Supplementary Materials for

Effect of Lard or Plus Soybean Oil on Blood Pressure and Other Cardiometabolic Risk Factors in Healthy Subjects: A Randomized Controlled-Feeding Trial

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Figure S1. Mean changes and diet contrast in nitric oxide in male and female participants. Error bars indicate SEM. Data are based on a mixed-model analysis of variance. The *P* value at the upper left indicates the test of whether the change between baseline and intervention period (mean of every 4 weeks) differed significantly between participants assigned to three diet groups. NO, nitric oxide; wk, week.

29 Figure S1

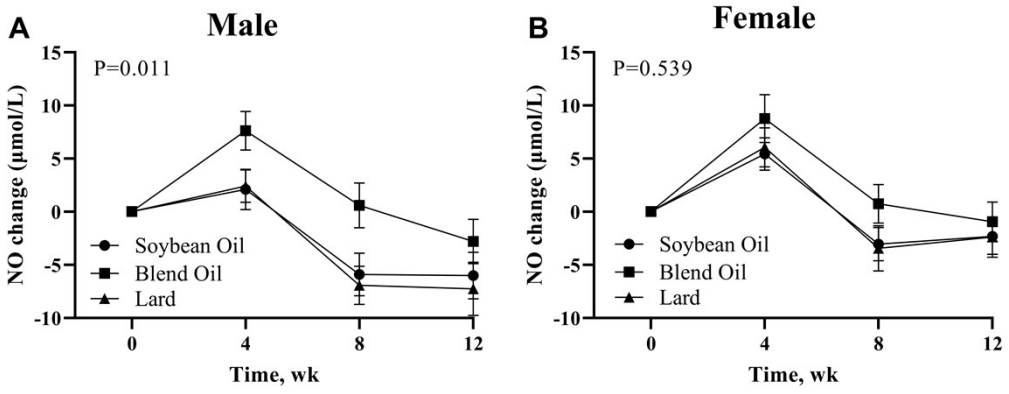

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Table S1. Fatty acid compositions of cooking oils and diets for three groups

Fatty acid	Three oils			Three diets		
	Soybean oil	Blend oil	Lard	Soybean oil group	Blend oil group	Lard group
SFA (%)						
C14:0	0.06 (0.01)	0.69 (0.12)	1.58 (0.09)	0.36 (0.10)	0.75 (0.06)	1.26 (0.07)
C16:0	8.58 (0.50)	16.04 (0.66)	25.17 (0.34)	14.90 (1.22)	19.73 (0.58)	25.29 (0.38)
C17:0	0.03 (0.01)	0.09 (0.01)	0.14 (0.01)	0.08 (0.03)	0.12 (0.03)	0.15 (0.03)
C18:0	1.78 (0.28)	6.10 (0.21)	11.97 (0.34)	4.80 (0.88)	7.69 (0.54)	10.99 (0.37)
C20:0	0.13 (0.01)	0.11 (0.01)	0.10 (0.01)	0.19 (0.09)	0.17 (0.09)	0.15 (0.09)
MUFA (%)						
C16:1n-7	0.30 (0.02)	1.17 (0.05)	2.36 (0.19)	1.36 (0.28)	1.87 (0.22)	2.60 (0.15)
C18:1n-9	21.44 (1.47)	30.10 (0.99)	41.65 (0.78)	28.92 (1.82)	34.81 (1.06)	41.87 (0.56)
C20:1n-9	0.08 (0.00)	0.29 (0.03)	0.59 (0.04)	0.14 (0.05)	0.28 (0.05)	0.45 (0.06)
PUFA (%)						
n-6 PUFA						
C18:2n-6	59.16 (1.88)	40.50 (1.61)	14.87 (0.21)	42.87 (3.72)	30.35 (2.03)	15.31 (0.87)
C20:2n-6		0.22 (0.02)	0.50 (0.03)	0.07 (0.05)	0.21 (0.04)	0.38 (0.05)
C20:3n-6		0.02 (0.00)	0.04 (0.00)	0.03 (0.03)	0.04 (0.02)	0.06 (0.02)
C20:4n-6		0.08 (0.00)	0.19 (0.01)	0.28 (0.03)	0.33 (0.04)	0.39 (0.05)
n-3 PUFA						
C18:3n-3	8.46 (0.40)	4.59 (0.23)	0.86 (0.04)	5.92 (0.56)	3.58 (0.25)	1.03 (0.21)
C20:5n-3				0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
C22:6n-3				0.07 (0.02)	0.07 (0.02)	0.07 (0.02)

Values are presented as means (SD). The fatty acid compositions of three oils were determined by gas chromatograph (Agilent 7820A). The fatty acid compositions of three diets were calculated by the Nutrition System of Traditional Chinese Medicine Combining with Western Medicine Version 11.0 (Medical College, Qingdao University, Shandong, China) from dietary intake of 7 consecutive days. SFA, saturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid.

38 Table S2. The compositions of the three oils used in the study

Components	Soybean oil	Blend oil	Lard
Sterols (mg/100 g)			
β-sitosterol	167.3 (30.6)	76.6 (12.0)	ND
Campesterol	65.0 (6.0)	31.6 (1.1)	ND
Stigmasterol	60.0 (13.7)	28.6 (2.0)	ND
Cholesterol	ND	49.2 (4.6)	102.2 (11.9)
Fat soluble vitamins (mg/100 g)			
vitamin D	ND	1.4×10^{-3} (0.3×10^{-3})	2.3×10^{-3} (0.6×10^{-3})
Tocopherol, alpha	13.2 (2.6)	7.0 (1.5)	0.7 (0.3)
Tocopherol, gamma	69.5 (6.5)	37.7 (6.4)	ND
Tocopherol, delta	20.6 (3.2)	13.4 (2.5)	ND

39 Values are presented as means (SD). ND, not detected.

Table S3. The baseline blood pressure of completed the study and dropout subjects

Groups	Baseline SBP			Baseline DBP		
	Subjects completed the study	Dropout subjects	*P*-Value*	Subjects completed the study	Dropout subjects	*P*-Value*
Soybean oil group	115.5 (12.9)	115.5 (9.7)	0.989	75.2 (8.6)	72.0 (8.1)	0.123
Blend oil group	116.8 (12.3)	117.1 (16.6)	0.904	76.0 (8.9)	74.7 (12.6)	0.527
Lard group	115.4 (9.8)	115.2 (8.2)	0.910	73.7 (8.3)	74.5 (7.3)	0.625

All values are means (SD). *The two tailed paired *t*-test was used for comparing the differences in blood pressure between completed the study and dropout subjects at the baseline. SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table S4. Protocol for screening and randomization

Advertising
Screening visit 1 by face-to-face or telephone or internet interview*
Major eligibility questions
Health questionnaire
Assessment of the tolerance to lard
Screening visit 2 by face-to-face or non-face-to-face interview†
Collection of basic personal information
Sign the informed consent form
3-day dietary records
Screening visit 3‡
Weight, height, waist circumferences, blood pressure
Overnight fasting blood for eligibility testing
Randomization was 12 days after the advertising

*The screening visit 1 was 2 days after the advertising. †The screening visit 2 was 7 days after the advertising. All potential subjects were asked to provide information about their basic personal information and 3-day dietary records and sign the informed consent form. ‡The screening visit 3 was 10 days after the advertising. Since participants were subjects working and living in PLA General Hospital, meaning all participants ate the same cooking oil (soybean oil) before the present study. Meanwhile, the cooking oils in the present study were commonly used in China, therefore no run-in period was included.

Table S5. Intention-to-treat and per-protocol analysis of blood pressure changes from baseline

Variable	Week	Soybean oil group	Blend oil group	Lard group	*P*-Value*		
					Time	Group	Time × group
ITT (n = 334)							
SBP (mm Hg)	0	115.5 (113.2, 117.8)	116.9 (114.3, 119.5)	115.3 (113.6, 117.1)	< 0.001	0.001	0.023
	Δ4	−2.1 (−4.3, 0.1)	−3.8 (−5.6, −2.0)	−1.5 (−3.7, 0.7)			
	Δ8	−3.6 (−6.1, −1.1)	−6.9 (−9.3, −4.5)[a]	−3.1 (−5.5, −0.7)[b]			
	Δ12	−3.3 (−5.7, −0.9)	−6.0 (−8.6, −3.4)[a]	−1.2 (−3.7, 1.4)[b]			
DBP (mm Hg)	0	74.6 (73.0, 76.2)	75.6 (73.7, 77.5)	74.0 (72.5, 75.5)	< 0.001	0.001	0.008
	Δ4	−1.4 (−3.2, 0.3)[a]	−4.2 (−5.8, −2.6)[b]	−0.4 (−2.6, 1.7)[a]			
	Δ8	−2.4 (−3.9, −0.9)	−4.5 (−6.3, −2.6)[a]	−1.1 (−3.1, 0.9)[b]			
	Δ12	1.5 (−1.0, 4.0)	0.8 (−1.7, 3.2)	3.3 (0.9, 5.8)			
PP (n = 245)							
SBP (mm Hg)	0	115.5 (112.8, 118.2)	116.8 (114.0, 119.6)	115.4 (113.2, 117.6)	< 0.001	< 0.001	0.006
	Δ4	−1.5 (−3.8, 0.9)	−3.5 (−5.4, −1.5)	−0.8 (−3.2, 1.6)			
	Δ8	−3.3 (−5.9, −0.8)[a]	−7.4 (−9.8, −5.1)[b]	−2.6 (−5.1, −0.2)[a]			
	Δ12	−3.1 (−5.5, −0.7)	−6.0 (−8.6, −3.4)[a]	−1.2 (−3.8, 1.4)[b]			
DBP (mm Hg)	0	75.2 (73.4, 77.0)	76.0 (74.0, 78.0)	73.7 (71.8, 75.6)	< 0.001	< 0.001	< 0.001
	Δ4	−1.8 (−3.7, 0.2)	−4.5 (−6.3, −2.7)[a]	0.6 (−1.8, 3.1)[b]			
	Δ8	−2.4 (−4.0, −0.8)[a]	−5.2 (−7.2, −3.2)[b]	0.2 (−1.8, 2.3)[c]			
	Δ12	1.6 (−0.9, 4.1)	0.8 (−1.7, 3.2)	3.4 (0.9, 5.8)			

All values are means (95% CIs). *Data are based on mixed-model analysis of variance; changes from baseline were calculated by subtracting 4-, 8-, and 12-week data from baseline data. ITT, intention-to-treat; PP, per-protocol; BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure. [a,b,c]Different superscripts indicate significant differences between groups. No superscript means no difference compared with any other group; Δ, change from baseline.

Table S6. Subgroup analysis of blood pressure in the intention-to-treat participants among three groups

Variable	Week	Soybean oil group	Blend oil group	Lard group	*P*-Value*		
					Time	Group	Time × group
BP: ≥ 130/80							
SBP (n = 9-18)	0	135.8 (130.9, 140.7)	138.7 (134.0, 143.5)	131.3 (128.8, 133.9)	< 0.001	< 0.001	0.001
	Δ4	−3.4 (−11.7, 5.0)	−7.6 (−12.8, −2.4)[a]	2.2 (−5.6, 10.0)[b]			
	Δ8	−6.6 (−12.7, −0.5)[a]	−11.1 (−18.1, −4.1)[a]	5.4 (−5.6, 16.3)[b]			
	Δ12	−7.0 (−11.3, −2.7)	−12.8 (−20.2, −5.5)[a]	1.4 (−6.9, 9.7)[b]			
DBP (n = 9-18)	0	87.6 (84.4, 90.7)	91.8 (87.1, 96.4)	88.3 (84.5, 92.2)	0.008	< 0.001	0.005
	Δ4	−2.2 (−8.0, 3.6)[a]	−10.0 (−14.1, −5.9)[b]	−1.3 (−11.4, 8.8)[a]			
	Δ8	−3.9 (−9.7, 1.8)	−8.5 (−14.3, −2.6)[a]	1.9 (−4.4, 8.2)[b]			
	Δ12	1.8 (−5.0, 8.6)	−6.2 (−13.1, 0.6)[a]	6.5 (−2.7, 15.7)[b]			
BP: < 130/80							
SBP (n = 93-101)	0	112.6 (110.7, 114.6)	112.7 (110.7, 114.7)	113.9 (112.3, 115.5)	< 0.001	0.074	0.429
	Δ4	−1.9 (−4.1, 0.4)	−3.0 (−4.9, −1.1)	−1.9 (−4.2, 0.4)			
	Δ8	−3.2 (−5.9, −0.4)	−6.1 (−8.7, −3.6)	−4.0 (−6.4, −1.6)			
	Δ12	−2.6 (−5.4, 0.1)	−4.6 (−7.3, −1.9)	−1.5 (−4.2, 1.3)			
DBP (n = 93-101)	0	72.7 (71.3, 74.2)	72.5 (71.1, 73.8)	72.7 (71.3, 74.1)	< 0.001	0.096	0.270
	Δ4	−1.3 (−3.2, 0.6)	−3.0 (−4.7, −1.3)	−0.3 (−2.5, 1.9)			
	Δ8	−2.1 (−3.7, −0.6)	−3.7 (−5.7, −1.8)	−1.4 (−3.5, 0.8)			
	Δ12	1.5 (−1.3, 4.2)	2.2 (−0.3, 4.7)	3.0 (0.4, 5.5)			
BMI: ≥ 25							
SBP (n = 39-44)	0	122.0 (118.2, 125.8)	121.4 (116.7, 126.2)	120.1 (117.4, 122.8)	< 0.001	0.002	0.012
	Δ4	−2.6 (−7.0, 1.9)	−4.1 (−7.3, −1.0)	−0.1 (−3.4, 3.3)			
	Δ8	−6.0 (−10.6, −1.4)	−4.9 (−10.0, 0.1)	−1.9 (−6.0, 2.2)			
	Δ12	−5.3 (−8.9, −1.8)[a]	−7.9 (−13.3, −2.5)[a]	1.8 (−1.8, 5.4)[b]			
DBP (n = 39-44)	0	79.4 (76.8, 82.0)	80.0 (76.9, 83.2)	78.2 (76.2, 80.3)	< 0.001	< 0.001	0.002
	Δ4	−2.2 (−5.2, 0.9)	−6.2 (−9.1, −3.3)[a]	0.1 (−3.3, 3.4)[b]			
	Δ8	−4.1 (−6.8, −1.5)	−5.7 (−9.0, −2.4)[a]	−0.4 (−3.7, 3.0)[b]			
	Δ12	1.3 (−2.4, 4.9)	−1.5 (−5.7, 2.6)[a]	4.5 (1.5, 7.5)[a]			
BMI: < 25							
SBP (n = 66-74)	0	112.1 (109.4, 114.7)	114.2 (111.3, 117.0)	112.2 (110.2, 114.2)	< 0.001	0.012	0.086
	Δ4	−1.8 (−4.3, 0.7)	−3.6 (−5.8, −1.3)	−2.6 (−5.5, 0.4)			
	Δ8	−2.3 (−5.3, 0.7)[a]	−8.0 (−10.5, −5.5)[b]	−3.9 (−6.9, −1.0)[a]			
	Δ12	−2.1 (−5.4, 1.1)	−4.9 (−7.7, −2.1)	−3.4 (−6.8, 0.1)			
DBP (n = 66-74)	0	72.0 (70.3, 73.8)	72.9 (70.7, 75.1)	71.1 (69.3, 73.0)	< 0.001	0.326	0.572
	Δ4	−1.0 (−3.2, 1.2)	−2.9 (−4.8, −1.0)	−0.8 (−3.7, 2.1)			
	Δ8	−1.4 (−3.3, 0.5)	−3.8 (−6.0, −1.5)	−1.6 (−4.1, 1.0)			
	Δ12	1.7 (−1.7, 5.1)	2.1 (−1.0, 5.1)	2.5 (−1.2, 6.1)			
Age: ≥ 45							

SBP (n = 21-33)	0	121.9 (116.7, 127.1)	127.6 (121.1, 134.1)	121.1 (117.7, 124.5)	< 0.001	0.043	0.146
	Δ4	−3.3 (−8.5, 1.9)	−2.1 (−6.2, 2.0)	0.6 (−6.1, 7.3)			
	Δ8	−4.4 (−9.1, 0.4)	−7.7 (−14.0, −1.4)	−2.8 (−9.3, 3.6)			
	Δ12	−4.9 (−8.9, −0.9)[a]	−12.3 (−19.9, −4.8)[b]	−0.9 (−7.8, 5.9)[a]			
DBP (n = 21-33)	0	77.7 (74.5, 80.9)	82.9 (76.8, 88.9)	79.3 (76.5, 82.0)	0.037	0.246	0.739
	Δ4	−2.2 (−6.1, 1.7)	−5.2 (−8.9, −1.5)	−1.1 (−5.3, 3.1)			
	Δ8	−1.9 (−4.7, 1.0)	−2.9 (−8.8, 2.9)	−1.4 (−6.7, 3.8)			
	Δ12	2.8 (−1.1, 6.7)	−1.7 (−10.1, 6.7)	1.3 (−3.1, 5.7)			
Age: < 45							
SBP (n = 80-90)	0	112.9 (110.6, 115.1)	114.4 (111.8, 117.0)	113.7 (111.8, 115.7)	< 0.001	0.008	0.107
	Δ4	−1.5 (−3.8, 0.7)	−4.1 (−6.2, −2.1)	−2.1 (−4.3, 0.1)			
	Δ8	−3.3 (−6.3, −0.3)	−6.7 (−9.3, −4.0)	−3.2 (−5.8, −0.6)			
	Δ12	−2.5 (−5.6, 0.6)	−4.5 (−7.1, −1.8)	−1.2 (−4.0, 1.5)			
DBP (n = 80-90)	0	73.3 (71.5, 75.1)	73.9 (72.1, 75.7)	72.5 (70.8, 74.2)	< 0.001	0.002	0.009
	Δ4	−1.1 (−3.0, 0.8)	−4.0 (−5.9, −2.1)	−0.2 (−2.8, 2.3)			
	Δ8	−2.6 (−4.5, −0.8)	−4.8 (−6.7, −2.9)	−1.0 (−3.2, 1.2)			
	Δ12	0.9 (−2.4, 4.1)[a]	1.4 (−1.0, 3.7)[a]	3.9 (1.0, 6.7)[b]			
Gender: male							
SBP (n = 40-50)	0	122.7 (119.3, 126.2)	123.8 (120.5, 127.1)	119.8 (117.5, 122.1)	< 0.001	< 0.001	0.001
	Δ4	−0.7 (−3.9, 2.5)	−3.4 (−5.9, −0.8)	0.6 (−3.5, 4.7)			
	Δ8	−3.3 (−6.9, 0.3)	−7.6 (−10.7, −4.4)[a]	−1.3 (−5.8, 3.2)[b]			
	Δ12	−2.9 (−6.9, 1.1)[a]	−7.3 (−10.5, −4.2)[a]	2.6 (−1.5, 6.6)[b]			
DBP (n = 40-50)	0	79.6 (77.2, 82.0)	79.4 (76.3, 82.5)	76.8 (74.5, 79.2)	< 0.001	0.002	0.034
	Δ4	−0.7 (−3.7, 2.2)	−2.4 (−5.0, 0.1)	1.8 (−1.8, 5.4)			
	Δ8	−1.1 (−3.6, 1.4)	−3.1 (−5.7, −0.6)[a]	1.1 (−2.5, 4.7)[b]			
	Δ12	2.6 (−1.3, 6.6)[a]	2.4 (−1.3, 6.2)[a]	8.1 (5.0, 11.1)[b]			
Gender: female							
SBP (n = 61-70)	0	110.9 (108.3, 113.4)	111.3 (108.0, 114.5)	112.8 (110.6, 115.0)	< 0.001	0.327	0.878
	Δ4	−3.0 (−6.0, 0.1)	−4.1 (−6.7, −1.5)	−2.7 (−5.3, −0.2)			
	Δ8	−3.9 (−7.3, −0.4)	−6.4 (−9.9, −2.8)	−4.2 (−7.0, −1.4)			
	Δ12	−3.6 (−6.7, −0.4)	−4.9 (−8.9, −0.8)	−3.1 (−6.3, 0.0)			
DBP (n = 61-70)	0	71.4 (69.6, 73.1)	72.5 (70.4, 74.6)	72.3 (70.4, 74.2)	< 0.001	0.027	0.112
	Δ4	−1.8 (−4.1, 0.4)[a]	−5.5 (−7.6, −3.3)[b]	−1.7 (−4.4, 1.0)[a]			
	Δ8	−3.2 (−5.2, −1.2)	−5.5 (−8.1, −2.9)	−2.3 (−4.7, 0.1)			
	Δ12	0.8 (−2.5, 4.1)	−0.6 (−3.8, 2.6)	0.8 (−2.4, 4.0)			

Values are presented as means (95% CIs). *Comparisons among three groups were performed using mixed-model analysis of variance; changes from baseline were calculated by subtracting 4-, 8-, and 12-week data from baseline data. BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; BMI, body mass index. [a,b]Different superscripts indicate significant

64 differences between groups. No superscript means no difference compared with any other group;

65 Δ, change from baseline.