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RELATION BETWEEN CHILDHOOD ASTHMA AND INDOOR ENVIRONMENTAL ELEMENTS IN DWELLINGS

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Abstract

A study of childhood asthma and housing environment through questionaire and field measurements was carried out in Kawasaki in November 1985. As results, 1) Indoor temperature and humidity: there was no difference between the groups of improved sign and not-improved. In the type of housing structure, however, average temperature was higher in multiple homes. 2) Concentrations of NO_2: there was no difference between the groups with and without asthma. As for NO_2 doses on children not-improved group showed significantly higher value. 3) Settled dust: no difference between the groups with and without asthma. Use of futon showed the increase of number of particles. 4) Mites on floor: no difference between the groups with and without , nor between improved and not-improved. 5) By questionaire those who became careful for ventilation were found to reach 92%.

Introduction

It has been reported that asthmatic children have remarkably increased in number these years in Japan. We had an opportunity to contact with sanitary section of Kawasaki city municipal authorities and the Group of Asthmatic Children's Parents, and to study to make clear the relation between childhood asthma and indoor environmental elements in dwellings.

Field measurements were carried out concerning the indoor environmental factors which might have something to do with childhood asthma in north-western residential district of Kawasaki, where air pollution is not so hard compared to that in south-eastern industrial part of the city[1]. At the same time those parents who have asthmatic children were surveyed by mailed questionaire concerning their state of living and physical exercise of the children.

Outline of study

Field study

Table 1: Number of homes measured

		Wooden private homes		Reinforced concrete multiple homes		Total	
With Asthma*	Improved	6	3	4+1**	3	10+1**	6
	Not-improved		3		1		4
Without Asthma		8		6		14	
Total		14		11		25	

*The children with asthma were divided into two groups: improved and not-improved, according to the criteria proposed by the Pediatric Clinical Group for Allergy in Japan.

**One home with two asthmatic children, one improved and the other not-improved, was excluded in each stastics of interest.

The outline of dwellings measured is shown in Table 1.

All the dwellings were located in Nakahara-ku and Miyamae-ku, both in north-western part of Kawasaki. The ages of the children ranged from 7 to 15.

Date of Field Measurements: Mainly three days from November 19 to 21, 1985.

Items and Method of Measurement are as follows:

1) Temperature, diurnal range of temperature and relative humidity : Yokohama National Univ. Type Environmental Clincal Thermomemory "YM-1" and Vinyl Globe Set[2] were used to examine temperature and relative humidity 1.2m high above floor at the corner of each child's bedroom . The data of Nov.21 whole day long were obtained and each diurnal average and range of temperature were calculated.

2) NO_2: Using badge type personal samplers, diurnal average of the NO_2 concentrations was obtained each at sitting room, kitchen, bedroom, and the surface of child's body.

3) Settled dust: Cover glasses with thin film of vaseline placed in Petri dish were used to get settled dust. Particles and fibers greater than 5μm in diameter and 20μm in length respectively, were sized and counted using optical microscope. Each averaged value per day, per $1cm^2$ was calculated.

4) Mites: Using vacuum cleaner with a bag of porous paper inserted into the distal end of its hose[4], samples on the surface of floor area of $1m^2$ were collected[4]. The numbers of pyroglyphid mites (Pyroglyphidae) were counted under a disecting microscope.

5) Others: The way of life, such as frequency of opening windows for ventilation, duration time of child's stay in bedroom, etc. was examined.

Study by Questionaire

The questionaire was conducted on 296 families with asthmatic children, half of them belonging to the Group of Asthmatic Children's Parents. Out of effective replies, 150 cases of children of 2 to 15 years of age who had fell ill more than 2 years before were analysed.

Results and Discussions

Temperature and Humidity

From the average values of temperature, diurnal range and relative humidity throughout the day in each home no significant difference can be seen among the improved, not-improved and without asthma groups. The relations between each of thermal elements and the housing construction type are shown in Table 2.

Table 2: Average temperature, diurnal range and relative humidity in difference of housing type

	Average temperature	Diurnal range	Relative humidity
Wooden family home	14.6°C	8.4°C	68.6%
RC multiple home	16.4°C	4.7°C	62.4%
p value	<0.05	<0.01	not significant

RC multiple homes were found to have significantly higher average temperature ($p<0.05$) and less diurnal range ($p<0.01$) than that of wooden private homes.

There was little difference between them in relative humidity. RC multiple homes' construction is featured to have both a merit that sudden change of indoor temperature which may cause fits is hard to happen, and a demerit that higher temperature is favorable for mites' growth and reproduction because of its high thermal capacity.

NO_2

Results of average values of NO_2 concentrations in rooms and personal dose are shown in Fig. 1a. to 1d. in difference of the groups with asthma and without asthma and Fig. 2a. to 2d. in difference of the groups of improved and not-improved.

There was no difference in NO_2 concentrations in rooms and personal dose between the groups with and without asthma, but as for the concentration of NO_2 doses on children, not-improved group showed significantly higher value. NO_2 doses' correlations with kitchen, sitting room, bedroom were 0.72, 0.83, 0.78 respectively, which were all significant ($p<0.05$). The correlations between kitchen and sitting room was 0.71, which was also significant ($p<0.05$). NO_2 is thought to have its source mainly in kitchen and to diffuse into whole rooms. Ventilation of kitchen is important.

Settled Particles

Average values of numbers of settled particles are shown in Table 3 and Fig. 3.

Table 3: Average number of particles per cm^2 and 24 hours

	Particles		Fibers	
	2-5μm	5μm-	20-100μm	100μm-
With asthma	1375	1104	32	18
Without asthma	1160	1070	33	17

There were no significant difference between children with and without asthma in any type of the settled particles. Between improved and not-

improved significant difference could not be found either.

As for the kinds of bedding, significantly higher values were obtained in the bedroom of "futon" (removable mattress) in both particles and fibers. In relation of numbers of particles and the difference of flooring type, however, there was no significant difference.

Mites

Numbers of mites found in $1m^2$ on each bedroom floor are shown in Fig. 4. Average values were 473 and 186, with and without asthma respectively (Fig. 4a), and 435, 458, improved and not-improved group respectively (Fig. 4b). Above differences are not both significant.

Mites were found in any of the homes measured. The number of them are 329 in average with a range from 12 to 1915. There was no significant difference between improved and not-improved.

In the difference of flooring type, the average numbers of mites found on bedroom floor with and without carpet were 661, 108 respectively, showing significant difference ($p<0.05$) (Fig. 4c).

Out of all the homes with asthmatic children 50% removed carpet from their bedroom and 40% children thereof had improved sign. The suggestion[4)5)] that removing carpet out of floor, especially of tatami-mats, is effective for prevention of asthma, also appears true in this study.

Some findings through questionaire

Some aspects of information obtained through questionaire to asthmatic children's parents were as follows:

1) The rate of improved children living in wooden private homes exceeded significantly that in RC multiple homes.

2) Those who became careful for ventilation and the way of cleaning rooms reached 92% and 64% respectively.

3) Respective 30 to 40% families became to arrange their indoor environments; drying futon in the sun, covering linen over blanket, not using spray products, or incense smoke, not smoking near the child, etc.

Acknowledgement

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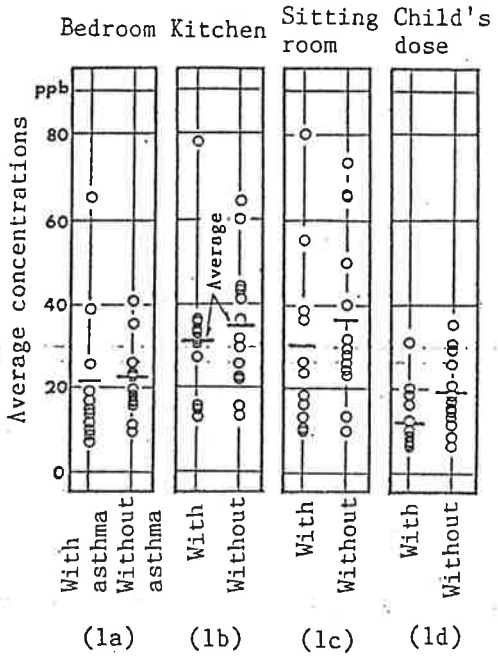

Fig. 1. NO_2 Concentrations in difference of groups with and without asthma

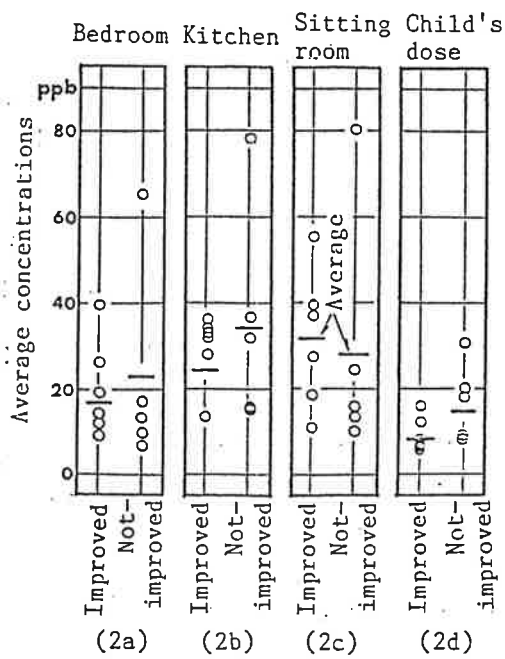

Fig. 2. NO_2 Concentrations in difference of groups of improved and not-improved

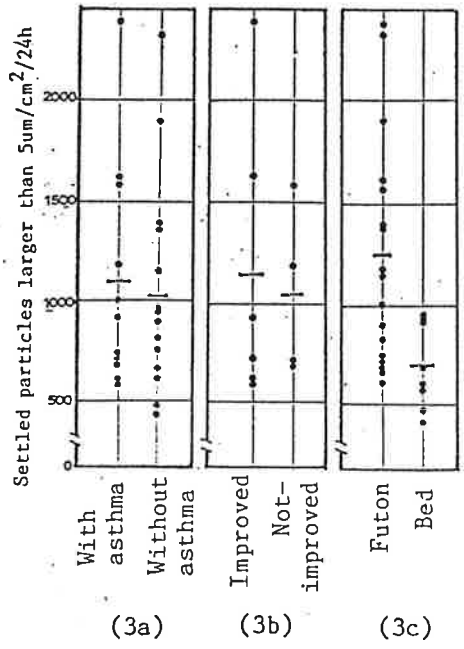

Fig. 3. Numbers of settled particles

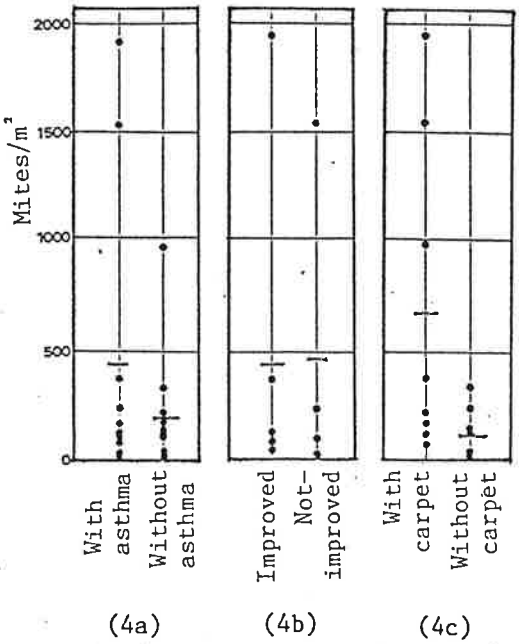

Fig. 4. Numbers of mites