HISTOPATHOLOGICAL EFFECTS OF THE FLOUR MITES, ACARUS SIRO ON THE SMALL INTESTINE OF WISTER RATS

ABSTRACT:

The present study is conducted to investigate the effect of the flour mite extract namely Acarus siro on the small intestinal tissues. Eighteen female albino rats were orally intubated with 0.2 ml/g bw of the mite’s extract 1day/week for 1, 2, and 3 months. The control group was orally intubated with 0.2 ml of the solvent (phosphate saline solution). Rats were dissected after treatment and the small intestines were removed and processed for histopathological study. The results showed histopathological lesions in the intestinal tissues such as necrosis and degeneration in the epithelial cells lining the villi, increase in the number and size of some goblet cells and focal degeneration in others, degeneration and atrophy in the crypt’s cells, flatness in the villi and edema in the tissue, invasion of inflammatory cells and diffusion of mucous in the intestinal cavity. The present study indicates that prolonged ingestion of mite-contaminated foods causes various alterations in the small intestinal tissues of rats.

INTRODUCTION:

Allergic diseases are increasing worldwide and mites are one of the most common causes of allergy (Olsson and Van Hage Hamsten, 2000).

Storage mites are recognized as a source of allergens by inhalation in certain occupational environments and in the domestic environment. They affected a wide range of food stuff such as grain, dried fruits, cheese and cereals. Thind and Clarke (1999) detected mites from the genera Acarus, Lepidoglyphus, and Tyrophagus in cereal-based food products including baby food, biscuits and flour. Matsumoto et al. (1996) reported two cases of systemic anaphylaxis in children resulting from the ingestion of food contaminated with large numbers of storage mites. Systemic allergic reactions following ingestion of mite-contaminated food have been reported (Erben et al., 1993; Blanco et al., 1997; Sanchez-Borges et al., 1997; Matsumoto et al., 2001; Matsumoto and Satoh, 2004).

The present investigation aimed to study the effect of ingestion of storage mites Acarus siro in the small intestine of albino rats.

MATERIALS AND METHODS:

Mite extraction:

A pure extract of the flour mite named Acarus siro was prepared containing approximately 300 mites/1ml of neutralized phosphate saline solution.

Experimental animals:

Twenty four female Wister rats were obtained from the animal house of King Fahd researches center, Jeddah K.S.A., aging from 3-6 weeks and weighing 80-120 g. Experimental animals were divided into four groups; six rats each. The first group (C) served as control, while the other groups G1, G2, and G3 constituted the experimental groups. Animal were housed in plastic cages with stainless-steel top, had free access to feed and water ad-libidum. Cages were cleaned daily and the sawdust bedding replaced. The animals were kept at 27 ± 2° C temperature and 60-80 % RH.

KEY WORDS:

Flour mites, Acarus siro, histopathology, small intestine.

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Experiment:

Experimental groups G₁, G₂, and G₃ were intubated orally with 0.2 ml/g bw of Acarus siro extract 1 day/week for 1, 2, and 3 months, respectively. The control group (c) received 0.2 ml/g bw phosphate saline solution.

Histopathological study:

Both control and treated rats were dissected after one, two, and three months of treatment, respectively. Small intestines were excised each month, fixed in 10% neutral formalin solution in separate labeled containers and processed for histological study using standard procedures. Tissues were stained with Haematoxylin-Eosin.

RESULTS:

Different apparent symptoms were noticed in rats treated with A. siro extract such as sneezing which lasted for 30 minutes after treatment then disappeared, wheezing, dyspnea, streaming eyes and nose, excessive appetite, and some case of diarrhea.

Examination of sections of small intestine of treated animals showed many changes in comparison with (Fig. 1).

3). Atrophy was observed in some cells of the intestinal crypts which led to narrowness in their lumen and focal degeneration in others, edema appeared in the tissue, inflammatory cells increased and some red blood cells showed malformation. A disturbance in the muscularis mucosa and increase thickness in the blood vessel wall was observed (Fig. 4).

Fig. 2. Photomicrograph of small intestine in treated rats after 1 month (G₁) showing detachment (arrows) of the tissue at the top of the villi (Vi), increase of inflammatory cells in the villous cavity (head arrow) and mucous (Mu) in the intestinal cavity (IC).

Fig. 3. Photomicrograph of small intestine in treated rats after 1 month (G₁) showing detachment (arrows) of the tissue at the top of the villi (Vi), increase of inflammatory cells in the villous cavity (head arrow) and mucous (Mu) in the intestinal cavity (IC).
Fig. 4. Photomicrograph of small intestine in treated rats after 1 month (G1) showing enlarged part of intestinal crypts (CL), focal degeneration in some crypts cells (FD) and atrophy in others (arrows), increase in size of goblet cells (GC), narrowing in its lumen (head arrow), edema in the tissue (E), malformation in some red blood cells (RBm), invasion of inflammatory cells, disturbance of the muscularis mucosa (Mcl.M) and thickness in the blood vessel wall (BV).

After the second month of treatment (G2) the previous changes continued with increased severity. These lesions include: destruction in the villi and degeneration of its epithelial lining which led to reduction in the villous length and degeneration of intestinal crypts at the base of the villi, hemorrhage in the lamina propria with mucous in the intestinal cavity and increased inflammatory cells (Fig. 5). Hyperplasia was observed in the epithelial layer with proliferation and necrosis with diffusion of inflammatory cells (Fig. 6). Moreover, an increase in the thickness of muscle layer, atrophy in lymphatic nodules with increased number of inflammatory cells, and increase in the number of goblet cells was obvious (Fig. 7).

After three months of treatment (G3), both epithelial cells and goblet cells were invaginated into the villous cavity (Fig. 8), malformation and flatness in the villi which reduced the number of normal villi, focal degeneration in some crypts cells and narrowness of its lumen, invasion of inflammatory cells and increase in the number of goblet cells, severe malformation occurred in the whole tissue and resulted in losing the normal structure of the villi (Fig. 9).

Fig. 5. Photomicrograph of small intestine in treated rats after 2 months (G2) showing: destruction (arrow) and degeneration (D) in the villi (Vi), disturbance in the epithelial cells (EP), hemorrhage in the villous cavity (H), increased mucous (Mu) and increased inflammatory cells (I), degeneration of the intestinal crypts (D).

Fig. 6. Photomicrograph of small intestine in treated rats after 2 months (G2) showing: enlarged part of the villi (Vi), hyperplasia (HP) and proliferation in the epithelial cells (EP) with necrosis in some cells (N), degeneration (D) in the tissue, edema (E), diffusion of inflammatory cells and red blood cells accumulation (RB).
DISCUSSION:

In the present study, some apparent changes were recorded in experimental animals after each treatment with the A. siro extraction such as wheezing, dyspnea, streaming eyes and nose. These results are in agreement with previous studies on some patients that developed wheezing, dyspnea few minutes after eating food affected with storage mites (Bernd et al., 2001; Matsumoto et al., 2001). Several studies reported anaphylaxis and same symptoms caused by ingestion of mites-contaminated food (Erben et al., 1993; Matsumoto et al., 1996; Blanco et al., 1997; Sanchez-Borges et al., 1997; Matsumoto & Satoh, 2004). These previous reports indicated that mite allergenicity persists despite the cooking process (Sanchez-Borges et al., 2005).

The present results showed necrosis in the epithelial cells lining the villi, similar reports were recorded previously by Aganu et al. (2003) and Sokar et al. (2003) after treating rats with the extraction of Steganotenia araliacea and Herniaria cinerea, respectively. The present results showed disturbance and degeneration in the epithelial lining. Mahdi (1995) reported same results in the epithelial lining the large intestine after treating rats with some chemical drugs. Moreover, the present data recorded edema in the tissue and invasion of inflammatory cells. These observations confirm those of Ching et al.
(2005) who recorded edema in the stomach and inflammatory cells aggregation after treating rats with Bright-Red & Egg-Yellow colorants.

Li et al. (2003) reported that colonoscopy of individuals affected with intestinal acarasis, brought out pale intestinal wall, punctuate ulcer and exfoliated cell from intestinal wall. Manoj-Kumar et al. (2000) reported that chewing areca nut in human causes significant alterations and could lead to malabsorption of nutrients in the intestinal epithelial cell lining which plays an important role in digestion and absorption functions.

The present study proved that oral treatment with 0.2 ml of A. siro extract for one, two, and three months led to various histopathological changes in the small intestine. The symptoms appeared after the first month and increased with the period of treatment, these changes may be due to the metabolic and toxic substances in the mite’s extraction. Millian et al. (2004) reported that proteins found in the metabolic waste products excreted in the feces by mites are the cause of the allergy reaction. The reason is that some mites allergens are enzymes (cysteine proteases and serine protease) that induce direct damage to airway and gastrointestinal mucosa. The hemorrhage, degeneration and destruction of the villi emphasize the circulation of the mites extraction in the villous cavity and its diffusion through the epithelial lining and the intestinal glands. Mucous decreased in the intestinal cavity as a defense mechanism to get rid of the strange substance in the body and because of goblets cells which increased in number and activity. Villous flatness reduced the number of normal villi and ceased their mechanical movement which led to incomplete digestion and absorption (Miike and Kita, 2003).

CONCLUSION:
Ingestion of storage mite-contaminated foods causes various symptoms, as well as different histopathological changes in the small intestine. Concern should be paid to storage mites and steps should be taken to avoid their presence in food.

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التأثيرات المرضية النسيجية لحلم الدقيق "أكوس سيرو" على الامعاء الدقيقة للجرذان

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يشمل هذا البحث دراسة تأثير تناول مستخلص حلم الدقيق أكوس سيرو على الامعاء الدقيقة للجرذان. تم معاملة ثمانية عشر جرذان على طريق الفم باستخدام نسب potrà العالية بواسطة مستخلص الحلم بكمية 0.2 مل/جم من وزن الجسم وذلك مرة واحدة أسبوعيا لمدة شهرين. وثلاثة أسابيع من المجموعة المختبرية تم عد ووزن كل جرذان من المجموعة المختبرية. وتم تشكيل المجموعة المختبرية للجرذان وثبت العناية بالجرذان. وتمت تقييم العودة إلى الامعاء الدقيقة للجرذان.

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