

Supplementary Table S1. Search strategy.

PubMed/MEDLINE	Scopus	Web of Science	Embase
1828	4726	3503	2127
("Alpha-linolenic acid"[Title/Abstract] OR "A-linolenic acid"[Title/Abstract] OR "Linoleate"[Title/Abstract] OR "Linoleic acid"[Title/Abstract] OR "Linoleate"[Title/Abstract] OR "Linoleic acid/alpha-linolenic acid"[Title/Abstract] OR "Linoleic acid/a-linolenic acid"[Title/Abstract] OR "Flaxseed"[Title/Abstract] OR "Linseed"[Title/Abstract] OR "Walnut"[Title/Abstract]) AND ("Glycosylated Hemoglobin"[Title/Abstract] OR "HbA1"[Title/Abstract] OR "HbA1c"[Title/Abstract] OR "Glycohemoglobin A"[Title/Abstract] OR "Glycated Hemoglobin"[Title/Abstract] OR "Blood Glucose"[Title/Abstract] OR "Blood Sugar"[Title/Abstract] OR "Hyperglycemia"[Title/Abstract] OR "Glycemia"[Title/Abstract] OR "HOMA"[Title/Abstract] OR "homeostatic model for insulin resistance"[Title/Abstract] OR "fasting blood insulin"[Title/Abstract] OR "FBI"[Title/Abstract] OR "FBG"[Title/Abstract] OR	(TITLE-ABS-KEY ("Glycated Hemoglobin A") OR TITLE-ABS-KEY ("Blood Glucose") OR TITLE-ABS-KEY ("Hyperglycemia") OR TITLE-ABS-KEY ("Insulin Resistance") OR TITLE-ABS-KEY ("Hyperinsulinism") OR TITLE-ABS-KEY ("Diabetes Mellitus") OR TITLE-ABS-KEY ("Glycosylated Hemoglobin") OR TITLE-ABS-KEY ("HbA1") OR TITLE-ABS-KEY ("Hb A1c") OR TITLE-ABS-KEY ("Glycohemoglobin A") OR TITLE-ABS-KEY ("Glycated Hemoglobin") OR TITLE-ABS-KEY ("Blood Sugar") OR TITLE-ABS-KEY (glycemia) OR TITLE-ABS-KEY ("HOMA") OR TITLE-ABS-KEY ("homeostatic model for insulin resistance") OR TITLE-ABS-KEY ("fasting blood insulin") OR TITLE-ABS-KEY ("FBI") OR TITLE-ABS-KEY ("FBG") OR TITLE-ABS-KEY ("FBS") OR TITLE-ABS-KEY ("Insulin Sensitivity") OR TITLE-ABS-KEY (insulin) OR TITLE-ABS-KEY (hyperinsulin) OR TITLE-ABS-KEY ("Oral Glucose Tolerance Test") OR TITLE-ABS-KEY ("OGTT") AND TITLE-ABS-KEY ("alpha-linolenic acid") OR TITLE-ABS-	TS=("Alpha-linolenic acid" OR "A-linolenic acid" OR "Linoleate" OR "Linoleic acid" OR "Linoleate" OR "Linoleic acid/alpha-linolenic acid" OR "Linoleic acid/a-linolenic acid" OR "Flaxseed" OR "Linseed" OR "Walnut") AND TS=("Glycated Hemoglobin A" OR "Blood Glucose" OR "Hyperglycemia" OR "Insulin Resistance" OR "Hyperinsulinism" OR "Diabetes Mellitus" OR "Glycosylated Hemoglobin" OR "HbA1" OR "Hb A1c" OR "Glycohemoglobin A" OR "Glycated Hemoglobin" OR "Blood Sugar" OR glycemia OR "HOMA" OR "homeostatic model for insulin resistance" OR "fasting blood insulin" OR "FBI" OR "FBG" OR "FBS" OR "Insulin Sensitivity" OR insulin OR "insulin*" OR	('alpha-linolenic acid':ab,ti OR 'a-linolenic acid':ab,ti OR 'linoleic acid':ab,ti OR 'linoleate':ab,ti OR 'linoleic acid/alpha-linolenic acid':ab,ti OR 'linoleic acid/a-linolenic acid':ab,ti OR 'flaxseed':ab,ti OR 'linseed':ab,ti OR 'walnut':ab,ti) AND ('glycated hemoglobin a':ab,ti OR 'blood glucose':ab,ti OR 'hyperglycemia':ab,ti OR 'insulin resistance':ab,ti OR 'hyperinsulinism':ab,ti OR 'diabetes mellitus':ab,ti OR 'glycosylated hemoglobin':ab,ti OR 'hba1':ab,ti OR 'hb a1c':ab,ti OR 'glycohemoglobin a':ab,ti OR 'glycated hemoglobin':ab,ti OR 'blood sugar':ab,ti OR 'glycemia':ab,ti OR 'homa':ab,ti OR 'homeostatic model for insulin resistance':ab,ti OR 'fasting blood insulin':ab,ti OR 'fbi':ab,ti OR

FBS[Title/Abstract] OR "Insulin Resistance"[Title/Abstract] OR "Insulin Sensitivity"[Title/Abstract] OR "Hyperinsulinemia"[Title/Abstract] OR Hyperinsulinism[Title/Abstract] OR Insulin [Title/Abstract] OR Hyperinsulin [Title/Abstract] OR "Oral Glucose Tolerance Test"[Title/Abstract] OR OGTT[Title/Abstract] OR "Diabetes Mellitus"[Title/Abstract])	KEY ("A-linolenic acid") OR TITLE-ABS-KEY ("Linoleate") OR TITLE-ABS-KEY ("Linoleic acid") OR TITLE-ABS-KEY ("Linoleic acid/alpha-linolenic acid") OR TITLE-ABS- KEY ("Linoleic acid/a-linolenic acid") OR TITLE-ABS-KEY ("Flaxseed") OR TITLE-ABS- KEY ("Linseed") OR TITLE-ABS-KEY (" Walnut"))	"hyperinsulin*" OR "Oral Glucose Tolerance Test" OR "OGTT")	'fbg':ab,ti OR 'fbs':ab,ti OR 'insulin sensitivity':ab,ti OR insulin:ab,ti OR 'insulin*':ab,ti OR 'hyperinsulin*':ab,ti OR 'oral glucose tolerance test':ab,ti OR 'ogtt':ab,ti)
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Supplementary Table S2. Dietary intakes of nutrient of the participants at intervention period.

Reference	Group	Energy (kcal/d)	Protein	Carboh ydrate	Fat	SFA	MUFA	PUFA	Total LA	Total ALA	LA and ALA Source
(% of total energy intake/d)											
Akrami2018	Low LA/ALA	2481	15.1	56.3	28.4	7.5	3.6	17.3 ^b	2.1 ^a	15.2 ^b	25 ml flaxseed oil
	High LA/ALA	2490	14.8	56.2	28.8	7.6	4.7	16.5 ^a	15.68 ^b	0.82 ^a	25 ml sunflower oil
Bemelmans2002	Low LA/ALA	2796.3			37.7	13.5	12.1	12.1	9.5	2.3 ^b	ALA-rich margarine
	High LA/ALA	2796.3			37.7	13.5	12.1	12.1	10.6	0.4 ^a	LA-rich margarine
Chen2020	Low LA/ALA	2248.2	16.3	52.0	31.7	7.2	11.9	7.5	7.1	1.0 ^b	27 g blend oil
	High LA/ALA	2161.4	16.1	53.4	30.5	7.4	11.3	6.8	6.3	0.21 ^a	27 g peanut oil
	High LA/ALA	2072.3	15.5	54.6	29.8	7.2	9.4	8.4	7.8	0.39 ^a	27 g corn oil
Damsgaard2008	Low LA/ALA	2722	15	48	36	12.2	13.2	5 ^a	4.07 ^a	0.86	10.3 g (0.0-52.5g/d) rapeseed oil
	High LA/ALA	2654.6	14	51	35	10.5	11.5	7.5 ^b	6.54 ^b	0.85	10.3 g (0.0-52.5g/d) sunflower oil
Finnegan2003	Low LA/ALA	2342.2 ^a	15.5	45.3	36	11.5	10.1	8.4	6.22 ^a	1.73 ^b	25 g ALA margarine (rapeseed and linseed oils)
	Low LA/ALA	2485.6 ^{ab}	15.4	43.7	37.8	12.3	10.9	8.8	4.74 ^a	3.44 ^c	25 g ALA margarine (rapeseed and linseed oils)
	High LA/ALA	2891.9 ^b	16.1	43.3	36.2	11.9	10.5	8.2	7.13 ^b	0.47 ^a	25 g LA margarine (sunflower and safflower oils)
Griffin2006	Low LA/ALA	2093.6	16.4	42.3	36.1	11.5	14.2	6.8 ^a	5.1 ^a	1.1 ^b	32 g rapeseed oil
	High LA/ALA	2148.6	16.4	41.0	37.4	12.2	14.4	8.2 ^b	7 ^b	0.5 ^a	32 g high-oleic sunflower oil
Kalgaonkar2011	Low LA/ALA	1541.1 ^a	17	45	40	18.69 ^b	11.10 ^a	10.66 ^b	8.76 ^b	1.90 ^b	31 g walnut-oil
	High LA/ALA	1718.2 ^b	19	44	39	15.19 ^a	18.33 ^b	4.11 ^a	3.93 ^a	0.18 ^a	31 g almond-oil
Kawakami2015	Low LA/ALA	2261.4	13.02	55.75	25.51				8.11 ^a	6.03 ^b	10 g flaxseed oil
	High LA/ALA	2289.8	13.33	53.51	28.42				15.68 ^b	1.6 ^a	10 g corn oil
Kontogianni2013	Low LA/ALA	1929.2	15.9	44.2	37.0	12.3	14.5 ^a	8.4 ^b		4.06 ^b	15 ml flaxseed oil

	High LA/ALA	1806.1	18.4	47.6	39.0	12.0	17.6 ^b	6.0 ^a		0.40 ^a	15 ml olive oil	
Kratz2002	Low LA/ALA	2318.3	14.4	46.9	38.8	10.7	23.3 ^b	3.4 ^a	3 ^a	0.4 ^a	Olive oil diet	
	Low LA/ALA	2574.0	14.3	47.3	38.4	9.1	19 ^b	8.9 ^b	6.4 ^b	2.5 ^b	Rapeseed oil diet	
	High LA/ALA	2538.2	14.2	47.6	38.2	10	8.7 ^a	18.4 ^c	18.1 ^c	0.3 ^a	Sunflower oil diet	
Lee2014	Low LA/ALA									1.8 ^a	1.9 ^b	7 echium oil capsules and 3 borage oil capsules
	High LA/ALA									3.96 ^b	0.06 ^a	9 corn oil capsules
Ma2010	Low LA/ALA	1765	17	39	45 ^b	10.88	9.18	16.83 ^b	13.26 ^b	2.96 ^b		56 g of shelled, unroasted English walnuts
	High LA/ALA	1685	19	43	38 ^a	12.52	9.61	4.91 ^a	3.31 ^a	0.43 ^a		Ad libitum diet without walnuts
McManus1996	Low LA/ALA									14.2% of total fatty acids	57.5% of total fatty acids	35 mg/kg body weight flaxseed oil
	High LA/ALA									13% of total fatty acids	0.9% of total fatty acids	35 mg/kg body weight olive oil
Minihane2005	Low LA/ALA				39	9	15 ^b	5.7 ^a	5 ^a	0.7		olive oil
	High LA/ALA				37	10	10 ^a	10.7 ^b	10 ^b	0.7		coin oil
Moszak2020	Low LA/ALA		20%	50-55%	25-30%					4.2 ^a	2.24 ^b	20 ml rapeseed oil
	High LA/ALA		20%	50-55%	25-30%					9.98 ^b	0.24 ^a	20 ml amaranth seed oil
Nelson2007	Low LA/ALA	1924.3			38.6	10.6	13.1	12.1	6.8	5.3 ^b		Subjects increased ALA intake to 5% of
	High LA/ALA	2062.9			35.8	12.2	13.8	7.1	6.12	0.6 ^a		total energy via flaxseed oil capsule. Subjects were advised to decrease their intake of high-fat foods, whole and 2% milk products, and added fats. Subjects

											were also provided lists of lower-fat alternatives to these foods.
Rezaei2020	Low LA/ALA	1807	66.30	13.17	20.77	6.18	5.58	8.82	3.62 ^a	9.96 ^b	20 g flaxseed oil
	High LA/ALA	1781	63.83	13.32	22.99	6.52	6.77	9.75	12.68 ^b	0.044 ^a	20 g sunflower oil
Schwab2018	Low LA/ALA	2215.5	15.6 ^a	38.2 ^a	42.5 ^b	12.1	15.0	11.6 ^b	5.48 ^b	5.04 ^b	27 g camelina sativa oil and canola oil
	High LA/ALA	1938.5	17.7 ^b	42.5 ^b	34.0 ^a	11.3	13.1	5.6 ^a	4.18 ^a	0.97 ^a	27 g canola oil and olive oil
Sodergren2001	Low LA/ALA	2127.1	14.8	47.3	35.9	10.3 ^a	15.7 ^b	7.5 ^b	5.4 ^b	1.8 ^b	Rapeseed oil provide 27% of total energy
	High LA/ALA	2318.3	14.4	47.5	36.2	17.6 ^b	10.9 ^a	4.6 ^a	4.0 ^a	0.4 ^a	Butter and olive oil provide 27% of total energy
Vargas2011	Low LA/ALA	1735	16.9	48.2	34.8			4.6	2.66 ^a	1.93 ^b	6 capsules flaxseed oil
	High LA/ALA	1735	16.9	48.2	34.8			3.91	3.51 ^b	0.39 ^a	6 capsules soybean oil
Zhou2019	Low LA/ALA	1927			33.72	7.89	10.13	11.44	7.85	3.82 ^c	25 ml flaxseed oil and corn oil
	Low LA/ALA	1917			33.57	8.12	10.42	11.60	8.92	2.35 ^b	25 ml flaxseed oil and corn oil
	High LA/ALA	1960			34.35	8.17	11.53	10.7	9.87	0.62 ^a	25 ml corn oil

SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; LA, linoleic acid; ALA, α -linolenic acid; Different letters indicate significant differences ($p < 0.05$) between each group, and the same letters indicate that there is no significant difference ($p > 0.05$) between each group.

Supplementary Table S3. Quality assessment of the included studies.

Study	Random Sequence Generation	Allocation Concealment	Blinding of Participants and Personnel	Blinding of Outcome Assessments	Incomplete Outcome Data	Selective Outcome Reporting	Other Bias
Akrami2018	L	U	U	U	L	L	L
Bemelmans2002	L	L	L	U	L	U	L
Chen2020	L	L	L	U	L	U	L
Damsgaard 2008	L	L	L	L	L	L	L
Finnegan2003	L	U	L	U	L	U	L
Griffin2006	U	U	U	U	U	U	L
Kalgaonkar2011	L	L	L	L	L	L	L
Kawakami 2015	U	U	L	U	L	U	L
Kontogianni 2013	L	L	H	U	L	U	L
Kratz2002	U	U	U	U	U	U	U
Lee 2014	U	U	H	U	L	U	L
Ma 2010	U	U	L	L	L	L	L
McManus1996	L	U	L	L	L	U	L
Minihane2005	U	U	L	U	L	U	L
Moszak2020	U	U	L	L	L	U	L
Nelson2007	U	U	U	L	L	L	L
Rezaei2020	L	L	L	U	L	L	L
Schwab2018	L	U	U	L	L	U	L
Sodergren2001	U	U	U	U	U	U	L
Vargas2011	U	U	L	U	U	U	U
Zhou2019	U	U	L	U	L	L	L

H: high risk of bias; U: unclear risk of bias; L: low risk of bias.