



# Dietary habits among patients with atopic dermatitis

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**Objective:** To evaluate the dietary habits among adult patients with moderate to severe atopic dermatitis and relate intake to clinical symptoms.

**Design:** Data were obtained from a clinical trial.

**Setting:** Five departments of dermatology at Norwegian University hospitals.

**Subjects:** Outpatients, 46 men (median age 27 y) and 92 women (median age 28 y).

**Method:** A quantitative food frequency questionnaire was filled in before attending the clinical trial. The results were compared to the diet of age- and sex-matched reference groups.

**Results:** Male patients had higher content of refined sugar in their diet than reference men ( $P=0.014$ ). Among female patients, the intake of saturated fatty acids was higher ( $P=0.049$ ), whereas the intake of very long-chain n-3 fatty acids was lower (eicosapentaenoic acid,  $P=0.032$ , docosahexaenoic acid,  $P=0.017$ ) than in the reference group. In both genders, more patients than reference subjects had vitamin D intake below recommended level. Furthermore, the female patients had significantly lower intake of fruit compared to the reference group ( $P=0.002$ ). No correlation was found between nutrient intake of the patients and their clinical scores.

**Conclusions:** The patients' diet were fairly similar to the diet of reference groups. The intake of vitamin D and very long-chain n-3 fatty acids was low, especially among female patients. Furthermore, we could not detect any association between dietary habits and clinical status.

**Descriptors:** atopic dermatitis; diet; fatty acids; foods; nutrients; vitamin D

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## Introduction

Atopic dermatitis is a common, multifactorial and complex disorder (Kapp *et al*, 1989; Stone *et al* 1973; Binkley, 1992), which is characterized as a chronic or chronic-recurrent inflammatory skin disease with marked pruritus.

In 10–20% of pediatric patients food hypersensitivity is suspected to be an important factor in development of atopic dermatitis (Binkley, 1992). It has therefore been quite common to advise patients to avoid foods which are likely to cause hypersensitivity, such as citrus products and other fruits as well as nuts, peas, fish and milk products. However, for adult patients, food hypersensitivity seems to be less important during development of the disease, and food restriction might be exaggerated. Very little documented information is available about the dietary habits among adult patients with atopic dermatitis, except from some intervention studies (Soter & Fitzpatrick, 1987; Bjørneboe *et al*, 1987; Søyland *et al*, 1994). Therefore, we evaluated the intake of foods and nutrients in a group of adult patients with moderate or severe atopic dermatitis. The patients' diet is compared to the diet of age- and sex-matched

reference groups, to examine if the intake of nutrients, especially the very long-chain n-3 fatty acids and vitamin D, was lower because of avoidance of some foods. Furthermore, we also evaluated the association between dietary intake of foods and nutrients to clinical signs of the patients with atopic dermatitis.

## Subjects and methods

### Study population

One hundred forty-five men and women with moderate to severe atopic dermatitis, according to the criteria of Hanifin & Rajka (1980), were recruited to a clinical trial where the effect of supplementation with very long-chain n-3 fatty acids was studied (Søyland *et al*, 1994). The participants were selected among outpatients from all five departments of dermatology at Norwegian University hospitals. Exclusion criteria were allergy to fish (defined by history), and systemic treatment or application of potent local corticosteroids that could influence their clinical state. None of the patients used systemic steroids, UV therapy or group II, III or IV topical steroids during the trial or the last 4 weeks prior to starting dietary supplementation. Only treatment with an emollient cream or hydrocortisone cream was allowed during the trial.

We obtained dietary data from 138 patients, 46 men (median age 27 y, range 17–45 y) and 92 women (median age 28 y, range 16–63 y). The median body mass index (BMI) for male patients was 23.2 (kg/m<sup>2</sup>) (range 17.4–44.3 (kg/m<sup>2</sup>), and for females 21.6 (kg/m<sup>2</sup>) (range 17.2–30.0 (kg/m<sup>2</sup>)). The dietary data for the patients were compared with results from a nationwide dietary survey

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Contributors: Kari Solvoll performed all analyses of data and wrote the first draft of the manuscript. Elisabeth Søyland coordinated the clinical study and took part in writing. Berit Sandstad acted as a statistical advisor. Christian A Drevon designed, took part in writing and supervised the study.

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performed in 1992 in collaboration with Statistics Norway, which was responsible for sampling of participants and collection of data (Johansson *et al*, 1997). The total sample ( $n = 1200$ , response rate 60%) was drawn according to procedures for random sampling. From this study, two age- and sex-matched subgroups were selected for comparison with data from the patients. The reference groups included data for 46 men aged 17–45 y (median 27 y) and 92 women aged 16–68 y (median 29 y).

#### Dietary monitoring

Before start of the study, the patients' usual diet was assessed by a self-administered quantitative food frequency questionnaire. It comprised approximately 180 food items and was designed to cover the whole diet (Solvoll *et al*, 1993). The frequency of consumption was given per day, per week or per month depending on the food item. The portion sizes were units such as slices, glasses, cups, pieces, deciliters and spoons. For all main meal food items the frequency of use ranged from 1 to 13 or more per month, and the portion size alternatives were five. The portion sizes of the different food items were converted to weights on the basis of standard portions estimated from previous Norwegian studies. The validity of the questionnaire was evaluated in a group of elderly women. Spearman rank correlation coefficients comparing intakes measured by the questionnaire and multiple weighed diet records for a total of 14 d ranged from 0.31 for vitamin C to 0.79 for carbohydrates, the median being 0.61 (Nes *et al*, 1992). An evaluation of the questionnaire was also performed among dermatologic outpatients (psoriasis and atopic dermatitis), who filled in the questionnaire and participated in a 48 h recall interview at the start and at the end of the above mentioned clinical trial. The Pearson correlation coefficients for energy and 16 nutrients were on average 0.44 and 0.50 at the two examinations, respectively (Solvoll *et al*, 1993). In addition, the dietary fatty acid pattern has been related to the fatty acid pattern in plasma phospholipids of 579 individuals (Andersen *et al*, 1996). For all these studies we show that there is good correlation and classification of subjects based on information from the food frequency questionnaire for the validated parameters.

The food frequency questionnaire was mailed to the patients, filled in at home and brought along to the first

physical examination at the outpatient clinics in the hospitals. The same food frequency questionnaire was used by the reference groups. The intake of energy and nutrients among patients as well as reference individuals, was calculated using a food data base developed at the Institute for Nutrition Research, University of Oslo (Nes *et al*, 1992). Dietary supplements such as cod liver oil and fish oil capsules are included in the calculations. Data for men and women are presented separately, since the nutritional requirements and food habits are different for the two genders.

#### Clinical assessment

As a measure of the clinical severity of atopic dermatitis, the physicians' evaluation was used at the first examination before start of the trial. Erythema, induration, pruritus, lichenification, scaling and area involved in atopic dermatitis were scored according to a 10-point scale. The highest score (10) represented severe dermatitis, whereas 0 represented no clinical signs or symptoms (Søyland *et al*, 1994). Clinical data were available from 45 men and 91 women. The median score values were 4.67 (range 0.83–7.17) and 4.17 (range 1.13–8.83) for men and women, respectively. The reference population was not examined for atopic dermatitis, but it may be expected that a few reference subjects were suffering from the disease. Although this may have been a source of bias, the results should not have been greatly affected.

#### Statistics

Median values with quartiles or ranges are presented. To evaluate the differences between groups, Wilcoxon signed rank test, and Spearman rank correlations were applied where appropriate. Relative risk ratio was calculated to evaluate the effect of diet on disease score. The statistical analyses were performed by use of the statistical package Minitab 10.0.

#### Results

The dietary intake among men with atopic dermatitis was similar to the intake of energy and nutrients in the reference group, except for higher intake of refined sugar among the patients ( $P < 0.05$ , Table 1). Among women with atopic

**Table 1** Intake of energy and nutrients among men given as medians (25th and 75th percentile)

n	Atopic dermatitis		Reference group		Recommended intake <sup>a</sup>
	46		46		
Energy (MJ)	11.6	(9.4, 14.3)	12.2	(8.7, 15.1)	10.7–12.8
Energy from Protein (%) <sup>b</sup>	16.2	(15.2, 17.5)	16.7	(15.0, 18.3)	10–15
Fat (%)	34.5	(29.6, 37.1)	34.5	(31.0, 38.8)	< 30
Carbohydrates (%)	47.1	(42.1, 52.0)	46.1	(41.3, 50.2)	55–60
Refined sugar (%)	6.6	(5.1, 10.5)	5.8	(3.9, 6.9)*	< 10
Alcohol (%)	1.6	(0.6, 2.1)	1.6	(0.5, 2.8)	< 5
Vitamin A (µg)	1376	(830, 2099)	1141	(814, 2169)	900
Vitamin D (µg)	4.7	(2.8, 7.3)	5.4	(3.3, 9.0)	5
Vitamin C (mg)	103	(80, 147)	96	(60, 176)	60
Thiamin (mg)	1.44	(1.31, 1.81)	1.50	(1.18, 2.06)	1.4
Calcium (mg)	1479	(1174, 1808)	1343	(912, 1747)	800
Iron (mg)	15.2	(11.5, 18.6)	15.2	(10.8, 20.3)	10
Fibre (g)	26	(17, 35)	24	(17, 34)	3/MJ
Cholesterol (mg)	438	(333, 609)	444	(343, 617)	

<sup>a</sup>Nordic Nutrient Recommendations for the age group 19–30 y.

<sup>b</sup>% of total energy intake.

\* $P < 0.05$  by Wilcoxon signed rank test.

dermatitis, the percentage of energy from fat was higher compared to what was found for women in the reference group ( $P < 0.05$ , Table 2). Dietary intake of carbohydrates was lower ( $P < 0.01$ ), whereas the intake of refined sugar was slightly higher among patients than the female reference group (n.s.). The median energy derived from alcohol was one percent in the group of female patients, which was twice as high as in the reference group ( $P < 0.05$ ).

In comparison with recommended intake of nutrients, the diet among male and female patients with atopic dermatitis was rich in protein and fat, whereas the percent of energy derived from carbohydrates was low (Table 1 and 2). The intake of vitamin D and iron was lower than recommended in both groups of women. Only 12 of the patients (13%) and 22 of the reference women (24%) met the recommendations of 5 µg/d of vitamin D.

The dietary fatty acid pattern was similar in the two groups of men, except for the ratio between polyunsaturated and saturated fatty acids which was lowest among the patients (Table 3). The male patients had markedly lower intake of the very long-chain omega-3 fatty acids than males in the reference group, although the differences were

not statistically significant. Median fat intake measured in the two female groups was similar (Table 3). However, dietary intake of saturated fatty acids was significantly higher among the female patients, than the reference women, whereas the intake of eicosapentaenoic acid (20:5, n-3) was lower ( $P < 0.05$ ). The ratio between eicosapentaenoic acid and arachidonic acid (20:4, n-6) was lower than the ratio found in the female reference group ( $P < 0.05$ ). This was also observed for the polyunsaturated/saturated fatty acid ratio ( $P < 0.01$ ).

The male patients had similar intake of foods compared to the reference group, except for lower consumption of coffee, and higher intake of tea and wine (Table 4). More patients than reference subjects reported use of wine and this contributed to the higher intake of alcohol among male as well as female patients. The female patients with atopic dermatitis had lower intake of fruit, especially oranges ( $P < 0.01$ ) and orange juice ( $P < 0.001$ ), compared to women of the reference group (Table 4).

The patients were evaluated according to nutrient intake and total clinical score including erythema, induration, pruritus, lichenification and total area of skin affected.

**Table 2** Intake of energy and nutrients among women given as medians (25th and 75th percentile)

n	Atopic dermatitis		Reference group		Recommended intake <sup>a</sup>
	92		92		
Energy (MJ)	7.6	(6.6, 9.7)	8.1	(6.5, 9.9)	8.2–10.2
Energy from					
Protein (%) <sup>b</sup>	16.5	(15.3, 18.4)	16.6	(15.0, 18.1)	10–15
Fat (%)	33.8	(31.2, 37.2)	32.1	(27.9, 36.0)*	< 30
Carbohydrates (%)	47.9	(44.4, 51.8)	50.1	(45.8, 54.6)**	55–60
Refined sugar (%)	7.1	(3.8, 9.5)	6.3	(4.8, 8.8)	< 10
Alcohol (%)	1.0	(0.3, 2.2)	0.5	(0.0, 1.6)*	< 5
Vitamin A (µg)	883	(643, 1319)	952	(675, 1462)	800
Vitamin D (µg)	2.3	(1.5, 3.4)	2.7	(1.6, 4.6)	5
Vitamin C (mg)	95	(69, 137)	109	(83, 146)	60
Thiamin (mg)	1.05	(0.86, 1.31)	1.12	(0.91, 1.39)	1.1
Calcium (mg)	991	(745, 1270)	968	(684, 1306)	800
Iron (mg)	10.8	(8.7, 13.8)	11.6	(9.3, 14.0)	12–18
Fibre (g)	19	(14, 24)	19	(16, 25)	3/MJ
Cholesterol (mg)	318	(236, 390)	313	(253, 388)	

<sup>a</sup>Nordic Nutrient Recommendations for the age group 19–30 y.

<sup>b</sup>% of total energy intake.

\* $P < 0.05$ ; \*\* $P < 0.01$  by Wilcoxon signed rank test.

**Table 3** Dietary intake of fat and fatty acids given as medians (25th and 75th percentiles)

n	Men				Women			
	Atopic dermatitis		Reference group		Atopic dermatitis		Reference group	
	46		46		92		92	
Fat, total (g)	96.6	(85.1, 132.4)	122.4	(76.4, 144.1)	70.0	(56.0, 89.0)	68.3	(50.5, 82.8)
Fatty acids								
Saturates (g)	38.7	(31.5, 55.3)	42.4	(30.2, 53.8)	29.0	(22.5, 37.5)	26.5	(21.3, 34.8)*
Monoenes (g)	35.7	(29.0, 48.4)	41.0	(27.3, 52.5)	24.9	(19.2, 31.9)	23.4	(18.6, 29.7)
Polyenes (g)	16.9	(12.3, 22.6)	18.5	(12.6, 31.1)	9.9	(7.7, 13.2)	10.5	(7.3, 15.0)
18:2 (g)	13.2	(9.3, 18.3)	14.7	(9.7, 24.1)	7.5	(5.5, 10.3)	7.4	(5.2, 11.1)
18:3 (g)	1.7	(1.2, 2.3)	1.8	(1.3, 3.0)	1.0	(0.8, 1.4)	1.0	(0.7, 1.5)
20:4 (g)	0.20	(0.16, 0.30)	0.22	(0.18, 0.31)	0.14	(0.11, 0.18)	0.15	(0.11, 0.18)
20:5 (g)	0.08	(0.03, 0.20)	0.16	(0.04, 0.33)	0.04	(0.02, 0.09)	0.07	(0.02, 0.18)*
22:5 (g)	0.04	(0.03, 0.06)	0.04	(0.03, 0.08)	0.02	(0.02, 0.03)	0.03	(0.02, 0.04)
22:6 (g)	0.20	(0.15, 0.44)	0.35	(0.13, 0.76)	0.13	(0.06, 0.23)	0.18	(0.09, 0.35)*
Polyenes/saturates	0.40	(0.31, 0.52)	0.50	(0.37, 0.64)**	0.36	(0.28, 0.44)	0.40	(0.33, 0.50)**
n-3/n-6	0.16	(0.15, 0.19)	0.16	(0.14, 0.21)	0.16	(0.15, 0.18)	0.17	(0.15, 0.23)*
20:5/20:4	0.45	(0.11, 1.02)	0.59	(0.20, 1.62)	0.33	(0.13, 0.61)	0.50	(0.20, 1.23)*

\* $P < 0.05$ ; \*\* $P < 0.01$  by Wilcoxon signed rank test.

**Table 4** Intake of foods (g per day) given as medians (25th and 75th percentiles)

n	Men				Women			
	Atopic dermatitis		Reference group		Atopic dermatitis		Reference group	
	46		46		92		92	
Bread	240	(158, 284)	232	(159, 282)	149	(110, 190)	157	(120, 197)
Potatoes	133	(80, 206)	108	(52, 175)	75	(49, 124)	82	(35, 114)
Vegetables	130	(75, 184)	94	(53, 194)	116	(71, 163)	112	(69, 151)
Fruit	175	(81, 299)	120	(75, 290)	131	(72, 233)	183	(124, 295)**
Fresh fruit	96	(37, 164)	72	(34, 165)	87	(38, 165)	115	(59, 165)
Oranges	6	(0, 38)	18	(4, 37)	4	(0, 28)	26	(11, 49)**
Orange juice	6	(0, 54)	19	(0, 58)	0	(0, 21)	21	(0, 139)***
Meat & meat products	166	(97, 228)	145	(109, 199)	93	(75, 127)	86	(64, 122)
Fish & fish products	85	(41, 118)	104	(44, 147)	50	(28, 91)	68	(33, 94)
Eggs	16	(8, 30)	17	(12, 27)	12	(8, 19)	15	(9, 21)
Milk	672	(422, 925)	549	(357, 902)	352	(178, 617)	330	(150, 553)
Cheese	33	(13, 52)	24	(10, 42)	30	(16, 48)	21	(10, 40)*
Edible fat	47	(28, 67)	53	(27, 76)	29	(17, 39)	26	(13, 39)
Chocolate, sweets	8	(3, 18)	5	(2, 11)	7	(3, 18)	7	(1, 18)
Coffee	120	(0, 420)	420	(120, 660)**	420	(0, 480)	240	(0, 420)
Tea	200	(0, 400)	0	(0, 50)**	200	(0, 400)	200	(0, 400)
Soft drinks	57	(22, 179)	65	(20, 170)	33	(9, 125)	34	(0, 108)
Beer	115	(14, 151)	79	(14, 171)	24	(0, 54)	7	(0, 47)
Wine	8	(0, 34)	0	(0, 10)*	13	(0, 25)	0	(0, 17)*

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$  by Wilcoxon signed rank test.

We did not find significant correlations between any of the nutrients and total clinical scores neither for male nor for female patients (data not shown). Also relative risk ratios (RR) were estimated, but the lack of relationship between diet and clinical symptoms remained unchanged (data not shown).

## Discussion

The major finding in this study was that there were very few differences between dietary intake among patients with atopic dermatitis and age- and sex-matched groups from the Norwegian population. However, we observed some differences.

The female patients in our study had higher intake of saturated fatty acids, whereas the intake of very long-chain n-3 acids was lower, compared to the reference group. The very long-chain n-3 fatty acids (eicosapentaenoic and docosahexaenoic acid) are found in fatty fish and products thereof (Drevon, 1992). Our patients seemed to have somewhat lower intake of fish and fish products than the reference groups, but the differences were not significant. In some cases fish allergy may provoke the clinical signs of atopic dermatitis (O'Neil *et al*, 1993). The low dietary intake of very long-chain n-3 fatty acids, especially among our female patients, might therefore be caused by fear of being sensitive to fish, in spite of the fact that all our patients were selected as not being allergic to fish. Polyunsaturated n-3 fatty acids are essential and may affect cellular responses via eicosanoids, altered substrate function, acylation of proteins, lipid peroxidation, altered membrane fluidity or interact with transcription factors (Drevon, 1993). The very long-chain n-3 fatty acids may decrease activation of human T-cells in vitro (Søyland *et al*, 1993; Calder *et al*, 1992). In eczematous skin disorders, activated T-cells are a major infiltrating cell type (Zachary *et al*, 1985). In a previous double-blind study, three months of supplementation with very long-chain n-3 fatty acids to

patients with atopic dermatitis was superior to the supplementation with olive oil (Bjørneboe *et al*, 1987). In the much larger double-blind, multi-centre study, in which our presently studied atopic patients participated, dietary supplementation with very long-chain n-3 fatty acids or corn oil, both types of oil supplementation caused a significant clinical improvement, compared with baseline scores, but there was no significant difference between the two groups (Søyland *et al*, 1994). Thus, the lack of correlation between intake of n-3 fatty acids and expression of dermatitis is in accordance with the lacking effects of n-3 fatty acids supplementation (Søyland *et al*, 1994).

The patients in our study had low intake of citrus products, such as oranges and juice. Many atopic patients get local itching from citrus fruits (Arshad *et al*, 1992), and this may be the reason for their low consumption of these fruits. However, the intake of vitamin C was not substantially lower compared to the reference group (Table 2).

Dietary intake of vitamin D was very low among the female patients as well as in the female reference group, as compared to the recommended intake. Approximately 60% and 47% of the patients and reference women, respectively, had vitamin D intake below 2.5 µg/d. Also more than half of the male patients had vitamin D intake below the recommended level. There are few vitamin D sources in the diet, fatty fish and fortified margarine being the most important. Low consumption of these foods will result in low intake of vitamin D. Whether their vitamin D status is satisfactory is unknown, since we did not evaluate their exposure to sunlight or the concentration of vitamin D metabolites in plasma.

Vitamin D and its analogues have multiple biologic effects on the immune response and on the skin (Texereau & Viac, 1992). They belong to the multifunctional steroid hormones, and may alter gene transcription, cytokine secretion from monocytes and T-lymphocytes, as well as secretion of antibodies from B cells (Green, 1993; Hewison, 1992). Moreover, proliferation of the keratinocytes in

the epidermal skin is inhibited, whereas the differentiation is augmented by vitamin D and its analogues (Bikle & Pillai, 1993). However, we did not find any correlation between the low dietary intake of vitamin D and the total clinical score as an indicator of active dermatitis.

In the group of male patients, higher intake of refined sugar was the only nutrient intake that differed significantly from the intake of nutrients in the age- and sex-matched reference group. In both the affected group and in the reference group several subjects had low intake of thiamin. Thus, it is possible that high intake of carbohydrates represents an extra metabolic load that might be of importance for development of atopic dermatitis in genetically prone individuals (Williams *et al*, 1942).

In conclusion, the dietary intake of energy and nutrients was fairly similar in the group of dermatologic outpatients and in the reference groups. Exceptions were higher intake of refined sugar among male patients, and higher intake of saturated fatty acids and lower intake of very long-chain n-3 fatty acids among female patients compared to the reference groups. The low intake of very long-chain n-3 fatty acids may be explained by low intake of fatty fish and fish products, which also resulted in low intake of vitamin D compared to recommended intake. The female patients had low intake of oranges and orange juice. However, association between the dietary intake of nutrients and the patients' total clinical score of atopic dermatitis was not found.

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