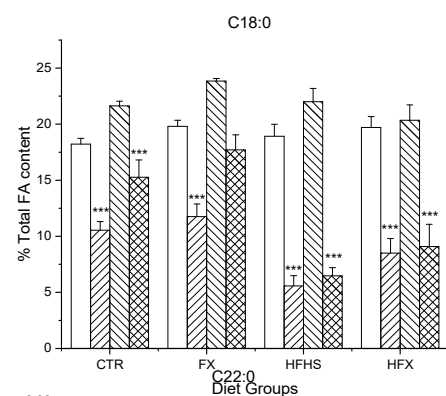
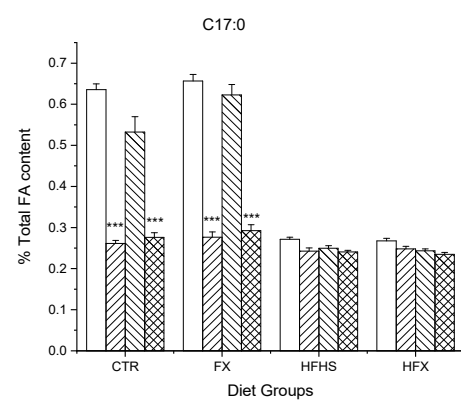
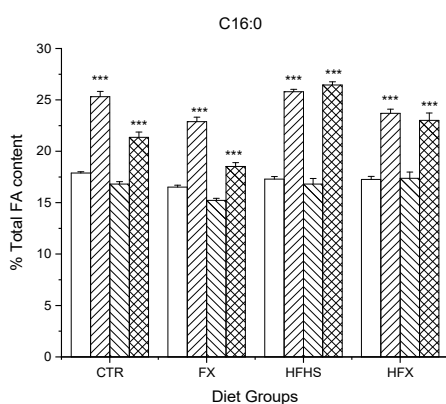
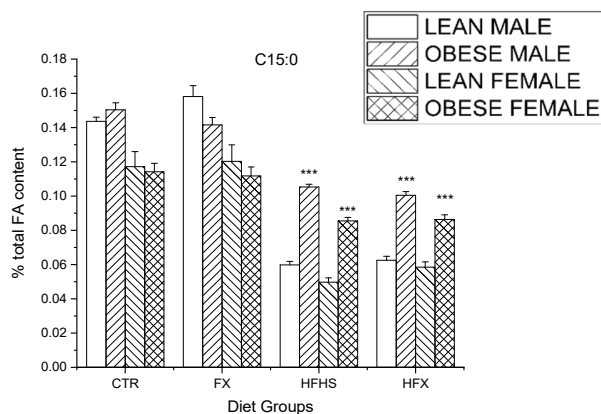
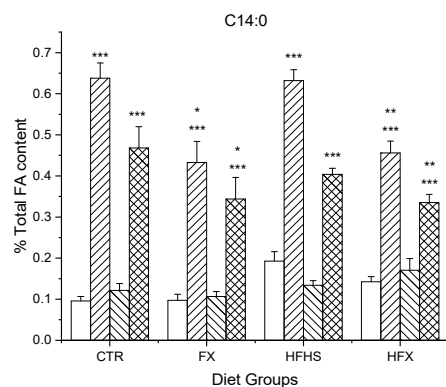


Figure S1. Composition of liver saturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

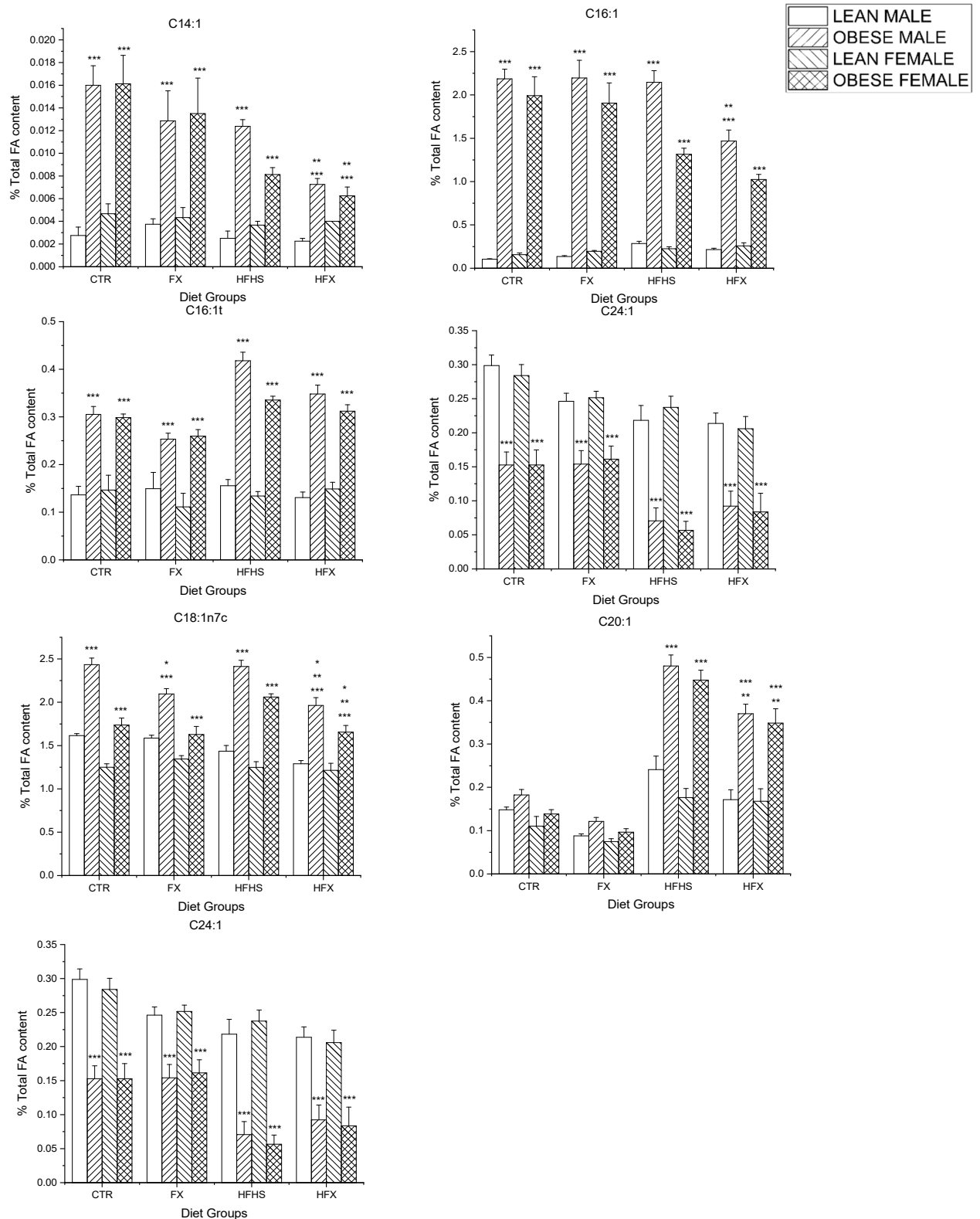


Figure S2. Composition of liver monounsaturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; *P < 0.05 versus respective control group; **P < 0.05 versus respective HFHS group; ***P < 0.05 obese vs lean within same respective dietary group; (n=7 or 8).

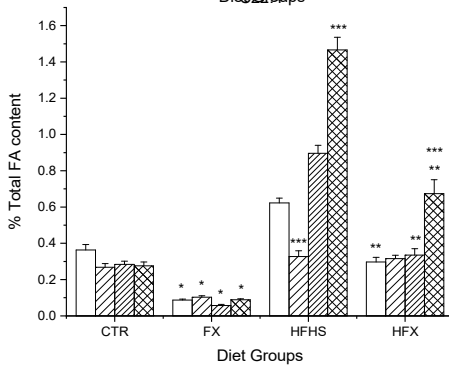
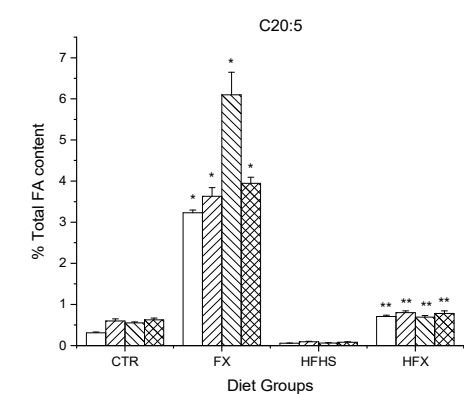
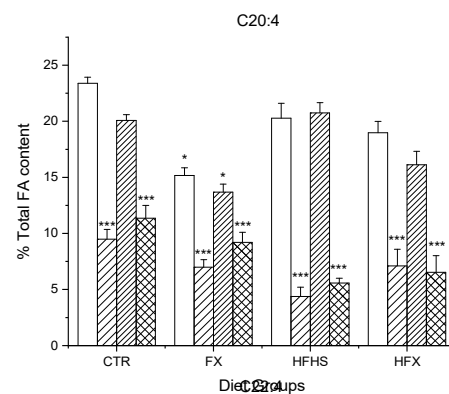
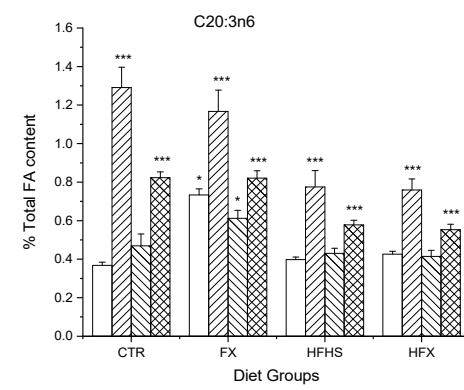
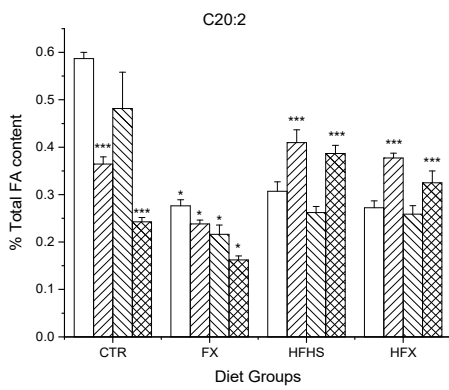
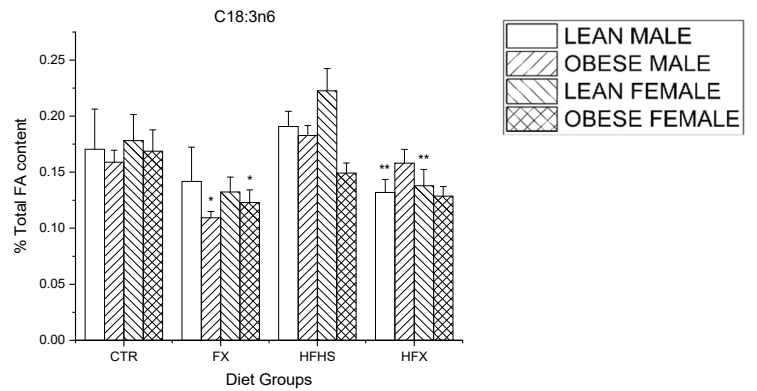
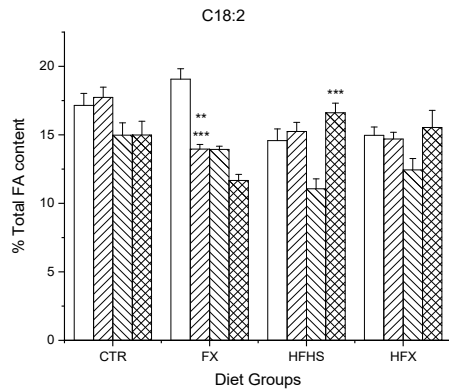


Figure S3. Composition of liver polyunsaturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

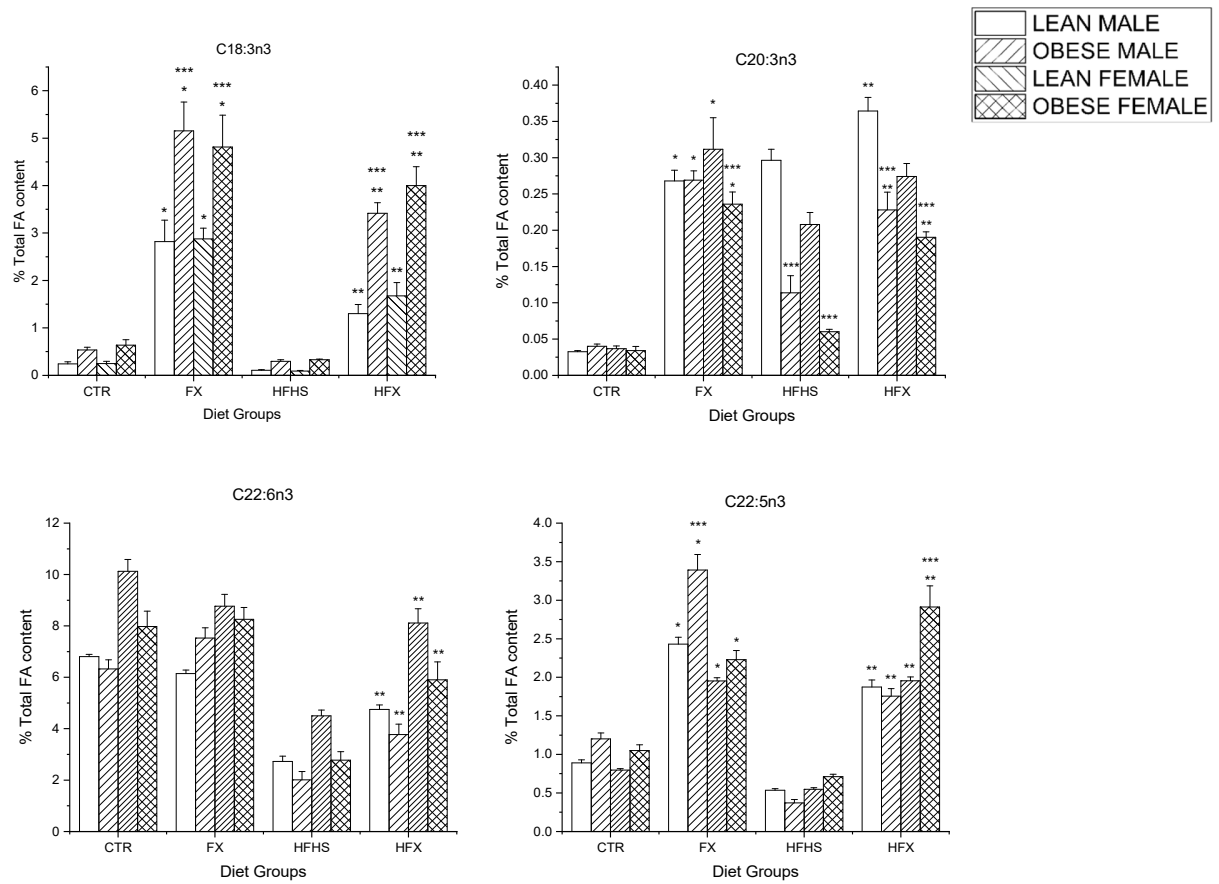


Figure S4. Composition of liver n-3 polyunsaturated fatty acids in lean and obese male and female JCR:LA rats as a function of diet. Abbreviations: CTR: control diet; FX: flaxseed supplemented diet; HFHS: high fat and high sucrose supplemented diet; HFX: high fat, high sucrose and flaxseed supplemented diet; * $P < 0.05$ versus respective control group; ** $P < 0.05$ versus respective HFHS group; *** $P < 0.05$ obese vs lean within same respective dietary group; (n=7 or 8).

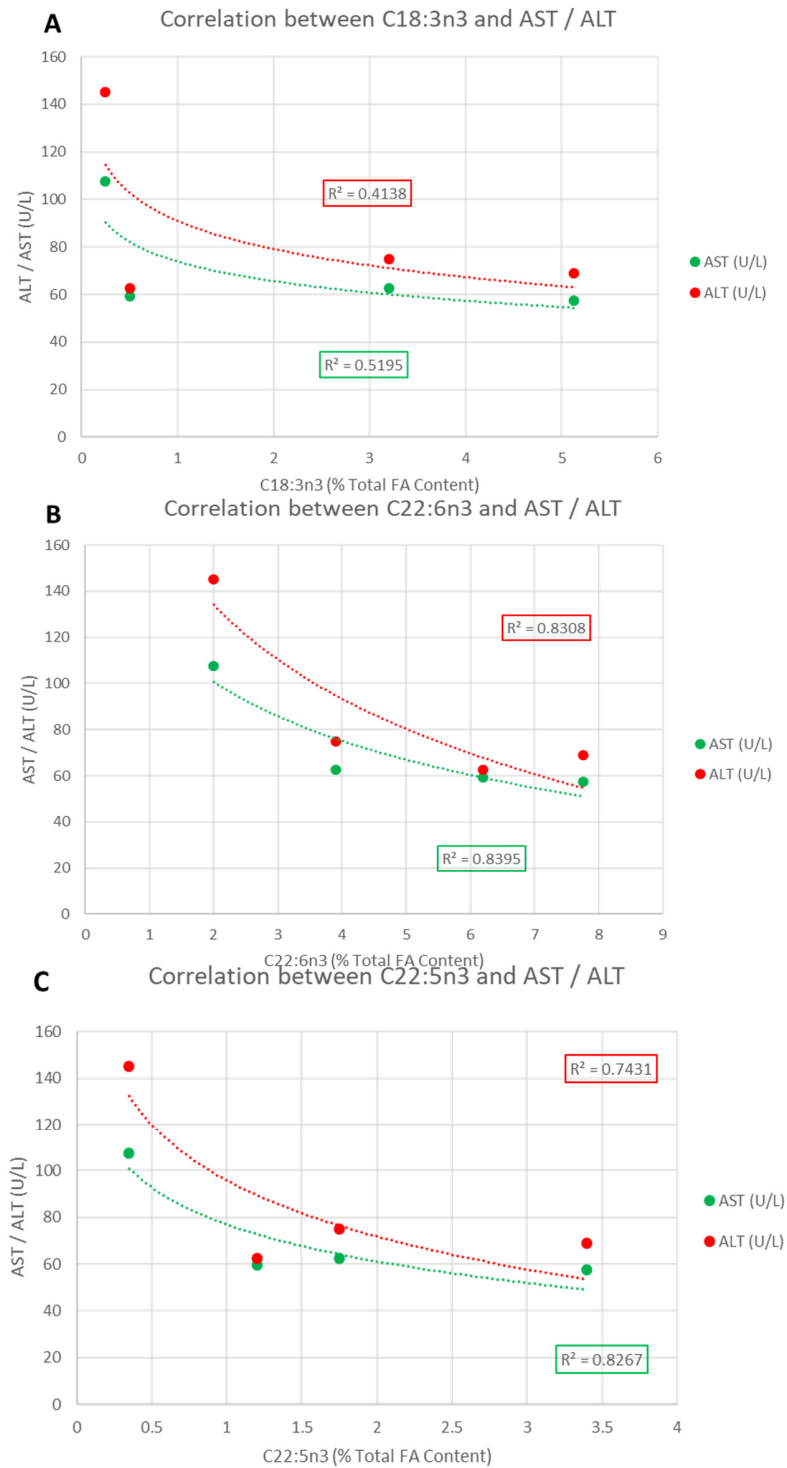


Figure S5. Logarithmic correlation between polyunsaturated fatty acids and ALT and AST release into the plasma. C18:3n3 (A); C22:6n3 (B); C22:5n3 (C).