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Consumption of polyunsaturated fatty acids and risk of incident psoriasis and psoriatic arthritis from the Nurses' Health Study II

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Dear Editor

Fish are rich in marine omega-3 fatty acids (FA) such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Since marine omega-3 FAs have anti-inflammatory and immunomodulatory properties¹, their potential use as a dietary adjunct in the treatment of psoriasis has been explored^{2,3}. Fish oil supplements have shown potentially protective effects on progression of psoriasis in small-scale (n=9~145) clinical studies²⁻⁴. However, fish oil's benefit for psoriasis has been difficult to confirm because of the lack of baseline measures of dietary and nutritional status⁵. To our knowledge, no prospective data are available on the association between dietary intake of omega-3 FAs and risk of psoriasis and psoriatic arthritis⁶. Therefore, we examined the association between consumption of polyunsaturated FAs and risk of incident psoriasis in the Nurses' Health Study II (NHSII).

Since 1989, NHS II participants have biennially completed a self-administered questionnaire regarding their personal medical history and lifestyle factors. Food frequency questionnaires (FFQ) for dietary intake in the previous year were also asked every four years since 1991. Participants were asked how often they had consumed a given unit or one portion size of each food item in the FFQ on average during the previous year, with nine frequency responses ranging from 'almost never' to '6 or more per day.' Nutrient intakes of participants were calculated by multiplying the consumption frequency of each food item with nutrient database prepared for specified amount of the food item. The nutrient database was based on the Harvard University Food Composition Database derived from the US Department of Agriculture (USDA) sources⁷ and supplemented with information from manufacturers. Dietary supplement intake was considered in calculation of each nutrient as

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well. Nutrient intake was adjusted with total energy intake by the residual method⁸. Previous studies have demonstrated reasonable levels of reproducibility and validity of the FFQ for ranking individuals by consumption of nutrients and foods^{9,10}. The fatty acid intake measured by the FFQ has also been validated in Nurses' Health Study showing moderate-to-strong correlations between dietary intakes and plasma biomarkers¹¹. Personal history of clinician-diagnosed psoriasis and the time-period of diagnosis were assessed in the 2005 questionnaire (before 1991, 1991–1994, 1995–1998, 1999–2002, or 2003–2005). Participants with self-reported psoriasis were mailed to complete the Psoriasis Screening Tool questionnaire (PST) and Psoriatic Arthritis Screening and Evaluation questionnaire (PASE). The validity of PST has been evaluated with 99% sensitivity and 94% specificity for psoriasis screening¹². The PASE also distinguished psoriatic arthritis from non-psoriatic arthritis patients with high sensitivity (70%–82%) and specificity (73%–80%)^{13,14}. The age-standardized baseline characteristics of participants in 1991 were examined according to quintiles of marine omega-3 FA consumption. The intakes of EPA, DHA, marine omega-3 FAs (sum of EPA and DHA), linoleic acid, arachidonic acid, omega-6 FAs (sum of linoleic acid and arachidonic acid) and omega-6/omega-3 FA ratio were categorized into quintiles. Cox proportional hazards models were used to estimate the multivariate-adjusted hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between consumption of polyunsaturated FAs and risk of psoriasis and psoriatic arthritis, adjusting for smoking status, personal history of cardiovascular disease, type 2 diabetes, hypertension, and hypercholesterolemia, body mass index (BMI), physical activity, alcohol intake, and total energy intake. All statistical analyses were conducted using SAS (version 9.4; SAS Institute Inc., Cary, NC) with two-sided *p* values at the significance level of 0.05.

Participants who consumed more marine omega-3 FAs were older, more physically active, consumed more alcohol, and had higher prevalence of hypertension and hypercholesterolemia at baseline (Table 1). After 1,137,635 person-years of follow-up, 602 cases of incident psoriasis were identified. Among them, 152 had concurrent psoriatic arthritis. The consumption of marine omega-3 FAs (EPA and DHA) either in total or individually was not associated with risk of psoriasis and psoriatic arthritis (Table 2). Consumption of individual fish items (canned tuna, dark meat fish, and other fish), which are a major source of marine omega-3 FAs, also showed no association with risk of psoriasis and psoriatic arthritis (data not shown). Interestingly, higher consumption of omega-6 FA and linoleic acid was not associated with psoriasis but associated with a lower risk of psoriatic arthritis (multivariate HR 0.55, 95% CI: 0.33–0.90 for top vs. bottom quintiles of omega-6 FA, and multivariate HR 0.45, 95% CI: 0.27–0.73 for linoleic acid) (Table 2).

In this study, we found no inverse associations between consumption of marine omega-3 FAs or their major food sources (total fish as well as individual fish items) and the risk of incident psoriasis or psoriatic arthritis. Rather, we found a protective association of higher consumption of omega-6 FA and linoleic acid on the risk of psoriatic arthritis. Previous studies have investigated only the association of high dose omega-3 FAs, not omega-6 FAs, with psoriasis. For example in a recent clinical trial, obese patients with plaque-type psoriasis were given an energy-restricted diet enriched in omega-3 FAs (average 2.6 g/d) with minimized intake of omega-6 FAs, and subsequently had improved clinical outcomes¹⁵. However, the mean intake of omega-3 FAs was 0.19g/d in our cohort study, much lower than

that in the clinical trial. When we stratified our results by obesity (<30 BMI or ≥30 BMI, only obese participants had a non-significant positive association between fish intake and psoriasis. Additionally, participants in the highest quintile of fish intake were at a lower risk of psoriatic arthritis compared to those in the lowest quintile of fish intake, although this was also not statistically significant.

In conclusion, we found no associations between consumption of marine omega-3 FAs and risk of incident psoriasis and psoriatic arthritis but inverse associations between consumption of omega-6 FA and linoleic acid and risk of psoriatic arthritis. Further studies are needed to elucidate this relationship.

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References

1. Wall R, Ross RP, Fitzgerald GF, et al. Fatty acids from fish: the anti-inflammatory potential of long-chain omega-3 fatty acids. *Nutr Rev*. 2010; 68:280–289. [PubMed: 20500789]
2. Millsop JW, Bhatia BK, Debbaneh M, et al. Diet and psoriasis, part III: role of nutritional supplements. *J Am Acad Dermatol*. 2014; 71:561–569. [PubMed: 24780177]
3. Calder PC. Omega-3 polyunsaturated fatty acids and inflammatory processes: nutrition or pharmacology? *Br J Clin Pharmacol*. 2013; 75:645–662. [PubMed: 22765297]
4. Ricketts JR, Rothe MJ, Grant-Kels JM. Nutrition and psoriasis. *Clin Dermatol*. 2010; 28:615–626. [PubMed: 21034986]
5. Johnson JA, Ma C, Kanada KN, et al. Diet and nutrition in psoriasis: analysis of the National Health and Nutrition Examination Survey (NHANES) in the United States. *Journal of the European Academy of Dermatology and Venereology*. 2014; 28:327–332. [PubMed: 23432373]
6. Christophers E. Psoriasis - epidemiology and clinical spectrum. *Clin Exp Dermatol*. 2001; 26:314–320. [PubMed: 11422182]
7. Institute. CFE. Agriculture handbook no 8. Washington, DC: US Department of Agriculture; 1989. Composition of foods: raw, processed, prepared.
8. Willett, WC. *Nutritional Epidemiology*. 2nd. New York: Oxford University Press; 1998.
9. Feskanich D, Rimm EB, Giovannucci EL, et al. Reproducibility and validity of food intake measurements from a semiquantitative food frequency questionnaire. *Journal of the American Dietetic Association*. 1993; 93:790–796. [PubMed: 8320406]
10. Willett WC, Sampson L, Stampfer MJ, et al. Reproducibility and validity of a semiquantitative food frequency questionnaire. *American journal of epidemiology*. 1985; 122:51–65. [PubMed: 4014201]
11. Sun Q, Ma J, Campos H, et al. Comparison between plasma and erythrocyte fatty acid content as biomarkers of fatty acid intake in US women. *The American journal of clinical nutrition*. 2007; 86:74–81. [PubMed: 17616765]
12. Dominguez P, Assarpour A, Kuo H, et al. Development and pilot-testing of a psoriasis screening tool. *British Journal of Dermatology*. 2009; 161:778–784. [PubMed: 19566664]

13. Dominguez PL, Husni ME, Holt EW, et al. Validity, reliability, and sensitivity-to-change properties of the psoriatic arthritis screening and evaluation questionnaire. Archives of dermatological research. 2009; 301:573–579. [PubMed: 19603175]
14. Husni ME, Meyer KH, Cohen DS, et al. The PASE questionnaire: pilot-testing a psoriatic arthritis screening and evaluation tool. Journal of the American Academy of Dermatology. 2007; 57:581–587. [PubMed: 17610990]
15. Guida B, Napoleone A, Trio R, et al. Energy-restricted, n-3 polyunsaturated fatty acids-rich diet improves the clinical response to immuno-modulating drugs in obese patients with plaque-type psoriasis: a randomized control clinical trial. Clin Nutr. 2014; 33:399–405. [PubMed: 24120032]

What's already known about this topic?

- Marine omega-3 fatty acids (FAs) have anti-inflammatory and immunomodulatory properties
- Fish oil supplements have shown potentially protective effects on progression of psoriasis in small-scale (n=9~145) clinical studies
- No prospective data are available on the association between dietary intake of omega-3 FAs and risk of psoriasis and psoriatic arthritis

What does this study add?

- We prospectively examined the association between consumption of polyunsaturated FAs and risk of incident psoriasis and psoriatic arthritis.

Age-adjusted baseline characteristics of the study population according to quintiles of marine omega-3 fatty acid consumption in 1991 in the NHSII (Nurses' Health Study II)

Table 1

	Marine omega-3 fatty acids				
	Q1	Q2	Q3	Q4	Q5
Age, years, mean (SD)*	35.7 (4.7)	35.9 (4.7)	36.1 (4.6)	36.4 (4.6)	37.0 (4.5)
White race, %	97.4	97.2	96.7	95.5	92.9
Body mass index, kg/m ² , mean (SD)	24.4 (5.3)	24.6 (5.3)	24.6 (5.2)	24.6 (5.2)	24.4 (5.1)
Physical activity, metabolic equivalent hrs/wk, mean (SD)	17.4 (23.7)	18.5 (24.3)	20.0 (25.5)	21.9 (27.2)	25.7 (31.2)
Current smoker, %	11.4	11.6	11.7	11.0	11.5
Alcohol intake, g/d, mean (SD)	2.4 (5.7)	2.7 (5.8)	3.00 (5.7)	3.7 (6.5)	3.9 (6.5)
Total energy intake, kcal, mean (SD)	1783.2 (555.4)	1807.6 (540.4)	1784.1 (541.5)	1840.5 (544.5)	1733.9 (534.9)
Hypertension, %	5.9	5.7	6.0	6.4	6.9
Hypercholesterolemia, %	13.5	13.8	14.6	14.5	15.8

Abbreviations: EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid. SD, standard deviation

^a All variables other than age are standardized to the age distribution of the study population.

Table 2

Hazard ratios (HRs) of psoriasis and psoriatic arthritis according to quintiles of marine omega-3 fatty acid and fish consumption in the NHSII (Nurses' Health Study II)

	Quintiles of marine omega-3 fatty acid consumption					P for trend
	Q1	Q2	Q3	Q4	Q5	
Risk of psoriasis						
Omega-3 fatty acids						
EPA						
Median (g/d)	0.01	0.02	0.04	0.08	0.13	
No. of cases/No. of person-years	127/238580	119/240142	109/199957	129/232302	118/226654	
Age-adjusted HR (95% CI)	1.00	0.94 (0.73, 1.21)	0.97 (0.75, 1.25)	1.01 (0.79, 1.29)	0.94 (0.73, 1.21)	0.76
Multivariable-adjusted ^a HR (95% CI)	1.00	0.91 (0.71, 1.17)	0.93 (0.72, 1.20)	0.98 (0.76, 1.25)	0.94 (0.73, 1.22)	0.87
DHA						
Median (g/d)	0.04	0.08	0.12	0.17	0.27	
No. of cases/No. of person-years	114/228761	127/220512	122/236116	119/220479	120/231767	
Age-adjusted HR (95% CI)	1.00	1.13 (0.88, 1.46)	1.03 (0.79, 1.32)	1.05 (0.81, 1.35)	1.00 (0.78, 1.30)	0.73
Multivariable-adjusted ^a HR (95% CI)	1.00	1.11 (0.86, 1.42)	1.00 (0.77, 1.29)	1.02 (0.78, 1.32)	0.99 (0.76, 1.29)	0.69
Total marine omega-3 fatty acids ^b						
Median (g/d)	0.06	0.10	0.15	0.25	0.40	
No. of cases/No. of person-years	114/228752	136/225161	115/230902	113/225144	124/227676	
Age-adjusted HR (95% CI)	1.00	1.20 (0.94, 1.54)	0.99 (0.76, 1.28)	0.98 (0.76, 1.27)	1.05 (0.81, 1.36)	0.75
Multivariable-adjusted ^a HR (95% CI)	1.00	1.17 (0.91, 1.50)	0.96 (0.74, 1.25)	0.95 (0.73, 1.24)	1.04 (0.80, 1.35)	0.76
Omega-6 fatty acids						
Linoleic acid						
Median (g/d)	7.00	8.27	9.21	10.30	12.20	
No. of cases/No. of person-years	119/229525	119/227235	124/226664	116/227231	124/226980	
Age-adjusted HR (95% CI)	1.00	0.99 (0.77, 1.28)	1.04 (0.81, 1.34)	0.96 (0.75, 1.24)	1.03 (0.80, 1.32)	0.90
Multivariable-adjusted ^a HR (95% CI)	1.00	0.95 (0.74, 1.23)	0.96 (0.75, 1.24)	0.88 (0.68, 1.14)	0.92 (0.71, 1.18)	0.42
Arachidonic acid						
Median (g/d)	0.09	0.12	0.14	0.17	0.22	

	Quintiles of marine omega-3 fatty acid consumption					P for trend
	Q1	Q2	Q3	Q4	Q5	
No. of cases/No. of person-years	102/220578	107/223149	127/238007	130/226890	136/229012	
Age-adjusted HR (95% CI)	1.00	1.03 (0.79, 1.36)	1.17 (0.90, 1.52)	1.24 (0.95, 1.60)	1.28 (0.99, 1.65)	0.03
Multivariable-adjusted ^a HR (95% CI)	1.00	0.99 (0.75, 1.30)	1.09 (0.84, 1.41)	1.12 (0.86, 1.45)	1.11 (0.85, 1.44)	0.32
Total Omega-6 fatty acids ^c						
Median (g/d)	6.74	8.26	9.44	10.80	13.13	
No. of cases/No. of person-years	117/226227	111/227564	144/228122	105/228044	125/227678	
Age-adjusted HR (95% CI)	1.00	0.94 (0.72, 1.21)	1.21 (0.95, 1.55)	0.88 (0.67, 1.14)	1.04 (0.81, 1.34)	0.91
Multivariable-adjusted ^a HR (95% CI)	1.00	0.90 (0.69, 1.17)	1.15 (0.90, 1.46)	0.81 (0.62, 1.06)	0.95 (0.74, 1.23)	0.54
Omega-6 ^c :omega-3 FA ^a						
Median	26.65	47.14	71.79	108.04	220.20	
No. of cases/No. of person-years	121/227673	127/227765	118/227975	120/227571	116/226650	
Age-adjusted HR (95% CI)	1.00	1.07 (0.83, 1.37)	0.99 (0.77, 1.28)	1.02 (0.79, 1.32)	1.00 (0.77, 1.29)	0.77
Multivariable-adjusted ^a HR (95% CI)	1.00	1.03 (0.80, 1.33)	0.95 (0.73, 1.23)	0.99 (0.76, 1.28)	0.98 (0.76, 1.28)	0.75
Risk of psoriatic arthritis						
Omega-3 fatty acids						
EPA						
Median (g/d)	0.01	0.02	0.04	0.08	0.13	
No. of cases/No. of person-years	32/238580	29/240142	25/199957	29/232302	37/226654	
Age-adjusted HR (95% CI)	1.00	0.88 (0.53, 1.46)	0.86 (0.51, 1.45)	0.85 (0.52, 1.42)	1.08 (0.67, 1.74)	0.54
Multivariable-adjusted ^a HR (95% CI)	1.00	0.85 (0.51, 1.41)	0.84 (0.49, 1.42)	0.87 (0.52, 1.45)	1.20 (0.74, 1.96)	0.24
DHA						
Median (g/d)	0.04	0.08	0.12	0.17	0.27	
No. of cases/No. of person-years	228761	220512	236116	220479	231767	
Age-adjusted HR (95% CI)	1.00	0.88 (0.52, 1.48)	0.84 (0.50, 1.41)	1.12 (0.69, 1.83)	1.01 (0.61, 1.65)	0.64
Multivariable-adjusted ^a HR (95% CI)	1.00	0.87 (0.51, 1.47)	0.84 (0.50, 1.42)	1.17 (0.71, 1.91)	1.06 (0.64, 1.76)	0.47
Total marine omega-3 fatty acids						
Median (g/d)	0.06	0.10	0.15	0.25	0.40	
No. of cases/No. of person-years	32/228752	29/225161	22/230902	31/225144	38/227676	

	Quintiles of marine omega-3 fatty acid consumption					P for trend
	Q1	Q2	Q3	Q4	Q5	
Age-adjusted HR (95% CI)	1.00	0.91 (0.55, 1.51)	0.66 (0.38, 1.13)	0.92 (0.56, 1.52)	1.07 (0.67, 1.71)	0.45
Multivariable-adjusted ^a HR (95% CI)	1.00	0.90 (0.54, 1.49)	0.65 (0.38, 1.13)	0.95 (0.58, 1.57)	1.16 (0.71, 1.88)	0.24
Omega-6 fatty acids						
Linoleic acid						
Median (g/d)	7.00	8.27	9.21	10.30	12.20	
No. of cases/No. of person-years	43/229525	31/227235	25/226664	27/227231	26/226980	
Age-adjusted HR (95% CI)	1.00	0.71 (0.45, 1.12)	0.56 (0.34, 0.92)	0.60 (0.37, 0.97)	0.57 (0.35, 0.92)	0.02
Multivariable-adjusted ^a HR (95% CI)	1.00	0.66 (0.41, 1.05)	0.50 (0.30, 0.82)	0.50 (0.31, 0.82)	0.45 (0.27, 0.73)	0.001
Arachidonic acid						
Median (g/d)	0.09	0.12	0.14	0.17	0.22	
No. of cases/No. of person-years	32/220578	23/223149	23/238007	31/226890	43/229012	
Age-adjusted HR (95% CI)	1.00	0.70 (0.41, 1.20)	0.66 (0.39, 1.13)	0.91 (0.55, 1.49)	1.22 (0.77, 1.92)	0.12
Multivariable-adjusted ^a HR (95% CI)	1.00	0.65 (0.38, 1.11)	0.58 (0.34, 1.00)	0.75 (0.46, 1.24)	0.91 (0.57, 1.45)	0.74
Omega-6 fatty acids ^b						
Median (g/d)	6.74	8.26	9.44	10.80	13.13	
No. of cases/No. of person-years	38/226227	34/227564	34/228122	19/228044	27/227678	
Age-adjusted HR (95% CI)	1.00	0.88 (0.55, 1.39)	0.87 (0.55, 1.38)	0.47 (0.27, 0.82)	0.66 (0.41, 1.09)	0.03
Multivariable-adjusted ^a HR (95% CI)	1.00	0.82 (0.51, 1.30)	0.79 (0.49, 1.25)	0.42 (0.24, 0.73)	0.55 (0.33, 0.90)	0.003
Omega-6 ^c :omega-3 FA ^b						
Median	26.65	47.14	71.79	108.04	220.20	
No. of cases/No. of person-years	43/227673	30/227765	24/227975	27/227571	28/226650	
Age-adjusted HR (95% CI)	1.00	0.73 (0.46, 1.16)	0.59 (0.36, 0.97)	0.68 (0.42, 1.10)	0.72 (0.44, 1.15)	0.89
Multivariable-adjusted ^a HR (95% CI)	1.00	0.67 (0.42, 1.06)	0.52 (0.31, 0.86)	0.59 (0.36, 0.96)	0.63 (0.39, 1.03)	0.66

Abbreviation: CI, confidence interval; HR, hazard ratio; EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid; FA, fatty acid.

^a Multivariate-adjusted analyses were adjusted for age (continuous), smoking (never smoker, past smoker, current smoker (1–14 cig/d), current smoker (15–25 cig/d), current smoker (> 25 cig/d)), body mass index (<21 kg/m², 21–22.9 kg/m², 23–24.9 kg/m², 25–26.9 kg/m², 27.0–29.9 kg/m², 30.0–32.9 kg/m², 33–34.9 kg/m², 35–39.9 kg/m², 40 kg/m²), alcohol intake (0 g/d, 0.1–4.9 g/d, 5.0–9.9 g/d, 10 g/d), physical activity (quintile, MET/w), total calorie intake (continuous), race (white, others) and major comorbidities (diabetes, cardiovascular disease, hypertension, and hypercholesterolemia, (yes or no)).

^b Omega-3 fatty acids: EPA and DHA.

Omega-9 fatty acids: arachidonic fatty acid and linoleic cis fatty acid.

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