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Field Study

Higher Prevalence of Dry Symptoms in Skin, Eyes, Nose and Throat among Workers in Clean Rooms with Moderate Humidity

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Abstract: Higher Prevalence of Dry Symptoms in Skin, Eyes, Nose and Throat among Workers in Clean Rooms with Moderate Humidity: Shih-Bin Su, *et al*. Department of Environmental and Occupational Health, College of Medicine, National Cheng Kung University, Taiwan—Objective: To determine whether working under relative humidity (RH) around 55 ± 5% may lead to dry symptoms among workers in tropical regions. **Methods:** We recruited 3,154 Taiwanese workers who had no history of skin diseases and compared dry symptoms between clean room workers (RH around 55 ± 5%) and other workers (RH around 65 ± 5%). **Results:** Clean room workers had higher prevalences of dry symptoms of the eye (odds ratio [OR]=1.62, 95% confidence interval [CI]: 1.40 to 1.86), nose and throat (OR=2.15, 95% CI: 1.66 to 2.79), and skin (OR=1.46, 95% CI: 1.23 to 1.73). In clean room workers, however, dry skin symptoms affected the palms (OR=1.72, 95% CI: 1.24 to 2.39), which are covered by gloves, more frequently than the face (OR=0.65, 95% CI: 0.45 to 0.94), which is exposed to the room air. We found working in clean rooms (adjusted OR [AOR]=1.38, 95% CI: 1.08 to 1.77), 24 to 30 yr of age (AOR=0.78, 95% CI: 0.62 to 0.99), family history of atopic diseases (AOR=1.75, 95% CI: 1.37 to 2.25), and skin moisturizer use (AOR=1.64, 95% CI: 1.30 to 2.06) were independent predictors of skin symptoms. In addition, working in clean rooms was an independent predictor of dry eye (AOR=1.30, 95% CI: 1.06 to 1.60) and dry nose and throat (AOR=1.70, 95% CI: 1.28 to 2.26) symptoms. **Conclusions:** Whereas the humidity in such working environments is not very low, for workers living in a high humidity environment, the relatively low humidity may still cause dry symptoms of the eye, nose, and throat.
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Key words: Clean room, Controlled environment, Dry eye, Dry mucosa symptoms, Low humidity

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In the high-tech electronic and optoelectronic industries, many manufacturing processes are placed in the "clean room" to ensure high quality and high yield. In clean rooms, dust particles in the air are controlled to extremely low levels, and the temperature and humidity are maintained at relatively low levels. In addition, workers have to wear special outfits covering almost all of their body surfaces to avoid contaminating the products while working in clean rooms. Because it is troublesome to exchange clothing and go through the cleaning processes, workers generally try to avoid going in and out of the clean rooms during their work shifts. Many clean room workers even reduce their water intake in order to minimize the need to go the bathroom at work[1–3]. Previous studies found working in environments with ultra-low humidity (relative humidity [RH]=1.5%) may cause skin symptoms, changes in skin functions, and even disorders such as xerotic eczema[4–8]. A study in Japan on workers working in environments with very low humidity also observed high prevalence of atopic dermatitis and skin dryness[9].

Thin film transistor liquid crystal display (TFT-LCD) manufacturing is currently the industry that generates the largest revenue for Taiwan, and hundreds of thousands of workers are employed by this industry. In most clean rooms for the production of TFT-LCD, the indoor RH is set around 55 ± 5%. Whereas this level of humidity is

not very low, the yearly average outdoor RH in southern Taiwan, a tropical area, is around 80 ± 5%[10]. Therefore, a large number of workers in this industry are exposed to a large humidity gradient between the indoor and outdoor environments, and this might cause adverse health effects due to excessive superficial water evaporation[11]. Our previous study found that dry eye symptoms and tear secretion dysfunction were more prevalent among clean room workers in TFT-LCD manufacturing plants in an industrial park in southern Taiwan[3]. In order to evaluate whether working in environments with a relatively low humidity may also cause dry skin and dry mucosa symptoms in a high-humidity country, we compared these symptoms between clean room workers and workers not working in clean rooms in the TFT-LCD industry in southern Taiwan.

Materials and Methods

We recruited workers working in an industrial park in Tainan, Taiwan, who received the annual routine health examination at the clinic in the park in September 2003. We included workers whose employment duration was more than one year, and divided them into two groups: those who worked in clean rooms on a regular basis, the "clean room" group; and the others who did not work in clean rooms on a regular basis, the "non-clean room" group.

The clean rooms are kept airtight, with the temperature maintained at around 22 to 25°C and RH at around 55 ± 5%. In other indoor working areas, the temperature is maintained at around 22 to 28°C, and the RH is maintained at around 65 ± 5%. To keep the production lines running 24 h a day, the factories have the workers work 12 h a day for two consecutive days and then rest for two days. During the day shift, workers have a 20-min break in the morning, a lunch break of 50 min, another 20-min break in the afternoon, and a dinner break of 50 min[1]. The schedule for breaks on the night shift is the same as that of the day shift, and therefore most workers stay in clean rooms for more than nine hours each shift.

We distributed a self-administered questionnaire to each participant, which included questions on demographic data (including gender and age), working history (including working area and working duration), medical history and family history of atopic diseases (including atopic dermatitis, allergic conjunctivitis, bronchial asthma, and allergic rhinitis), and current dry skin and mucosa symptoms (including dry eye, dry nose, dry throat, and dry skin).

All data analyses were conducted using the SPSS (Version 12.0, NC) software, and differences in prevalence rates of dry skin symptoms and other variables were evaluated by the chi-square or Fisher's exact test at a two-tailed significance level of 0.05. Univariate and multi-variate logistic regressions were performed to identify predictors of dry skin symptoms. The protocol of this study was approved by the Research and Ethical Review Board of the Chi-Mei Medical Center.

Results

All the 4,523 potential participants agreed to participate in the study, and 4,340 completed the standard questionnaire, yielding a response rate of 96%. Among them, 3,068 (70.7%) were clean room workers and 1,272 (29.3%) were non-clean room workers. The two groups had similar overall prevalences of history of skin and atopic diseases (27.0% vs. 28.2%, p=0.394), but the clean room group had a higher proportion with a history of allergic conjunctivitis (3.7% vs. 1.9%, p=0.002) and a lower proportion with a history of urticaria (7.3% vs. 9.2%, p=0.037). The 1,186 (27.3%) participants who had history of skin or atopic diseases before their current employment had a higher proportion of women (62.1% vs. 55.5%, p<0.001) and a higher prevalence of family history of atopic diseases (43.2% vs. 12.8%, p<0.001), including atopic dermatitis, bronchial asthma, allergic rhinitis, allergic conjunctivitis, and urticaria.

In further analyses, we excluded participants who had a history of skin diseases or atopic diseases before their current employment, including 342 with urticaria, 179 with drug eruptions, 159 with xerotic dermatitis, 51 with psoariasis vulgaris, 9 with ichthyosis vulgaris, 240 with atopic dermatitis, 693 with allergic rhinitis, 138 with allergic conjunctivitis, and 47 with asthma; some had histories of more than one disease. In the remaining 3,154 participants, 2,241 were clean room workers and 913 were non-clean room workers. In comparison with non-clean room workers, clean room workers had a higher proportion of women (66.2% vs. 29.5%, p<0.001), a younger age distribution (p<0.001), and shorter employment durations (p<0.001) (Table 1). We found clean room workers had higher prevalences of dry eye symptoms (35.3% vs. 22.1%, p<0.001), dry nose and throat symptoms (16.7% vs. 8.5%, p<0.001), and dry skin symptoms (itching, scaling, and or fissuring) (19.7% vs. 12.9%, p<0.001) (Table 2). In clean room workers, skin symptoms were more likely to affect the palms (odds ratio [OR]=1.72, 95% confidence interval [CI]: 1.24 to 2.39), but less likely to affect the face (OR=0.65, 95% CI: 0.45 to 0.94) (Table 3). About 61% of the cases showed these symptoms within the first several months of their current employment. There were missing responses for each symptom, and the number of valid respondents for each analysis is presented in Tables 2 and 3.

Using uni-variate logistic regression, we found that female gender, clean room worker, age, family history of atopic disease, and moisturizer use were associated with dry skin symptoms (Table 4). Because employment

Table 1. Comparison of demographic characteristics among participants without history of atopic or skin diseases

Variable	Clean room (N=2,241)	Non-clean room (N=913)	p[a]
Gender			<0.001
Men	758 (33.8%)	644 (70.5%)	
Women	1,483 (66.2%)	269 (29.5%)	
Age (yr)			<0.001
<24	642 (28.6%)	43 (4.7%)	
24–27	717 (32.0%)	154 (16.9%)	
28–30	469 (20.9%)	221 (24.2%)	
>30	413 (18.4%)	495 (54.2%)	
Employment duration (yr)			<0.001
0–2	963 (43.0%)	291 (31.9%)	
3–4	1,049 (46.8%)	401 (43.9%)	
>4	229 (10.2%)	221 (24.2%)	

[a]p value for χ^2 test.

Table 2. Comparisons of dry symptoms between clean room and non-clean room workers

Variable	Clean room workers (N=2,241)	Non-clean room workers (N=913)	Odds Ratio (95%CI)[a]
Skin itching and scaling over lower legs and forearm in winter season (N=3,057)			
No	1,959 (90.0%)	793 (90.0%)	
Yes	217 (10.0%)	88 (10.0%)	1.00 (0.93–1.08)
Having dry eye symptoms (N=3,126)			
No	1,437 (64.8%)	704 (77.9%)	
Yes	785 (35.3%)	200 (22.1%)	1.62 (1.40–1.86)*
Having dry nose and throat symptoms (N=3,104)			
No	1,833 (83.9%)	827 (91.8%)	
Yes	367 (16.7%)	77 (8.5%)	2.15 (1.66–2.79)*
Having dry skin symptoms (N=3,136)			
No	1,791 (81.3%)	788 (88.7%)	
Yes	440 (19.7%)	117 (12.9%)	1.46 (1.23–1.73)*

[a]CI: confidence interval. *p<0.05 for χ^2 test.

duration did not appear to be associated with dry skin symptoms and the OR was close to 1 (the null value) after adjusting for other factors, we did not include it in the final multiple regression model. After adjusting for gender, employment duration, family history of atopic diseases, and moisturizer use, we found working in clean rooms was associated with dry skin symptoms (adjusted OR [AOR]=1.38, 95% CI: 1.08 to 1.77) (Table 4). In addition, age between 24 and 30 yr (AOR=0.78, 95% CI: 0.62 to 0.99), family history of atopic diseases (AOR=1.75, 95% CI: 1.37 to 2.25), and moisturizers use were independent predictors of dry skin symptoms (AOR=1.64, 95% CI: 1.30 to 2.06). However, dry skin symptoms affected the palms, which are covered by gloves, more frequently than the face, which is exposed to the room air (Table 3).

Working in clean rooms was an independent predictor of dry eye (AOR=1.30, 95% CI: 1.06 to 1.60) and dry nose and throat (AOR=1.70, 95% CI: 1.28 to 2.26) symptoms, and these body parts are likely to be affected by ambient humidity in clean rooms. In addition, we also found that male gender was an independent protective factor for both dry eye (AOR=0.33, 95% CI: 0.27 to 0.40) and dry nose and throat (AOR=0.57, 95% CI: 0.44 to 0.74) symptoms, while family history of atopic disease was an positive independent predictor for both dry eye (AOR=1.94, 95% CI: 1.55 to 2.43) and dry nose and throat (AOR=2.01, 95% CI: 1.54 to 2.62) symptoms.

Table 3. Distribution of affected sites of dry skin symptoms

Site[a]	Clean room workers (N=423)	Non-clean room workers (N=115)	Odds Ratio (95%CI)[b]
Face	60 (14.2%)	26 (22.6%)	0.65 (0.45–0.94)*
Body	36 (8.5%)	15 (13.0%)	0.70 (0.44–1.11)
Upper limb	63 (14.9%)	12 (10.4%)	1.39 (0.81–2.41)
Hand palm	253 (59.8%)	49 (42.6%)	1.72 (1.24–2.39)*
Thigh	19 (4.5%)	8 (7.0%)	0.71 (0.39–1.29)
Leg	70 (16.5%)	21 (18.3%)	0.91 (0.60–1.38)

[a]a participant may have more than one affected site. [b]CI: confidence interval. *$p<0.05$ for χ^2 test.

Table 4. Predictors of dry skin, dry eye, and dry nose and throat symptoms

	With dry skin symptoms		With dry eye symptoms		With dry nose and throat symptoms	
Variable	N (%)	AOR[a] (95%CI)	N (%)	AOR[b] (95%CI)	N (%)	AOR[c] (95%CI)
Gender						
Female	382 (21.9%)	1	747 (42.9%)	1	320 (18.6%)	1
Male	175 (12.6%)	0.85 (0.65–1.12)	238 (17.2%)	0.33 (0.27–0.40)*	124 (8.9%)	0.55 (0.43–0.71)*
Clean room worker						
No	117 (12.9%)	1	200 (22.1%)	1	77 (8.5%)	1
Yes	440 (19.7%)	1.38 (1.08–1.77)*	785 (35.3%)	1.30 (1.06–1.60)*	367 (16.7%)	1.65 (1.25–2.19)*
Age (yr)						
<24	165 (24.1%)	1	286 (42.1%)	1	130 (19.3%)	1
24–30	258 (16.6%)	0.78 (0.62–0.99)*	501 (32.3%)	1.03 (0.84–1.26)	228 (14.8%)	1.01 (0.79–1.31)*
>30	134 (14.9%)	0.86 (0.63–1.16)	198 (22.0%)	0.85 (0.65–1.11)	86 (9.6%)	0.81 (0.58–1.14)
Employment duration (yr)						
0–2	227 (18.2%)	NA	348 (27.9%)	1	162 (13.1%)	NA
3–4	246 (17.1%)	NA	493 (34.4%)	1.24 (1.04–1.47)*	220 (15.5%)	NA
>5	84 (18.8%)	NA	144 (32.3%)	1.31 (1.02–1.70)*	62 (14.1%)	NA
Family history of atopic disease						
No	444 (16.3%)	1	795 (29.3%)	1	350 (13.0%)	1
Yes	110 (27.3%)	1.75 (1.37–2.25)*	186 (46.6%)	1.94 (1.55–2.43)*	94 (23.7%)	2.02 (1.55–2.63)*
Moisturizers use						
No	257 (13.6%)	1	NA	NA	NA	NA
Yes	294 (24.2%)	1.64 (1.30–2.06)*	NA	NA	NA	NA

NA: not available; variable not included in the model. [a]AOR: adjusted odds ratio form multiple logistic regression, the model includes gender, working area, age, family history of allergic disease, and moisturizer use. [b]AOR: adjusted odds ratio form multiple logistic regression, the model includes gender, working area, age, employment duration, family history of allergic disease. [c]AOR: adjusted odds ratio form multiple logistic regression, the model includes gender, working area, age, employment duration, family history of allergic disease. *$p<0.05$.

Employment duration also had a positive association with dry eye symptoms (Table 4).

Discussion

Studies on health effects of ultra-low environmental humidity (<5%) are limited but have generally observed adverse effects on the skin[6–9]. There are relatively more studies on the effects of RH in the 5% to 30% range, and they have generally found skin effects as well, especially in people with pre-existing atopic eczema[12–18]. In particular, Wyon[19] and Nordstrom *et al.*[20] described an improvement of dry symptoms and sick building syndrome after humidification, and Reinikainen *et al.*[21] reported a decrease in symptoms of allergic reactions in office workers subsequent to an elevation in RH from 20% to 40% in the working environment. These

intervention studies further support the causal links between moderate low environmental humidity and symptoms of dryness and allergies. The level of RH studied in the current study, 55%, was higher than those of previous studies, but we found that even at this level, people living in a high humidity environment may develop dry symptoms.

As in other studies of clean room workers in Taiwan[1, 2, 22, 23], most of the clean room workers in our study were young women. Because the industry park has a history of operation of less than 10 yr and most of the production lines were established in the recent years, it was not surprising to see that clean room workers, who mostly worked in the manufacturing departments, had shorter employment durations than non-clean room workers. In the current study, we found the prevalences of dry skin, dry eye, and dry nasal and throat symptoms were increased in clean room workers (Table 2). Dry symptoms affecting the eyes, mucus membrane, and skin have been reported in a population exposed to RH of around 10%[12], and humidification was found to be effective in reducing these symptoms[19, 20]. In another study of the TFT-LCD industryworkers in Taiwan, clean room workers were found to have a higher prevalence of tear secretion dysfunction, which can contribute to dry eyes[3]. Furthermore, another study observed a decrease in symptoms of allergic reactions in office workers subsequent to an elevation in RH from 20% to 40%[21]. These results indicate that even in an environment with moderate RH, dry and allergic symptoms may occur.

In comparison with non-clean room workers, we found clean room workers were more likely to have skin symptoms on the palms (OR=1.72, 95% CI: 1.24 to 2.39), but less likely on the face (OR=0.65, 95% CI: 0.45 to 0.94) (Table 3). In clean rooms, workers need to wear protective gloves all the time (for 9 h or more each shift), and this may have caused hand dermatitis, with irritant contact dermatitis as the major type of disease[24, 25]. Therefore, the dry symptoms observed on the skins of these workers were not caused by the relatively low humidity alone, and thus, should be studied separately from other dry symptoms in the future research. On the other hand, workers wear masks while working in clean rooms, and the humidifying effect of the air exhaled by the workers themselves may protect the portion of the face covered by the mask from dry symptoms. The fact that no difference in the prevalence of dry skin symptoms was observed for other body parts between the two groups probably indicated that the clothing covering the other parts of the body was effective at protecting the skin from the effects of the relatively low humidity. Therefore, there are multiple factors affecting the skin symptoms observed in clean room workers, not just the humidity of the work environment. In addition, we found the risk factors for dry skin symptoms were different between men and women, a result which provides further support for the multiple-factor scenario and indicates that gender was a potential effect modifier.

While working in clean rooms, workers do not have their eyes covered, and therefore it is not unexpected to observe a higher prevalence of dry eye symptoms among clean room workers (Table 3). On the other hand, although most workers cover the respiratory tract with a mask while working in a clean room, the nose and throat are the parts through which the dry air is first inhaled into the body. Therefore, it is also understandable that a higher prevalence of dry nasal and throat symptoms was observed in clean room workers (Table 2).

In the current study, we found workers who used moisturizers on a daily basis had a higher prevalence of dry skin symptoms. As a skin moisturizer is usually applied to relieve dry skin symptoms[26], an acceptable explanation is that moisturizer use is the outcome of dry skin symptoms rather than the cause. Still, even after adjusting for this factor and other risk factors such as family history of allergic diseases and age, we found working in the clean rooms was an independent risk factor for developing dry skin symptoms (AOR=1.38, 95% CI: 1.08 to 1.77). Whereas the results of our study indicate that the occurrence of dry skin symptoms in clean room workers has multiple factors, the increases in dry symptoms for the eye, nose and throat were statistically significant, and the associations between the relatively low humidity in the clean room environment and these symptoms are biologically plausible. Our study calls attention to the fact that the prevalence of dry symptoms was significantly higher among clean room workers than among office workers even after adjusting the gender, age, family history, *etc*. In some indoor manufacturing environments, increasing the humidity does not necessarily affect the quality of the products. In such cases, measures to increase the humidity to a level comparable to the living environment may be desirable. Further intervention studies should be conducted to identify the appropriate levels of humidity in different geographic regions.

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References

1) Wang J-N, Su S-B, Guo H-R. Urinary tract infection among clean-room workers. J Occup Health 2002; 44: 329–33.
2) Su S-B, Lin K-H, Chang H-Y, Lee C-W, Guo H-R. Using urine specific gravity to evaluate hydration status

among workers working in ultra-low humidity environment. J Occup Health 2006; 48: 284–9.
3) Su S-B, Lu C-W, Sheen J-W, Kuo S-C, Guo H-R. Tear secretion dysfunction and its related factors among woman workers engaged in light-on tests in the TFT-LCD industry. BMC Public Health 2006; 6: 303.
4) Veien NK, Hattel T, Laurberg G. Low-humidity dermatosis from car heaters. Contact Dermatitis 1997; 37: 138.
5) Guest R. Clean rooms and itchy faces. J Soc Occup Med 1991; 41: 37–40.
6) Su S-B, Guo H-R. Xerotic eczema—Discussion on the environmental and occupational factors and demonstration of a case. Primary Med Care Family Med 2004; 19: 139–43 (in Chinese).
7) Chou T-C, Lin K-H, Wang S-M, Lee C-W, Su S-B, Shih T-S. Transepidermal water loss and skin capacitance alterations among workers in an ultra-low humidity environment. Arch Dermatol Res 2005; 296: 489–95.
8) Chou T-C, Lin K-H, Sheu H-M, Su S-B, Lee C-W, Guo H-R. Alternations in health examination items and skin symptoms resulting from atmospheric exposure to ultra-low humidity—A three-year longitudinal self-matched study. Int Arch Occup Environ Health 2007; 80: 290–7.
9) Sato M, Fukayo S, Yano E. Adverse environmental health effects of ultra-low relative humidity indoor air. J Occup Health 2003; 45: 133–6.
10) Taiwan Central Weather Bureau. Monthly Mean Relative Humidity. [Online]. 2004 [cited 2004 Nov 1]; Available from : URL: http://www.cwb.gov.tw/V4.
11) Egawa M, Oguri M, Kuwahara T, Takahashi M. Effect of exposure of human skin to a dry environment. Skin Res Technol 2002; 8: 212–8.
12) Andersen IB, Lundqvist GR, Proctor DF. Human nasal mucosal function under four controlled humidities. Am Rev Respir Dis 1972; 106: 438–49.
13) Rycroft RJ. Low humidity and microtrauma. Am J Ind Med 1985; 8: 371–3.
14) Arundel AV, Sterling EM, Biggin JH, Sterling TD. Indirect health effects of relative humidity in indoor environments. Environ Health Perspect 1986; 65: 351–61.
15) Eberlein-Konig B, Spiegl A, Przybilla B. Change of skin roughness due to lowering air humidity in climate chamber. Acta Derm Venereol 1996; 76: 447–9.
16) White IR, Rycroft RJ. Low humidity occupational dermatosis—An epidemic. Contact Dermatitis 1982; 8: 287–90.
17) Sunwoo Y, Chou C, Takeshita J, Murakami M, Tochihara Y. Physiological and subjective responses to low relative humidity in young and elderly men. J Physiol Anthropol 2006; 25: 229–38.
18) Sunwoo Y, Chou C, Takeshita J, Murakami M, Tochihara Y. Physiological and subjective responses to low relative humidity. J Physiol Anthropol 2006; 25: 7–14.
19) Wyon P. Sick buildings and the experimental approach. Environ Technol 1992; 13: 313–22.
20) Nordstrom K, Norback D, Akselesson R. Effect of air humidification on the sick building syndrome and perceived indoor air quality in hospitals: A four month longitudinal study. Occup Environ Med 1994; 51: 683–8.
21) Reinikainen LM, Jaakkola JJ, Seppanen O. The effect of air humidification on the sick building syndrome and perceived indoor air quality in office workers: A six-period cross-over trial. Arch Environ Health 1992; 47: 8–15.
22) Uter W, Gefeller O, Schwanitz HJ. An epidemiological study of the influence of season (cold and dry air) on the occurrence of irritant skin changes of the hands. Br J Dermatol 1998; 138: 266–72.
23) Su S-B, Wang J-N, Lu C-W, Guo H-R. Reducing urinary tract infections among female clean room workers. J Women's Health 2006; 15: 872–8.
24) Shiao S-C J, Sheu H-M, Hsieh M-Y, Chen C-J, Du D, Guo YL. Prevalence and related factors of occupational hand dermatoses among electronics workers. Occup Safety Health Res Quarterly 1996; 4: 41–51.
25) Kwon S, Campbell LS, Zirwas MJ. Role of protective gloves in the causation and treatment of occupational irritant contact dermatitis. J Am Acad Dermatol 2006; 55: 891–6.
26) Lazar AP, Lazar P. Dry skin, water, and lubrication. Dermatol Clin 1991; 9: 45–51.