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• CLINICAL RESEARCH •

Acaroid mite, intestinal and urinary acariasis

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Abstract

AIM: To investigate epidemiology and pathogenic mite species of intestinal and urinary acariasis in individuals with different occupations.

METHODS: A total of 1994 individuals were tested in this study. History collection, skin prick test and pathogen identification were conducted. The mites were isolated from stool and urine samples by saturated saline flotation methods and sieving following centrifugation, respectively.

RESULTS: Among the 1994 individuals examined, responses to the skin prick test of "+++", "++", "+","±" and "-" were observed at frequencies of 3.96 % (79), 3.21 % (64), 2.31 % (46), 1.25 % (25) and 89.27 % (1780), respectively. A total number of 161 (8.07 %) individuals were shown to carry mites, with 92 (4.61 %) positive only for stool samples, 37 (1.86 %) positive only for urine samples and 32 (1.60 %) for both. The positive rate of mites in stool samples was 6.22 % (124/1994), being 6.84 % (78/1140) for males and 5.39 % (46/854) for females. No gender difference was observed in this study (χ^2=1.77, P>0.05). The mites from stool samples included *Acarus siro*, *TyroPhagus putrescentiae*, *Dermatophagoides farinae*, *D. pteronyssinus*, *Glycyphagus domesticus*, *G.ornatus*, *Carpoglyphus lactis and Tarsonemus granaries*. The positive rate of mites in urine samples was 3.46 % (69/1994). The positive rates for male and female subjects were found to be 3.95 % (45/1140) and 2.81 % (24/854) respectively, with no gender difference observed (χ^2=1.89, P>0.05). Mites species in urine samples included *Acarus siro*, *Tyrophagus putrescentiae*, *T. longior*, *Aleuroglyphus ovatus*, *Caloglyphus berlesei*, *C. mycophagus*, *Suidasia nesbitti*, *Lardoglyphus konoi*, *Glycyphagus domesticus*, *Carpoglyphus lactis*, *Lepidoglyphus destructor*, *Dermatophagoides farinae*, *D. pteronyssinus*, *Euroglyphus magnei*, *Caloglyphus hughesi*, *Tarsonemus granarus* and *T. hominis*. The species of mites in stool and urine samples were consistent with those separated from working environment. A significant difference was found among the frequencies of mite infection in individuals with different occupations (χ^2=82.55, P<0.001), with its frequencies in those working in medicinal herb storehouses, those in rice storehouse or mills, miners, railway workers, pupils and teachers being 15.89 % (68/428), 12.96 % (53/409), 3.28 % (18/549), 2.54 % (6/236), 5.10 % (13/255) and 2.56 % (3/117), respectively.

CONCLUSION: The prevalence of human intestinal and urinary acariasis was not associated with gender, and these diseases are more frequently found in individuals working in medicinal herb, rice storehouses or mills and other sites with high density of mites. More attention should be paid to the mite prevention and labor protection for these high-risk groups.

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INTRODUCTION

Various species of mites often infest stored foodstuffs and various drugs, and cause losses in food and drug products, especially in humid and warm area[1-9]. They are small creatures of about half a millimeter in body size and creamy white in color, proving difficult to be detected from drugs and food products. Therefore, the incidence of various forms of human acariasis presumably caused by the ingestion of mite-infested food is unusually high in China[10]. In this study we investigates the epidemiological characteristics and pathogenic mite species of intestinal and urinary acariasis in individuals with different occupations in Anhui Province.

MATERIALS AND METHODS

Population

A total of 1994 subjects with the average age of 35 years (6-63 years), 1 140 males and 854 females, were examined in this study, including medicinal herb storehouse workers (n=428), rice storehouse or mill workers (n=409), miners (n=549), railway workers (n=236), pupils (n=255) and teachers (n=117). Special attention was paid to individuals with intestinal or/and urinary symptoms.

Methods

History collection, skin prick test and etiological examination were carried out on the 1994 subjects.

History collection A questionnaire, administered by a nurse, was used to collect information from each subject investigated. Information was collected by means of in-person, telephone, interview, including age, gender, history of present illness, anamnesis, symptomatology (i.e. abdominal pain, diarrhea, abdominal cramps, urethremorrhage, urodynia, cloudy urine, frequency of micturition), onset date and duration of symptoms, personal habits, living environmental hygiene and the date of stool and urine sample collection.

Skin prick test Skin prick test were performed with the concentrations of 1:100 (W/V) of the test extract. After skin disinfection, a little of extract (about 0.01 ml) was dripped on skin surface of right forearm flexor, then a special disinfectant needle was used to prick into the skin through the drop of the extract. The depth of needle in skin was limited about 0.5-1 mm and there was no bloodshed. About 5 cm apart from the extract drop, normal saline in proximal and histamine in distalis were used for negative and positive control solution. The mean diameter of the wheals or areolae was measured 15-20 min after the test. The reactions with the mean diameter up to 1.5

mm, 2 mm, 3 mm, 5 mm and 10 mm were regarded as ±, +, ++, +++ and ++++, respectively.

The test extract was made according to NIBSC82/518 approved by World Health Organization (WHO) in 1984. The purified fraction was prepared as follows: the mites were then frozen and thawed several times after having been cultured in the initial medium for several months. A 48-hr maceration in a borate buffer (pH 8.5) was followed by centrifugation. The supernatant was neutralized and submitted to precipitation with a series of acetone. The fraction precipitated at 80 % acetone was isolated, washed and dried. This purified extract was lyophilized or stored as a solution in the presence of 50 % glycerol and 5 % phenol[11-14].

Etiological examination All individuals were asked to provide stool and urine samples for etiological examination. Mites in stool samples were separated by saturated saline flotation methods, and the mites were identified under microscope. Each stool sample was examined for three times Specimens containing adult or larval mites, eggs, or hypopus were considered positive.

Samples of the first urine in the morning and 24 hours' urine of all individuals were collected for separation of mites. After centrifugation and filtration with a copper sieve, they were examined under a microscope for adult or larval mites, eggs or hypopus.

Blood examination Leukocytes were also counted and sorted in 30 patients with mites detected.

Detection of mites from working environment Directicopy, waterenacopy and tullgren were used to identify mites from mill floor dust, stores of medicinal herbs including wolfberry fruit, ophiopogon root liquorice, boat-fruited sterculia seed and safflower.

Colonoscopy After defecation, the patients with mites found in their stools were examined by routine colonoscopy.

Cystoscopy After emiction, the patients with mites detected in their urine were examined by routine cystoscopy.

Statistical analysis

The positivity rates were expressed as percentages, and the statistical analysis was carried out by using χ^2 test. A probability value of less than 0.05 was considered statistically significant.

RESULTS

Skin prick test

The skin prick test was definitely positive in 189 subjects, with the results "+++", "++", "+", "±" and "-" observed in 79 (3.96 %), 64 (3.21 %), 46 (2.31 %), 25 (1.25 %) and 1 780 (89.27 %), respectively among the 1994 individuals examined.

Etiological examination

Of 1994 individuals investigated, mites were detected from stool or/and urine samples in 161 (8.07 %) subjects, with the positive rates in stool, urine and in both being 4.61 % (92), 1.86 % (37) and 1.60 % (32), respectively.

The positive rate of mites in stool samples was 6.22 % (124/1 994), with that for male and female subjects being 6.84 % (78/1 140) and 5.39 % (46/854), respectively. No gender difference was found in this series (χ^2=1.77, P>0.05). The mites from stool samples included *Acarus siro*, *TyroPhagus putrescentiae*, *Dermatophagoides farinae*, *D. pteronyssinus*, *Glycyphagus domesticus*, *G.ornatus*, *Carpoglyphus lactis* and *Tarsonemus granaries*. Among 124 cases with mites in stool samples, 54 (43.55 %) were positive for adult mites, 13 (10.48 %) for larval mites, 43 (34.68 %) for both adult and larval mites, 3 (2.42 %) for both adult mites and eggs, 6 (4.84 %) for adult and larval mites and eggs, 3 (2.42 %) for both larval mites and eggs and 2 (1.61 %) for both hypopus and eggs. Mite concentration was also estimated, being 1-2 /cm^3, 2-4 /cm^3 and >5 /cm^3 in 6, 30 and 88 cases, respectively.

Totally, mites were detected from urine samples at a frequency of 3.46 % (69/1 994). The positive rate for male and female subjects were 3.95 % (45/1140) and 2.81 % (24/854), respectively, with no gender difference found in this series (χ^2=1.89, P>0.05). The mites in urine samples were separated and identified, including *Acarus siro*, *Tyrophagus putrescentiae*, *T. longior*, *Aleuroglyphus ovatus*, *Caloglyphus berlesei*, *C. mycophagus*, *Suidasia nesbitti*, *Lardoglyphus konoi*, *Glycyphagus domesticus*, *Carpoglyphus lactis*, *Lepidoglyphus destructor*, *Dermatophagoides farinae*, *D. pteronyssinus*, *Euroglyphus magnei*, *Caloglyphus hughesi*, *Tarsonemus granarus* and *T. hominis*. Among the 69 positive cases, 19 cases (27.54 %) were found to be positive for adult mites, 18 (26.09 %) for larval mites, 11 (15.94 %) both adult and larval mites, 3 (4.35 %) for adult mites and eggs, 11 (15.94 %) adult and larval mites and eggs, 6 (8.70 %) for larval mites and eggs, and 1 (1.44 %) for both hypopus and eggs. The mite concentrations were shown to be <0.5 /ml, 0.6-1 /ml, 1.1-1.5 /ml and >1.5 /ml, respectively, in 32, 25, 10 and 2 cases, reflecting the verity infectiosity of mites among different individuals.

Relationship between skin prick test and etiological examination

The results of etiological examination are correlative to skin prick test. One hundred and sixty-one of the 189 cases (85.19 %) positive skin-prick reaction were found to be positive for mites in their stool or / and urine samples. The intensities of the skin prick reaction were also found to be associated to mite concentrations in stool or / and urine samples, with the reactions "+++", "++" and "+" corrective to 100 % (79/79), 90.63 % (58/64) and 37.50 % (24/46), respectively.

Blood examination

Leukocytes were counted and sorted in so cases, most of them being in the range of (5.55-10.4)×10^9/L with the exception of 4 cases [(11.0-12.9)×10^9/L]. The esoinophilic granulocyte count was high [(0.32-0.78)×10^9/L]. The average value of constituent ratio of eosinophilic granulocyte was 0.09 (0.04-0.11) and was higher than the normal range (P<0.01).

Mites separated from working environment

The samples of mill floor dust (30 shares), stores of medicinal herbs (146 species) including wolfberry fruit, ophiopogon root liquorice, boat-fruited sterculia seed, safflower and other working environmental foodstuffs were collected and used for mites isolation. Numbers of mites per gram were shown to be 91-1862, 21-186, 0-483, 10-348, 51-712, and 311-1193, in mill floor dust, traditional Chinese medicine stores, traditional Chinese herbs including candied fruit, dry fruit, brown sugar, and expired cake. Twenty-two species, from 9 families of mites were separated and identified out of them, including *Acaridae*, *Lardoglyphidae*, *Glycyphagidae*, *Chortoglyphidae*, *Carpoglyphidae*, *Histiostomidae*, *Pyroglyphidae*, *Tarsonemus*, *Cheyletus*. The mite species isolates from working environmentwere were shown to be similar to those from stored food staffs.

Relationship between acariasis and occupation

Of the 1994 subjects investigated, mites were detected in 68 individuals (15.89 %) working in traditional Chinese medical storehouses, and 53 rice storehouse or mill workers 53 (12.96 %), being higher than those with other occupations (Table 1).

Table 1 Prevalence of intestinal and urinary tract mite infection in individuals with different occupations

Occupations	*n*	Only in stool		Only in urine		Both in stool and urine		Total	
		n	%	*n*	%	*n*	%	*n*	%
Traditional medical storehouse workers	428	32	7.48	24	5.61	12	2.80	68	15.89[a]
Rice storehouse or mill workers	409	28	6.85	12	2.93	13	3.18	53	12.96[a]
Miners	549	16	2.91	0	0	2	0.36	18	3.28[a]
Railway workers	236	5	2.12	0	0	1	0.42	6	2.54[a]
Pupils	255	9	3.53	1	0.39	3	1.18	13	5.10[a]
Teachers	117	2	1.71	0	0	1	0.85	3	2.56[a]
Total	1994	92	4.61	37	1.90	32	1.65	161	8.07

[a]χ^2=82.55, P<0.001.

Colonoscopy

Colonoscopy performs in 16 patients with mites found only in stool, showing pale intestinal wall, punctate ulcer, and exfoliated cell from intestinal wall. In addition, live mites and eggs were observed in tissues, especially in marginal zone of ulcer.

Cystoscopy

Cystoscopy was performed in the 11 patients with mites only found in urine samples, showing Pachymucosa, uroepithelial hyperplasia, lymphocyte and plasmaocyte infiltration in membrana propria and a lot of dense pink abscess in the trigone. In addition, trabecularism of inner wall of urinary bladder changed slightly, local of lateral wall was congestive, and blood capillary was also congestive and dilated. By cystoscopy, 4 adult mites were found in 3 of 11 subjects, which were identified to be *Lardoglyphus konoi*, *Euroglyphus magnei*, *Tarsonemus granarus*, and neither larval mite nor egg was found.

DISCUSSION

The acaroid mite is a kind of arthropod and its geographic distribution appears to be global[15,16]. Acaroid mites infestation is a well-known problem for stored grain, often influencing quality and hygienic condition of the grain[1-9]. However, little is known about acariasis. Acaroid mite can survive in many environments including the storehouse, human and animal bodies. Its infestion in human can cause acariasis in several organs including the lung, intestine and urinary tract[17-26].

In this study, mites were identified in 124 of the 1994 stool samples. The mite species observed in stool samples included *Acaridae*, *Glycyphagidae*, *Carpoglyphidae*, *Pyroglyphidae and Tarsonemus*, being in accordance with those found in the working places of the patients. This confirmed that mites being able to live in intestinal tract and causing intestinal acariasis were transmitted through living environment and stored foods. The respiratory infection through the polluted air may also be an alternative pathway. Eight sampling sites had been set up in a traditional Chinese medicine plant, and 13 mites had been isolated from the dust samples collected from the 640 L volume of air in the working environment of the plant. When dust with mites ingested, some of mites might go into intestine through mouth, nasal cavity or gorge. The mites living in intestinal tract may stimulate mechanically and damage intestinal tissues with its gnathosoma, chelicera, feet, and other structures[27,28]. In addition, they may also intrude into mucous layer and deep tissues, and cause necroinflammation and ulcers[29-33]. This has been approved in this study by colonoscopy, with spotty necrosis, petechial hemorrhage and ulcer observed. The most frequent symptoms of the intestinal acariasis were abdominal pain, diarrhea and pyohemofecia [10, 34,45].

Urinary acariasis was caused by mites parasitizing in human urinary tract. Mite isolation from urine is essential for its diagnosis. In the present study, 1994 individuals with different occupation were surveyed 69 patients found from their urine samples, 17 mite species were identified, with most of them being *Acaridida*. Apparently the pathogenic mites come from environment. Regarding the transmission path, the following possibilities have been proposed. First, the insects may enter the urinary tract by crawling from vulva. Second, they may enter the body through skin and reach urinary tract in some way. Third, mites in respiratory or alimentary system may enter the blood circulation, and reach kidney and urinary tract[46-50]. Acarid in human urinary system may damage urethral epithelia, for the mites are good at digging. Furthermore, they can also invade loose connective tissue and small blood vessel in urinary tract, and caused an ulcer. Under cystoscopy, a lot of dense pink abscess were found in trigone of urinary bladder in this study.

The incidence of intestinal and urinary acariasis was shown in this study to vary greatly and was linked to occupations, being higher in individuals working in traditional Chinese medicine (16 %) and rice storehouses or mills (13 %) than in those with other occupations (2.5-8.1 %). The densities of mites in traditional Chinese medicine and rice storehouses were shown to be high. When peoples exposed to these environment for a long time, the possibility to be infected may be greater than those in environments with low densities of mites. It is important to note that some patients with acariasis have habits of having teas immersed by traditional Chinese herbs, such as Liriope longipedicellata, Radix glycyrrhizae, boat-fruited sterculia seed, and eating dried kern like dateplum persimmon, candied jujube and Crataegus cuneata. Therefore, the prevalence of acariasis was related to personal habits and densities of mites in working environment and stored foodstuffs.

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