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Overview of workers hand skin hydration levels on tofu maker at the tofu factory in Matraman district, East Jakarta

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ABSTRACT

The parameters of human skin health can be assessed from the level of skin hydration. Skin hydration level is the water content in the stratum corneum which is strongly influenced by natural moisturizing factor (NMF) and intercellular lipids. These components can be disrupted when exposed to irritants, such as detergents, too acidic substances, and so on. This condition can cause a decrease in skin hydration levels and becomes inactive, thereby it increases the skin's sensitivity to exogenous factors and infections. Traditional tofu factory workers are workers who have a risk of experiencing a decrease in skin hydration levels due to frequent exposure to tofu-making ingredients with an acidic pH. In Matraman Sub-district, East Jakarta, there are several tofu factories with the manufacturing process that is still processed traditionally. This descriptive observational study with a cross-sectional design aims to determine the overview of hand skin hydration levels in tofu-making workers located in the traditional tofu factory at Matraman District, East Jakarta. So that the workers and factory owners are expected to improve the quality of their workers. Data were obtained by measuring skin hydration levels in 100 study subjects using SK-IV corneometer and filling out questionnaires. Results: an overview of the skin hydration levels of right-handed and left-handed subjects with an average of 20,42% (very dry skin). The average level of skin hydration was lowest in the 60-70 year age group (19,35%), and in the 20-30 year age group (21,65%) and the male group had higher levels (20,59%). Level measurement at the hand location was obtained very dry skin category on the back of the right hand (100%). The more frequent of the frequency exposure to chemicals, the lower the hydration level of the skin (20,08%).

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INTRODUCTION

The skin hydration level is the water content in the epidermis layer maintained by the stratum corneum which is strongly influenced by natural moisturizing factor (NMF) and intercellular

lipids(Jung et al., 2021). Sufficient water content in the skin helps maintain the structure so that the skin can work properly(Wen et al., 2021). Skin exposure with various factors, one of which is exposure to irritants or allergens with a long duration and more acidic or more alkaline pH rather than the normal skin pH (pH=5,5)(Lukić et al., 2021). Then, it can damage the skin barrier causing the increase TransEpidermal Water Loss (TEWL) which resulting(Jansen van Rensburg et al., 2019) in decreased levels of skin hydration at risk of causing dermatitis. The skin easily causes symptoms or complaints called irritant contact dermatitis (DKI)(Achmad & Cahyawari, 2022).

According to Perdoski (Indonesian Association of Dermatologists and Venereologists) 90% of occupational skin diseases commonly found are contact dermatitis, both allergic and irritant(Rahmawati & Akil, 2020). According to research in 2012 conducted in Australia, 79% to 95% of the incidence of contact dermatitis is due to work and 44% is the incidence of DKI (Ahmed et al., 2019)with symptoms of erythema, bullae, squama, edema, and dry skin. Places of predilection for contact dermatitis are usually found on the arms, hands, and fingers (Warshaw et al., 2019). Occupations that are at risk of contact dermatitis, namely hairdressers and makeup, janitors, health workers, agricultural workers(Milam et al., 2020), and other food-related jobs, namely tofu-making workers, especially those who still use traditional methods, are very at high risk of experiencing DKI because their hands are exposed to chemicals used in the tofu-making process, such as vinegar acid (pH=4), lactic acid (pH=5,06-5,61) and CaSo4 (pH=7). Based on research data conducted on tofu workers in the Binjai area, 72% of workers experienced contact dermatitis due to exposure to chemicals used in the tofu making process (RHIZKIYANA, 2019). Skin disease does not cause death, but it is very disturbing for the sufferer and causes a decrease in work productivity(Kelly et al., 2021).

Matraman District, East Jakarta has several tofu factories with traditional manufacturing processes(Irawaty, 2018). Workers at the factory are in direct contact with the materials used in the tofu manufacture without protective equipment so that they have the risk of dermatitis (Badriah & Heriana, 2020). Damage skin components, such as moisturizing factor (NMF) and intercellular lipids consequences of irritants increase the TEWL and cause the skin to become dehydrated and if left unchecked(Vater et al., 2021), it will cause disease complaint, such as DKI. According to the explanation above(Makmur, 2022), added with the absence of data on the hydration levels of hand skin in tofu factory workers in Matraman District, East Jakarta, the researchers are interested in conducting research on the skin overview hydration levels in the hand skin of tofu factory workers in its area(Simpson, 2019).

Formulation of the Problem: (1) What is the description of hand skin hydration levels in tofu-making workers at the tofu factory in Matraman District, East Jakarta? (2) What is the description of hand skin hydration levels based on age and gender in tofu-making workers at the tofu factory in Matraman District, East Jakarta? (3) What is the description of hand skin hydration levels based on the location of measurements on tofu-making workers at the tofu factory in Matraman District(Zimberoff, 2021), East Jakarta? (4) What is the description of hand skin hydration levels based on the chemical frequency of exposure during work on tofu-making at the tofu factory in Matraman District(PRABHAKAR, n.d.), East Jakarta?.

RESEARCH METHOD

The study started from January 2022 to April 2022 on tofu-making workers at the traditional tofu factory in Matraman District, East Jakarta(Tajidan et al., 2022). This study was conducted using a cross sectional observational descriptive research design(Aggarwal & Ranganathan, 2019). Data collection was carried out by filling out questionnaires of the research subjects after which the examination of skin hydration levels using the SK-IV corneometer/ It is able to provide efficient and sensitive results for skin hydration measurements in four skin areas, namely the back of the left right hand, and the palm of the left-right hand(Wu et al., 2021).

RESULTS AND DISCUSSIONS

This study obtained 100 subjects who have been in line with the inclusion criteria with the age range of 20-68 years(Rollo et al., 2020). Based on gender, the majority of subjects were male (79%) (Table 1)(Zucker & Prendergast, 2020). In accordance with the data of the Central Statistics Agency (BPS) states that the number of Jakarta's population of men is more than women, namely 5,35 million people.10 Subjects were then grouped by age(Oktadiana et al., 2022), obtained a majority in the age group of 30-40 years (30%). Based on the habits of the subjects majority (65,0%) stated that using hand sanitzer during the COVID-19 pandemic with a frequency of <5 times/day (51,0%), washing hands >10 times/day during the tofu making process (41,0%), not using moisturizer (73,0%), drinking water >8 glasses/day (71,0%) and not using gloves during the tofu making process (93,0%). As many as 40% of subjects admitted that being exposed to chemicals while working with a frequency of <5 times/day (Table 1).

Table 1. Characteristics of the Research Subject

Variable	Frequency (%) N=100	Mean±SD	Median (Min; Max)
Age	-	42,14±11,67	42 (20;68)
20-30	17 (17,0%)	-	-
30-40	30 (30,0%)	-	-
40-50	29 (29,0%)	-	-
50-60	18 (18,0%)	-	-
60-70	6 (6,0%)	-	-
Gender	-	-	-
Male	79 (79,0%)	-	-
Female	21 (21,0%)	-	-
Working time	-	16,15±11,39	1^{5} (0,50;45)
History of Skin Diseases	-	-	-
Yes	49 (49,0%)	-	-
No	51 (51,0%)	-	-
Wearing *Hand Sanitizer*			
Yes	65 (65,0%)	-	-
No	35 (35,0%)	-	-
Frequency of Using *Hand sanitizer*	-	-	-
Not Wearing	35 (35,0%)	-	-
<5 times/day	51 (51,0%)	-	-
5-10 times/day	12 (12,0%)	-	-
>10 times/day	2 (2,0%)	-	-
The Use of *Hand sanitizer*			
Yes	65 (65,0%)		
No	35 (35,0%)		
Hand Washing Frequency	-	-	-
<5 times/day	38 (38,0%)	-	-
5-10 times/day	21 (21,0%)	-	-
>10 times/day	41 (41,0%)	-	-
Frequency of Exposure to Chemicals	-	-	-
< 5 times/day	40 (40,0%)	-	-
5-10 times/day	31 (31,0%)	-	-
>10 times/day	29 (29,0%)	-	-
Application of Moisturizer			
Yes	27 (27,0%)		
No	73 (73,0%)		
Frequency of Moisturizer Application			
2 times/day	25 (25,0%)		

Variable	Frequency (%) N=100	Mean±SD	Median (Min; Max)
2-6 times/day	2 (2,0%)		
No	73 (73,0%)		
Frequency Drinking			
<5 glasses/day	1 (1,0%)		
5-8 glasses/day	28 (28,0%)		
>8 glasses/day	71 (71,0%)		
Wearing Gloves at work			
Yes	7 (7,0%)		
No	93 (93,0%)		

Description of hand skin hydration levels in tofu maker workers

Based on the measurement of skin hydration levels, it was obtained that range of 16,68% to 32,45% with the average hydration levels of right and left-hand skin being 20,42% or including the very dry skin category (Table 2) due to exposure to chemicals used in the process of making tofu.

Table 2. Hand Skin Hydration Levels

Variable	Frequency (%)	Mean±SD	Median (Min; Max)
Hydration Levels	-	20,42±2,67	20,03 (16,68;32,45)
Very Dry	100 (100,0%)	-	-
Dry	-	-	-
Normal	-	-	-

Description of hand skin hydration levels by age group and gender

Calculation of hydration levels by age group is obtained that the highest average hydration levels of hand skin is 21,65% in the age group of 20-30 years, and the lowest average hydration levels is 19,35% in the age group of 61-70 years (Table 3). In this measurement results, it appears that in each age group of 10 years, a decrease in skin hydration levels of approximately 1% is obtained(Bolke et al., 2019). This result shows that the increasing age and the level of skin hydration will decrease due to aging factors(Bolke et al., 2019). In line with the results of research conducted in Germany by Agustin M et al, the incidence of dry skin is highest in the age group 60-70 years compared to the age of 16-59 year(Lindqvist, 2020)s. Normally, the level of skin hydration ranges from 43-46%. However, with age, the skin becomes more dry physiologically because the skin has decreased elasticity due to the collagen content in the skin, where collagen has a role to bind water in the skin.12 In addition, duration work can also affect skin hydration levels. The average duration of work of the subjects aged 16 years (Table 1), the longer duration of work, the longer the exposure to chemicals in the process of making tofu.

Table 3. Hand Skin Hydration Levels by Age Group

Variable	Average Rate Hand Skin Hydration
Age	
20 - 30	21,65%
31 - 40	20,54%
41 – 50	20,40%
51 – 60	19,44%
61 – 70	19,35%

Based on the gender, higher hydration levels were found in male rather than in women (Table 4). Male have higher androgen hormones so it can cause sebaceous glands to be more active than women. The histology of men's skin, which is 20% thicker, allows for denser collagen tissue than women's.14,15 Collagen tissue plays a role in increasing water transfer in the dermis. In this study, the majority of water consumption habits were male subjects who had a consumption habit of drinking as much as > 8 glasses per day. This is supported by Palma et al research, people who drink more than 3,200 ml/day has a positive impact on the physiological skin.

Table 4. Hand Skin Hydration Levels by Gender

Variable	Average Rate Hand Skin Hydration
Gender	-
Male	20,59%
Female	19,77%

Description of Hand Skin Hydration Levels based on Measurement Location

The measurement results of hand skin hydration levels to the measurement location was obtained skin hydration levels of 100 research subjects (100,0%) is very dry on the back of the right hand compared to the location of the right palm (97,0%) while the left hand obtained the same results for the back and palms of the hand is very dry (97,0%) (Table 5). In the results of this study, the skin hydration levels of the back of the right hand are mostly drier than the palm of the hand. The thickness of the stratum corneum on the palms indicates a higher level of skin hydration.18 The thick stratum corneum allows a thicker layer of keratin located in the corneum distratum. Keratin substances located in keratinocyte cells play a role in protecting the epidermis from dehydration.19 Research data by Mariko Egawa et al states that the thickness of the stratum corneum on the back of the hand is 29,3 microm and the thickness of the stratum corneum on the palm of the hand is 173,0 microm. It means that the back of the hand is thinner than the palm of the hand.20 These results are different from the study by Ramos e silva et al which stated that anatomical location affects the barrier function of the skin; hydration levels are lower in the soles of the feet, palms of the hands, and the inside of the forearms. This can be caused because the palms of the hands and feet have more sweat glands than other skin locations so that it can increase skin hydration levels.

Table 5. Hand Skin Hydration Levels Based on Measurement Location

Hand Skin Hydration	Measurement Location							
	Left Dorsal		Left Palmar		Right Dorsal		Right Palmar	
	N	%	N	%	N	%	N	%
Very Dry	97	97,0	97	97,0	100	100.0	97	97,0
Dry	3	3,0	0	0,0	-	-	1	1,0
Normal	-	-	1	1,0	-	-	2	2,0
Humid	-	-	1	1,0	-	-	-	-
Very Humid	-	-	1	1,0	-	-	-	-

Description of Hand Skin Hydration Levels based on Frequency of Chemical Exposure

Based on the frequency of exposure to chemicals, it is obtained the lowest average hydration levels in subjects with exposure >10 times/day by 20,08%, and the highest in subjects with exposure <5 times/day by 20,90% (Table 6). At the time of this study, it was found that the majority of workers do not use gloves so that the risk of workers exposed to xerosis cutis is increasing. Proksch and Brasch also said in their study that the most common agents that cause damage to the skin barrier are water, detergents, and chemical diversity. Too frequent exposure to chemicals can affect the structure of lipid bilayer on the skin protective layer that will cause various skin disorders. In the long term, it will have an impact on skin irritation. This is in line with previous research conducted on tofu-making workers in the Binjai area with the result that 72% of workers experienced contact dermatitis due to exposure to chemicals used in the tofu-making process.9

Table 6. Hand skin hydration levels based on frequency of chemical exposure

Variable	**Frequency (%)**	**Average Hydration Levels**
Exposure to Chemicals	-	
< 5 times	40	20,29%
5-10 times	31	20,15%
> 10 times	29	20,09%

Besides the tofu coagulant in this study is obtained, as many as 51 research subjects (51,0%) using alcohol-based hand sanitizer during the COVID-19 pandemic with a frequency of <5 times/day

(Table 1). The use of surfactants, soap, and alcohol can cause improper desquamation and provoke the appearance of dry and flaky skin. This is supported by Mushtaq et al's research that hand hygiene practices during the COVID-19 pandemic increase the risk of impaired skin barrier function. Sometimes, it can also worsen pre-existing skin conditions. Then, looked from the frequency of hand washing by workers as many as 41 subjects washing their hands >10 times/day (Table 1) can also affect the condition of the skin of workers' hands. The increasing frequency of hand washing allows for more frequent exposure of the hands to water and hand washing soap, causing a decrease in the moisture content of the stratum corneum. This is in line with research conducted by Beiu et al which states that washing hands can cause disruption of the skin barrier and create dry skin.

This study also asked about the habit of using moisturizers and found the majority of subjects (73,0%) did not use moisturizers (Table 1), one of the recommended xerosis cutis treatment strategies is the use of skin moisturizers regularly. According to research by Gade Anita et al moisturizer formulated to prevent dry skin.4 Moisturizers can also help to maintain the water content in the skin around 10-30% and the structure and also function of the skin. A moisturizer must be applied to moist skin immediately after showering, as this will reduce evaporation.4 The frequency of using moisturizers are very low and even not at all. This is due to the lack of information about the use of moisturizers so that there is too late early prevention of xerosis cutis. It is defined as skin that loses hydrolipids and is characterized by a decrease in the quantity and quality of Natural Moisturizing Factors. In addition, xerosis cutis can be one of the triggers for skin infections and can occur simultaneously or be part of skin diseases. So that, it can be used as an indicator of a person's health in general.

CONCLUSION

In this study, the hydration levels of the subjects' skin, right-handed and left-handed with a range of 16,68 to 32,45% and an average of 20,42%. Based on these results, these are categorized in very dry skin. In the age and gender groups, the lowest average hydration level is 19,35%. In the age group of 60-70 years and the highest average hydration level is 21,65% in the age group of 20-30 years. The male gender group has higher hydration levels (20,59%) than female. Measurement of hand skin hydration levels based on location is obtained that the lowest hydration levels in right hand dorsal and belongs to very dry skin (100%) category. Based on the frequency of exposure to chemicals, it is obtained that the lowest average hydration levels in research subjects with exposure to chemicals clumping know >10 times/day by 20,08%, and the highest average hydration in research subjects with exposure <5 times/day by 20,90%. It is recommended for factory workers to wear Personal Protective Equipment, namely gloves to protect their hands considering that in their work mixing tofu ingredients. In fact, they are still traditionally supported by maintaining skin hygiene after work and the use of skin moisturizers to prevent decreased skin hydration levels. Every day the tofu factory produces tofu in large quantities. It must be better if the factory owners think about using stirring machines and mechanical filters to reduce worker direct contact with tofu ingredients.

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