

Composition differences between organic and conventional meat; a systematic literature review and meta-analysis

APPENDIX

Table A1 below provides results of the standard and sensitivity 1 meta-analyses, and sensitivity analysis 2 and 3 to allow the effect of using different data handling and inclusion criteria, and meta-analysis methods (weighted vs unweighted) on the results of meta-analyses to be assessed (see online supplementary Table S5 for summary of inclusion criteria).

Table A2 below provides results of the weighted sensitivity meta-analysis (sensitivity analysis 4) to allow the effect of exclusion of 20% of studies with the least precise treatment effects on the results of meta-analyses to be assessed (see online supplementary Table S5 for summary of inclusion criteria).

Table A3 below provides results of weighted sensitivity meta-analysis (sensitivity analysis 5) after exclusion of studies considered to have less scientifically sound methods of fatty acids assessments (see online supplementary Table S5 for inclusion criteria).

Table A1. Results of meta-analysis comparing composition of organic (ORG) vs conventional (CONV) meat using two different protocols.

Parameter	an*	Weighted meta-analyses							Unweighted meta-analyses				
		n	SMD	95% CI	P†	Heterog.‡	MPD§	95% CI	n	Ln ratio	P†	MPD§	95% CI
<i>Major components</i>													
Fat	S,1	22	-0.35	-0.80, 0.10	0.125	Yes (89%)	-22.21	-43.92, -0.51	34	4.45	0.012	-21.46	-40.34, -2.59
	2,3	22	-0.35	-0.80, 0.10	0.125	Yes (89%)	-22.21	-43.92, -0.51	38	4.46	0.028	-18.93	-38.90, 1.04
Intramuscular fat	S,1	7	-0.25	-0.74, 0.25	0.331	Yes (79%)	-12.40	-37.76, 12.97	9	4.44	0.065	-21.73	-45.58, 2.12
	2,3	8	-0.16	-0.62, 0.31	0.509	Yes (79%)	-8.82	-31.87, 14.24	12	4.44	0.029	-20.84	-39.97, -1.71
Protein	S,1	17	0.19	-0.17, 0.54	0.307	Yes (78%)	1.02	-0.51, 2.55	23	4.62	0.059	1.07	-0.20, 2.34
	2,3	17	0.19	-0.17, 0.54	0.307	Yes (78%)	1.02	-0.51, 2.55	25	4.62	0.044	1.08	-0.13, 2.29
<i>Fatty acids</i>													
ALA (cis-9,12,15-18:3)	S,1	22	0.70	-0.30, 1.71	0.169	Yes (97%)	17.00	-11.49, 45.49	32	4.80	0.008	35.08	1.34, 68.82
	2,3	24	0.90	-0.16, 1.97	0.097	Yes (97%)	32.01	-16.06, 80.08	35	4.87	0.005	56.06	9.40, 102.72
SFA	S,1	26	-0.35	-0.79, 0.10	0.127	Yes (92%)	-2.37	-5.69, 0.94	38	4.59	0.103	-1.67	-4.17, 0.83
	2,3	27	-0.36	-0.79, 0.07	0.101	Yes (91%)	-3.57	-7.54, 0.39	40	4.59	0.084	-2.22	-5.16, 0.72
12:0 (lauric acid)	S,1	11	-0.01	-0.55, 0.53	0.974	Yes (84%)	4.94	-21.44, 31.31	15	4.66	0.270	7.94	-12.61, 28.48
	2,3	11	-0.01	-0.55, 0.53	0.974	Yes (84%)	4.94	-21.44, 31.31	16	4.66	0.228	8.33	-10.90, 27.57
14:0 (myristic acid)	S,1	23	-1.06	-2.12, -0.01	0.049	Yes (98%)	-18.35	-31.97, -4.72	27	4.47	0.003	-18.11	-30.25, -5.97
	2,3	25	-1.23	-2.27, -0.20	0.020	Yes (98%)	-20.87	-34.16, -7.58	30	4.44	<0.001	-20.83	-32.41, -9.25

n, number of data points included in the comparison; MPD, mean percent difference; SMD, standardised mean difference of random-effect model; CI, 95% confidence intervals; SFA, saturated fatty acids; ALA, α -linolenic acid. *Analysis: S, standard meta-analysis, 1,2,3, sensitivity analysis 1, 2 and 3 (see main article and online supplementary Table S5 for details); †P value <0.05 indicates significance of the difference in composition between organic and conventional meat; ‡Heterogeneity and the I² Statistic; §Magnitude of difference between organic and conventional samples (value <0 indicate higher concentration in CONV, value >0 indicate higher concentration in ORG); ||Ln ratio = Ln(ORG/CONV × 100%).

Table A1 cont. Results of meta-analysis comparing composition of organic (ORG) vs conventional (CONV) meat using two different protocols.

Parameter	an*	Weighted meta-analyses							Unweighted meta-analyses				
		<i>n</i>	SMD	95% CI	<i>P</i> †	Heterog.‡	MPD§	95% CI	<i>n</i>	Ln ratio	<i>P</i> †	MPD§	95% CI
16:0 (palmitic acid)	S,1	24	-0.51	-1.01, -0.01	0.044	Yes (91%)	-10.85	-27.67, 5.98	30	4.55	0.043	-8.50	-22.03, 5.02
	2,3	26	-0.44	-0.94, 0.05	0.080	Yes (91%)	-14.02	-31.44, 3.40	33	4.54	0.031	-10.98	-24.81, 2.86
20:0 (arachidic acid)	S,1	9	0.33	-0.15, 0.81	0.177	Yes (81%)	53.61	-39.93, 147.16	12	4.91	0.020	66.98	-14.18, 148.14
	2,3	9	0.33	-0.15, 0.81	0.177	Yes (81%)	53.61	-39.93, 147.16	13	4.98	0.008	79.77	1.02, 158.53
MUFA	S,1	24	-1.01	-1.57, -0.45	<0.001	Yes (94%)	-7.97	-12.47, -3.48	36	4.55	<0.001	-6.55	-10.01, -3.09
	2,3	24	-1.01	-1.57, -0.45	<0.001	Yes (94%)	-7.97	-12.47, -3.48	37	4.54	<0.001	-6.77	-10.16, -3.38
14:1	S,1	4	-0.02	-0.43, 0.39	0.909	No (0%)	-1.85	-15.46, 11.77	6	4.42	0.141	-27.93	-76.62, 20.77
	2,3	5	-0.24	-0.74, 0.26	0.346	Yes (33%)	-18.04	-51.47, 15.4	8	4.25	0.035	-57.86	-115.49, -0.22
16:1 (palmitoleic acid)	S,1	18	-0.10	-0.36, 0.16	0.443	Yes (53%)	-9.10	-30.33, 12.13	23	4.55	0.182	-10.04	-27.65, 7.57
	2,3	20	-0.14	-0.39, 0.11	0.272	Yes (49%)	-15.81	-38.15, 6.53	26	4.49	0.041	-18.19	-36.95, 0.57
OA (cis-9-18:1)	S,1	22	-0.48	-1.12, 0.16	0.138	Yes (94%)	-3.71	-8.43, 1.01	27	4.56	0.016	-4.91	-9.16, -0.66
	2,3	23	-0.49	-1.09, 0.12	0.113	Yes (94%)	-4.00	-8.55, 0.54	29	4.56	0.006	-5.35	-9.35, -1.35
PUFA	S,1	23	1.15	0.51, 1.80	<0.001	Yes (95%)	23.29	11.27, 35.31	35	4.75	<0.001	18.90	7.28, 30.51
	2,3	23	1.15	0.51, 1.80	<0.001	Yes (95%)	23.29	11.27, 35.31	36	4.77	<0.001	21.05	9.00, 33.1
n-3 FA	S,1	21	1.31	0.16, 2.45	0.026	Yes (98%)	46.99	10.08, 83.89	31	4.85	<0.001	38.38	12.16, 64.61
	2,3	22	1.30	0.21, 2.38	0.019	Yes (98%)	52.27	15.59, 88.94	32	4.87	<0.001	42.28	15.77, 68.8

n, number of data points included in the comparison; MPD, mean percent difference; SMD, standardised mean difference of random-effect model; CI, 95% confidence intervals; MUFA, monounsaturated fatty acids; OA, oleic acid; PUFA, polyunsaturated fatty acids; FA, fatty acids. *Analysis: S, standard meta-analysis, 1,2,3, sensitivity analysis 1, 2 and 3 (see main article and online supplementary Table S5 for details); †*P* value <0.05 indicates significance of the difference in composition between organic and conventional meat; ‡Heterogeneity and the *I*² Statistic; §Magnitude of difference between organic and conventional samples (value <0 indicate higher concentration in CONV, value >0 indicate higher concentration in ORG); ||Ln ratio = Ln(ORG/CONV × 100%).

Table A1 cont. Results of meta-analysis comparing composition of organic (ORG) vs conventional (CONV) meat using two different protocols.

Parameter	an*	Weighted meta-analyses							Unweighted meta-analyses				
		n	SMD	95% CI	P†	Heterog.‡	MPD§	95% CI	n	Ln ratio	P†	MPD§	95% CI
EPA (cis-5,8,11,14,17-20:5)	S,1¶	13	0.02	-0.85, 0.89	0.966	Yes (95%)	0.93	-37.51, 39.37	20	4.58	0.403	-6.11	-35.79, 23.56
	2,3	16	-0.24	-1.03, 0.55	0.547	Yes (94%)	-52.82	-122.6, 16.9	25	4.55	0.369	-9.18	-74.52, 56.17
DPA (cis-7,10,13,16,19-22:5)	S,1	11	0.40	-0.36, 1.17	0.304	Yes (92%)	30.45	-0.18, 61.07	15	4.82	0.007	29.49	7.07, 51.91
	2,3	11	0.40	-0.36, 1.17	0.304	Yes (92%)	30.45	-0.18, 61.07	15	4.82	0.010	29.49	7.07, 51.91
DHA (cis-4,7,10,13,16,19-22:6)	S,1	14	0.17	-0.24, 0.59	0.404	Yes (75%)	13.84	-35.39, 63.07	22	4.68	0.246	8.63	-23.91, 41.18
	2,3	15	0.10	-0.33, 0.53	0.651	Yes (77%)	-13.19	-83.24, 56.86	23	4.61	0.492	-8.77	-54.93, 37.39
VLC n-3 FA (EPA+DPA+DHA)	S,1	-	-	-	-	-	-	-	15	4.79	0.017	24.20	3.57, 44.83
	2,3	-	-	-	-	-	-	-	15	4.79	0.020	24.20	3.57, 44.83
n-6 FA	S,1	19	0.97	0.15, 1.78	0.020	Yes (96%)	16.34	1.73, 30.94	29	4.70	0.010	12.57	1.92, 23.22
	2,3	19	0.97	0.15, 1.78	0.020	Yes (96%)	16.34	1.73, 30.94	29	4.70	0.008	12.57	1.92, 23.22
LA (cis-9,12-18:2)	S,1	23	0.61	-0.07, 1.29	0.077	Yes (95%)	8.53	-11.48, 28.55	30	4.68	0.097	9.69	-7.07, 26.44
	2,3	25	0.47	-0.19, 1.13	0.166	Yes (95%)	-2.51	-26.27, 21.24	33	4.64	0.286	3.36	-16.29, 23.01
AA (cis-5,8,11,14-20:4)	S,1¶	13	0.45	-0.05, 0.94	0.079	Yes (80%)	11.67	-8.16, 31.50	19	4.61	0.461	1.40	-14.68, 17.47
	2,3	16	0.19	-0.32, 0.69	0.471	Yes (84%)	-6.96	-32.28, 18.36	23	4.56	0.286	-6.08	-26.44, 14.29
n-6/n-3 ratio	S,1	17	-0.75	-1.72, 0.23	0.133	Yes (97%)	-21.98	-46.56, 2.60	32	4.42	0.004	-27.71	-48.05, -7.38
	2,3	18	-0.95	-1.96, 0.06	0.066	Yes (97%)	-66.39	-156.5, 23.7	34	4.33	0.001	-56.99	-107.6, -6.4

n, number of data points included in the comparison; MPD, mean percent difference; SMD, standardised mean difference of random-effect model; CI, 95% confidence intervals; EPA, eicosapentaenoic acid; DPA, docosapentaenoic acid; DHA, docosahexaenoic acid; FA, fatty acids; LA, linoleic acid; AA, arachidonic acid. *Analysis: S, standard meta-analysis, 1,2,3, sensitivity analysis 1, 2 and 3 (see main article and online supplementary Table S5 for details); †P value <0.05 indicates significance of the difference in composition between organic and conventional meat; ‡Heterogeneity and the I² Statistic; §Magnitude of difference between organic and conventional samples (value <0 indicate higher concentration in CONV, value >0 indicate higher concentration in ORG); ||Ln ratio = Ln(ORG/CONV × 100%); ¶Outlying data-pairs for which the % difference between ORG and CONV was over 50 times higher than the mean value were removed.

Table A1 cont. Results of meta-analysis comparing composition of organic (ORG) vs conventional (CONV) meat using two different protocols.

Parameter	an*	Weighted meta-analyses							Unweighted meta-analyses				
		n	SMD	95% CI	P†	Heterog.‡	MPD§	95% CI	n	Ln ratio	P†	MPD§	95% CI
PUFA/SFA ratio	S,1	4	2.75	-2.05, 7.55	0.261	Yes (100%)	50.44	-33.29, 134.16	10	4.85	0.015	36.28	-1.26, 73.82
	2,3	4	2.75	-2.05, 7.55	0.261	Yes (100%)	50.44	-33.29, 134.16	11	4.88	0.006	41.06	5.84, 76.29
<i>Minerals and undesirable metals</i>													
Copper (Cu)	S,1	3	-4.77	-8.92, -0.63	0.024	Yes (98%)	-25.96	-42.61, -9.30	4	4.36	0.064	-27.80	-40.12, -15.48
	2,3	5	-5.24	-7.58, -2.9	<0.001	Yes (96%)	-30.13	-41.66, -18.6	6	4.34	0.015	-30.67	-40.14, -21.19
Iron (Fe)	S,1	4	1.00	-0.65, 2.66	0.236	Yes (96%)	13.79	2.14, 25.43	5	4.77	0.068	18.86	5.44, 32.27
	2,3	6	1.24	-0.15, 2.64	0.081	Yes (97%)	13.11	3.60, 22.61	7	4.75	0.028	16.83	5.98, 27.67
Selenium (Se)	S,1	-	-	-	-	-	-	-	3	4.53	0.256	-8.12	-27.34, 11.10
	2,3	4	-2.56	-3.11, -2.01	<0.001	Yes (74%)	-17.99	-25.73, -10.25	5	4.50	0.097	-12.17	-25.06, 0.72
<i>Other</i>													
Cholesterol	S,1	-	-	-	-	-	-	-	5	4.58	0.189	-3.01	-10.60, 4.59
	2,3	-	-	-	-	-	-	-	6	4.57	0.145	-3.48	-9.75, 2.79
Atherogenicity index¶	S,1	4	0.47	-0.17, 1.11	0.148	Yes (79%)	6.64	-0.66, 13.94	5	4.67	0.062	7.02	1.32, 12.72
	2,3	4	0.47	-0.17, 1.11	0.148	Yes (79%)	6.64	-0.66, 13.94	5	4.67	0.058	7.02	1.32, 12.72
Thrombogenicity index¶	S,1	4	-0.35	-0.64, -0.06	0.018	No (0%)	-4.40	-6.73, -2.08	5	4.57	0.028	-3.99	-5.97, -2.02
	2,3	4	-0.35	-0.64, -0.06	0.018	No (0%)	-4.40	-6.73, -2.08	5	4.57	0.029	-3.99	-5.97, -2.02

n, number of data points included in the comparison; MPD, mean percent difference; SMD, standardised mean difference of random-effect model; CI, 95% confidence intervals; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids. *Analysis: S, standard meta-analysis, 1,2,3, sensitivity analysis 1, 2 and 3 (see main article and online supplementary Table S5 for details); †P value <0.05 indicates significance of the difference in composition between organic and conventional meat; ‡Heterogeneity and the I² Statistic; §Magnitude of difference between organic and conventional samples (value <0 indicate higher concentration in CONV, value >0 indicate higher concentration in ORG); ||Ln ratio = Ln(ORG/CONV × 100%); ¶Reported in publications.

Table A2. Weighted meta-analysis results after exclusion of 20% of studies with the least precise treatment effects (sensitivity analysis 4, see main article and online supplementary Table S5 for details) for parameters shown in Fig. 3 and 4 of the main paper.

Parameter	<i>n</i>	SMD	95% CI	<i>P</i> *	Heterogeneity†	MPD‡	95% CI
<i>Primary outcome</i>							
PUFA	18	0.89	0.46, 1.33	<0.001	Yes (89%)	18.93	10.03, 27.84
n-3 FA	17	0.56	-0.12, 1.23	0.104	Yes (94%)	35.43	-2.24, 73.11
<i>Secondary outcome</i>							
12:0 (lauric acid)	9	-0.07	-0.68, 0.55	0.835	Yes (87%)	0.17	-25.6, 25.93
14:0 (myristic acid)	18	-0.09	-0.41, 0.24	0.593	Yes (76%)	-4.94	-13.34, 3.47
16:0 (palmitic acid)	19	-0.25	-0.71, 0.2	0.275	Yes (89%)	-1.07	-3.86, 1.72
<i>Exploratory outcome</i>							
Fat	18	-0.53	-0.99, -0.08	0.021	Yes (89%)	-31.78	-55.21, -8.35
Intramuscular fat	6	-0.06	-0.46, 0.33	0.765	Yes (64%)	-1.37	-17.06, 14.33
SFA	21	-0.27	-0.58, 0.04	0.092	Yes (82%)	-1.83	-5.43, 1.77
MUFA	19	-0.83	-1.25, -0.42	<0.001	Yes (89%)	-7.87	-12.5, -3.24
OA (cis-9-18:1)	18	-0.24	-0.61, 0.12	0.194	Yes (81%)	-0.63	-3.73, 2.47
ALA (cis-9,12,15-18:3)	18	0.17	-0.28, 0.63	0.460	Yes (84%)	10.57	-3.82, 24.96
EPA (cis-5,8,11,14,17-20:5)§	10	-0.38	-1.14, 0.37	0.321	Yes (93%)	-5.34	-49.3, 38.63
DPA (cis-7,10,13,16,19-22:5)	9	0.17	-0.47, 0.8	0.607	Yes (89%)	25.74	-6.41, 57.89
DHA (cis-4,7,10,13,16,19-22:6)	11	0.19	-0.27, 0.65	0.408	Yes (80%)	29.08	-17.8, 75.97
n-6 FA	15	0.56	0.08, 1.04	0.022	Yes (88%)	8.34	-2.27, 18.96
LA (cis-9,12-18:2)	18	0.43	0.09, 0.78	0.014	Yes (78%)	13.24	2.49, 23.99
AA (cis-5,8,11,14-20:4)§	10	0.19	-0.28, 0.66	0.427	Yes (76%)	-0.65	-19.25, 17.95
n-6/n-3 ratio	14	-0.18	-0.96, 0.6	0.651	Yes (95%)	-9.87	-31.28, 11.55

n, number of data points included in the comparison; SMD, standardised mean difference of random-effect model; CI, 95% confidence intervals; MPD, mean percentage difference; PUFA, polyunsaturated fatty acids; FA, fatty acids; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; OA, oleic acid; ALA, α -linolenic acid; EPA, eicosapentaenoic acid; DPA, docosapentaenoic acid; DHA, docosahexaenoic acid; LA, linoleic acid; AA, arachidonic acid. **P* value <0.05 indicates significance of the difference in composition between organic and conventional meat; †Heterogeneity and the I^2 Statistic; ‡Magnitude of difference between organic (ORG) and conventional (CONV) samples (value <0 indicate higher concentration in CONV, value >0 indicate higher concentration in ORG); §Outlying data pairs (where the MPD between ORG and CONV was over fifty times greater than the mean value including the outliers) were removed.

Table A3. Weighted meta-analysis results after exclusion of studies considered to have less scientifically sound methods of fatty acids assessments (sensitivity analysis 5, see main article and online supplementary Table S5 for details) for parameters shown in Fig. 3 and 4 of the main paper.

Parameter	<i>n</i>	SMD	95% CI	<i>P</i> *	Heterogeneity†	MPD‡	95% CI
<i>Primary outcome</i>							
PUFA	20	1.31	0.56, 2.07	0.001	Yes (96%)	25.49	11.96, 39.01
n-3 FA	18	1.36	-0.01, 2.74	0.052	Yes (98%)	43.69	1.85, 85.53
<i>Secondary outcome</i>							
12:0 (lauric acid)	9	-0.03	-0.71, 0.64	0.927	Yes (86%)	0.58	-30.54, 31.71
14:0 (myristic acid)	21	-1.21	-2.40, -0.02	0.047	Yes (98%)	-20.82	-35.27, -6.36
16:0 (palmitic acid)	22	-0.57	-1.13, -0.01	0.046	Yes (92%)	-11.53	-29.89, 6.83
<i>Exploratory outcome</i>							
Fat	18	-0.36	-0.90, 0.17	0.183	Yes (90%)	-13.70	-33.32, 5.92
Intramuscular fat	7	-0.25	-0.74, 0.25	0.331	Yes (79%)	-12.40	-37.76, 12.97
SFA	23	-0.45	-0.94, 0.04	0.069	Yes (92%)	-3.57	-6.90, -0.24
MUFA	21	-1.01	-1.64, -0.38	0.002	Yes (95%)	-6.82	-11.20, -2.43
OA (cis-9-18:1)	20	-0.53	-1.25, 0.18	0.144	Yes (95%)	-3.88	-9.05, 1.28
ALA (cis-9,12,15-18:3)	21	0.74	-0.33, 1.80	0.175	Yes (97%)	16.94	-12.94, 46.82
EPA (cis-5,8,11,14,17-20:5)§	13	-0.21	-1.10, 0.68	0.643	Yes (94%)	-36.01	-90.93, 18.92
DPA (cis-7,10,13,16,19-22:5)	10	0.45	-0.41, 1.31	0.307	Yes (93%)	32.80	-0.67, 66.27
DHA (cis-4,7,10,13,16,19-22:6)§	8	-0.04	-0.49, 0.40	0.844	Yes (62%)	6.13	-17.57, 29.83
n-6 FA	17	1.09	0.17, 2.01	0.020	Yes (96%)	16.57	0.43, 32.71
LA (cis-9,12-18:2)	22	0.64	-0.08, 1.37	0.082	Yes (95%)	7.75	-13.13, 28.64
AA (cis-5,8,11,14-20:4)§	10	0.24	-0.25, 0.73	0.335	Yes (76%)	0.83	-18.31, 19.96
n-6/n-3 ratio	16	-0.52	-1.44, 0.40	0.265	Yes (97%)	-13.70	-33.34, 5.95

n, number of data points included in the comparison; SMD, standardised mean difference of random-effect model; CI, 95% confidence intervals; MPD, mean percentage difference; PUFA, polyunsaturated fatty acids; FA, fatty acids; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; OA, oleic acid; ALA, α -linolenic acid; EPA, eicosapentaenoic acid; DPA, docosapentaenoic acid; DHA, docosahexaenoic acid; LA, linoleic acid; AA, arachidonic acid. **P* value <0.05 indicates significance of the difference in composition between organic and conventional meat; †Heterogeneity and the I^2 Statistic; ‡Magnitude of difference between organic (ORG) and conventional (CONV) samples (value <0 indicate higher concentration in CONV, value >0 indicate higher concentration in ORG); §Outlying data pairs (where the MPD between ORG and CONV was over fifty times greater than the mean value including the outliers) were removed.