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Importance of Household Cleaning Practices for the Removal of House Dust Mite Allergens at Home: A Study

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Abstract

House is a place where people live and carry out different activities. Accumulation of dust is an outcome of various kinds of activities and movements in and out of the house. These dust particles contain minute organisms called “house dust mite” which are microscopic in nature and cause allergic symptoms. HDMs are found in settled dust of furniture and furnishings in indoors. These are higher in number where there is high humidity and low light intensity. The main reasons for their occurrence are improper ventilation and faulty cleaning practices. The objective of the present investigation is to study the nature of household cleaning pattern adopted by the homemakers. The study also seeks to find out the concentration of HDMs in indoors. Moreover, the study also ascertains the awareness of respondents regarding factors responsible for the growth of HDMs and their management. Higher concentration of HDMs was found in living room. HDMs proliferation depends on microclimatic factors and season such as temperature, relative humidity, air flow rate and light intensity. Significant relationship was found between microclimatic factors (temperature, relative humidity and light intensity) and HDMs during rainy period. Various HDMs related complications faced by the homemakers were asthma, skin rashes, coughing, fatigue, headache etc. Few of the respondents had severe complications related to HDMs although homemakers had awareness regarding microorganism, but they were not aware of HDMs.

***Key words*:** HDMs, Microorganism, Relative humidity, Air flow rate, Light intensity

House is the place where people live and carry out different activities which leads to accumulation of dust in the house. These dust particles contain minute (microscopic) organisms called ‘house dust mites’ which are a serious common indoor pollutant. They are found in high densities where there is more humidity, low light intensity, high air flow rate, improper ventilation, unhygienic or faulty cleaning practices, improper waste disposal, overcrowding, increased gadgets, poor housing conditions, pets etc. Most of the inmates are not aware of these pollutants and unconsciously easily become victim of its health hazards. Hence, hygienic practices for cleaning indoor environment and proper waste disposal will be helpful in mitigating dust mites. The mite densities are found higher in living, dining, bedroom, kitchen and bathroom where the humidity is high and rooms suffer from low light intensity.

Cleaning involves heavy physical labour and lot of time is spent in keeping the house spic and span, hence daily, weekly, periodical or seasonal cleaning is done which help in getting rid of household pests. In a house, inefficient cleaning can create dust accumulation in the household furnishings, mattress, carpet, curtains, soft toys, upholstered furniture and flooring, kitchen corners etc. The dust from these furnishings cannot be removed by normal cleaning procedures; it requires effective housekeeping practices for day-to-day cleaning. Even after long and rigorous cleaning time, both live mites and dust remain and the absence of the cleaning may develop high mite population in household furnishings, which are responsible for the infestation of house dust mite problems. The respiratory allergies are caused by the inhalation of dead or living mites, their faecal matter or other by products. House dust mites are also responsible for causing asthma, rhinitis and contact dermatitis.

Most of the diseases today are attributed to genetics, poor hygiene and environment pollution. The causative factors for this changing pattern are rapid urbanization, western lifestyles and changes in our traditional food habits, outdoor as well as indoor air pollution. The U.S. Government Environmental Protection Agency (EPA) warns people that "Most people are aware that outdoor air pollution can damage their health but may not know that indoor air pollution can also have significant effects”. EPA studies of human exposure to air pollutants indicate that indoor air levels of many pollutants may be 2-5 times and occasionally more than 100 times higher than outdoor levels (www.indoorpollution.com, 2008). According to the World Development Report in 1997, 1.5 billion people live exposed to dangerous levels of air pollution, 1 billion live without clean water and 2 billion live without sanitation [1].

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Research investigating human exposures to priority pollutants has suggested that settled house dust might be a significant source for indoor air quality [2]. Exposure to dust and its associated contaminant load may be of particular concern for children who tend to play or crawl on the floor and place objects in their mouths that have been in intimate contact with dusty floors [3].

Therefore, an efficient cleaning practice requires arduous physical labor and substantial time. Lack of these efficient cleaning practices may create heavy settlement of dust in the houses (www.accari.org.2007). A speck of dust may contain fabric fibers, human skin particles, animal dander, microscopic creatures called mites, bacteria, parts of cockroaches, mold spores, food particles and other debris. Of these, animal dander, house dust mites, and cockroaches are the most common culprits. A person may be allergic to one or more of these substances, and, if exposed to the dust, will have an allergic reaction. Unlike some other kind of mites, house dust mites are not parasites living on plants, animals and humans. House dust mites primarily live on dead skin cells, commonly called dander, which are shed regularly by humans and their animal pets [4]. A number of species of house dust mites have been found throughout the world. *Dermatophagoides farinae* and *Dermatophagoides pteronyrsinus* are the two most common species that are found in house dust samples of India.

Habitat of house dust mites

House dust mites prosper in houses or areas where there is high humidity and lower light intensity [5]. Carpet, mattress and upholstered furniture or the places near the human rest provide suitable conditions for the presence of house dust mites in indoor household environment [6-7]. House dust mites thrive in the environment provided by beds, kitchens and homes in general, where the sun rays do not reach them [8-11]. The bed is the most intimate human environment and serves as the focus of infestation, because the common house dust mites feed on human dander, which is shed mostly in the bed.

Dust mites are found in high concentration in pillows, mattresses, carpeting and upholstered furniture. They remain in mattresses, carpets, furniture and bedding, since they can climb lower down through the fabric to avoid sun, vacuum cleaners, and other hazards and climb higher up to the surface where humidity is high to get another skin cell to feed on. Even in dry climates, dust mites survive and reproduce easily in bedding, especially in pillows because of the humidity generated by the human body during breathing and perspiring. Human beings are important carriers of dust mites from one place to another through their bodies and clothing [12]. Bathrooms and kitchen are also important places that create a higher concentration of house dust mite allergen in houses; due to pets; the severity of allergy increases many folds [13-14].

Table 1 Health risks from HDMs: Symptoms and complications from house dust mites

S. No.	Symptoms	S. No.	Complications
1.	Wheezing	1.	Frequent ear infection (otitis media) in children
2.	Coughing	2.	Drowsiness and other side effects of anti- histamines
3.	Breathlessness	3.	Sinusitis and / or nasal polyps
4.	Tight feeling in the chest	4.	Anaphylaxis (a rare but severe allergic reaction)
5.	Running nose, itchy nose	5.	Disruption of life cycle
6.	Itchy eyes	6.	Children may breathe through the mouth instead of nose with resultant facial changes
7.	Itchy skin, skin rashes	7.	Hives or other skin rashes
8.	Headache, fatigue and depression		

House dust mites are the major cause of year-round complaints of stuffy nose, sneezing and watery eyes what some people describe as a 'permanent cold'. However, there are reports of red rashes around the neck. Other allergic reactions may include headaches, fatigue and depression [15-16].

Role of micro climatic factors for growth of house dust mites

Temperature: Summer season temperature of respondents' different rooms was ranging from 24.71 °C to 25.39 °C which is an ideal condition for HDMs growth. The temperature ranging from 17.75 °C to 18.77 °C during winter season is ideal for HDMs growth. Several research studies also reported winter temperature from 15 °C - 19 °C provides suitable conditions for the growth of HDMs in home.

Relative humidity (*RH*): The summer RH of respondents' different rooms was in between 66.54 to 67.58 per cent. In winter season RH of respondents' different rooms varied from 53.57 to 54.60 per cent. HDMs are higher in number in houses or areas where there is high RH. They just love to live in higher RH of 70 to 80 per cent in which their development and food consumption increases.

Air flow rate (*AFR*): In summers AFR was ranging from 0.74 to 0.90 m/sec. In winters it varies with 0.15 to 0.20 m/sec in different rooms. The air flow rate of the houses depends upon the outer air flow pattern. The increased AFR brings more dust in indoors which increases HDMs in settled dust. At the same time HDMs flow from one place to another also increases.

Light intensity (*LI*): light intensity of summer is higher than winter. The growth of HDMs is very much influenced by the light. The concentration of HDMs is higher where the light intensity is low.

MATERALS AND METHODS

The study was carried in Udaipur district of Rajasthan with the objective of to study the household cleaning pattern adopted by the homemakers that were 120. From the selected sample of 120 respondents' information regarding household cleaning pattern adopted for various room furnishings, furniture and flooring, drawers and cabinets, health status of the respondents, awareness about HDMs were gathered because concentration of settled dust was found to be higher in these areas. Most of the households' environmental conditions promote growth of HDMs like high humidity, lower temperature, lower light intensity, improper ventilation, unhygienic conditions, over-crowding, pets, living habits of occupants etc. The outcomes were shown under these subheads.

RESULTS AND DISCUSSION

Involvement of respondents in household cleaning

- *Major responsibility*: Forty-six per cent of the respondents take major responsibility of house cleaning. Few of the respondents' daughters also bear major responsibility of house cleaning (16.66 per cent) which can be attributed to their preoccupation in other activities like studying or employed outside the house hence they have less time for cleaning activities.

- *Help received by respondents*: Homemakers take help of the family members or hired help in performing daily household cleaning activities like sweeping, dusting and mopping etc. Majority of the respondents receive help in house cleaning from their daughters (43.33 per cent), sister in laws (20 per cent), husbands (14.16 per cent), daughter in laws (10.83 per cent) and servants (5 per cent).

Washing clothes

Hand washing of clothes was common practice adopted by near about half (49.36 per cent) of the respondents. In commercial zone more than three fourth of the respondents (80 percent) belonged to higher HDM category used machine for washing clothes. Forty five percent of respondents dry clothes in the courtyard of the house. A meagre percentage (2.5 per cent) of the respondents' dries clothes within the house due to lack of open space in the house.

Livestock and pets

Those respondents' having livestock (18 per cent) they keep livestock in the courtyard (50 per cent), outside the house (41.66 per cent) and inside the house (8.33 per cent). Those respondents having pets (27.33 per cent) out of which less than one third of the respondents' (31.25 per cent) keep their pets in the house especially in commercial zone (49 per cent). Three fourth of the respondents which were having pets give food to their pets in the courtyard and rest of them give food inside the home. The average time spent in livestock/pets cleaning was 15.65 min./day. Average time spent by the respondents in cleaning of shed was 14.86 min./day. Respondents of industrial zone spent more than the average time (16.79 min./day) than commercial zone (14.17 min./day) and residential zone (13.63 min./day). More time spent in livestock/pets cleaning practices shows the awareness of respondents about hygiene and sanitation [17-19].

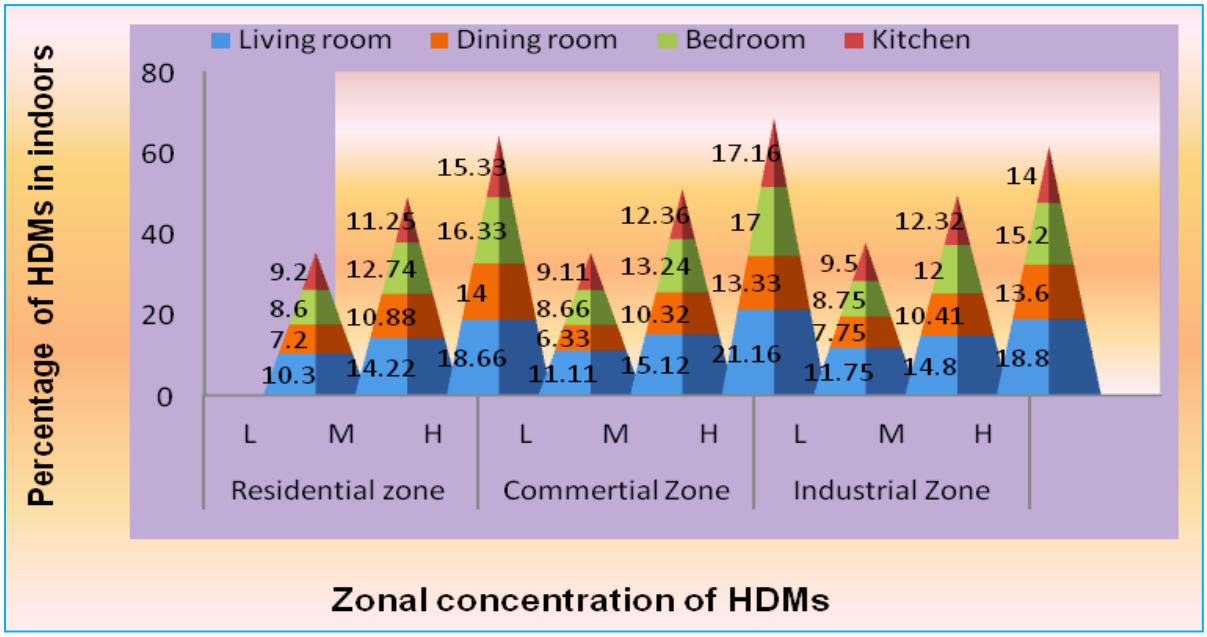

Fig 1 Zonal concentration of HDMs

Storage of household items

- *Kitchen*: Metal container for grain storage was used mostly by all the three zones respondents (residential zone=70 per cent, commercial zone=40 per cent and industrial zone=60 per cent). Majority of the respondents store foodstuffs like pulses, rice, sugar, tea leaves, spices etc. in small containers (87.72 per cent) for consumption within few months. Most common mite control measure used for grains and foodstuff storage was sun exposure (41.45 per cent) and use of insecticides (52.26 per cent). All of the respondents use strainer and check the grains and foodstuff before storage or use. Respondents use 6 to 8 hours occasionally in cleaning grains and foodstuff in all the three zones.

- *Dining room*: Storage of utensils in dining room showcase was higher in residential zone (68.11 per cent) as compared to other zones especially in high HDM category (77.88 per cent). Few of the respondents clean utensils occasionally (14.89 per cent) and it was more in commercial zone (16.98 per cent). Washing of utensils and equipment was found to be higher in residential zone (68.11 per cent). For both dusting and washing of dining room stored utensils and equipment respondents take 2 to 4 hours in a month.

- *Bed room*: Storage of bedding in boxes was higher in commercial zone (94.67 per cent) and residential zone (70 per cent). Respondents belonging to high HDM category store their beddings in boxes in all the three zones. Majority of the respondents expose bedding in sun (98.68 per cent) use naphthalene balls (78.91 per cent). Occasional refilling of bedding was done by the respondents to keep mattresses clean.

- *Living room*: Only a small percentage of the respondents (12.28 per cent) store furniture in living room and it was more among commercial zone respondents (16.00 per cent) higher HDM category (20.00 per cent). Less than one fifth of the respondents (18.33 per cent) store carpet in box/store room. In residential zone and commercial zone a small

percentage of respondents use vacuum cleaner (20.00 per cent each) for cleaning dust from carpet. Though, 14.89 per cent of the respondents use disinfectant for cleaning carpet. Mode of living room furniture cleaning was dusting by cloth (43.33 per cent) and for carpet, vacuum cleaning (35.53 per cent).

CONCLUSION

People should be aware of factors which are responsible for HDMs growth. There are various household, housing, microclimatic factors and seasonal variations which affect HDM concentration in indoors. Household factors like family size, adult female in the household, presence of children below 5 years of age, living habits of the respondents affect HDMs growth and concentration in indoor. Moreover, age of the house, type of the house, period of occupancy, number of storey, pets affect HDMs concentration. The environmental conditions of households like humidity, temperature, air flow rate and light intensity also affect HDMs concentration. Apart from these factors, season also plays an important role in HDMs growth. People were found to be conscious of micro-organisms proliferation during rainy period but they were not aware of microscopic invisible HDMs. HDMs settled in house dust are viewed as the most important source of indoor allergens in settled house dust which affect the health status of inmates. They are mostly responsible for year-round complaints of stuffy nose, sneezing and watery eyes and permanent cold. Moreover rhinitis, dermatitis and conjunctivitis were other major problems associated with HDMs.

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