MSC Journal Of Medical Surgical Concerns
ISSN 2797-8400 (Print)
ISSN 2797-8419 (Online)
Doi: 10.56922

NOMOR
286/DST/C3/HM.01.00/26

ARTICLE INFORMATION
Received: April 19, 2026
Revised: July 15, 2026
Available online: July 30, 2026
at: https://e-jurnal.iphorr.com/index.php/msc

Association between frequency of powdered detergent use and irritant contact dermatitis among laundry workers

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Abstract

Background: Irritant contact dermatitis (ICD) is a non-allergic inflammatory skin reaction caused by direct exposure to irritants. Laundry workers are vulnerable because repeated wet work and detergent contact can disrupt the skin barrier.
Purpose: To examine the association between powdered detergent use frequency and ICD among laundry workers.
Method: This cross-sectional analytic study included all 60 laundry workers in the study population in Tulang Bawang Barat Regency, Lampung Province, in January 2026. Data were collected using a questionnaire, clinical history taking, and physical skin examination. Categorical data were summarized as frequencies and percentages, and the chi-square test assessed the association between powdered detergent use frequency and ICD.
Results: High-frequency powdered detergent use was reported by 26 workers (43.3%), while 17 (28.3%) reported moderate use and 17 (28.3%) reported low use. ICD was identified in 42 workers (70.0%). Powdered detergent use frequency was significantly associated with ICD ($p = 0.004$).
Conclusion: Powdered detergent use frequency was associated with ICD among laundry workers. Because the study was cross-sectional, the finding should be interpreted as an association rather than evidence of causation.

Keywords: Irritant contact dermatitis; Laundry workers; Occupational exposure; Powdered detergent.

INTRODUCTION

Irritant contact dermatitis is a non-allergic inflammatory reaction caused by direct exposure to chemical or physical irritants. Clinical manifestations may include erythema, itching, dryness, scaling, stinging, and fissuring at sites of contact. Repeated exposure can impair the stratum corneum, increase transepidermal water loss, and reduce skin-barrier function (Scheinman, Vocanson, Thyssen, Johansen, Nixon, Dear, Botto, Morot, & Goldminz, 2021; Li & Li, 2021; Novak-Bilić, Vučić, Japundžić, Meštrović-Štefekov, Stanić-Duktaj, & Lugović-Mihić, 2018; Patel & Nixon, 2022; Bains, Nash, & Fonacier, 2019).

Laundry work combines wet work with repeated handling of detergents and other cleaning agents. Surfactants and alkaline ingredients can remove surface lipids and increase susceptibility to irritation, particularly when exposure is frequent or prolonged. Inadequate glove use, pre-existing atopic disease, and repeated hand washing may further increase occupational skin risk (Jacobsen, Rasmussen, Bregnhøj, Isaksson, Diepgen, & Carstensen, 2022; Schütte, Tamminga, de Groene, Kezic, & van der Molen, 2023; Sedeh, Michaelsdóttir, Jemec, Mortensen, & Ibler, 2023; Kersh, Johansen, Ojeaga, & de la Feld, 2021; Jakasa, Thyssen, & Kezic, 2018).

DOI: https://doi.org/10.56922/msc.v6i3.3774

Evidence from Indonesian laundry workers and international occupational-health guidance identifies detergent exposure, wet work, and insufficient personal protection as relevant contributors to occupational dermatitis (Harahap & Sundari, 2022; Health and Safety Executive, 2023; DermNet New Zealand, 2021). However, evidence from small-scale laundry services in Tulang Bawang Barat Regency remains limited. Local data are needed to support practical prevention through exposure reduction, appropriate gloves, skin-care education, and timely clinical assessment.

This study therefore examined the association between powdered detergent use frequency and irritant contact dermatitis among laundry workers in Tulang Bawang Barat Regency.

RESEARCH METHOD

A quantitative analytic observational study with a cross-sectional design was conducted among laundry workers in Tulang Bawang Barat Regency, Lampung Province, Indonesia, in January 2026. The independent variable was powdered detergent use frequency, and the dependent variable was the presence of irritant contact dermatitis.

All 60 laundry workers in the study population were included through total population sampling. Data were collected using a questionnaire, clinical history taking, and a physical skin examination.

The study questionnaire classified powdered detergent use frequency as low, moderate, or high.

Irritant contact dermatitis was identified through clinical history taking and physical skin examination, consistent with occupational dermatitis assessment that integrates exposure history and clinical findings (Houle, Holness, & DeKoven, 2021; Lampel & Powell, 2019). Among workers with ICD, severity was categorized as mild, moderate, or severe based on the observed clinical manifestations. Mild ICD included mild erythema, mild itching, and mild dryness; moderate ICD included scaling, clearly visible erythema, persistent itching, and mild fissuring; and severe ICD included hyperkeratosis, extensive fissuring or cracking, and severe stinging or burning.

Categorical variables were summarized using frequencies and percentages. The association between powdered detergent use frequency and ICD was assessed using the chi-square test, with statistical significance set at $p < 0.05$.

Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Malahayati (No. 5417/EC/KEP-UNMAL/V/2026.

RESEARCH RESULTS

A total of 60 laundry workers were included. Table 1 summarizes participant age, powdered detergent use frequency, and the occurrence of irritant contact dermatitis.

Table 1. Participant age, powdered detergent use, and irritant contact dermatitis (N = 60)

Variable	Results, n (%)
Age, mean ± SD (range), years	35.92 ± 9.61 (20–58)
20–29	18/30.0
30–39	23/38.3
40–49	14/23.3
50–59	5/8.3
Powdered detergent use frequency	
Low	17/28.3
Moderate	17/28.3
High	26/43.3
Irritant contact dermatitis	
Absent	18/30.0
Present	42/70.0

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Participants had a mean age of 35.92 ± 9.61 years (range, 20–58 years), and the largest age group was 30–39 years (23/38.3%). High-frequency powdered detergent use was the most frequently reported category, identified in 26 workers (43.3%). Irritant contact dermatitis was present in 42 workers (70.0%).

Table 2. Powdered detergent use frequency and irritant contact dermatitis (N = 60)

Powdered detergent use frequency	Irritant contact dermatitis, n (%)	Irritant contact dermatitis, n (%)	Total, n (%)	p value
	Absent	Present		
Low	10/58.8	7/41.2	17/100.0	0.004
Moderate	5/29.4	12/70.6	17/100.0	
High	3/11.5	23/88.5	26/100.0	
Total	18/30.0	42/70.0	60/100.0	

The proportion of workers with ICD increased from 41.2% in the low-frequency group to 70.6% in the moderate-frequency group and 88.5% in the high-frequency group. The chi-square test showed a statistically significant association between powdered detergent use frequency and ICD (p = 0.004).

Table 3. Irritant contact dermatitis severity by powdered detergent use frequency (n = 42)

Powdered detergent use frequency	ICD severity, n (%)	ICD severity, n (%)	ICD severity, n (%)	Total, n (%)
	Mild	Moderate	Severe	
Low	5/71.4	2/28.6	0/0.0	7/100.0
Moderate	4/33.3	6/50.0	2/16.7	12/100.0
High	3/13.0	10/43.5	10/43.5	23/100.0

Mild ICD predominated among affected workers in the low-frequency group, whereas moderate and severe ICD were more common in the high-frequency group. This secondary distribution is descriptive until the corresponding statistical test is confirmed.

DISCUSSION

The principal finding was a statistically significant association between powdered detergent use frequency and ICD among laundry workers. ICD was increasingly common across the low-, moderate-, and high-frequency groups. Because exposure and outcome were measured at the same time, the result supports an association but does not establish that frequent detergent use preceded or caused dermatitis.

The finding is consistent with Indonesian evidence linking occupational detergent exposure and protective practices with dermatitis among laundry workers (Harahap & Sundari, 2022). Systematic reviews likewise identify wet work, cleaning agents, repeated skin exposure, and individual susceptibility as important occupational contact-dermatitis factors (Jacobsen et al., 2022; Schütte et al., 2023; Sedeh et al., 2023). Variation between studies may reflect differences in detergent formulations, exposure duration, glove use, pre-existing skin disease, and diagnostic procedures.

A biologically plausible mechanism is cumulative disruption of the epidermal barrier. Surfactants and alkaline cleaning agents can remove natural lipids, increase transepidermal water loss, and facilitate inflammation. Continued exposure may produce progressive erythema, dryness, scaling, fissuring, and hyperkeratosis (Patel & Nixon, 2022; Bains et al., 2019; Jakasa et al., 2018; Johansen, Bonefeld, Schwensen, Thyssen, & Uter, 2022). Nevertheless, this study did not directly measure detergent composition, concentration, contact duration, wet-work hours, or skin-barrier function; these mechanisms therefore remain explanatory rather than demonstrated within the present data. The descriptive severity pattern showed that mild ICD was more common in the low-frequency group, while moderate and severe lesions were more common in the high-frequency group. This pattern is compatible with

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cumulative irritant exposure, but inferential interpretation should be deferred until the statistical test and p value for the 3 × 3 severity table are verified.

This study has several limitations. The cross-sectional design precludes conclusions about temporal direction or causality. Total population sampling within one regency and the small sample limit generalizability. Detergent-use frequency was questionnaire-based; the category thresholds, questionnaire validity and reliability, and exposure duration were not fully reported. The diagnostic and severity-assessment procedures were also insufficiently described, creating potential outcome misclassification. Potential confounders, including glove use, wet-work duration, detergent concentration, atopic history, other chemical exposures, and skin-care practices, were not adjusted for. In addition, no effect estimates or confidence intervals from a multivariable analysis were available.

The findings support practical occupational-health measures, including reducing direct detergent contact, using suitable protective gloves, rinsing and drying the hands appropriately, applying skin-care measures, and seeking early clinical assessment when symptoms develop. Evidence-based prevention combines exposure control, appropriate personal protection, education, and early intervention (Bauer, Rönsch, Elsner, Dittmar, Bennett, Schuttelaar, Lukács, John, & Williams, 2018; British Association of Dermatologists, n.d.; Holness, 2019; Srinivas & Sethy, 2023). These measures should complement, rather than replace, efforts to improve detergent-handling procedures and workplace education.

CONCLUSION

Powdered detergent use frequency was significantly associated with irritant contact dermatitis among laundry workers in Tulang Bawang Barat Regency ($p = 0.004$). ICD occurred more frequently among workers reporting high-frequency detergent use than among those reporting low-frequency use. Because the study was cross-sectional and did not adjust for important occupational and individual factors, the finding should not be interpreted as evidence of causation.

SUGGESTION

Laundry businesses should strengthen education on safer detergent handling, consistent use of suitable gloves, hand drying, and skin care, while facilitating early referral for persistent symptoms. Future studies should use larger multicenter samples, validated exposure and diagnostic instruments, detailed measures of detergent concentration and wet-work duration, and multivariable analyses that account for glove use, atopic history, co-exposures, and other potential confounders. Prospective designs would better establish the temporal relationship between exposure and dermatitis.

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