

Development of occupational skin diseases during vocational training in baker and confectioner apprentices: a follow-up study

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Baker and confectioner apprentices have been included in a prospective follow-up study in the region of East Thuringia, to evaluate risk factors for the development of hand dermatitis. Starting in August 1996, the apprentices have been interviewed and examined in a standardized way right at the beginning ($n=91$) of their vocational training, 6 ($n=79$) and 12 months ($n=63$) later. To gain objective data, TEWL score was also assessed at 3 standardized sites on the hands. In their case histories, 3.3% ($n=3$) of the apprentices reported hand dermatitis. The 1st assessment after 2 to 4 weeks vocational training revealed hand eczema in 17.5% ($n=16$) of the individuals. At the follow-up after 6 months of training 29.1% ($n=23$), and after 12 month of training 27.0% ($n=17$), of the apprentices had hand dermatitis of mild to moderate severity. Within 6 months, the TEWL score rose significantly ($p<0.001$) from $11.9 \text{ g m}^{-2} \text{ h}^{-1}$ (± 5.4) to $16.8 \text{ g m}^{-2} \text{ h}^{-1}$ (± 9.5). After 12 months, the TEWL score was $14.9 \text{ g m}^{-2} \text{ h}^{-1}$ (± 4.6). For the atopic skin diathesis (>10 points of Diepgen's atopy score), there was a significant tendency to be a predictive factor for the development of occupational hand dermatitis. TEWL score failed to correlate with the development of skin damage in our study. The same was true for respiratory atopy and metal sensitization.

Key words: baker; confectioner; hand dermatitis; occupational; TEWL score; wet work; atopy; skin protection; skin care; prevention; follow-up study. © Munksgaard, 1998.

Accepted for publication 22 July 1998

Statistical reports of occupational diseases (OD) show high incidences for work-related diseases in bakers and confectioners. The main occupational problems are allergic bronchial asthma and occupational skin diseases (OSD). Disease-related problems lead to limitations in general conditions and physical capacity of the employees and are the main cost factors for the social insurance institution for the food industry and related professions (Berufsgenossenschaft für Nahrungsmittel und Gaststätten (BGN)). In 1995, the BGN registered 1233 cases of OD 4301 (occupational asthma and related diseases) and 1488 cases of OD 5101 (OSD) in bakers and confectioners. As a result of the various prevention activities, registered cases of OD 4301 decreased by 18%, and those of OD 5101 by 38% between 1990–1995 (1).

Especially in bakers and confectioners, occu-

pational hand dermatitis – besides allergic asthma – is the other major problem in the food processing industry and related professions. In 1995, 31.1 % of all registered cases of OD 5101 concerned bakers (82%) and confectioners (18%) (2). Initially, most of the affected employees show irritant contact dermatitis. Consecutive developments of allergic or protein contact dermatitis are rare but important events. Work-related allergies may cause long-term illness and eventually unemployment or occupational reorientation, which is crucial in a time of high unemployment rates and shortness of governmental social support.

Several studies have been published in the past about the risk factors for OSD in hairdressers, health care professions and metal workers (5–8). This is the first follow-up study to evaluate predictive factors for occupational hand dermatitis in

bakery apprentices. Special emphasis was given to the rôle of transepidermal water loss (TEWL) and atopy.

Materials and Methods

In co-operation with the Research Center for Applied System Safety and Industrial Medicine, Erfurt (Germany), a prospective epidemiologic follow-up study in baker and confectioner apprentices was initiated. Starting in August 1996, all available apprentices of the studied professions at the occupational school of Gera (East Thuringia) have been included. Written informed consent was given to an exploration and dermatologic examination.

91 apprentices were interviewed and examined between 2 and 4 weeks after the beginning of training, 79 after 1/2 a year at work and 63 after 1 year. Changing numbers were due to drop outs, withdrawn consent or unavailability at the date of examination. Only those were included who had been present at every examination. %s have been calculated for these numbers at the appropriate time points. A last follow-up assessment will be done at the end of the training after 3 years.

The following data were obtained in a standardized interview: occupational and leisure time activities and exposure to possible allergens and irritants, skin care and cleansing practice, history of hand eczema and metal sensitization.

A dermatological examination of the hands was

performed. Hand dermatitis was defined as mild when erythema and scaling appeared on the dorsal aspects and interdigital folds of the hands, moderate when infiltration and papules were seen and the affected area enlarged, and severe when vesicles and fissures appeared additionally. Differential diagnoses were made by clinical course and personal history.

Atopic skin diathesis was assessed by means of Diepgen's criteria for atopy (3). TEWL (Tewameter, Firm Courage & Khazaka GmbH, Köln) was measured under standardized conditions in a semi-open box on the dorsal aspects of the right or left hands at 3 different sites. Further details of measurement procedures are in accordance with Pinnagoda (4). Mean scores were calculated. Statistical evaluation has been done using the software-package SPSS. Relative risks were calculated using crosstabs with dichotomous variables.

Results

Endogenous risk factors

Baker and confectioner apprentices were included in a follow-up study starting in August 1996 in East Thuringia. 91 apprentices were interviewed and examined at the initial examination, 79 at the 1st follow-up examination after 6 months, and 63 after 1 year (Table 1). 2 of them dropped out because of personal reasons after 6 months. 2 apprentices cancelled their training because of occupational bronchial asthma.

57% ($n=59$) were female. The mean age was 17.7 ± 1.34 years. 63.7% ($n=66$) had skin piercing, 23.1% ($n=24$) reported metal sensitization (Table 2).

A relevant atopic skin diathesis, as assessed by Diepgen's atopy score and defined by the presence of more than 10 points, was found in 13.2% ($n=12$) of the apprentices. Allergic rhinitis was reported by 9.9% ($n=9$) and bronchial asthma by 5.5% ($n=5$) of the trainees (Table 2). 3.3% ($n=3$) of the trainees had pre-occupational hand dermatitis. Occupational skin disease of the hands occurred in 17.5% ($n=16$) after 2–4 weeks of practical work, in 29.1% ($n=23$) after 6 months and in 27.0% ($n=17$) after 12 months (Fig. 1).

Almost 1/3 of the apprentices developed skin problems within the 1st month of the vocational training. Irritant contact dermatitis was by far the most common diagnosis, followed by allergic contact dermatitis, atopic and dishidrotic hand dermatitis. A comparable ranking in differential diagnosis was seen at the 2nd follow-up (Fig. 2).

At the 1st follow-up the development of skin problems was related to female sex ($p<0.05$) and, as expected, to pre-occupational hand dermatitis

Table 1. Timetable of examinations

	Week	<i>n</i>	%
initial examination	2–4	91	100
1st follow-up	25–27	79	86
2nd follow-up	52–56	63	69

Table 2. Demographic profile and atopy in bakers and confectioners

	<i>n</i>	
Demographic profile		
age	17.7±1.34	91
sex	57.0%	59
piercing	63.7%	66
metal sensitization	23.1%	24
Prevalence of atopic disease		
<i>Atopic skin diathesis:</i>		
no atopic skin diathesis	40.7%	37
atopic skin diathesis unlikely	38.5%	35
atopic skin diathesis uncertain	7.7%	7
atopic skin diathesis relevant	13.2%	12
<i>Respiratory atopy:</i>		
allergic rhinitis	9.9%	9
bronchial asthma	5.5%	5

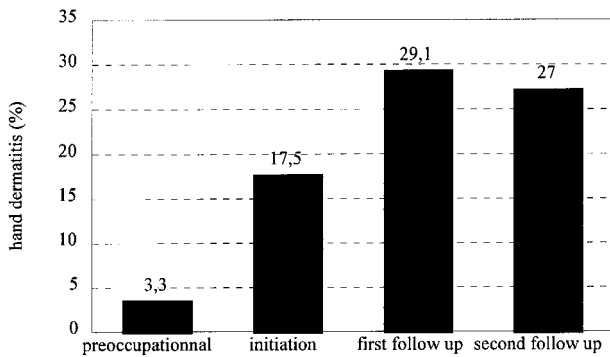
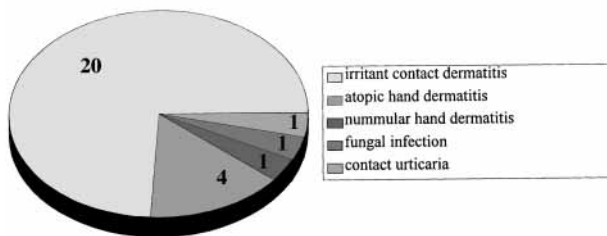


Fig. 1. Prevalence of occupational hand dermatitis.

first follow up



second follow up

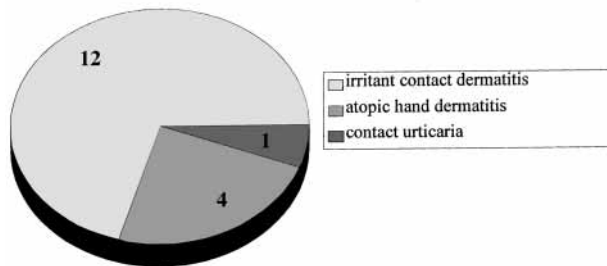


Fig. 2. Differential diagnoses after 6 and 12 months of training.

($p < 0.05$). Bakers and confectioners had a higher risk of occupational hand dermatitis than bakery shop assistants at both follow-ups ($p < 0.05$).

After 12 months at work the association of hand dermatitis with female sex was no longer significant. No association with pre-occupational hand dermatitis was found, but a non-significant association with flexural eczema. Apprentices with relevant atopic skin diathesis had hand dermatitis more frequently than non-atopics, though the risk was not as significant as shown in previous occupational studies. At the initial examination, atopic individuals had a 3.9 fold relative risk for the development of hand eczema (CI 1.1–14.7), which was significant. After 6 months, calculated relative risk decreased to 1.15 (CI 0.13–10.35), lacking sig-

nificance. After 12 months, relative risk for hand dermatitis in atopics was elevated 3.7 fold (CI 0.3–44.0 n.s.). No correlation between occupational hand dermatitis and flexural dermatitis, respiratory atopy, serum IgE > 100 IU/ml or metal sensitization was found at any of the follow-ups.

Exogenous risk factors

Besides endogenous risk factors, exogenous risk factors were analysed. At the 1st follow-up only the preparation of fruit for more than 4 h a day was identified to be a risk factor for the development of hand dermatitis ($p < 0.05$). Wet work in general, cleansing or disinfection of working materials, and manual preparation of dough, as well as leisure habits, were not significantly correlated with the development of occupational hand dermatitis.

After 12 months at work, hand dermatitis was significantly correlated with cleansing over 1 h a day ($p < 0.01$), with a relative risk of 1.7 (CI 1.3–2.1). Hand washing more than 20× a day was correlated with a relative risk of hand dermatitis (OR 2.95, CI 0.85–10.0 n.s.). Further non-significant correlations were found between hand dermatitis and disinfection procedures, as well as fruit handling for more than 1 h a day. No correlations were found for dough making, hot work and different leisure time habits.

TEWL score

The mean of the TEWL score at the beginning of the training was $11.9 \text{ g m}^{-2} \text{ h}^{-1}$ (± 5.4). After 6 months, it rose significantly to $16.8 \text{ g m}^{-2} \text{ h}^{-1}$ (± 9.5) ($p < 0.0001$). After 12 months, the TEWL score was $14.9 \text{ g m}^{-2} \text{ h}^{-1}$ (± 4.6) and still significantly elevated compared to the initial examination ($p < 0.02$) (Fig. 3). The cut off point for discriminating normal from elevated TEWL scores was defined as $12 \text{ g m}^{-2} \text{ h}^{-1}$.

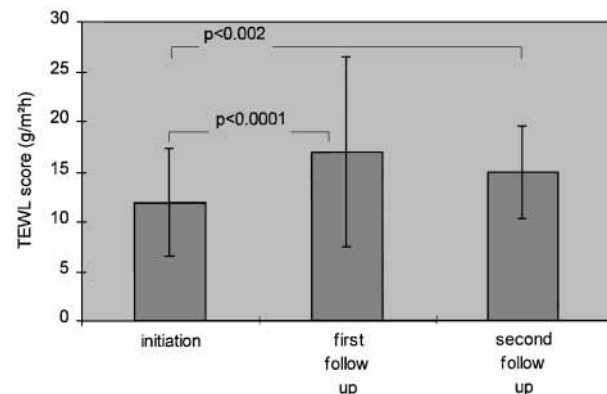


Fig. 3. Time course of TEWL score.

At the initial examination, elevated TEWL scores were associated with female sex, with a relative risk of 1.38 (0.91–1.9), hand washing more than 5× per day 2.54 (0.81–7.9), dough making 1.5 (0.63–3.6), confectioner's work 1.44 (0.6–3.5) and present hand dermatitis 1.84 (0.6–5.5). No significant correlations were found because of the low numbers of cases in the groups compared. Bakers and confectioners have higher level of TEWL than bakery shop assistants. Lower TEWL seemed to be correlated with the use of skin care products.

No correlation was found to elevated IgE levels >100 IU/ml, pre-occupational flexural dermatitis, allergic asthma, metal sensitivity, skin atopy >10 points (Diepgen), use of skin care products, wet work, our fruit handling.

At the 1st follow-up examination, 6 months after the beginning of training, the following significant correlations could be found: TEWL score was positively correlated with female sex ($p<0.07$). Lower TEWL scores were more common in shop assistants than in bakers or confectioners ($p<0.001$). Again, no correlation was found with pre-occupational flexural or hand dermatitis, skin care practice or metal sensitization, serum IgE>100 IU/ml, respiratory atopy or skin atopy.

After 12 months of training, elevated TEWL scores were significantly correlated with baker and confectioner occupation ($p<0.001$), dough making ($p<0.001$) and female sex ($p<0.05$). Furthermore, the use of skin care products more than 5× a day (OR1.2 CI 0.2–5.2 n.s.) and cleansing (OR1.7 CI 0.13–20.7n.s.) showed a positive tendency towards elevated TEWL scores. TEWL scores failed to be associated with pre-occupational flexural or hand eczema, skin care practice or metal sensitization, serum IgE>100 IU/ml, respiratory atopy or skin atopy.

Discussion

We investigated the rôle of endogenous and exogenous risk factors as well as the assessment of TEWL as predictive factors for the development of occupational hand dermatitis in baker and confectioner apprentices.

It has been shown previously that constitutional factors, e.g., atopic skin diathesis and especially present or previous flexural or hand dermatitis, are closely related to the development of skin problems during vocational training in nursery and hairdresser apprentices (5–7). We reported a 1.7-fold (CI 1.12–2.86) relative risk for the development of OSD in hairdressers and nurses with confirmed atopic skin diathesis (8).

The initial examination showed a correlation of skin atopy and hand dermatitis (OR 3.9). No sig-

nificant correlations were found in the 1st (OR 1.15 CI 0.13–10.35) and 2nd (OR 3.7 CI 0.3–44) follow-up. Possibly, skin atopy in healthy bakers and confectioners does not play a comparable rôle for the development of hand dermatitis to that shown in hairdressers and nurses. In a recent study, no relationship between “atopic skin” and skin irritability was found in healthy metalworker trainees (9). On the other hand, a possible reason for these observations may be the limited number of apprentices with atopic skin diathesis (13.2%) in our study group, statistical analysis therefore being rather limited. Respiratory atopy (OR=0.31 (CI 0.04–1.9)) and metal sensitization (OR=0.35 (CI 0.07–1.7)) have not been found to be risk factors in our group, but discussion in this particular area is far from over (10, 11).

In recent years, wet work exceeding more than 4 h a day was identified as a risk factor for the development of occupational hand dermatitis in hairdressers (5). A weak influence of exogenous risk factors was also seen in our study population. In baker and confectioner apprentices only fruit handling more than 4 h a day ($p<0.05$) and cleansing more than 1h a day ($p<0.01$) were significantly correlated to hand dermatitis ($p<0.05$). No significant correlation was found to wet work in general or disinfection of equipment, which is a relevant part of a baker's daily wet work load. This might be due to the reasons discussed above.

Due to the higher irritant potential of the occupation, bakers and confectioners had higher TEWL scores than shop assistants ($p<0.001$). This was not accompanied by a higher incidence of hand dermatitis. We conclude that TEWL score reflects the current irritant exposure, but is no predictor for the development of hand dermatitis in the future.

Furthermore, elevated levels of TEWL scores were associated with female sex ($p<0.05$). This is probably related to different occupational and leisure time habits and not to female sex in particular. Other groups did not find this difference (12). The use of skin care products seemed to be correlated with a lower TEWL at the 1st follow-up, but this correlation was lost at the 2nd follow-up.

One has to consider that apprentices with skin problems will use care products more often and that therefore the TEWL score will be in the balance between the level of skin disease and effectiveness of skin care procedures. There was no correlation between hand dermatitis and TEWL either. Probably the same phenomenon applies because of intensified skin care procedures in affected people. Halkier-Sorensen et al. (13) found the identical situation in cooks who used skin care products.

As a conclusion of our study, assessment of

baseline TEWL score is not sufficient for prediction of a potential personal risk of developing hand dermatitis in bakers and confectioners. So far, risk assessment for the development of hand dermatitis and the detection of "pre-hand dermatitis" is easier, more reliable and standardized by clinical examination and personal history than by using TEWAmetry. In prevention studies with apprentices in skin-hazardous occupations, it is more necessary than ever to be aware of these factors, since skin problems appear in almost 1/3 of apprentices within the 1st 6 months of their vocational training.

Acknowledgement

This study was supported by the social insurance institutions of the food industry of Germany.

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