Received: 8 June 2020 | Revised: 17 August 2020 | Accepted: 26 August 2020

DOI: 10.1111/apa.15562

REGULAR ARTICLE

ACTA PÆDIATRICA NURTURING THE CHILD WILEY

Family socio-economic status and childhood coeliac disease seem to be unrelated—A cross-sectional screening study

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Funding information
This study was funded by the Swedish Research Council, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, the Swedish Council for Working Life and Social Research, the Swedish Coeliac Association's research fund and Västerbotten County Council.

Abstract

Aim: The aim of our study was to examine whether there is a difference in coeliac disease prevalence in regard to parents' education level and occupation, and whether this differs between screened and clinically diagnosed children at the age of 12 years.

Methods: The study, Exploring the Iceberg of Celiacs in Sweden (ETICS), was a school-based screening study of 12-year-old children that was undertaken during the school years 2005/2006 and 2009/2010. Data on parental education and occupation were reported from parents of the children. Specifically, by parents of 10 710 children without coeliac disease, 88 children diagnosed with coeliac disease through clinical care, and 231 who were diagnosed during the study.

Results: There were no statistically significant associations between occupation and coeliac disease for either the clinically detected (prevalence ratio 1.16; confidence interval 0.76-1.76) or screening-detected coeliac disease cases (prevalence ratio 0.86; confidence interval 0.66-1.12) in comparison with children with no coeliac disease. Also, there were no statistically significant associations for parental education and coeliac disease diagnosis.

Conclusion: There was no apparent relationship between coeliac disease and socio-economic position. Using parents' socio-economic status as a tool to help identify children more likely to have coeliac disease is not recommended.

KEYWORDS

children, coeliac disease, education, occupation, screening

1 | BACKGROUND

Coeliac disease is a common genetic autoimmune disease that is characterised by a permanent intolerance to gluten. The only effective treatment for coeliac disease is a life-long gluten-free diet, which in most patients leads to the recovery of the damaged mucosa of the small intestine.[1] The prevalence of coeliac disease has commonly been reported to be around 1% in Western populations,[2] but there are also studies that have shown a prevalence as high as 2%-3% in Finland and Sweden.[3,4] Moreover, screening studies have revealed that the majority of coeliac disease patients are undiagnosed.[4,5] It is widely known that the risk of having coeliac disease is strongly linked to genetics and that the human leucocyte antigens of isotype DQ2 and DQ8 are necessary to develop the disease.[1] However, not all persons who are

Abbreviations: ETICS, exploring the iceberg of celiacs in Sweden; CD, Coeliac disease.

genetically predisposed go on to develop coeliac disease, which raises more questions on the aetiology of the disease. There is limited knowledge about other factors that are linked to the development of coeliac disease, although environmental factors such as infant feeding practices and infections have been associated with disease development.[6-8]

Some studies on the aetiology of coeliac disease have investigated the role of socio-economic factors such as occupation, income and education, but evidence is still sparse and in some cases contradictory.[9-20] The hygiene and the microflora hypotheses provide a groundwork for understanding the role of environmental factors in the aetiology of coeliac disease.[21] These are supported by some studies on coeliac disease.[10,22]

It has been shown that coeliac disease is more prevalent among school children in a part of Finland where the socio-economic status is higher than in a comparable population in the adjacent Russian Karelia.[10] However, a study from southeast England showed that belonging to a low socio-economic class increased the risk of coeliac disease.[16] A Swedish biopsy-based study reported only a weak association with a low occupation status, while no association with education level was identified, despite having over 29 000 diagnosed coeliac disease cases.[14] Also, other Swedish studies present some links between an increased risk of coeliac disease for children and their parents' in a lower socio-economic strata.[11,13,19,23]

On the other hand, in another Swedish study that included all coeliac disease cases diagnosed between 1998 and 2003, an increased risk of childhood coeliac disease was shown to be strongly associated with higher income.[13] Also, two studies in the United Kingdom showed that coeliac disease was more common in areas with a higher mean income.[18,20] Similarly, a Dutch study, which did not include individual socio-economic factors, showed that coeliac disease was more common when those diagnosed during childhood lived in an area where the overall socio-economic status was higher than those diagnosed during adulthood.[9]

Even though studies have provided evidence on the association between socio-economic status and coeliac disease, these results are still contradicting, and they have not focused on screening-detected coeliac disease cases. The observed differences in coeliac disease prevalence might imply different rates of clinical diagnosis rather than a direct influence on the aetiology of coeliac disease. No investigation has yet studied a larger population of individuals diagnosed through screening.

The aim of our study was to examine whether there is a difference in coeliac disease prevalence in regard to parents' education level and occupation, and whether this differs between screened and clinically diagnosed children at the age of 12 years.

Key notes

- Previous studies on socio-economic status and coeliac disease risk have shown contradicting results, and most of these studies are based on individuals clinically diagnosed, thus a minority of all cases.
- From a population-based screened cohort, we found no evidence that socio-economic status is associated with the risk of developing coeliac disease.
- There was no apparent gender difference in the association between socio-economic status and coeliac disease prevalence.

2 | PARTICIPANTS AND METHODS

2.1 | Study material

For the current study, data from the Exploring the Iceberg of Celiacs in Sweden (ETICS) study was used. This study was a multi-centre cross-sectional school-based screening of coeliac disease among 12-year-olds in Sweden. ETICS was conducted during the school years 2005/2006 and 2009/2010 in five different regions.[24] A total of 18 325 children were invited, of whom 13 279 children participated. A total of 100 children already had a diagnosis of coeliac disease through clinical care before the study started, and an additional 242 children were diagnosed with coeliac disease following the screening.[4,24]

At the time of the screening, and before the result of the blood sample were known, parents or other legal guardians of the participating children were asked to respond to a questionnaire. The questionnaire was sent to their home with two reminders, and a prepaid envelope addressed to the study administration. From this questionnaire, we used responses from the parents about their current labour market status, their current or most recent occupation, and their education level. In total, 11 239 (85%) of 13 279 parents in the ETICS study responded to the questionnaire.

The Regional Ethical Review Board of Umeå University approved the ETICS study.

2.2 | The questionnaire

Socio-economic status was defined based on three questions. The first question measured education level with five alternatives: <9 years at school, finished primary school, which corresponds to 9 years of school, finished upper secondary school, which corresponds to 12 years of school, at least 1 year of education after upper secondary school and university diploma. The second question asked about the parents' labour market status with the following response alternatives: currently employed, self-employed, student, unemployed more or <6 months, working from home, parental leave and retired (either early-retired or age-retired). The third question asked the respondent to specify with words their current or most recent occupation. A socio-economic classification was obtained from these answers based on the socio-economic classification system defined by Statistics Sweden in 1982,[25] both

TABLE 1 Characteristics of the population divided into coeliac disease (CD) groups

	Clinical CD (n = 88)		Screened CD (n = 231)		No CD (n = 10 710)	
	n	%	n	%	n	%
Participants (n = 11 029)						
Boys (n = 5608)	30	34	101	44	5477	51
Girls (n = 5421)	58	66	130	56	5233	49
Mother's occupation (n = 10 189)						
Student (n = 424)	6	7.1	5	2.3	413	4.2
Manual worker (n = 3063)	31	36	56	26	2976	31
Non-manual worker with low educational demand (n = 1923)	15	18	49	23	1859	19
Non-manual worker with intermediate educational demand (n = 2939)	22	26	56	26	2861	29
Non-manual worker with high educational demand (n = 1840)	11	13	51	24	1778	18
Household occupation (n = 10 420)						
Student (n = 115)	0	0	1	0.5	114	1.1
Manual worker (n = 2331)	26	30	39	18	2266	22
Non-manual worker with low educational demand (n = 2317)	16	19	51	23	2250	22
Non-manual worker with intermediate educational demand (n = 2402)	19	22	50	23	2333	23
Non-manual worker with high educational demand (n = 3255)	25	29	78	36	3152	31
Mother's educational level (n = 10 597)						
Less than 9 y at school (n = 180)	1	1.1	1	0.5	178	1.7
Primary school (n = 739)	9	10	11	5.0	719	7.0
College (n = 3098)	21	24	76	35	3001	29
At least 1 y of education after college (n = 1941)	16	18	36	17	1889	18
University diploma (n = 4639)	40	46	94	43	4505	44
Household educational level (n = 10 770)						
Less than 9 y at school (n = 97)	0	0	1	0.5	96	0.9
Primary school (n = 419)	6	6.8	8	3.6	405	3.9
College (n = 2844)	22	25	57	26	2765	26
At least 1 y of education after college (n = 1935)	16	18	42	19	1877	18
University diploma (n = 5475)	44	50	113	51	5318	51

for each parent individually and for the highest classification between them. Codes for occupations were divided into the following groups: students 1-3, manual workers 11, 12, 21, 22 and 86-89, non-manual workers with low educational demand 33-36, 76, 77 and 79, non-manual workers with intermediate educational demand 46, and non-manual workers with high educational demand 56, 57, 60 and 78. The highest parental occupation of the child's parents was chosen according to the instructions from Statistics Sweden.

2.3 | Statistical analysis

Descriptive statistics are presented using frequency tables, cross-tabulations, and mean and median values. Associations between coeliac disease prevalence and socio-economic factors were analysed with prevalence ratios. In our analyses, we included children who had a coeliac disease diagnosis either before, referred to as clinical coeliac disease, or during the ETICS screening study, referred to as screened coeliac disease, or had a blood sample that did not indicate presence of coeliac disease, referred to as no coeliac disease. We also combined the first two groups into any coeliac disease to compare with no coeliac disease. In our analyses, the categories of manual worker and non-manual worker with low educational demand were combined and referred to as low-skilled workers, while the other categories for non-manual workers were combined and referred to as high-skilled workers. Furthermore, education level was divided into no university degree and university degree. The category of students was excluded in the analyses because the group had mixed education levels and different occupational backgrounds.

Statistical significance was defined at the 5% level. Microsoft Access was used for data handling. Stata 13.1 (StataCorp LP) was used for descriptive statistics. Prevalence ratios were calculated with WinPepi 11.65, including results for boys and girls separately, using the traditional log-transformation method to estimate confidence intervals.[26]

3 | RESULTS

There were 11 029 parents who responded to the questionnaire and whose child belonged to one of the three groups: clinically diagnosed, screening diagnosed or no coeliac disease. We excluded responses to the questionnaire from 161 parents to children who had no previous coeliac disease diagnosis and who did not provide a blood sample and 49 parents to children who were referred to a biopsy due to positive serology without having a confirmed coeliac disease diagnosis.

In both coeliac disease groups, there was a higher proportion of girls than boys with a coeliac disease diagnosis (Table 1). A similar observation was made in a previous article from the ETICS study.[24] The relationship between occupation level and education with coeliac disease diagnosis is also presented in Table 1.

There were no statistically significant relationships between occupation and coeliac disease when we analysed the data for either of the coeliac disease groups in comparison with children with no coeliac disease, regardless of whether we used household or mother's occupation (Table 2). Furthermore, there was no statistically significant relationship between any coeliac disease, whether screening-detected or clinically diagnosed, and any of the socio-economic measures (Tables 2 and 3). There was a numerical indication that those with lower socio-economic status were often diagnosed clinically, while screening-detected coeliac disease was common if parents had a higher socio-economic status. Also, for education level, there were no statistically significant relationships with the different coeliac disease groups (Table 3). The pattern for the prevalence ratios was similar as for occupation with estimates showing an even lower effect with prevalence ratios being closer to 1.

When the results were calculated for boys and girls separately, we found no statistical significance for either occupation or education (Tables 4 and 5). However, it was more common to have clinically diagnosed coeliac disease among boys whose parents had a higher occupation, as well as a longer education, while the opposite was observed for girls. For children who were diagnosed with coeliac disease through the ETICS study, there was a non-significant increased risk for coeliac disease for girls whose parents had high-skilled worker as the highest occupation.

4 | DISCUSSION

This study of 10 819 parents whose children had a coeliac disease diagnosis either clinically or through screening found no evidence for any statistically significant relationships between occupation and education and coeliac disease. However, there was a numerical

TABLE 2 Association between coeliac disease (CD) and occupation

	Low-skilled workers		High-skilled workers		Prevalence ratio (confidence interval)
	n	%	n	%	
Household occupation					
Clinical CD	42	49	44	51	1.16 (0.76-1.76)
Screened CD	90	41	128	59	0.86 (0.66-1.12)
Any CD	132	43	172	57	0.93 (0.75-1.17)
No CD	4516	45	5485	55	1
Mother's occupation					
Clinical CD	46	58	33	42	1.33 (0.85-2.08)
Screened CD	105	50	107	50	0.94 (0.72-1.23)
Any CD	151	52	140	48	1.03 (0.82-1.30)
No CD	4835	51	4639	49	1

TABLE 3 Association between coeliac disease (CD) and education

	No university degree		University degree		Prevalence ratio (confidence interval)
	n	%	n	%	
Household education					
Clinical CD	44	50	44	50	1.03 (0.68-1.57)
Screened CD	108	49	113	51	0.99 (0.76-1.28)
Any CD	152	49	157	51	1.00 (0.80-1.25)
No CD	5143	49	5318	51	1
Mother's education					
Clinical CD	47	54	40	46	0.92 (0.60-1.39)
Screened CD	124	57	94	43	1.03 (0.79-1.34)
Any CD	171	56	134	44	0.99 (0.80-1.24)
No CD	5787	56	4505	44	1

TABLE 4 Association between coeliac disease (CD) and occupation, divided according to the sex of the child

	Boys					Girls				
	Low-skilled workers		High-skilled workers		Prevalence ratio (confidence interval)	Low-skilled workers		High-skilled workers		Prevalence ratio (confidence interval)
	n	%	n	%		n	%	n	%	
Household occupation										
Clinical CD	11	38	18	62	0.74 (0.35-1.57)	31	54	26	46	1.45 (0.94-2.23)
Screened CD	43	46	50	54	1.04 (0.69-1.56)	47	38	78	62	0.74 (0.52-1.06)
Any CD	54	44	68	56	0.96 (0.68-1.37)	78	43	104	57	0.92 (0.69-1.22)
No CD	2306	45	2793	55	1	2210	45	2692	55	1
Mother's occupation										
Clinical CD	12	46	14	54	0.84 (0.39-1.81)	34	64	19	36	1.68 (0.96-2.93)
Screened CD	49	54	41	46	1.16 (0.77-1.75)	56	46	66	54	0.80 (0.57-1.14)
Any CD	61	53	55	47	1.08 (0.75-1.55)	90	51	85	49	1.00 (0.78-1.28)
No CD	2441	51	2381	49	1	2394	51	2258	49	1

TABLE 5 Association between coeliac disease (CD) and education, divided according to the sex of the child

	Boys					Girls				
	Low-skilled workers		High-skilled workers		Prevalence ratio (confidence interval)	Low-skilled workers		High-skilled workers		Prevalence ratio (confidence interval)
	n	%	n	%		n	%	n	%	
Household education										
Clinical CD	11	37	19	63	0.60 (0.28-1.25)	33	57	25	43	1.37 (0.82-2.30)
Screened CD	50	53	45	47	1.14 (0.76-1.69)	58	46	68	54	0.89 (0.63-1.26)
Any CD	61	49	64	51	0.98 (0.69-1.38)	91	49	93	51	1.02 (0.77-1.36)
No CD	2707	49	2776	51	1	2497	49	2606	51	1
Mother's education										
Clinical CD	12	41	17	59	0.55 (0.26-1.15)	35	60	23	40	1.18 (0.70-1.99)
Screened CD	54	57	40	43	1.05 (0.70-1.58)	70	56	54	44	1.01 (0.71-1.43)
Any CD	66	54	57	46	0.90 (0.64-1.28)	105	57	77	43	1.06 (0.79-1.41)
No CD	2961	56	2306	44	1	2826	56	2199	44	1

indication that lower socio-economic status was related to an increased chance of being diagnosed clinically, while diagnosis through screening was more common if the parents had a higher socio-economic status. Despite inviting over 18 000 children to the study, we had limited number of children who were diagnosed with coeliac disease. Therefore, we remain cautious when presenting conclusions about the relationship between socio-economic status and the risk of having coeliac disease, either clinically or by screening.

Our study was in line with previous studies that could not provide statistical evidence for an association between socio-economic status and the prevalence of coeliac disease. The observed numerical, but not statistically significant indication that lower socio-economic status was related to an increased risk of being diagnosed clinically follows the same pattern as seen in previous Swedish studies.[11,13,19,23] However, we cannot relate the results for screening-detected cases to previous studies in which they were clinically diagnosed. Some previous studies attributed health disparities according to socio-economic status to differences in help-seeking behaviours.[27,28] Persons from deprived areas tend to be less likely to seek medical care and are potentially less likely to undergo coeliac disease testing. Thus potentially explaining the higher coeliac disease incidence in areas with higher socio-economic status in the British studies.[18,20] However, our findings did not support this stance as we observed a higher, although not significant, coeliac disease prevalence for the group with lower socio-economic status in the clinical cases.

Our study does not promote efforts for case finding related to parental occupation or education. However, further research on socio-economic conditions and coeliac disease in populations with larger welfare gradients than Sweden and with privatised health care may be more suited to identify this association.

The hygiene and the microflora hypotheses provide a common explanation for the potential role of socio-economic status in coeliac disease aetiology.[21] In our study, we included all cases of coeliac disease, both clinical and screening-detected, thus eliminating the variations in coeliac disease risk attributed to differences in clinical diagnosis. We found no association between any coeliac disease and any of the socio-economic measures. These findings suggest that socio-economic status does not influence the risk of developing coeliac disease.

To our knowledge, ours is the first study to assess the relationship between socio-economic status and coeliac disease risk with both clinically and screening-detected coeliac disease patients. The diagnosis of coeliac disease was biopsy verified for both clinically and screening-detected coeliac disease cases. A limitation of our study was that the geographical areas were not randomly chosen and they only covered around 10% of Swedish children. Consequently, the proportion of clinical cases might differ to other regions. However, a previous ETICS publication concluded that participating areas were representative of the whole population regarding socio-economic status.[24] We therefore expect any differences to have negligible impact on our conclusions.

Almost 40% of the children invited to the ETICS study did not respond to the questionnaire. Participation might be high among already diagnosed children, while it is more unlikely among other children as they lack knowledge about coeliac disease. Moreover, 86% of the parents to children with clinically diagnosed coeliac disease answered the questionnaire, implying that results for them were representative. Previous reports show similarities between participants and non-participants in ETICS.[4,24] It is therefore likely that non-participation had a negligible effect on the prevalence's for children without a coeliac disease diagnosis prior to our study. The measurements of parental education and occupation might affect our results because these were self-reported. However, parents reported this information in a standard way. The occupation classifications are from a well worked through definition by Statistics Sweden,[25] making it a reliable tool to use.

5 | CONCLUSION

There was no apparent relationship between coeliac disease and socio-economic status. However, there were some indications that children of a lower socio-economic background are more frequently being diagnosed clinically and that children of a higher socio-economic background to a greater extent have an undiagnosed coeliac disease later detected in the screening. Despite a large study sample, we could not confirm a dependency between socio-economic status and the risk of having coeliac disease.

ACKNOWLEDGEMENTS

We would like to thank all participating children and their families. Furthermore, we would like to thank the all the school personnel and the ETICS research team for their contributions.

CONFLICT OF INTEREST

The authors report no conflicts of interest.

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How to cite this article: Norström F, Namatovu F, Carlsson A, Högberg L, Ivarsson A, Myléus A. Family socio-economic status and childhood coeliac disease seem to be unrelated—A cross-sectional screening study. *Acta Paediatr*. 2021;110:1346–1352. https://doi.org/10.1111/apa.15562