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Contact With Farm Animals in Early Life and Juvenile Inflammatory Bowel Disease: A Case-Control Study

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ABSTRACT

OBJECTIVE. The aim of this study was to test the association between farm animal contact in infancy and the development of juvenile Crohn disease and ulcerative colitis.

METHODS. A case-control study was conducted in 13 children's hospitals by using a mailed questionnaire. Case subjects with Crohn disease or ulcerative colitis who were registered in these hospitals were eligible (response rate: 90%). Children who underwent strabismus surgery at 11 of the 13 centers served as control subjects (response rate: 85%). All children 6 to 18 years of age who were born in Germany without malformations were included (444 case subjects with Crohn disease, 304 case subjects with ulcerative colitis, and 1481 control subjects).

RESULTS. Regular contact with farm animals during the first year of life was associated inversely with Crohn disease and ulcerative colitis. In addition, regular contact with cats in infancy was linked inversely with case status. Allergic rhinitis was correlated significantly with Crohn disease but not with ulcerative colitis.

CONCLUSION. Contact with farm environments in infancy might decrease the risk of juvenile Crohn disease and ulcerative colitis.

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Key Words

Crohn disease, ulcerative colitis, allergy, farm animals

Abbreviations

CI—confidence interval
CD—Crohn disease
IBD—inflammatory bowel disease
OR—odds ratio
UC—ulcerative colitis

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APPROXIMATELY 12 000 CHILDREN and adolescents in Germany suffer from inflammatory bowel disease (IBD). The overall direct and indirect costs of IBD exceed 1000 euros per patient per month.¹ The recent increase in the incidence of Crohn disease (CD), especially in industrialized countries,² and the marked geographical variation in disease prevalence³⁻⁵ suggest that environmental factors contribute to the pathogenesis of IBD. Such increases in incidence and regional variations have also been observed for atopic diseases such as allergic rhinitis and atopic asthma.⁶

A possible explanation for these observations is the so-called "hygiene hypothesis," which suggests an increased risk of T helper type 1 cell diseases (such as CD) and T helper type 2 cell diseases (such as respiratory allergies) in response to declining levels of microbial exposure in early life.⁷ This association could be mediated through decreased stimulation of regulatory cytokines by infectious organisms (eg, bacteria, viruses, and parasites).^{5,8,9} In this context, it has been shown that parasitic infections protect patients from respiratory allergies⁸ and might be effective in the treatment of IBD.¹⁰

With respect to respiratory allergies, a number of epidemiologic studies showed reduced prevalence of respiratory allergies among persons with early infant contact with farm animals.¹¹⁻¹⁴ The burden of microbial compounds, such as endotoxins, β -glucans, and muramic acid, found in these environments might be responsible for this inverse association.^{15,16} To date, only 2 studies included data on the risk of IBD among subjects with farm contact,^{17,18} and both surveys focused on adults. The first study reported a decreased mortality rate for IBD in farmers,¹⁷ whereas a recent case-control study of adults with IBD reported an inverse association between living on a farm during the first 12 years of life and the risk of CD.¹⁸ The available findings on the association between contact with pets and IBD have been contradictory.¹⁸⁻²⁰ To our knowledge, the link between contact with farm animals during infancy and the development of juvenile IBD has not yet been investigated. Therefore, we conducted a multicenter, case-control study in Germany to assess the potential association between contact with farm animals and the subsequent development of juvenile IBD.

METHODS

Study Population

The study was conducted at 13 pediatric IBD referral centers across Germany. Control subjects were inpatients undergoing strabismus surgery at the ophthalmic referral center closest to the IBD referral center. Whenever possible, we chose an ophthalmic referral center located in the same town as the respective IBD referral center. In 1 town, the ophthalmic referral center was 24 km (15 miles) from the study's IBD referral center. One

ophthalmic referral center refused to participate, and no ophthalmic referral center was available for 1 IBD center; for those 2 centers, control subjects were sampled from the closest ophthalmic referral center participating in the study.

Centers provided address data for all available case and control subjects in the chosen age range (between 6 and 18 years of age on January 1, 2006). We included patients irrespective of age at diagnosis (case subjects) or date of strabismus surgery (control subjects). Control subjects were selected randomly with the aim of attaining 2:1 frequency matching with respect to the year of birth of case subjects. The study was approved by the ethics committee of the Ludwig-Maximilians-University Munich.

Procedures

Parents of the 1133 case subjects and 2482 control subjects were contacted between March 2006 and August 2006, by using a postal questionnaire. One hundred five case subjects had responded to the postal questionnaire during a pilot study in Munich between July 2005 and August 2005. Up to 2 reminders were sent to all nonresponders within 3 weeks after the questionnaire mailing. In addition, for centers with response rates of <90% after the third mailing, nonresponders (48 case subjects and 370 control subjects) were contacted via telephone up to 5 weeks after the first mailing. Of those subjects, 224 agreed to complete the questionnaire via telephone.

Nine hundred five subjects (252 case subjects and 653 control subjects) were not eligible. The majority of noneligible control subjects ($n = 468$) had moved since strabismus surgery. In addition, subjects born outside Germany (20 case subjects and 54 control subjects) were excluded, because we were studying early childhood environments, which might differ considerably from country to country. Ethnicity may be associated with the risk of IBD,⁵ but a stratified analysis was not possible because of small numbers. We also excluded from analyses case subjects with indeterminate colitis, because of their small number ($n = 37$). Finally, we excluded 13 case subjects and 68 control subjects with congenital malformations, because the latter may be associated with both strabismus and exposure to farm animals in infancy. Overall, questionnaire data were available for 89.8% of eligible case subjects and 85.2% of eligible control subjects (Table 1).

Questionnaire

Most of the 27 items of the parental questionnaire had been used earlier in a study on farm animal contact and type 1 diabetes mellitus.²¹ The items were taken mainly from preexisting validated questionnaire instruments (from the International Study of Asthma and Allergies in Childhood²² and the Allergies and Endotoxin Study¹⁵). In addition to standard sociodemographic factors (age,

TABLE 1 Study Population and Responses

	Case, n (%)	Control, n (%)
Centers	13	11
Contacted	1133 (100.0)	2482 (100.0)
Not eligible	252 (22.4)	653 (26.3)
No address available	37 (14.7)	468 (71.7)
Different diagnosis or indeterminate colitis	93 (36.9)	1 (0.2) ^a
Malformation	13 (5.2)	68 (10.4)
Died	1 (0.4)	2 (0.3)
Born outside Germany	20 (7.9)	54 (8.3)
Outside age range	39 (15.5)	0 (0.0)
Other	49 (19.4)	60 (9.2)
Eligible study population	881 (100.0)	1829 (100.0)
Responders	791 (89.8)	1558 (85.2)
Missing data	43 (4.8)	77 (4.2)
Included in data analyses	748 (84.9)	1481 (81.0)

Inclusion criteria included age of 6 to 18 years for patients in 13 pediatric IBD referral centers in Germany (case subjects) and patients undergoing strabismus surgery in the department of ophthalmology at 11 of the 13 hospitals (control subjects).

^a One control patient received a diagnosis of indeterminate colitis.

gender, place of birth, and parental education), we assessed potential risk factors for IBD (IBD among parents, birth weight, gestational age, infant nutrition, day care, and number of siblings). Data on environmental factors included type of municipality of residence (village, rural town, or urban area), consumption of raw farm milk during infancy ("Which type of cow milk, if any, did your child mainly consume during the first year of life: cow milk from supermarkets, nonboiled raw cow milk directly from the farm, boiled cow milk directly from the farm, or no cow milk at all?"), and regular contact with farm animals or pets ("Has/had your child regular [at least once per week] contact with the following animals . . .?"). The timing of regular contact with animals (first year of life or second to sixth year of life) was also ascertained. Furthermore, the presence of respiratory allergies was assessed. Parents of case subjects were also asked about the type (CD, ulcerative colitis [UC], or indeterminate colitis) and age of onset of IBD.

Statistical Analyses

The analyses were restricted to case and control subjects with complete data (748 case subjects and 1481 control subjects) (Table 1). We used cross-tabulation to observe bivariate distributions of categorical predictors and outcomes. Because data were not matched individually, unconditional analyses could be used. We developed nominal regression models to assess the association of the risk of CD or UC with the type of residency and with exposure to animals during infancy, with adjustment for potential confounders, namely, study region (North, East, West, or South), age in quartiles (≤ 11 years, 12–14 years, 15–16 years, or 17–18 years), gender, duration of exclusive breastfeeding (< 5 months versus ≥ 5 months), parental history of IBD (CD, UC, or indeterminate colitis, yes or no), number of older siblings (≥ 2 older siblings

versus 0 or 1 older sibling), highest parental educational level (≥ 12 years versus < 12 years of schooling), and maternal smoking during pregnancy (yes or no). Adjustment for study centers instead of region did not change the results substantially. Therefore, the models were adjusted for study region to increase statistical power. The fully adjusted odds ratios (ORs) were compared with those adjusted only for age and gender. Models assessing the association between regular contact with animals and CD or UC were restricted to subjects living in rural areas. Because contact with animals very early in life has been shown to play a major role in protection from respiratory allergies^{11,14,15} and because we found farm animal and pet contact during the first year and second to sixth years of life to be highly collinear ($R^2 = 0.52$ and $R^2 = 0.39$, respectively), we included only a variable for animal contact during the first year of life in these models.

RESULTS

Descriptive Statistics

We analyzed data for 748 case subjects and 1481 control subjects. The mean age at diagnosis for patients with CD was 11 years (SD: 3.5 years), and that for patients with UC was 10 years (SD: 3.7 years). In the bivariate analyses, control subjects, compared with case subjects, were slightly younger, were more likely to have a lower birth weight, and were less likely to have parents with IBD or parents with a high school education (Table 2).

Compared with control subjects, patients with CD were less likely to be female (patients with CD: 39%; 95% confidence interval [CI]: 34%–43%; control subjects: 52%; 95% CI: 50%–55%), to have > 1 older sibling (patients with CD: 10%; 95% CI: 7%–13%; control subjects: 17%; 95% CI: 15%–19%), and to have been exposed to maternal smoking during pregnancy (patients with CD: 6%; 95% CI: 4%–8%; control subjects: 11%; 95% CI: 9%–12%). Twenty-nine percent (95% CI: 25%–33%) of patients with CD reported a doctor's diagnosis of allergic rhinitis, whereas the prevalence among control subjects was only 18% (95% CI: 15%–20%).

Five percent (95% CI: 3%–8%) of subjects with UC and 13% (95% CI: 11%–15%) of control subjects had ≥ 2 younger siblings. In addition, 31% (95% CI: 26%–36%) of subjects with UC had received nutritional supplements (any nutrition other than breast milk, including juice) later than 4 months of age, compared with only 22% (95% CI: 20%–24%) of the control group.

Living in Urban Areas

Case subjects with CD and UC were more likely to live in urban areas than were control subjects (patients with CD: 21%; 95% CI: 17%–25%; patients with UC: 22%; 95% CI: 17%–28%; control subjects: 15%; 95% CI:

TABLE 2 Selected Descriptive Characteristics of the Study Population

	CD (N = 444)	UC (N = 304)	Control (N = 1481)
Age, mean $\pm$ SD, y ^a	14.0 $\pm$ 2.9	13.7 $\pm$ 3.2	13.1 $\pm$ 3.3
Age at diagnosis, mean $\pm$ SD, y	11.0 $\pm$ 3.5	10.2 $\pm$ 3.7	NA
Study region, n (%) ^b			
Northern Germany	140 (31.5)	102 (33.6)	452 (30.5)
Eastern Germany	34 (7.7)	25 (8.2)	131 (8.8)
Western Germany	144 (32.4)	105 (34.5)	400 (27.0)
Southern Germany	126 (28.4)	72 (23.7)	498 (33.6)
Female gender, n (%) ^c	172 (38.7)	146 (48.0)	770 (52.0)
Birth weight of $\leq$ 2500 g, n (%) ^c	52 (11.7)	34 (11.2)	314 (21.2)
Allergic rhinitis, n (%) ^c	128 (28.8)	67 (22.0)	263 (17.8)
Family history, n (%)			
$\geq$ 2 older siblings ^b	45 (10.1)	44 (14.5)	250 (16.9)
$\geq$ 2 younger siblings ^b	53 (12.0)	16 (5.3)	191 (12.9)
Parents with IBD ^c	41 (9.2)	30 (9.9)	26 (1.8)
Day care attendance, n (%) ^d			
At age 0–1 y	51 (11.7)	47 (15.7)	47 (10.1)
At age 2–5 y	341 (78.4)	228 (76.0)	1163 (79.2)
Never	43 (9.9)	25 (8.3)	158 (10.8)
Nutrition, n (%)			
Breastfeeding for $<$ 6 mo ^e	293 (66.1)	190 (63.1)	1020 (69.8)
Nutritional supplements other than breastfeeding at $<$ 5 mo ^{b,f}	335 (75.5)	209 (68.8)	1145 (77.3)
Raw milk consumption during first year of life	11 (2.5)	4 (1.3)	39 (2.7)
Maternal smoking during pregnancy, n (%) ^b	26 (5.9)	30 (9.9)	160 (10.8)
$\geq$ 12 y of schooling, n (%) ^e	188 (42.3)	133 (43.8)	546 (36.9)
Place of residence, n (%) ^b			
City	94 (21.2)	67 (22.0)	221 (14.9)
Rural town	134 (30.2)	91 (29.9)	457 (30.9)
Village	216 (48.6)	146 (48.0)	803 (54.2)
Regular contact with pets (ever), n (%)			
Dogs	213 (48.0)	149 (49.0)	718 (48.5)
Cats ^c	180 (40.5)	115 (37.8)	758 (51.2)
Regular contact with pets during first year of life, n (%)			
Dogs ^d	73 (16.4)	55 (18.1)	311 (21.0)
Cats ^c	76 (17.1)	35 (11.5)	336 (22.7)
Cats or dogs ^b	121 (27.3)	74 (24.3)	481 (32.5)
Living on farm, n (%)			
Now	17 (3.8)	9 (3.0)	70 (4.7)
During first year of life	21 (4.7)	13 (4.3)	99 (6.7)
Regular contact with farm animals (ever), n (%)			
Cattle ^e	34 (7.7)	22 (7.2)	170 (11.5)
Pigs ^b	20 (4.5)	11 (3.6)	115 (7.8)
Sheep or goats ^e	19 (4.3)	16 (5.3)	109 (7.4)
Regular contact with farm animals during first year of life, n (%) ^e			
Cattle ^c	12 (2.7)	7 (2.3)	95 (6.4)
Pigs ^b	9 (2.0)	3 (1.0)	58 (3.9)
Sheep or goats	7 (1.6)	4 (1.3)	42 (2.8)
Cattle, pigs, sheep, or goats ^c	19 (4.3)	12 (3.9)	129 (8.7)

Total numbers might differ because of missing data. NA indicates not applicable; regular, at least once per week.

^a $P < .001$ (analysis of variance).

^b $P < .01$ (χ^2 test).

^c $P < .001$ (global test comparing the 3 groups) (χ^2 test).

^d $P < .10$ (χ^2 test).

^e $P < .05$ (χ^2 test).

^f Any nutritional supplements other than breast milk, including juice.

13%–17%) (Table 2). After adjustment for potential confounders, the ORs were 1.5 (95% CI: 1.1–2.0) for CD and 1.5 (95% CI: 1.1–2.1) for UC (Table 3). In this model, the odds of doctor-diagnosed rhinitis were increased significantly with CD (OR: 1.6; 95% CI: 1.3–2.1) but not UC (OR: 1.2; 95% CI: 0.9–1.7).

Regular Contact With Animals in Infancy

To reduce potential confounding or effect modification by place of living, the adjusted analyses of the association between regular childhood contact with animals and IBD were restricted to subjects living in rural areas. Model 1 included regular contact with pets (cats or dogs)

TABLE 3 Associations Between Selected Factors and CD and UC

	OR (95% CI)			
	CD (n = 444)		UC (n = 304)	
	Adjusted for Age and Gender	Fully Adjusted ^a	Adjusted for Age and Gender	Fully Adjusted ^a
Parents with IBD	5.5 (3.3–9.2)	5.3 (3.1–9.0)	6.2 (3.6–10.6)	6.0 (3.4–10.4)
Male gender	1.7 (1.4–2.1)	1.6 (1.3–2.0)	1.2 (0.9–1.5)	1.1 (0.9–1.4)
Nutrition other than breast milk at <5 mo	0.9 (0.7–1.1)	0.9 (0.7–1.3)	0.6 (0.5–0.8)	0.7 (0.5–0.9)
Birth weight of ≤2500 g	0.5 (0.4–0.7)	0.5 (0.4–0.7)	0.5 (0.3–0.7)	0.5 (0.3–0.8)
Maternal smoking during pregnancy	0.5 (0.3–0.8)	0.5 (0.3–0.8)	0.9 (0.6–1.3)	0.9 (0.6–1.4)
≥2 older siblings	0.5 (0.4–0.8)	0.6 (0.4–0.8)	0.8 (0.6–1.2)	0.9 (0.6–1.2)
Rhinitis	1.7 (1.3–2.2)	1.6 (1.3–2.1)	1.2 (0.9–1.7)	1.2 (0.9–1.7)
Living in urban area	1.5 (1.1–2.0)	1.5 (1.1–2.0)	1.6 (1.2–2.2)	1.5 (1.1–2.1)

Results of the adjusted nominal regression analysis, in comparison with 1481 control subjects, are presented.

^a Adjusted for age, gender, region, and parental education and mutually adjusted for all other variables listed in the table.

or farm animals (cattle, pigs, sheep, or goats) during the first year of life (Table 4). The odds of regular contact with any farm animal during the first year of life were reduced significantly with CD (OR: 0.5; 95% CI: 0.3–0.9) and UC (OR: 0.4; 95% CI: 0.2–0.8). For regular contact with pets, no statistically significant association with either CD (OR: 1.0; 95% CI: 0.8–1.3) or UC (OR: 0.9; 95% CI: 0.6–1.2) was seen after adjustment for potential confounders.

Model 2 included regular contact with each type of farm animal, as well as cats and dogs, during infancy (Fig 1). For CD, the OR for those with regular contact with cattle was reduced significantly (OR: 0.4; 95% CI: 0.2–0.9), whereas the OR for those with regular contact with cats was reduced with only borderline significance after adjustment (OR: 0.8; 95% CI: 0.6–1.1). The odds of UC were significantly inversely related to regular contact with cattle (OR: 0.3; 95% CI: 0.1–0.9) and cats (OR: 0.5; 95% CI: 0.3–0.8).

DISCUSSION

Statement of Principal Findings

Our study provides new evidence that contact with farm animals, particularly contact occurring during the first year of life, which is one of the most important protecting factors against respiratory allergies, might also reduce the risk of IBD in children. We also found that children with CD had an increased risk of allergic rhinitis. Taken together, these findings indicate that the hy-

giene hypothesis holds true not only for allergic diseases but also for IBD.

Strengths and Weaknesses of the Study

We were able to achieve high statistical power by including a large number of subjects, among whom there was a high prevalence of exposure to farm animals in early life. Furthermore, we used a detailed questionnaire instrument containing mainly standardized items.^{15,22} In addition, we achieved a high response rate of >85%.

Our study also confirmed some of the known risk patterns for juvenile IBD. CD was associated with male gender, whereas UC was not,¹⁸ and both CD and UC were associated with parental IBD.^{18,23} The urban/rural variation in CD and UC, as well as the protective effect of having older siblings with respect to CD risk, also strengthens previous findings.^{5,18} To evaluate more thoroughly the validity of our results, we analyzed the association between infant farm animal contact and allergic rhinitis among control subjects. This analysis confirmed the protective effect of farm animal contact on respiratory allergies seen in earlier studies (OR: 0.6; 95% CI: 0.3–1.0).^{12,13,24}

Loss of ~20% of control subjects because of migration out of eligible areas after strabismus surgery could potentially cause selection bias. Although it is unlikely that those who moved differed systematically from those who did not, with respect to the study variables, we have

TABLE 4 Associations Between Animal Contact During the First Year of Life and CD and UC

	OR (95% CI)			
	CD (n = 350)		UC (n = 237)	
	Adjusted for Age and Gender	Fully Adjusted ^a	Adjusted for Age and Gender	Fully Adjusted ^a
Pets	0.8 (0.6–1.1)	1.0 (0.8–1.3)	0.7 (0.5–0.9)	0.9 (0.6–1.2)
Farm animals	0.5 (0.3–0.8)	0.5 (0.3–0.9)	0.3 (0.2–0.6)	0.4 (0.2–0.8)

Results of the adjusted nominal regression analysis, in comparison with 1260 control subjects, are presented. Analyses were restricted to subjects living in rural areas. Regular contact indicates at least once per week; pets, cats or dogs; farm animals, cattle, pigs, sheep, or goats.

^a Adjusted for age, gender, region, parental education, birth weight, maternal smoking during pregnancy, older siblings, allergic rhinitis, and parental IBD and mutually adjusted for all other variables listed in the table.

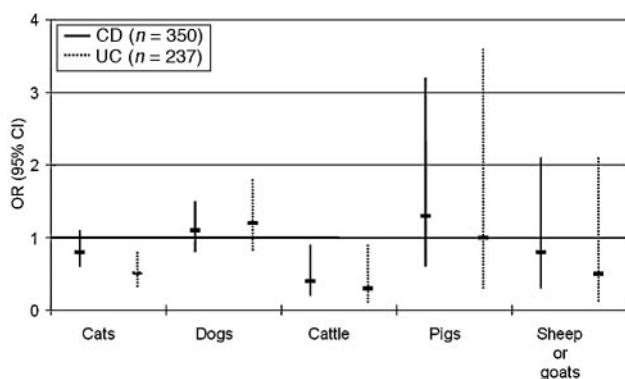


FIGURE 1

Associations between contact with types of animals during the first year of life and CD and UC. Shown are the results of the adjusted nominal regression model (adjusted for age, gender, region, parental education, birth weight, maternal smoking during pregnancy, older siblings, allergic rhinitis, and parental IBD and mutually adjusted for all other variables), in comparison with 1260 control subjects. Analyses were restricted to subjects living in rural areas.

no information that would enable us to describe that group.

The selection of IBD patients from referral centers might have biased the study sample toward selection of case subjects with more severe IBD that required treatment in such specialized centers. Therefore, our results might not be generalizable to case subjects with less severe IBD.

Approximately 10% of the responders completed the questionnaire during a telephone interview, which might have introduced a reporting bias.²⁵ Restricting our analyses to those who answered the written questionnaire did not change our results (data not shown).

Because of the relatively small number of children with newly diagnosed IBD, we could not restrict our study to incident cases. Similarly, children generally undergo strabismus surgery at ~6 years of age. Therefore, control subjects had to be selected from the files of the referral centers, and a recall bias might have resulted. Because the parents of case subjects and control subjects were unlikely to be aware of a potential association between farm factors and IBD, recall bias was likely small. We did not match case subjects and control subjects individually, because matching results in a loss of potential study subjects and thus reduces the efficiency of a study. Furthermore, matching may result in greater difficulty in controlling for additional confounders.²⁶

A major concern in any case-control study involves the selection of a control group that reflects the underlying study base adequately.²⁷ Because IBD typically is treated at local referral centers covering a wide geographic area, selection of population-based control subjects by using data from the population registries of all communities where case subjects were located was not feasible. Therefore, hospital-based control subjects who underwent treatment in a referral center with a similar

coverage area needed to be selected. Like treatment of juvenile IBD, strabismus surgery is performed only at a few specialized referral centers. Because 11 of 13 referral centers for IBD were located in towns with referral centers for strabismus surgery, control subjects who underwent strabismus surgery were considered equally likely to have been treated in the same hospital had they been diagnosed as having IBD.²⁷ Restricting our analyses to cases in which referral centers for strabismus surgery and IBD were located in the same town did not change the risk estimates (data not shown).

In addition, strabismus surgery is associated neither with the type of municipality (rural or urban) nor with exposure to farm animals during infancy. This was supported by the fact that the place of residence of control subjects was similar to that in an earlier study that used a comparable questionnaire instrument.²¹ Because congenital malformations may be associated with strabismus and parents of children with malformations may be more concerned about contact with farm animals, we excluded case subjects and control subjects with congenital malformations, aiming to reduce a potential bias from the selection of patients with strabismus. Nevertheless, bias may arise because prematurity and low birth weight are known risk factors for strabismus.^{28,29} This bias may explain the higher prevalence among the control subjects, compared with the case subjects, of preterm births, low birth weight, and maternal tobacco smoking during pregnancy. The fact that the prevalence of prematurity, low birth weight, and maternal tobacco smoking during pregnancy among case subjects were comparable to those reported in previous German studies provides additional evidence for this conjecture.^{21,30} The higher prevalence of prematurity among control subjects might also be one reason for the lack of an association between raw milk consumption and case status. This association was described previously for allergic diseases¹⁴ but could not be confirmed for IBD in the adjusted analysis of a recent study by Bernstein et al.¹⁸ However, the small number of children who consumed raw milk during the first year of life ($n = 54$) limited the power of these analyses in our study. Overall, restricting our analyses to children with normal birth weight did not change our findings (adjusted ORs for farm animal contact during infancy: CD: OR: 0.6; 95% CI: 0.3–1.0; UC: OR: 0.4; 95% CI: 0.2–0.8).

Discussion of the Results in the Context of Previous Studies

Our finding of a protective effect of early contact with cats with respect to IBD is in line with a recent study among adult patients with IBD¹⁸ but contradicts another survey pointing to an increased risk for juvenile CD associated with contact with pets.²⁰ However, the latter study included mainly urban citizens and did not distinguish between different types of pets.

The observation that contact with animals during the

first year of life was associated generally with IBD is in line with results from studies on respiratory allergies. It is hypothesized that early contact with farming environments is especially effective, through an interaction with the innate immune system. Unfortunately, we did not assess prenatal contact with farming environments.¹¹

Living on a farm during infancy was not itself associated with IBD. One explanation might be the small number of subjects who lived on a farm. Another issue could be that farm living does not necessarily indicate contact with farm animals. As shown earlier for respiratory allergies, the protective effect of farming is associated mainly with livestock exposure,^{11,12} which could be mediated by the microbial compounds found in these environments. It is in line with the hypothesis that early childhood exposure to microbial compounds helps to establish an immunologic balance between proinflammatory and tolerance-inducing regulatory T cells.^{8,10} In addition to such epidemiologic evidence, recent clinical trials showed that gastrointestinal parasitic infections may be effective in the treatment of CD and especially UC.¹⁰

To our knowledge, our survey is the first to show a link between allergic rhinitis and IBD. This association was seen only for CD and could be attributable to similarities in the *NOD2/CARD15* polymorphism.^{31,32} Whether CD was also associated with asthma could not be evaluated, because our questionnaire did not include this information.³²

CONCLUSIONS

The results of this study indicate that farm animal contact during infancy, one of the major factors protecting individuals against childhood allergies, might also decrease the risk of juvenile IBD. This observation is in accordance with the hypothesis that atopic diseases and IBD might have similar pathophysiologic mechanisms.³² Prospective studies with objective exposure data are warranted to confirm our findings. In the long run, these findings might facilitate the development of effective prevention strategies.

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STUDY FINDS COLLEGE-PREP COURSES IN HIGH SCHOOL LEAVE MANY STUDENTS LAGGING

“Only a quarter of high school students who take a full set of college-preparatory courses—four years of English and three each of mathematics, science and social studies—are well prepared for college, according to a study of last year's high school graduates released yesterday by ACT, the Iowa testing organization. The study analyzed about 1.2 million students who took the ACT, one of the country's major college admissions tests, along with the SAT, and graduated from high school last June. The study predicted whether students had a good chance of scoring a C or better in introductory college courses based on their test scores and the success rates of past test takers. Only 26 percent were ready for college-level work in all four core areas. Another 19 percent were not adequately prepared in any of them. . . . Cynthia B. Schmeiser, president and chief operating officer of the ACT Education Division, said she was stunned by the low level of accomplishment for students who had taken the core curriculum, which was recommended 24 years ago in ‘A Nation at Risk,’ a federal Department of Education Commission report that prompted widespread efforts to improve American education. ‘What's shocking about this, is that since “A Nation at Risk,” we have been encouraging students to take this core curriculum with the unspoken promise that when they do, they will be college ready,’ she said. ‘What we have found now, is that when they do, only one in four is ready for college-level work.’”

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Contact With Farm Animals in Early Life and Juvenile Inflammatory Bowel Disease: A Case-Control Study

Katja Radon, Doris Windstetter, Anna Laura Poluda, Beatrice Mueller, Erika von Mutius, Sibylle Koletzko and Chronische Autoimmunerkrankungen und Kontakt zu Tieren (Chronic Autoimmune Disease and Animal Contact) Study Group

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