

Frequency of Humidifier and Humidifier Disinfectant Usage in Gyeonggi Province

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Objectives: This study is a cross-sectional study to investigate the frequency of humidifier and humidifier disinfectant usage in the general population.

Methods: A questionnaire was applied to 94 subjects (46 male, 48 female) from the general population of Gyeonggi Province. The questionnaire consisted of 3 scales (general characteristics, 5 items about humidifier usage, 5 items about humidifier disinfectant usage).

Results: Thirty-five (37.2%) of the 94 subjects use a humidifier and humidifier disinfectant usage was found to be 18.1%. The frequency of humidifier usage is 4.8 times per a week and the humidifier disinfectant usage is 2.4 times per a week. Humidifier usage rate was highest in January, and then tended to rise gradually from October.

Conclusions: Although this study population was not representative, we can say that approximately 50 percent of the humidifier users use a humidifier disinfectant and the trend of using a humidifier has shown seasonality.

Key words: Humidifier, Humidifier disinfectant

INTRODUCTION

Epidemiological investigation was carried out by the Korea Center for Disease Control and Prevention (KCDC) according to the increase of pregnant mothers who were suffering from acute lung injury at the intensive care unit of hospital A of Seoul City in April of 2011. At the beginning of the investigation, it was found that the related disease was a severe lung disease from an unknown cause, and that the possibility of a contagious disease did not exist or was very low, and it was reported that the number of pregnant mothers with the relevant disease would not increase after June [1]. Hereafter, the relevant disease was temporarily designated as lung damage with an unknown cause. In order to investigate risk factors that could trigger respiratory disease, hospital-based patient and control group investigations was done. Out of 28 patients who suffer from lung damage from unknown causes registered in hospital A after 2001, according to hospital-based patient-control group investigation based on 18 patients who agreed to participate in the investigation, humidifier disinfectant was presumed to be the risk factor. The usage rate of humidifier or humidifier disinfectant of the patient group was 94.4%, the usage rate of humidifiers in the control group was 55.4%, the usage rate of humidifier disinfectant was 26.4%, and the odds ratio was 47.3 (95%

confidence interval [CI], 6.0 to 369.7) [2].

Humidifiers are used for the purpose of preventing respiratory disease by maintaining suitable humidity. If the cleaning of the inside of a humidifier is insufficient, germs or fungi could grow inside water of the humidifier, and if inhaled, respiratory diseases, such as humidifier fever, can be induced [3]. To prevent this danger and for the purpose of cleaning the inside of humidifier, humidifier disinfectant is being used not only inside, but outside of Korea [4]. However, in Korea, people use an interesting and unique method in which they dilute the humidifier disinfectant in the water and prevent the microorganisms from growing and polluting the water.

Recently there have been reports that stated that when humidifier disinfectant is sprayed with water inside a humidifier it could be directly inhaled and can cause lung damage, and after an animal inhalation poisoning experiment, abnormal symptoms were discovered

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Table 1. Humidifier and humidifier disinfectant usage rate by demographic characteristics of study population (N=94)

Variables categories	n (%)	Humidifier user ^a			Humidifier disinfectant user ^a		
		n (%)	χ^2	p-value	n (%)	χ^2	p-value
Gender							
Male	46 (48.9)	18 (19.1)	0.14	0.831	9 (9.6)	0.13	0.75
Female	48 (51.1)	17 (18.1)			8 (8.5)		
Age (y)							
≤ 39	25 (26.6)	15 (16.0)	12.94	0.005	8 (8.5)	4.80	0.19
40 - 49	21 (22.3)	10 (10.6)			3 (3.2)		
50 - 59	26 (27.7)	7 (7.4)			4 (4.3)		
≥ 60	22 (23.4)	3 (3.2)			2 (2.1)		
Occupation							
White-collar workers	15 (16.0)	8 (8.5)	2.01	0.366	4 (4.3)	1.01	0.61
Blue-collar workers	34 (36.2)	12 (12.8)			5 (5.3)		
Others [†]	45 (47.9)	15 (16.0)			8 (8.5)		
Education period (y)							
≤ 9	23 (24.5)	4 (4.3)	7.73	0.021	2 (2.1)	9.157	0.01
10 - 12	36 (38.3)	19 (20.2)			12 (12.8)		
≥ 13	35 (37.2)	12 (12.8)			3 (3.2)		
Total	94 (100)	35 (37.2)			17 (18.1)		

^a Including unemployed, student, soldiers, housewife, [†] Humidifier user who answered "yes" to the question "Did you used a humidifier after 2006?".

[†] Humidifier disinfectant user who answered "yes" to the question "Did you used a humidifier disinfectant?".

experimental mice that inhaled some humidifier disinfectant products, which led the KCDC to recommend refraining from the use of humidifier disinfectant [5]. In this situation, the humidifier usage power of Korea's general population group and information about the usage manner of humidifier disinfectant would help in finding out the cause and effect with the disease through comparison with the usage manner of patient group, but the related research is non-existent in Korea.

Therefore, this research aimed to investigate the humidifier and humidifier disinfectant usage manner based on residents of a city as targets, and to provide a basis data for future research.

MATERIALS AND METHODS

I. Subjects

This investigation was carried out from August 8th-12th in 2011, and out of 300 people registered to investigate of multiple chemical sensitivity, 94 people who agreed to participate were chosen as the final targets by applying the convenience sampling method, and this investigation was designed based on adults above 19 years old who resided in Gwangmyeong City in Gyeonggi Province.

II. Questionnaire

In order to understand humidifier and humidifier disinfectant usage manner, a questionnaire was conducted containing 5 questions related to humidifier usage, 5 questions related to common use of humidifier disinfectant,

and population sociological characteristics (sex, age, occupation, time spent on education), etc.

Questions related to the usage of humidifier were included "Have you ever used humidifier inside the house after 2006?", "Where is the location that you use humidifier?", "If you used a humidifier, when was it?", "How many times in a week did you use humidifier?", and "How many hours, on average, do you use humidifier?".

Questions related to the usage of humidifier disinfectant were included, for "Have you ever used a humidifier disinfectant?", "If you have ever used a humidifier disinfectant, when was it?", "What is the actual frequency of the use of humidifier disinfectant?", "What is your one-time usage amount of humidifier disinfectant? (1 container = 10 mL), and "What is your monthly usage amount (bottle/month)?".

III. Defining Index and Statistical Analysis

Humidifier usage experience rate was defined as percentage of people who said "Yes" to the question, "Have you ever used humidifier inside the house after 2006?", and humidifier disinfectant usage experience rate was defined as percentage of people who said "Yes" to the question, "Have you ever used humidifier disinfectant after 2006?". The monthly predictable experience rate of a use of humidifier was presumed to be, out of a number of people who have experienced using a humidifier, a percentage of people who have had experience using the humidifier disinfectant and the monthly usage experience rate. Population sociological characteristics are shown in terms of frequency using SPSS version 12.0 (SPSS Inc., Chicago, IL, USA). Humidifier and humidifier disinfectant usage experience rate is presented as

a percentage, and was verified through χ^2 -test and Fisher's test. Weekly usage number used average usage number, and average usage hour used average as well as standard deviation.

RESULTS

I. Characteristics of Study Subjects

A total of 94 people agreed to participate in the research, 48.0% were male and 51.1% were female. In terms of age, subjects in their 50s made up the highest proportion with 27.7%, and then the next highest were subjects above 60 (25.5%). White-collar job participation was low with 16.0% and a period of education of 10-12 years was the highest with 38.3% (Table 1).

II. Humidifier and Humidifier Disinfectant Usage Frequency

After 2006, humidifier usage experience rate was 37.2% (35 people). Subjects below 39 years old had the highest humidifier usage experience with 16%, and then the next highest was subjects in their 40s with 10.6%. Humidifier usage experience rate showed a significant difference according to age ($p = 0.005$). Period of education of 10 to 12 years was the highest with 20.2%, and then the next highest was 13 years or more (12.8 %); the humidifier usage experience rate showed a significant difference according to the period of education ($p = 0.021$) (Table 1).

After 2006, humidifier disinfectant usage experience rate was 18.1% (17 people). Period of education of 10 to 12 years was the highest with 12.8% (12 people) and, humidifier disinfectant showed a significant difference

Table 2. Humidifier and humidifier disinfectant usage frequency and usage time about humidifier users in study (N=35)

	Usage frequency ^a (times/ wk)	Using time ^b	
		Day (mean \pm SD)	Night (mean \pm SD)
Humidifier	4.8	3.8 \pm 1.8	5.3 \pm 2.7
Humidifier disinfectant	2.4	-	-

SD, standard deviation.

^a Humidifier and humidifier disinfectant usage frequency per week.

^b Humidifier usage time per day.

according to period of education ($p = 0.010$) (Table 1).

The average number of usage of humidifier in a week was 4.8 times, the average length of use during the week was 3.8 \pm 1.8, and average time of use during the night was 5.3 \pm 2.7. The average number of usage of humidifier disinfectant in a week was 2.4 times (Table 2).

III. Humidifier and Predicted Humidifier Disinfectant Usage Manner

According to 35 people who said they use a humidifier between January 2006 and August 2011, Figure 1 showed the monthly predictable experience rate of a humidifier disinfectant based on the monthly use experience rate of a humidifier as a foundation by investigating period of use of humidifier each year.

The monthly usage experience rate of a humidifier was the highest in January with 32%, and thereafter it showed a tendency to decrease. September was the lowest, and it showed a tendency to increase after October. The monthly predictable experience rate of humidifier disinfectant showed a similar tendency to humidifier usage experience rate.

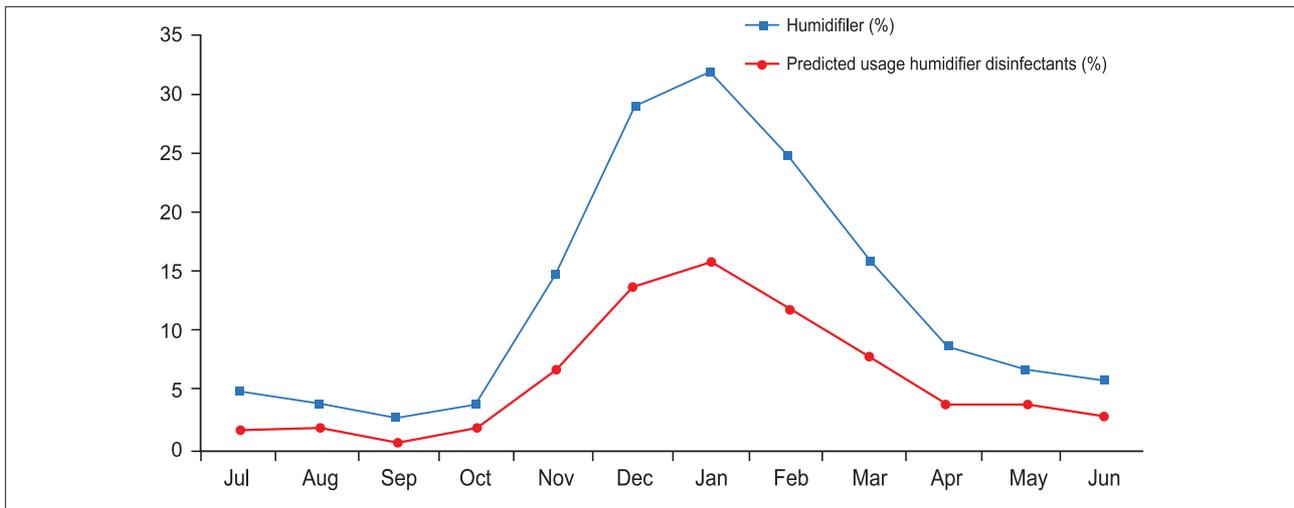


Figure 1. Monthly distribution of humidifier usage frequency and predicted usage rate of humidifier disinfectants for a humidifier user in this study.

DISCUSSION

As a result of having investigated the general group, it was found that 37.2% used a humidifier and 18.1% used humidifier disinfectant. Humidifier usage rate in Korea, which has been reported, among a control group of the patient/control group research was 55.4% [2], in the old peoples' group of age above 65 years old was 22.7% [6], and from the pregnant mother's group was 58.6% [7]. Humidifier disinfectant usage rate has not been reported within Korea other than the result reported from hospital-based patient-control group research control group, and there has not been a report about time or frequency of use of humidifier and humidifier disinfectant.

Based on the research results and reported results, in general, it could be presumed that about 50% of instances where people use humidifiers also use humidifier disinfectant. In addition, monthly behavior of use of humidifiers, and predicted monthly behavior of use of humidifier disinfectant showed a very similar tendency. Also, during the months of June through October where the usage rate of a humidifier is low, it was presumed that there is almost no use of humidifier disinfectant.

This research, as an index related to the usage experience rate of humidifier and humidifier disinfectant used an accumulated usage experience rate after having confirmed whether or not the subjects used the humidifier and humidifier disinfectant from 2006 up to the present. However, the humidifier usage rate in the previous researches is presumed to be the time usage rate that confirmed whether or not participants used a humidifier at the time of research. Because the research subjects that each index calculated were different, a direct comparison on usage rate of a humidifier suggested per research was difficult, but it was judged that understanding seasonality when it comes to the use of a humidifier would be helpful.

Just to delineate this research result as a general population's general present condition, there exists a limit in terms of the representability of research subjects and the validity of investigation tools. However, this research was

significant in terms of the fact that this research was the first to be investigated in Korea based on general people as subjects, and this research could be utilized as a reference data when explaining seasonality which was an outcome from patients who were suffering from "lung damage from unknown cause" due to exposure to the humidifier disinfectant from now on. In addition, considering the current situation where health obstacles due to humidifiers and humidifier disinfectant are reported continuously, detailed additional investigation based on a group that has representability related to usage behavior is required.

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