

# The association between low grade inflammation and skin diseases: A cross-sectional survey in the Northern Finland Birth Cohort 1966

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## INTRODUCTION

- Low grade inflammation is a chronic, subclinical and systemic condition (1), which contributes to the pathogenesis of many noncommunicable diseases, such as atherosclerosis (2) and type 2 diabetes (3).
- Low grade inflammation is detectable via a minor elevation of certain inflammatory markers, such as C-reactive protein (CRP), and it is usually measured by a high sensitivity CRP (hs-CRP) test (4, 5).
- Although several skin diseases (5, 6, 7) have an inflammatory background, the association between skin diseases and systemic inflammation has been studied only in a disease-specific manner.
- By using data from the unique 1966 Northern Finland Birth Cohort 1966 (NFBC1966) we aimed to determine, in an unselected adult population, any association between low grade inflammation and any of the most common skin diseases.

## MATERIAL AND METHODS

- A whole body investigation on 1, 930 adults belonging to a well documented regional population that has been followed since birth in 1966 was performed by dermatologists.
- High sensitive C-reactive protein (hs-CRP) level was measured as a marker of low grade inflammation (n = 1,906, n = 884 males and n = 1,022 females).
- Multinomial logistic regression analysis was used to calculate the association between inflammation and selected skin disorders.

## RESULTS

- Hs-CRP was normal (<1 mg/L) in 61.6%, slightly elevated (1-3 mg/L) in 28.0% and highly elevated (>3 mg/L) in 10.4% of the participants. Median hs-CRP level for females was 0.8 mg/L and 0.7 mg/L for males, (p = 0.27) (Table I).
- Hs-CRP was higher in participants with atopic eczema (p = 0.03), rosacea (p = 0.001) and onychomycosis (p = 0.01) (Table II).
- Hs-CRP was also higher in study cases who had any skin disease that was classified as severe enough needing further evaluation or treatment, compared to those needing no further care (p = 0.016)(Table II).

- After adjustment for confounding factors (smoking, education, physical activity, systemic disease and the use of contraceptives) atopic eczema (OR 2.2, 95% CI 1.2-3.9), onychomycosis (OR 2.0, 1.2-3.2) and rosacea (OR 1.7, 1.1-2.5) associated with low grade inflammation (Table III).
- After additionally adjusting for body mass index, the risks for atopic eczema (OR 2.4, 1.3-4.6) and onychomycosis (OR 1.9, 1.1-2.0) remained statistically significant (Table III).

## CONCLUSIONS

- Low grade inflammation is present in several skin diseases
- It is known that the presence of one inflammatory disease exacerbates the risk for others (8). Thus, patients with dermatological conditions such as atopic eczema, rosacea or fungal skin infection, may carry a heightened risk for noncommunicable inflammatory diseases such as atherosclerosis, and this should be kept in mind when treating patients with cutaneous disorders.

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Table I. Baseline characteristics of the study population.

Characteristics	Male (n = 894)	Female (n = 1,036)
Body mass index (mean $\pm$ SD)	27.2 (4.2)	26.6 (2.7)
Normal or underweight	276 (30.9)	483 (46.7)
Overweight	439 (49.1)	318 (30.8)
Obese	179 (20.0)	233 (22.5)
hs-CRP (median, Q1-Q3)	0.7 (0.2-23.5)	0.8 (0.2-35.6)
hs-CRP		
<1 mg/L	570 (64.5)	604 (59.1)
1-3 mg/L	235 (26.6)	298 (29.2)
>3 mg/L	79 (8.9)	120 (11.7)
Smoking status		
Non-smoker	405 (47.1)	574 (57.4)
Former smoker	261 (30.4)	237 (23.7)
Current smoker	193 (22.5)	189 (18.9)
Education		
Basic/Secondary	565 (63.2)	619 (59.7)
Tertiary	329 (36.8)	417 (40.3)
Physical activity		
Inactive	169 (19.7)	224 (22.4)
Lightly active	340 (39.7)	382 (38.1)
Active	304 (35.5)	379 (37.8)
Very active	44 (5.1)	17 (1.7)
Use of hormonal contraceptives		
No	894 (100.0)	659 (63.6)
Yes	0 (0.0)	377 (36.4)
Systemic disease		
No	405 (46.8)	348 (34.5)
Yes	460 (53.2)	660 (65.5)

Table II The association between skin diseases and hs-CRP elevation.

Skin diseases		hs-CRP levels			p-value
		<1 mg/L	1-3 mg/L	>3 mg/L	
<b>Eczemas:</b>					
	No	864 (62.4)	384 (27.7)	137 (9.9)	
	Yes	310 (59.5)	149 (28.6)	62 (11.9)	
Atopic eczema	No	1,122 (61.9)	510 (28.1)	182 (10.0)	
	Yes	51 (56.0)	23 (25.3)	17 (18.7)	
Hand eczema	No	1,060 (61.1)	493 (28.4)	183 (10.5)	
	Yes	113 (66.9)	40 (25.7)	16 (9.5)	
<b>Psoriasis:</b>	No	1,146 (61.6)	520 (27.9)	195 (10.5)	
	Yes	24 (58.5)	13 (31.7)	4 (9.8)	
<b>Autoimmune diseases:</b>	No	1,126 (61.6)	513 (28.1)	188 (10.3)	
	Yes	48 (60.8)	20 (25.3)	11 (13.9)	
<b>Sebaceous gland diseases:</b>	No	890 (63.7)	378 (27.0)	130 (9.3)	
	Yes	284 (55.9)	155 (30.5)	69 (13.6)	
Acne vulgaris	No	1,090 (62.1)	482 (27.5)	183 (10.4)	
	Yes	83 (55.3)	51 (34.0)	16 (10.7)	
Rosacea	No	1,019 (63.0)	445 (27.5)	153 (9.5)	
	Yes	154 (53.7)	87 (30.3)	46 (16.0)	
<b>Skin infections:</b>	No	675 (62.9)	296 (27.6)	102 (9.5)	
	Yes	499 (59.9)	237 (28.5)	97 (11.6)	
<b>Fungal skin infections:</b>	No	812 (63.1)	351 (27.3)	124 (9.6)	
	Yes	362 (58.5)	182 (29.4)	75 (12.1)	
Onychomycosis	No	1,067 (61.8)	490 (28.4)	169 (9.8)	
	Yes	107 (59.4)	43 (23.9)	30 (16.7)	
Tinea pedis	No	875 (62.7)	382 (27.4)	138 (9.9)	
	Yes	299 (58.5)	151 (29.5)	61 (11.9)	
<b>Bacterial skin infections:</b>	No	1,113 (62.2)	495 (27.7)	181 (10.1)	
	Yes	61 (52.1)	38 (32.5)	18 (15.4)	
Folliculitis	No	1,113 (62.2)	495 (27.7)	182 (10.2)	
	Yes	61 (52.6)	38 (32.8)	17 (14.7)	
<b>Virus skin infections:</b>	No	1,037 (61.4)	472 (27.9)	180 (10.7)	
	Yes	137 (63.1)	61 (28.1)	19 (8.8)	
<b>Hair follicle disorders:</b>	No	760 (60.4)	360 (28.6)	139 (11.0)	
	Yes	414 (64.0)	173 (26.7)	60 (9.3)	
<b>Requirement of treatment:</b>	No	477 (62.7)	223 (29.3)	61 (8.0)	
	Yes	695 (60.8)	310 (27.1)	138 (12.1)	

Table III Risk for elevated hs-CRP in skin disease types and in participants whose disease required further treatment.

Skin disease	Crude hs-CRP		Adjusted 1* hs-CRP		Adjusted 2 hs-CRP	
	1-3 mg/L	>3 mg/L	1-3 mg/L	>3 mg/L	1-3 mg/L	>3 mg/L
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Any skin diseases <sup>†</sup>	1.13 (0.87 - 1.46)	1.64 (1.07 - 2.51)	1.17 (0.89 - 1.54)	1.80 (1.14 - 2.82)	1.03 (0.77 - 1.38)	1.48 (0.93 - 2.38)
Atopic eczema	0.99 (0.59 - 1.66)	2.20 (1.24 - 3.90)	1.02 (0.60 - 1.72)	2.15 (1.19 - 3.90)	1.13 (0.65 - 1.96)	2.44 (1.28 - 4.64)
Eczema stanicum	1.26 (0.37 - 4.33)	3.49 (1.01 - 12.1)	1.15 (0.33 - 3.97)	3.03 (0.86 - 10.7)	0.68 (0.18 - 2.55)	1.48 (0.38 - 5.83)
Rosacea	1.31 (0.98 - 1.75)	1.96 (1.34 - 2.87)	1.19 (0.88 - 1.60)	1.68 (1.13 - 2.50)	1.06 (0.77 - 1.45)	1.45 (0.95 - 2.21)
Onychomycosis	0.88 (0.60 - 1.28)	1.84 (1.18 - 2.88)	0.90 (0.61 - 1.32)	1.98 (1.24 - 3.16)	0.87 (0.58 - 1.31)	1.87 (1.14 - 3.07)
Sebaceous gland diseases	1.27 (1.01 - 1.61)	1.68 (1.21 - 2.34)	1.18 (0.93 - 1.50)	1.50 (1.07 - 2.10)	1.14 (0.89 - 1.47)	1.43 (1.00 - 2.04)
Requirement for treatment	0.96 (0.77 - 1.18)	1.62 (1.16 - 2.27)	0.95 (0.76 - 1.19)	1.63 (1.15 - 2.32)	0.86 (0.68 - 1.08)	1.45 (1.00 - 2.09)