

Short communication

Relationship between total and allergen-specific IgE serum levels and presence of symptoms in farm workers sensitized to *Tetranychus urticae*

Background: Clinical complaints in atopic subjects with asthma and rhinitis occur more frequently in the presence of high total and allergen-specific IgE serum levels. Here we report on the relationship between total and allergen-specific IgE serum levels and presence of symptoms in an unselected farmer population sensitized to *Tetranychus urticae* (TU).

Methods: Farmers were recruited as previously described. Total IgE and allergen-specific IgE were measured by immunoassay in TU-positive skin prick test (SPT) farmers ($n = 58$) and two control groups including *Dermatophagoides pteronyssinus* (Dp)-positive SPT subjects ($n = 40$) and non-atopic, TU-negative SPT healthy farmers ($n = 25$).

Results: Both TU+ and Dp+ subjects had significantly higher total IgE values ($P < 0.001$) than healthy non-atopic subjects. TU-specific IgE levels were significantly more elevated in symptomatic than non-symptomatic TU+ subjects ($P = 0.028$). Dp-specific IgE levels were higher in symptomatic than non-symptomatic Dp+ subjects ($P = 0.003$). Finally, total IgE levels were significantly higher in the symptomatic than non-symptomatic subgroups in both TU+ and Dp+ subjects ($P < 0.0001$ and $P = 0.007$, respectively). Logistic regression analysis showed that only total IgE concentrations were significant predictors of current symptoms in TU+ subjects.

Conclusions: High total IgE and allergen-specific IgE levels are associated with symptoms in TU+ subjects. Definition of their predictive value requires further studies.

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Introduction

Tetranychus urticae (TU), also known as 'red spider mite', is a macroscopic (0.5–1 mm) phytophagous mite, occurring world-wide, that infests many vegetables and ornamental flowers cultured in open fields or greenhouses, as well as other plants and fruit trees in the summer–autumn period (1). Because TU is the most common phytophagous mite in southern Italy, farm workers living in this area are at increased risk of developing TU-mediated occupational allergic diseases. Indeed, we have already reported on the occurrence of TU-related allergic diseases in farm workers, namely, a seasonal occupational rhinitis, mostly associated with asthma and/or contact urticaria, and an isolated hand-localized recurrent dermatitis (1, 2). Nevertheless, since the occurrence of allergic sensitization and diseases in active farm workers is quite frequent (3, 4), TU-induced allergy may be misdiagnosed because of the potential causative role of other allergens in causing symptoms in these workers. On the other hand, data

comparing asthma and allergy in farmers and the general population have shown a generally lower prevalence of allergic diseases in the former (5). Therefore, to define better the actual importance of TU as a cause of occupational complaints in this workforce, we recently undertook a large cross-sectional study aiming at determining the prevalence of TU-induced, IgE-mediated sensitization/clinical allergy in a general, unselected sample of farmers living in southern Italy, a temperate climate area (6). The results of this study showed that TU was a common non-traumatic, allergic occupational hazard for farmers, thus confirming and extending previous data obtained in apple-cultivating farmers in a subtropical climate (7) and in selected greenhouse workers (8).

Previous studies have shown that elevated serum IgE levels may be significantly associated with a higher frequency of symptoms in atopic subjects with asthma or rhinitis (9–11). Few studies have also addressed the

role of allergen-specific IgE levels as predictors of symptoms (12, 13). Therefore, as a complement to the above study (6), we now report here on the association between total and TU-specific IgE antibody levels and occurrence of symptoms, and on their role as predictors of symptoms in the same farmer population.

Material and methods

Study population

Farmers were enrolled as previously described (6). Briefly, out of 1280 randomly selected subjects, 960 farmers (75% response rate) gave their informed consent and entered the study. All farmers were invited to fill in a detailed questionnaire for assessment of their past medical history and current clinical complaints and were then subjected to a skin prick test (SPT) session with 24 commercially available local common inhalant and food allergens (CAL) and a TU whole-body extract (6). Patients were considered atopic if they showed at least one positive SPT result to any one CAL. Finally, all TU SPT-positive farmers, whether atopic or not (i.e., with or without a positive SPT to any one CAL in association with TU positivity), underwent a single-blind specific TU exposure test in a pesticide-free, oleander greenhouse specifically infested by TU (6).

Serum IgE testing

IgE determinations were performed in all TU SPT-positive farm workers and in two other groups randomly selected with computer assistance. Of these latter, one included *Dermatophagoides pteronyssinus* (Dp) SPT-positive farm workers, with an equal number of symptomatic and non-symptomatic subjects, and the other included non-atopic and TU SPT-negative healthy farm workers. As described in detail elsewhere (1), total and allergen-specific IgE values were measured by immunoassay according to the manufacturer's instructions (Phadezym RAST/PRIST, Pharmacia, Uppsala, Sweden), and expressed as absorbance values at 420 nm.

Finally, the nomenclature used in this manuscript complies with EAACI recommendations (14).

Statistical analysis

Data were initially examined by the normality test of Kolmogorov–Smirnov. Because of the non-Gaussian distribution of IgE levels, data were compared by nonparametric means with the Mann–Whitney *U*-test and the Kruskal–Wallis *H*-test with the Dunn test for multiple comparisons. Binary logistic regression was used to evaluate the relationship between symptoms as the dependent variable (no = 0; yes = 1) and total and allergen-specific IgE levels

as the independent continuous variable. The coefficients obtained from the logistic regression analyses were also expressed in terms of odds of occurrence of an event. Data are presented as medians with 25th and 75th percentiles. A *P*-value of 0.05 or less was considered significant. The SPSS software package for Windows (release 11.0.1–15 Nov 2001; SPSS Inc., Chicago, IL, USA) was used for statistical analysis and selection of random samples. The Dunn test was performed with GraphPad PRISM (release 3.0.2).

Results

Of the 960 subjects studied, 273 (28.4%) were atopic as assessed by the CAL panel. The prevalence rate of atopy was 27.9% in males and 29% in females. However, when the number of subjects with an isolated positivity to TU was included, the total number of subjects displaying a positive SPT rose to 293 (30.5%); of these, 235 were only positive to CAL, 20 had an isolated positivity to TU, and 38 were positive to both CAL and TU. All subjects considered, 58 (6%) had positive SPT to TU (31 males; mean age = 29.6 ± 3.9 years) (6).

In the 123 investigated subjects (58 with positive TU SPT, 40 with positive Dp SPT, and 25 healthy non-atopic farmers), the median absorbance values at 420 nm of TU- or Dp-specific IgE levels and total serum IgE levels are reported in Table 1.

There was no difference in total IgE levels between TU+ and Dp+ subjects but both had significantly higher total IgE values ($P < 0.001$) than healthy non-atopic subjects; consistently, TU-specific IgE levels were detected only in TU+ subjects, whereas Dp-specific IgE levels were higher in Dp+ subjects than TU+ subjects and controls (Table 1).

When subjects were stratified according to SPT positivity for TU or Dp and the contemporary presence/absence of current symptoms, we found that among Dp+ subjects the Dp-specific IgE level was significantly higher in the symptomatic than in the non-symptomatic subgroup ($P = 0.003$), whereas TU-specific IgE levels were higher in subjects without symptoms ($P = 0.021$). Likewise, TU-specific IgE levels were significantly more elevated in symptomatic than non-symptomatic TU+ subjects ($P = 0.028$), whereas no difference was observed with regard to Dp-specific IgE levels between the two subgroups (Table 2). Finally, total IgE levels were

Table 1. Total IgE and allergen-specific IgE levels in TU+, Dp+, and control subjects

IgE	TU+ (I, <i>n</i> = 58)	Dp+ (II, <i>n</i> = 40)	Controls (III, <i>n</i> = 25)	<i>P</i> -value*		
				I vs II	I vs III	II vs III
Total	1.85 (1.40–2.70)	1.62 (1.21–2.07)	0.33 (0.25–0.75)	0.0001	NS	< 0.001
TU specific	1.33 (0.81–2.00)	0.17 (0.10–0.33)	0.18 (0.15–0.28)	0.0001	< 0.001	< 0.001
Dp specific	0.80 (0.25–1.40)	1.39 (0.86–1.84)	0.10 (0.10–0.19)	0.0001	< 0.01	< 0.001

Data are expressed as medians with 25th and 75th percentiles.

* *P* significance level by the Kruskal–Wallis *H*-test and the Dunn test for multiple comparisons.

NS = not significant.

Table 2. Total IgE and allergen-specific IgE levels in TU+ and Dp+ subjects, stratified according to concurrent presence (Yes) or absence (No) of symptoms

IgE	TU+		<i>P</i> *	Dp+		<i>P</i> *
	No (<i>n</i> = 28)	Yes (<i>n</i> = 30)		No (<i>n</i> = 20)	Yes (<i>n</i> = 20)	
Total	1.40 (0.70–1.80)	2.40 (1.90–2.88)	< 0.0001	1.32 (0.88–1.79)	1.85 (1.52–2.28)	0.007
TU specific	1.16 (0.80–1.74)	1.75 (0.96–2.18)	0.028	0.21 (0.15–0.59)	0.11 (0.09–0.27)	0.021
Dp specific	0.73 (0.27–1.20)	1.10 (0.22–1.50)	0.354	1.11 (0.72–1.44)	1.70 (1.27–2.00)	0.003

Data are expressed as medians with 25th and 75th percentiles.

* *P* significance level by Mann–Whitney *U*-test.

significantly higher in the symptomatic than non-symptomatic subgroups in both TU+ and Dp+ subjects ($P < 0.0001$ and $P = 0.007$, respectively, Table 2).

When subjects were stratified according to sensitivity (single or multiple), no significant differences were observed with regard to total and allergen-specific IgE levels within each group (TU+ or Dp+). Concern about a possible cross-reaction between TU-specific and Dp-specific IgE was ruled out in a previous work (1). Finally, the logistic regression model using the absence (= 0)/presence (= 1) of symptoms as a dependent variable, and total IgE and TU or Dp-specific IgE serum level as independent variables, showed that total and Dp-specific IgE concentrations were significant predictors of current symptoms in subjects with positive Dp SPTs, whereas only the total IgE concentration held a significant predictive value in TU-positive subjects (Table 3).

Discussion

In this short report, we provide more data from our recent study on the prevalence of TU-induced allergic occupational diseases in greenhouse and open-field farmers (6). Specifically, in our unselected study population,

we defined the association between total IgE and allergen-specific IgE levels and presence/absence of symptoms as well as their role as predictors of symptoms. As would be expected, farm workers with TU sensitization showed higher total IgE levels than non-atopic farmers. These levels were also found to be significantly associated with presence of symptoms. These data are in agreement with those by Burrows et al. (9, 10), who showed that, in a general population sample in Tucson, AZ, the prevalence of rhinitis and asthma was closely related to the level of total serum IgE, with rhinitis being more strictly associated with atopy. Consistent data have been reported by other authors as well, who stressed the association of asthma and hay fever symptoms with increased serum total IgE concentration, this relationship being strongest for asthma (11). These findings are not surprising, since IgE is the trigger of immediate type of allergy when bound by allergen at the surface of mast cells. Thus, it is perfectly reasonable that elevated IgE levels may be associated with occurrence of allergic symptoms. It would also be expected that allergen-specific IgE levels would correlate with symptoms in sensitized subjects. The above speculation has indeed been confirmed in epidemiological studies (12, 13). In our study, elevated Dp- and TU-specific IgE levels were consistently associated with clinical complaints in both Dp+ and TU+ subjects. However, when we investigated by binary logistic regression analysis the predictive value of total IgE and allergen-specific IgE levels for symptom occurrence, total and allergen-specific IgE levels were found to be predictive only in Dp+ subjects. In TU+ subjects, only total IgE levels were significant symptom predictors. Further prospective studies with larger population samples may contribute to better refine the role of allergen-specific IgE in TU+ subjects.

In conclusion, elevated total and allergen-specific IgE levels are associated with symptoms in TU+ subjects. Further studies are required to better define the predictive value of TU-specific IgE on symptom occurrence. It should also be stressed that symptomatic farm workers with high serum IgE levels but no skin reactivity to common allergens should be subjected to further SPT with TU, since this may result useful to identify the cause of their complaints.

Table 3. Binary logistic regression examining the relationship between symptoms as dependent variable (absence = 0; presence = 1), and total IgE and TU- or Dp-specific IgE serum levels as independent variables in TU- or Dp-positive subjects. The coefficients obtained from the logistic regression analyses were also expressed in terms of odds of occurrence of an event

Variable	Regression coefficient	<i>P</i>	OR	CI
TU-positive subjects				
Total IgE	2.028	< 0.0001	7.599	2.437–23.694
Dp-specific IgE	0.490	0.396	1.632	0.526–5.063
TU-specific IgE	0.106	0.876	1.112	0.293–4.224
Intercept	– 4.343			
Dp-positive subjects				
Total IgE	2.146	0.018	8.553	1.452–50.363
Dp-specific IgE	2.346	0.022	10.443	1.408–77.469
TU-specific IgE	– 0.448	0.773	0.639	0.030–13.406
Intercept	– 6.432			

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