

SUPPLEMENTAL MATERIAL

Supplemental Table 1. Baseline Features of the WHI-OS Cohort According to DHA+EPA Acid Quartiles

	DHA+EPA Intake (g/1000 kcal)								p-value
	Q1	Q2		Q3		Q4			
Age (years)	20962	63.6 (7.5)	21442	63.6 (7.4)	20945	63.5 (7.3)	21144	63.5 (7.2)	0.026
Ethnicity									<0.001
White	18127	86	18491	85	17723	84	17204	80	
African American	1167	6	1466	7	1650	8	1870	9	
Hispanic	1012	5	763	4	619	3	503	2	
American Indian / AK	122	1	83	0.4	71	0.3	64	0.3	
Asian / Pacific Islander	272	1	368	2	610	3	1163	6	
Unknown	262	1	271	1	272	1	340	2	
Diabetes (%yes)	755	4	889	4	827	4	771	4	0.009
CAD (%yes)	616	3	639	3	618	3	638	3	0.966
Atrial fibrillation (%yes)	963	5	963	5	893	4	879	4	0.106
Body mass index (kg/m ²)	20962	27 (6)	21442	28 (6)	20945	27 (6)	21144	27 (6)	<0.001
HDL-cholesterol* (mg/dl)	242	61 (16)	272	64 (17)	226	63 (17)	215	68 (19)	0.001
Triglycerides* (mg/dl)	242	153 (80)	273	153 (85)	226	149 (93)	215	139 (91)	0.339
Systolic Blood Pressure	20952	127 (18)	21429	127 (18)	20924	127 (18)	21127	126 (17)	<0.001
Alcohol use (%)									<0.001
Never drinker	3159	15	2376	10	1845	9	1754	9	
Past drinker	4712	23	3958	19	3498	17	3255	15	
Current drinker	13091	63	15108	71	15602	74	16135	76	
Smoking status (%)									<0.001
Never	11296	54	11096	52	10421	50	10067	48	
Former	8173	39	8868	41	9310	44	10095	47	
Current	1493	7	1478	7	1214	6	982	5	
Physical activity (METs/wk)	20962	12 (14)	21442	13 (14)	20945	14 (14)	21144	16 (15)	<0.001
Education (%)									<0.001
≤ High school / GED	5611	27	4867	23	3891	19	3060	15	
Some college	8048	38	8171	38	7582	36	6939	32	
College graduate	7303	35	8404	39	9472	45	11145	53	
Energy intake (kcal/day)	20962	1606	21442	1636	20945	1580	21144	1464	<0.001
Fiber intake (g/1000 kcal)	20962	11 (4)	21442	11 (4)	20945	11 (4)	21144	12 (4)	<0.001
Fruit and Vegetable intake	20962	4 (2)	21442	4 (2)	20945	5 (2)	21144	5 (2)	<0.001
SFA intake (%kcal)	20962	10.6 (3.6)	21442	10.4 (3.3)	20945	10.0 (3.1)	21144	9.0 (3.0)	<0.001
TFA intake (%kcal)	20962	2.3 (1.2)	21442	2.2 (1.1)	20945	2.0 (1.0)	21144	1.7 (0.9)	<0.001
DHA+EPA intake (%kcal)	20962	0.02 (0.01)	21442	0.04 (0.01)	20945	0.07 (0.01)	21144	0.17 (0.09)	<0.001

ALA intake (%kcal)	20962	5.6 (2.1)	21442	5.7 (1.9)	20945	5.6 (1.8)	21144	5.2 (1.8)	<0.001
α -Linoleic Acid (%kcal)	20962	0.65 (0.27)	21442	0.67 (0.26)	20945	0.68 (0.3)	21144	0.68 (0.27)	<0.001

* WHI blood subsample participants only (n=955). Means and SD's weighted by ethnicity.

Supplemental Table 2. Baseline Features of the WHI-OS Cohort According to ALA Quartiles

	ALA Intake (g/1000 kcal)								p-value
	Q1	Q2	Q3	Q4					
Age (years)	21243	63.2 (7.4)	21169	63.4 (7.3)	21094	63.7 (7.4)	20987	63.9 (7.4)	<0.001
Ethnicity									<0.001
White	18924	89	18360	87	17663	84	16598	78	
African American	974	5	1345	6	1713	8	2121	10	
Hispanic	677	3	659	3	720	3	841	4	
American Indian / AK	82	0.4	81	0.4	82	0.4	95	0.5	
Asian / Pacific Islander	306	1	459	2	645	3	1003	5	
Unknown	280	1	265	1	271	1	329	2	
Diabetes (%yes)	560	3	764	4	891	4	1027	5	<0.001
CAD (%yes)	709	3	600	3	629	3	573	3	0.001
Atrial fibrillation (%yes)	872	4	936	4	922	4	968	5	0.084
Body mass index (kg/m ²)	21243	27 (5)	21169	27 (6)	21094	27 (6)	20987	28 (6)	<0.001
HDL-cholesterol* (mg/dl)	216	62 (15)	239	62 (17)	236	66 (19)	264	64 (18)	0.078
Triglycerides* (mg/dl)	216	149 (73)	239	154 (81)	236	143 (80)	265	151 (121)	0.608
Systolic Blood Pressure	21229	126 (18)	21160	127 (18)	21072	127 (18)	20971	128 (18)	<0.001
Alcohol use (%)									<0.001
Never drinker	1979	9	2194	10	2336	11	2625	13	
Past drinker	3822	18	3692	17	3840	18	4069	19	
Current drinker	15442	73	15283	73	14918	71	14293	68	
Smoking status (%)									<0.001
Never	10819	51	10850	51	10849	51	10362	49	
Former	9438	44	9183	43	8887	42	8938	43	
Current	986	5	1136	6	1358	7	1687	8	
Physical activity (METs/wk)	21243	16 (15)	21169	14 (14)	21094	13 (14)	20987	12 (14)	<0.001
Education (%)									<0.001
≤ High school / GED	3821	18	4157	20	4586	22	4865	23	
Some college	7475	35	7775	36	7735	37	7755	37	
College graduate	9947	47	9237	44	8773	41	8367	40	
Energy intake (kcal/day)	21243	1518	21169	1583	21094	1603	20987	1583	<0.001
Fiber intake (g/1000 kcal)	21243	12 (4)	21169	11 (4)	21094	11 (4)	20987	10 (4)	<0.001
Fruit and Vegetable intake	21243	5 (2)	21169	4 (2)	21094	4 (2)	20987	4 (2)	<0.001
SFA intake (%kcal)	21243	8.2 (2.8)	21169	9.8 (3.0)	21094	10.6 (3.2)	20987	11.3 (3.4)	<0.001
TFA intake (%kcal)	21243	1.6 (0.7)	21169	2.0 (0.9)	21094	2.3 (1.1)	20987	2.4 (1.3)	<0.001
DHA+EPA intake (%kcal)	21243	0.07 (0.08)	21169	0.08 (0.07)	21094	0.08 (0.07)	20987	0.08 (0.08)	<0.001
ALA intake (%kcal)	21243	3.9 (1.1)	21169	5.0 (1.1)	21094	5.8 (1.2)	20987	7.4 (2.0)	<0.001

α -Linoleic Acid (%kcal)	21243	0.40 (0.06)	21169	0.55 (0.04)	21094	0.71 (0.05)	20987	1.04 (0.23)	<0.001
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* WHI blood subsample participants only (n=955). Means and SD's weighted by ethnicity.

Supplemental Table 3. Baseline Features of the WHI-OS Cohort According to TFA Quartiles

	TFA Intake (g/1000 kcal)								p-
	Q1		Q2		Q3		Q4		
Age (years)	21183	63.3 (7.3)	21148	63.5 (7.4)	21137	63.6 (7.3)	21025	63.8 (7.4)	<0.001
Ethnicity									<0.001
White	18174	85	18140	85	17779	84	17452	83	
African American	925	4	1179	6	1673	8	2376	11	
Hispanic	751	4	771	4	775	4	600	3	
American Indian / AK	56	0.3	90	0.4	105	0.5	89	0.4	
Asian / Pacific Islander	914	4	679	3	539	3	281	1	
Unknown	363	2	389	1	266	1	227	1	
Diabetes (%yes)	513	2	705	3	901	4	1123	5	<0.001
CAD (%yes)	644	3	587	3	599	3	681	3	0.021
Atrial fibrillation (%yes)	840	4	930	4	916	4	1012	5	<0.001
Body mass index (kg/m ²)	21183	26 (5)	21148	27 (5)	21137	28 (6)	21025	28 (6)	<0.001
HDL-cholesterol* (mg/dl)	222	65 (17)	229	64 (17)	254	65 (18)	250	62 (16)	0.084
Triglycerides* (mg/dl)	222	138 (72)	229	143 (75)	255	156 (82)	250	158 (118)	0.075
Systolic Blood Pressure	21183	125 (18)	21138	126 (18)	21127	127 (18)	21009	128 (18)	<0.001
Alcohol use (%)									<0.001
Never drinker	1854	9	2048	10	2444	12	2788	13	
Past drinker	3478	16	3537	17	3925	18	4483	22	
Current drinker	15851	75	15563	73	14768	70	13754	65	
Smoking status (%)									<0.001
Never	10285	49	10634	50	10946	52	11015	52	
Former	10155	48	9395	45	8738	41	8158	39	
Current	743	3	1119	5	1453	7	1852	9	
Physical activity (METs/wk)	21183	19 (16)	21148	15 (14)	21137	12 (13)	21025	10 (120)	<0.001
Education (%)									<0.001
≤ High school / GED	2781	13	3554	17	4773	23	6321	30	
Some college	6929	33	7579	36	7914	37	8318	40	
College graduate	11473	54	10015	47	8450	40	6386	30	
Energy intake (kcal/day)	21183	1394 (474)	21148	1527 (537)	21137	1648 (623)	21025	1722 (686)	<0.001
Fiber intake (g/1000 kcal)	21183	14 (4)	21148	11 (3)	21137	10 (3)	21025	9 (3)	<0.001
Fruit and Vegetable intake	21183	5 (2)	21148	5 (2)	21137	4 (2)	21025	3 (2)	<0.001
SFA intake (%kcal)	21183	7.1 (2.3)	21148	9.6 (2.6)	21137	11.1 (3.1)	21025	12.1 (2.9)	<0.001
TFA intake (%kcal)	21183	1.0 (0.2)	21148	1.6 (0.2)	21137	2.2 (0.2)	21025	3.5 (0.9)	<0.001

DHA+EPA intake (%kcal)	21183	0.10 (0.10)	21148	0.08 (0.07)	21137	0.07 (0.06)	21025	0.06 (0.06)	<0.001
ALA intake (%kcal)	21183	4.3 (1.6)	21148	5.1 (1.6)	21137	5.8 (1.6)	21025	7.0 (1.8)	<0.001
α -Linoleic Acid (%kcal)	21183	0.61 (0.29)	21148	0.63 (0.25)	21137	0.68 (0.25)	21025	0.77 (0.26)	<0.001

* WHI blood subsample participants only (n=955). Means and SD's weighted by ethnicity.

Supplemental Table 4. Multivariate hazard ratios for incident HF based on baked/broiled and fried fish categories

	<1/month	1-3/month	1-2/week	3-4/week	≥5/week	Trend P-value
Baked/broiled fish						
Number of participants	11700	26344	35034	8109	3306	
Person-years	110243	253778	346142	80016	32282	
Number of HF events	294	646	700	167	51	
Incidence Rates (per 10,000 person-years)	26.7	25.5	20.2	20.9	19.4	
Model 1*	1.00	1.04 (0.90, 1.19)	0.91 (0.79, 1.05)	1.03 (0.85, 1.25)	0.76 (0.56, 1.02)	0.073
Model 2†	1.00	1.03 (0.89, 1.18)	0.89 (0.77, 1.02)	0.99 (0.81, 1.21)	0.71 (0.52, 0.96)	0.022
Model 3§	1.00	1.03 (0.89, 1.18)	0.89 (0.77, 1.02)	0.99 (0.80, 1.21)	0.70 (0.51, 0.95)	0.022
	<1/month	1-3/month	≥1/week			
Fried Fish						
Number of participants	63609	18015	2869			
Person-years	625924	170610	25928			
Number of HF events	1305	451	102			
Incidence Rates (per 10,000 person-years)	20.8	26.4	39.4			
Model 1*	1.00	1.09 (0.97, 1.21)	1.50 (1.22, 1.84)			<.001
Model 2‡	1.00	1.07 (0.96, 1.20)	1.52 (1.23, 1.88)			0.001
Model 3§	1.00	1.06 (0.95, 1.19)	1.48 (1.19, 1.84)			0.005

*Adjusted for age, ethnicity, education, physical activity, smoking, alcohol, diabetes, hypertension, AF, MI/CABG/PTCA, BMI, time-dependent MI

†Model 1 + fiber, fruit/vegetable servings, fried fish servings, saturated fat intake (%), DHA+EPA (%), linolenic acid (ALA, %), linoleic acid (%)

‡Model 1 + fiber, fruit/vegetable servings, non-fried fish servings, saturated fat intake (%), DHA+EPA (%), linolenic acid (ALA, %), linoleic acid (%)

§Model 2 + fried food servings, sodium intake (mg)

Supplemental Table 5. Multivariate hazard ratios for incident HF based on Subtype of Baked/Broiled Fish (White Fish, Dark Fish, Tuna Fish)

	<1/month	1-3/month	≥1/week	Trend P-value
White fish (sole, snapper, cod)				
Number of participants	45161	32327	7005	
Person-years	433704	319729	69029	
Number of HF events	1064	653	141	
Incidence Rates (per 10,000 person-years)	24.5	20.4	20.4	
Model 1*	1.00	0.92 (0.83, 1.02)	0.97 (0.81, 1.16)	0.234
Model 2†	1.00	0.91 (0.82, 1.01)	0.95 (0.79, 1.14)	0.155
Model 3‡	1.00	0.91 (0.82, 1.01)	0.95 (0.79, 1.15)	0.173
	<1/month	1-3/month	≥1/week	Trend P-value
Dark fish (salmon, mackerel, bluefish)				
Number of participants	59578	20817	4098	
Person-years	577541	205147	39773	
Number of HF events	1416	379	63	
Incidence Rates (per 10,000 person-years)	24.5	18.5	15.8	
Model 1*	1.00	0.90 (0.80, 1.01)	0.81 (0.63, 1.04)	0.019
Model 2†	1.00	0.89 (0.79, 1.00)	0.79 (0.61, 1.02)	0.011
Model 3‡	1.00	0.89 (0.79, 1.00)	0.78 (0.61, 1.02)	0.012
	<1/month	1-3/month	≥1/week	Trend P-value
Tuna fish				
Number of participants	35842	39882	8769	
Person-years	346411	390854	85197	
Number of HF events	814	867	177	
Incidence Rates (per 10,000 person-years)	23.5	22.2	20.8	
Model 1*	1.00	0.96 (0.87, 1.05)	0.94 (0.80, 1.11)	0.309
Model 2†	1.00	0.95 (0.86, 1.05)	0.92 (0.78, 1.09)	0.228
Model 3‡	1.00	0.95 (0.86, 1.05)	0.92 (0.77, 1.09)	0.233

*age, ethnicity, education, physical activity, smoking, alcohol, diabetes, hypertension, AF, MI/CABG/PTCA, BMI, time-dependent MI

†Model 1 + fiber, fruit/vegetable servings, fried fish servings, saturated fat intake (%), DHA+EPA (%), linolenic acid (ALA, %), linoleic acid (%)

‡Model 2 + fried food servings, sodium intake (mg)

Supplemental Table 6. Summary HR for Supplemental Figure.

Baked/Broiled	Fried	HR (95% CI)	Interaction P-value
<1/month	<1/month	1.00	0.216
<1/month	1 month - <3/week	0.93 (0.68, 1.27)	
<1/month	≥1/week	2.28 (1.38, 3.75)	
<1 month - <3/week	<1/month	0.95 (0.82, 1.10)	
<1 month - <3/week	1 month - <3/week	1.05 (0.89, 1.25)	
<1 month - <3/week	≥1/week	1.29 (0.97, 1.72)	
≥3/week	<1/month	0.95 (0.77, 1.18)	
≥3/week	1 month - <3/week	0.88 (0.61, 1.25)	
≥3/week	≥1/week	1.31 (0.86, 2.00)	

Supplemental Table 7. Multivariate hazard ratios for incident HF based on Caloric Adjusted DHA+EPA and ALA quartiles

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Trend P-value
DHA+EPA intake (g/1000 kcal)	0-0.02	0.021-0.04	0.041-0.07	0.071-0.17	
Number of participants	20962	21442	20945	21144	
Person-years	201773	209077	205201	206411	
Number of CHF events	496	512	450	400	
Model 1*	1.00	1.02 (0.90, 1.15)	0.93 (0.82, 1.05)	0.83 (0.73, 0.94)	0.002
Model 2†	1.00	1.00 (0.89, 1.14)	0.94 (0.83, 1.07)	0.93 (0.81, 1.06)	0.176
Model 3‡	1.00	1.00 (0.89, 1.14)	0.95 (0.83, 1.08)	0.94 (0.82, 1.08)	0.266
ALA intake (g/1000 kcal)	0.01-0.4	0.41-0.6	0.61-0.7	0.71-1.0	
Number of participants	21243	21169	21094	20987	
Person-years	211467	207484	203963	199548	
Number of CHF events	422	457	474	505	
Model 1*	1.0	1.08 (0.95, 1.23)	1.10 (0.96, 1.25)	1.16 (1.02, 1.32)	0.026
Model 2†	1.0	1.00 (0.88, 1.14)	1.00 (0.88, 1.14)	1.03 (0.90, 1.17)	0.706
Model 3§	1.0	1.00 (0.87, 1.14)	1.00 (0.86, 1.16)	1.05 (0.87, 1.25)	0.668

*Adjusted for age

†Model 1 + ethnicity, education, physical activity, smoking, alcohol, diabetes, hypertension, AF, MI/CABG/PTCA, BMI, time-dependent MI

‡Model 2 + fiber, fruit/vegetable servings, saturated fat intake (%), linolenic acid (ALA, %), linoleic acid (%)

§Model 2 + fiber, fruit/vegetable servings, saturated fat intake (%), DHA+EPA (%), linoleic acid (%)

Supplemental Table 8. Multivariate hazard ratios for incident HF based on Unadjusted DHA+EPA and ALA quartiles

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Trend P-value
DHA+EPA intake (g/d)	<0.048	0.048-0.092	0.093-0.163	>0.163	
Number of participants	21013	21252	21051	21177	
Person-years	201315	207171	206859	207115	
Number of HF events	510	492	435	421	
Model 1*	1.00	0.97 (0.86, 1.10)	0.89 (0.78, 1.01)	0.88 (0.77, 1.00)	0.019
Model 2†	1.00	0.95 (0.84, 1.08)	0.91 (0.80, 1.03)	0.95 (0.83, 1.08)	0.290
Model 3‡	1.00	0.94 (0.83, 1.07)	0.89 (0.78, 1.02)	0.93 (0.81, 1.06)	0.186
ALA intake (g/d)	<0.711	0.711-1.019	1.020-1.465	>1.465	
Number of participants	21238	21092	21155	21008	
Person-years	207053	207513	206828	201066	
Number of HF events	443	464	468	483	
Model 1*	1.0	1.06 (0.93, 1.20)	1.07 (0.94, 1.21)	1.14 (1.01, 1.30)	0.049
Model 2†	1.0	1.06 (0.93, 1.20)	1.03 (0.90, 1.17)	1.03 (0.90, 1.17)	0.773
Model 3§	1.0	1.02 (0.89, 1.17)	0.98 (0.84, 1.14)	0.93 (0.77, 1.12)	0.404

*Adjusted for age

†Model 1 + ethnicity, education, physical activity, smoking, alcohol, diabetes, hypertension, AF, MI/CABG/PTCA, BMI, time-dependent MI

‡Model 2 + fiber, fruit/vegetable servings, saturated fat intake (%), linolenic acid (ALA, %), linoleic acid (%)

§Model 2 + fiber, fruit/vegetable servings, saturated fat intake (%), DHA+EPA (%), linoleic acid (%)

Supplemental Table 9. Multivariate hazard ratios for incident HF based on Caloric Adjusted TFA quartiles

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Trend P-value
TFA Intake (g/1000 kcal)	0.01-1.0	1.1-1.6	1.7-2.2	2.3-3.5	
Number of participants	21183	21148	21137	21025	
Person-years	210997	207928	204348	199189	
Number of HF events	347	442	514	555	
Model 1*	1.0	1.26 (1.10, 1.45)	1.48 (1.29, 1.70)	1.58 (1.38, 1.81)	<.001
Model 2†	1.0	1.11 (0.96, 1.28)	1.16 (1.01, 1.33)	1.12 (0.98, 1.29)	0.124
Model 3‡	1.0	1.06 (0.91, 1.23)	1.10 (0.94, 1.30)	1.05 (0.88, 1.26)	0.612

*Adjusted for age

†Model 1 + ethnicity, education, physical activity, smoking, alcohol, diabetes, hypertension, AF, MI/CABG/PTCA, BMI, time-dependent MI

‡Model 2 + fiber, fruit/vegetable servings, saturated fat intake (%), linolenic acid (ALA, %), linoleic acid (%)

Supplemental Table 10. Multivariate hazard ratios for incident HF based on Unadjusted TFA quartiles

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Trend P-value
TFA Intake (g/d)	<1.892	1.892-3.008	3.009-4.754	>4.754	
Number of participants	21146	21143	21198	21006	
Person-years	207309	207762	206649	200740	
Number of HF events	416	412	462	568	
Model 1*	1.0	1.00 (0.87, 1.15)	1.11 (0.97, 1.27)	1.43 (1.26, 1.63)	<.001
Model 2†	1.0	0.94 (0.82, 1.08)	0.97 (0.85, 1.11)	1.08 (0.95, 1.23)	0.160
Model 3‡	1.0	0.90 (0.77, 1.04)	0.90 (0.77, 1.05)	0.98 (0.82, 1.16)	0.966

*Adjusted for age

†Model 1 + ethnicity, education, physical activity, smoking, alcohol, diabetes, hypertension, AF, MI/CABG/PTCA, BMI, time-dependent MI

‡Model 2 + fiber, fruit/vegetable servings, saturated fat intake (%), linolenic acid (ALA, %), linoleic acid (%)

Figure Legend

Supplemental Figure. Multivariate-adjusted HR for incident HF based on the combination of baked/broiled fish and fried fish consumption.

