

Diarrhea and acaroid mites: A clinical study

Chao-Pin Li, Yu-Bao Cui, Jian Wang, Qing-Gui Yang, Ye Tian

Chao-Pin Li, Yu-Bao Cui, Jian Wang, Qing-Gui Yang, Ye Tian,
Department of Etiology and Immunology, School of Medicine, Anhui
University of Science & Technology, Huainan 232001, Anhui
Province, China

Correspondence to: Dr. Chao-Pin Li, Department of Etiology and
Immunology, School of Medicine, Anhui University of Science &
Technology, Huainan 232001, Anhui Province, China. cpli@aust.edu.cn
Telephone: +86-554-6658770 **Fax:** +86-554-6662469

Received: 2002-12-28 **Accepted:** 2003-02-05

Abstract

AIM: To explore the characteristics of diarrhea caused by
acaroid mites.

METHODS: Acaroid mites in fresh stools of 241 patients
with diarrhea were separated by flotation in saturated saline.
Meanwhile, skin prick test, total IgE and mite-specific IgE
were detected in all patients.

RESULTS: The total positive rate of mites in stool samples
of the patients was 17.01 % (41/241), the positive rates of
mites in male and female patients were 15.86 % (23/145)
and 18.75 % (18/96), respectively, without significant
difference ($P>0.05$). The percentage of skin prick test as
"+++", "++", "+", "±" and "-" was 9.13 % (22/241), 7.47 %
(18/241), 5.81 % (14/241), 4.98 % (12/241) and 72.61 %
(175/241), respectively. The serum levels of total IgE, mite-
specific IgE in patients with and without mites in stool
samples were (165.72±78.55) IU/ml, (132.44±26.80) IU/ml
and (145.22±82.47) IU/ml, (67.35±45.28) IU/ml,
respectively, with significant difference ($P<0.01$). The
positive rate of mites in stool samples in staffs working in
traditional Chinese medicine storehouses or rice storehouses
(experimental group) was 26.74 % (23/86), which was
significantly higher than that (11.61 %, 18/155) in people
engaged in other professions ($\chi^2=8.97$, $P<0.01$).

CONCLUSION: Acaroid mites cause diarrhea and increase
serum levels of total IgE and mite-specific IgE of patients,
and the prevalence of diarrhea caused by acaroid mites is
associated with occupations rather than the gender of patients.

Li CP, Cui YB, Wang J, Yang QG, Tian Y. Diarrhea and acaroid
mites: A clinical study. *World J Gastroenterol* 2003; 9(7):
1621-1624

<http://www.wjgnet.com/1007-9327/9/1621.asp>

INTRODUCTION

Grain or flour mite is a serious and widespread pest of stored
foodstuffs, particularly grain and grain products^[1-10]. Further
studies have shown that some mites with strong vitality not
only live freely, feeding on a wide variety of food, but also
exist in animals or human intestines. After ingesting
contaminated food by mites, like grain and grain products,
individuals might have diarrhea, abdominal pain, burning
sensation around anus and other symptoms of gastrointestinal

tract^[11]. The characteristics of diarrhea caused by acaroid mites
were investigated in 241 patients with diarrhea in this study.

MATERIALS AND METHODS

Patients

Two hundred and forty-one patients with diarrhea (male 145
and female 96, aged from 6 to 58 years) were divided into
experimental group ($n=86$) including staffs working in
traditional Chinese medicine storehouses ($n=47$) and staffs
working in rice storehouses or mills ($n=39$), and control group
($n=155$) including miners ($n=36$), staffs of railway system
($n=34$), pupils ($n=62$) and others ($n=23$).

Reagents

Horse anti-human IgE and standard working solution for IgE
(17 000 IU/ml) were provided by Beijing Institute of Biological
Products, and horse anti-human horseradish peroxidase-IgE
was provided by Third Affiliated Hospital, Shanghai Second
Medical University.

Methods

History-taking, separation of mites from stool samples, skin
prick test and detection of total IgE and mite-specific IgE were
carried out in all 241 subjects.

History-taking Detailed information of each subject was
collected via telephone and personal interview, including age,
gender, present history, anamnesis, symptoms (i.e. abdominal
pain, cramps, diarrhea, urodynia, cloudy urine, and urination
frequency), onset and duration of symptoms, personal
hygienic habits, living conditions and the date of stool
samples collected.

Stool examination The stool samples were collected, the mites
were separated by flotation in saturated saline and identified
under microscope. Stool examination was performed three
times for each person, positive specimens were labeled once
either adult or larval mite, egg, or hypopus was found.

Skin prick test Skin prick test was performed with the
concentration of 1:100 (W/V). After skin was disinfected, a
little of extract (about 0.01 ml) was dripped on skin of the
right forearm flexor, then a sterile needle was pricked into the
skin through the drop of the extract for about 0.5-1 mm in
depth without bloodshed. About 5 cm distal and proximal of
the prick site, normal saline and histamine were used as
negative and positive control, respectively. The mean diameter
of the wheals or areolae was measured 15~20 min after the
test. The reactions of skin prick test with the mean diameter
1.5 mm, 2 mm, 3 mm, 5 mm and 10 mm were
regarded as ±, +, ++, +++ and +++, respectively. Otherwise,
the reaction was judged as negative^[12,13].

The test extract was prepared according to WHO approved
document NIBSC 82/518 in 1984. The purified fraction was
prepared as follows: the mites cultured in initial medium for
several months were frozen and thawed several times. A 48-h
maceration in borate buffer at pH 8.5 was centrifuged. The
supernatant was neutralized and submitted to acetone
precipitation at gradually increasing concentrations. The
fraction precipitated in 80 % acetone was isolated, washed
and dried. The purified extract was lyophilized or stocked in

50 % glycerol and 5 % phenol^[14-16].

Detection of total IgE and mite-specific IgE To investigate humoral immune function in individuals with diarrhea caused by acaroid mites, the levels of total IgE and mite-specific IgE in peripheral blood of mite-positive individuals were tested with ELISA. Peripheral venous blood of the subjects was withdrawn and saved in eppendorf tubes, then the optical density (OD) value was tested on enzyme labeling meters. Positive and negative control tubes were included each time. When the OD value in the tested sample was 2.1 times that or more in negative control, it was regarded as positive.

Mites separated from environment Directcopy, waterenacopy and tullgren were used to separate mites from mill floor dust, stores of traditional Chinese medicine, and traditional Chinese herbs of wolfberry fruit, ophiopogon root liquorice, boat-fruited sterculia seed and safflower, etc.

Statistical analysis

The positive rates were expressed as percentage, and t and χ^2 tests were used in statistical analysis. A probability value of less than 0.05 was considered statistically significant.

RESULTS

Stool examination

The positive rate of mites in stool samples in all the individuals was 17.01 % (41/241), and was 15.86 % (23/145) and 18.75 % (18/96), respectively in samples from male and female subjects, without significant difference ($\chi^2=0.34$, $P>0.05$). The mites separated from stool samples were confirmed to be *Acarus siro*, *Tyrophagus putrescentiae*, *Dermatophagoides farinae*, *D. pteronyssinus*, *Glycyphagus domesticus*, *G. ornatus*, *Carpoglyphus lactis* and *Tarsonemus granaries*. Among 41 cases with mites in stools, adult mites, larval mites, both adult and larval mites, adult mites and eggs, adult and larval mites and eggs, larval mites and eggs, and both hypopus and eggs were found in 15, 6, 11, 3, 2, 2 and 2 cases, and the constituent ratios of them were 36.59 %, 14.63 %, 26.83 %, 7.32 %, 4.88 %, 4.88 % and 4.88 %, respectively. In addition, the statistics of this investigation showed that the case number with concentration of mites of 1-2/cm³, 2-4/cm³ and >5/cm³ was 6, 12 and 23, respectively. Among the 41 mite-positive cases, 3 cases had other intestinal parasites, 6 cases had pathogenic bacteria. The remaining 32 cases had mites in stool samples only.

Skin prick test

The percentages of cases with “+++”, “++”, “+”, “±” and “-” were 9.13 % (22/241), 7.47 % (18/241), 5.81 % (14/241), 4.98 % (12/241) and 72.61 % (175/241), respectively. The positive number of skin prick test was 54, of which, 41 subjects with mites in stools were all included. In other words, all the 22 subjects with “+++” reaction were confirmed to be mite-positive, and 14 subjects with mites in stools were found in the 18 subjects with “++” reactions, 5 subjects with mites in stools were found in the 14 subjects with “+” reaction. However, all the 41 subjects with mites in stools were positive in skin prick test.

Detection of total IgE and specific IgE

The levels of total IgE and mite-specific IgE in 41 cases with mites were higher than those in individuals without mites ($P<0.01$) (Table 1).

Relationship between diarrhea caused by acaroid mites and occupation

Among the 241 patients with diarrhea, the positive rate of mites

in experimental group was 26.74 % (23/86), which was higher than that in control group ($\chi^2=8.97$, $P<0.01$) (Table 2).

Table 1 Serum total IgE and mite-specific IgE in patients with diarrhea (IU/ml, $\bar{x}\pm s$)

Group	<i>n</i>	Total IgE (IU/ml)	Specific IgE (IU/ml)
Mite-positive cases	41	165.72±78.55 ^a	145.22±82.47 ^b
Mite-negative cases	200	132.44±26.80	67.35±45.28
Total	241	138.10±35.37	80.59±53.62

^a $P<0.01$, $t=4.81$; ^b $P<0.01$, $t=8.52$ vs mite-negative cases.

Table 2 Mites in stool samples in patients with different occupations (*n*, %)

Groups	Cases	Positive number	Positive rate
Experimental group	86	23 ^c	26.74
Staffs working in traditional Chinese medicine storehouses	47	14	29.79
Staffs working in rice storehouses or mills	39	9	23.08
Control group	155	18	11.61
Miners	36	4	11.11
Staffs of railway system	34	3	8.82
Pupils	62	8	12.90
Others	23	3	13.04
Total	241	41	17.01

^c $P<0.01$, $\chi^2=8.97$ vs control group.

Mites separated from work environment

Samples of mill floor dust (30 shares), stores of traditional Chinese medicine, and traditional Chinese herbs (146 species) of wolfberry fruit, ophiopogon root liquorice, boat-fruited sterculia seed, safflower and other work environment and foodstuffs were collected and separated for mites. The results showed that the number of breeding mites per gram was 91-1862, 21-186, 0-483, 10-348, 51-712, and 311-1193, in mill floor dust, traditional Chinese medicine stores, traditional Chinese herbs such as candied fruit, dry fruit, brown sugar, and expired cake. Twenty-two species of mites were separated and identified belonging to nine families, i.e. *Acaridae*, *Lardoglyphidae*, *Glycyphagidae*, *Chortoglyphidae*, *Carpoglyphidae*, *Histiostomidae*, *Pyroglyphidae*, *Tarsonemus*, *Cheyletus*. The results of this study showed that the mites separated from work environment were identical to those from stored food.

DISCUSSION

In this study, *Acarus siro*, *Tyrophagus putrescentiae*, *Dermatophagoides farinae*, *D. pteronyssinus*, *Glycyphagus domesticus*, *G. ornatus*, *Carpoglyphus lactis* and *Tarsonemus granaries* were separated from stool of patients with diarrhea. This confirmed that acaroid mites were able to parasitize in human intestines, which might play an important role in diarrhea. Like other intestinal parasites, the mites living in intestinal tract may stimulate mechanically and damage intestinal tissues with its gnathosoma, chelicera and feet^[17-25]. Certainly they may also intrude into mucous and deep tissues, and cause inflammation and necrosis.

The results of this study support the idea that the patients with mites in stool samples are allergic to acaroid mites. Skin

prick test is one of the specific methods for clinical diagnosis of allergic disease. After superficial layer of skin is pierced by a special needle, interaction occurs between the test extract and mastocytes in the skin, which causes mastocytes degranulation and inflammation-media release like histamine that is able to increase capillary telangiectasia and permeability. Thereby wheal and flush appear on the surface of skin tested^[26,27]. Among the 241 patients tested with skin prick test, 54 subjects had positive reactions. This demonstrated that some of the patients with diarrhea were allergic to acaroid mites. Moreover, the results of skin prick test on 41 patients with mites in their stools were all positive. It provided the evidence that acaroid mites in intestine might lead to the allergy of patients to acaroid mites. The reason why there were no mites found in stools taken from 13 patients with positive reaction of skin prick test is that mites live in other locus besides intestines, and that mites may be missed in detection with saturated saline flotation methods.

Although the serum level of total IgE is a marker of human sensitization to extrinsic allergen, the level of specific IgE is a sensitive index for allergic reaction to acaroid mites^[28-34]. In this study, the levels of specific IgE in 41 patients with mites were higher than those without mites. This provides another evidence that acaroid mites can cause allergy. The dejecta, products of metabolism, and cleaved pieces of dead mites in intestine may stimulate lymphocytes and reticuloendothelial system, and produce specific antibodies, such as IgE.

This study confirms that the prevalence of diarrhea caused by acaroid mites was associated with the patients' occupation. The positive rates of mites in stools of staffs working in traditional Chinese medicine storehouses and rice storehouses or mills were 29.79 % (14/47) and 23.08 % (9/39), respectively, which were higher than those of patients with other occupations. However, no significant association was observed between diarrheas caused by the organism with the gender of patients. The positive rates of mites in male and female patients were 15.86 % (23/145) and 18.75 % (18/96), respectively.

Eight species of acaroid mites separated from stool samples could be found in the house dust collected from traditional Chinese medicine storehouses, rice storehouses and flourmills, suggesting that the source of diarrhea caused by acaroid mites is mites in our living environment and stored food. Generally speaking, the path of the mites invading human is related to ingestion of stored food. However, some mites in dust or in air might invade intestine through mouth, or nasal cavity, gorge^[35-37]. We have set up eight sampling sites in traditional Chinese medicine storehouses by dust sampler, and separated thirteen mites from dust samples collected from 640 L of air in work environment of the storehouses.

In conclusion, acaroid mites in our living and working environments may invade human intestines and cause diarrhea. The levels of total IgE, mite-specific IgE of the patients with diarrhea caused by acaroid mites increased, the prevalence was associated with the patient's occupation rather than gender. It is suggested that separation of mites from stool samples, skin prick test and detection of total IgE and mite-specific IgE should be used in the diagnosis of diarrhea caused by acaroid mites.

REFERENCES

- Sun HL**, Lue KH. Household distribution of house dust mite in central Taiwan. *J Microbiol Immunol Infect* 2000; **33**: 233-236
- Cadman A**, Prescott R, Potter PC. Year-round house dust mite levels on the Highveld. *S Afr Med J* 1998; **88**: 1580-1582
- Croce M**, Costa-Manso E, Baggio D, Croce J. House dust mites in the city of Lima, Peru. *Investig Allergol Clin Immunol* 2000; **10**: 286-288
- Arlian LG**, Neal JS, Vyszenski-Moher DL. Reducing relative humidity to control the house dust mite *Dermatophagoides farinae*. *J Allergy Clin Immunol* 1999; **104**: 852-856
- Mumcuoglu KY**, Gat Z, Horowitz T, Miller J, Bar-Tana R, Ben-Zvi A, Naparstek Y. Abundance of house dust mites in relation to climate in contrasting agricultural settlements in Israel. *Med Vet Entomol* 1999; **13**: 252-258
- Arlian LG**, Neal JS, Vyszenski-Moher DL. Fluctuating hydrating and dehydrating relative humidities effects on the life cycle of *Dermatophagoides farinae* (Acari: Pyroglyphidae). *J Med Entomol* 1999; **36**: 457-461
- Raciewicz M**. House dust mites (Acari: Pyroglyphidae) in the cities of Gdansk and Gdynia (northern Poland). *Ann Agric Environ Med* 2001; **8**: 33-38
- Solarz K**. Risk of exposure to house dust pyroglyphid mites in Poland. *Ann Agric Environ Med* 2001; **8**: 11-24
- Sadaka HA**, Allam SR, Rezk HA, Abo-el-Nazar SY, Shola AY. Isolation of dust mites from houses of Egyptian allergic patients and induction of experimental sensitivity by *Dermatophagoides pteronyssinus*. *J Egypt Soc Parasitol* 2000; **30**: 263-276
- Boquete M**, Carballada F, Armisen M, Nieto A, Martin S, Polo F, Carreira J. Factors influencing the clinical picture and the differential sensitization to house dust mites and storage mites. *J Investig Allergol Clin Immunol* 2000; **10**: 229-234
- Li CP**, Wang J. Intestinal acariasis in Anhui Province. *World J Gastroenterol* 2000; **6**: 597-600
- Baratawidjaja IR**, Baratawidjaja PP, Darwis A, Soo-Hwee L, Fook-Tim C, Bee-Wah L, Baratawidjaja KG. Prevalence of allergic sensitization to regional inhalants among allergic patients in Jakarta, Indonesia. *Asian Pac J Allergy Immunol* 1999; **17**: 9-12
- Yun YY**, KO SH, Park JW, Lee IY, Ree HI, Hong CS. Comparison of allergenic components between German cockroach whole body and fecal extracts. *Ann Allergy Asthma Immunol* 2001; **86**: 551-556
- Nuttall TJ**, Lamb JR, Hill PB. Characterization of major and minor *Dermatophagoides* allergens in canine atopic dermatitis. *Res Vet Sci* 2001; **71**: 51-57
- Basomba A**, Tabar AI, de Rojas DH, Garcia BE, Alamar R, Olaguibel JM, del Prado JM, Martin S, Rico P. Allergen vaccination with a liposome-encapsulated extract of *Dermatophagoides pteronyssinus*: a randomized, double-blind, placebo-controlled trial in asthmatic patients. *J Allergy Clin Immunol* 2002; **109**: 943-948
- Akçakaya N**, Hassanzadeh A, Camcioglu Y, Cokugras H. Local and systemic reactions during immunotherapy with adsorbed extracts of house dust mite in children. *Ann Allergy Asthma Immunol* 2000; **85**: 317-321
- Van der Geest LP**, Elliot SL, Breeuwer JA, Beerling EA. Diseases of mites. *Exp Appl Acarol* 2000; **24**: 497-560
- Zhou X**, Li N, Li JS. Growth hormone stimulates remnant small bowel epithelial cell proliferation. *World J Gastroenterol* 2000; **6**: 909-913
- Fryauff DJ**, Prodjodipuro P, Basri H, Jones TR, Mouzin E, Widjaja H, Subianto B. Intestinal parasite infections after extended use of chloroquine or primaquine for malaria prevention. *J Parasitol* 1998; **84**: 626-629
- Zhou JL**, Xu CH. The method of treatment on protozoon diarrhea. *Shijie Huaren Xiaohua Zazhi* 2000; **8**: 93-95
- Herwaldt BL**, de Arroyave KR, Wahlquist SP, de Merida AM, Lopez AS, Juranek DD. Multiyear prospective study of intestinal parasitism in a cohort of Peace Corps volunteers in Guatemala. *J Clin Microbiol* 2001; **39**: 34-42
- Fan WG**, Long YH. Diarrhea in travelers. *Shijie Huaren Xiaohua Zazhi* 2000; **8**: 937-938
- Feng ZH**. Application of gene vaccine and vegetable gene in infective diarrhea. *Shijie Huaren Xiaohua Zazhi* 2000; **8**: 934-936
- Xiao YH**. Treatment of infective Diarrhea with antibiotic. *Shijie Huaren Xiaohua Zazhi* 2000; **8**: 930-932
- Komatsu S**, Nimura Y, Granger DN. Intestinal stasis associated bowel inflammation. *World J Gastroenterol* 1999; **5**: 518-521
- Davis MD**, Richardson DM, Ahmed DD. Rate of patch test reactions to a dermatophagoides mix currently on the market: a mite too sensitive? *Am J Contact Dermat* 2002; **13**: 71-73
- Obase Y**, Shimoda T, Tomari SY, Mitsuta K, Kawano T, Matsuse H, Kohno S. Effects of pranlukast on chemical mediators in induced sputum on provocation tests in atopic and aspirin-intolerant asthmatic patients. *Chest* 2002; **121**: 143-150

- 28 **Silva DA**, Gervasio AM, Sopelete MC, Arruda-Chaves E, Arruda LK, Chapman MD, Sung SS, Taketomi EA. A sensitive reverse ELISA for the measurement of specific IgE to Der p 2, a major Dermatophagoides pteronyssinus allergen. *Ann Allergy Asthma Immunol* 2001; **86**: 545-550
- 29 **Pumhirun P**, Jane-Trakoonroj S, Wasuwat P. Comparison of *in vitro* assay for specific IgE and skin prick test with intradermal test in patients with allergic rhinitis. *Asian Pac J Allergy Immunol* 2000; **18**: 157-160
- 30 **Nahm DH**, Kim HY, Park HS. House dust mite-specific IgE antibodies in induced sputum are associated with sputum eosinophilia in mite-sensitive asthmatics. *Ann Allergy Asthma Immunol* 2000; **85**: 129-133
- 31 **Walusiak J**, Palczynski C, Wyszynska-Puzanska C, Mierzwa L, Pawlukiewicz M, Ruta U, Krakowiak A, Gorski P. Problems in diagnosing occupational allergy to flour: results of allergologic screening in apprentice bakers. *Int J Occup Med Environ Health* 2000; **13**: 15-22
- 32 **Kanceljak-Macan B**, Macan J, Buneta L, Milkovic-Kraus S. Sensitization to non-pyroglyphid mites in urban population of Croatia. *Croat Med J* 2000; **41**: 54-57
- 33 **Morsy TA**, Saleh WA, Farrag AM, Rifaat MM. Chironomid potent allergens causing respiratory allergy in children. *J Egypt Soc Parasitol* 2000; **30**: 83-92
- 34 **Chew FT**, Lim SH, Goh DY, Lee BW. Sensitization to local dust-mite fauna in Singapore. *Allergy* 1999; **54**: 1150-1159
- 35 **Paufler P**, Gebel T, Dunkelberg H. Quantification of house dust mite allergens in ambient air. *Rev Environ Health* 2001; **16**: 65-80
- 36 **Roux E**, Hyvelin JM, Savineau JP, Marthan R. Human isolated airway contraction: interaction between air pollutants and passive sensitization. *Am J Respir Crit Care Med* 1999; **160**: 439-445
- 37 **Ponsonby AL**, Kemp A, Dwyer T, Carmichael A, Couper D, Cochrane J. Feather bedding and house dust mite sensitization and airway disease in childhood. *J Clin Epidemiol* 2002; **55**: 556-562

Edited by Ren SY and Wang XL