INTRODUCTION

Pityriasis versicolor (PV) is the most common superficial Malassezia infection seen in adolescents and young adults. PV is a mild and chronic infection of the skin's stratum corneum caused by Malassezia furfur and other Malassezia species. These yeast species are found on human skin as normal flora and will only cause disease under certain circumstances, such as a warm and humid environment.

The prevalence of PV globally reaches 50% in hot and humid areas and 1.1% in cold regions. While in subtropical countries, namely Central and Northern Europe, its prevalence is only 0.5-1% of all fungal diseases. PV prevalence in tropical countries could reach 60%. In contrast, in subtropical countries or areas with four seasons, the prevalence tends to be lower, which is below 1%, primarily found in the young adult age group. In men, it is mainly detected at the age of 21-25 years, while in women, around the age of 26-30 years. In some occupations, the prevalence of PV in men is higher than in women. In the United States, it is estimated that 2-8% of the entire population, not differentiated between men and women at the age of 20-30 years, has a prevalence ratio of 1.09% men and 0.6% women.

According to the study of Crespo et al. in 2000, Gupta et al. in 2002, and Moniri et al. in 2009, the highest prevalence of PV was observed in the 20-30 years age group, indicating that the peak of infection is associated with sebum production. In children, only a few cases were found at this age. Although there is no exact incidence in Indonesia, it is estimated that 40-50% of the population in tropical countries is affected by this disease. The study conducted at the H. Adam Malik General Hospital Medan in 2009-2012 found that PV incidence was 19.5% of all superficial fungal infections.

Sebaceous glands produce sebum which Malassezia needs in its metabolism. Sebum is generally found in the face, scalp, chest, and back. The sebaceous glands produce sebum in pilosebaceous units, which contain many lipids, consisting of triglycerides, free fatty acids, squalene, wax, and cholesterol. At the same time, the most abundant component is triglycerides. Androgen hormones influence sebum secretion. In children, sebum production is not perfect yet because the number of sebaceous glands is still tiny, which will grow in number starting at puberty.
Sebum is a lipid-rich substance that functions as an emollient in improving skin barrier function.\textsuperscript{13-16} The survival of Malassezia on the skin depends on its ability to adapt to changes in the human host environment (sebum, sweat, immune response, temperature, and occlusion) and the surrounding environment (humidity, temperature, or UV) and changes occurring in the local environment such as bacteria, viruses, dermatophytes, or parasites.\textsuperscript{6,14} According to a study conducted by Park et al. in 2012 in Seoul, who examined sebum levels on the face, body, and back of the hands, sebum levels on the face were higher in the PV group than in the healthy group.\textsuperscript{17} In Indonesia, there has been no research on the correlation between sebum levels and PV. Therefore, the researcher wanted to know sebum levels in PV subjects and healthy subjects at H. Adam Malik General Hospital Medan.

**METHOD**

This study is an observational analytic study with a cross-sectional method conducted at the Dermatology and Venereology Clinic of H. Adam Malik General Hospital Medan from December 2020 to July 2021.

The subjects of this study were those aged above 17 years suspected of having PV and healthy subjects (non-PV) willing to participate in the study by signing a consent form. Subjects will be excluded if PV subjects received topical antifungal and oral antifungal treatment in the last two weeks, subjects with skin keratinization disorders such as psoriasis, drug eruption, and subjects with chronic kidney failure (CKD). The sample size in this study was 62 people. The method used for sampling was consecutive sampling.

This research has received ethical clearance from the Research Ethics Commission of the Faculty of Medicine, Universitas Sumatra Utara, with letter number DP 02.01/XV/2.2.1/3068/2021. All research subjects underwent history taking, physical examination and dermatology examination, KOH examination on PV subjects, and sebum levels in all subjects by the researcher. The data obtained will be analyzed univariately by providing an overview of the basic characteristics of the research subject. Bivariate analysis was also carried out to compare the mean sebum levels in PV and non-PV subjects and compare sebum levels categorically. The data obtained will be analyzed univariately by providing an overview of the basic characteristics of the research subject. Bivariate analysis was also carried out to compare the mean sebum levels in PV and non-PV subjects and compare sebum levels categorically. Categorical sebum level analysis was performed using the Fisher exact test, and the mean difference analysis was performed using the Mann-Whitney test. Results were declared significant with p-value < 0.001.

**RESULTS**

The study subject's demographic characteristics based on age, gender, and level of education were explained in Table 1. In the case of PV, most distribution occurs in age group < 20 – 40 years as many as 24 subjects (77.4%) and minimal occur in age group > 60 years as many as one subject (3.2%). As many as 31 subjects male is more than female that is 27 subjects (87.1%) in PV group and 26 subjects (83.9%) in non PV group. In the case of PV, most distribution occurs in Senior High School as many as 25 subjects (80.6%).

The comparison of sebum level with PV and non-PV is shown in Table 2. Most of the subjects from the PV group with sebum level < 55 mg/cm\(^2\) (dry) as many as 26 subjects (83.9%) and non PV group as many as 29 subjects (93.5%). Fischer’s exact test shows no significant correlation between sebum level on the chest and back with PV (p=0.425).

The difference in sebum level on the chest and back in PV and non-PV groups are explained in Table 3. The average sebum level result on the chest in the PV subject group was 20.97 mg/cm\(^2\). Meanwhile, in the non-PV group obtained the average sebum level result was 16.29 mg/cm\(^2\) (p=0.338). The average sebum level result on back in PV subject group was 24.13 mg/cm\(^2\). Meanwhile, in the non-PV group obtained the average sebum level result was 21.71 mg/cm\(^2\) (p=0.827). The average sebum level result on the chest and back in PV was 22.55 mg/cm\(^2\). Meanwhile, in the non-PV group obtained the average sebum level result in the Non-PV group was 19 mg/cm\(^2\). The Mann-Whitney test found no significant correlation between sebum level on the body and skin barrier function.

### Table 1. Demographic characteristics of study subjects.

<table>
<thead>
<tr>
<th>Variable</th>
<th>PV (n, %) n=31</th>
<th>Non PV (n, %) n=31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20 year</td>
<td>8 (25.8)</td>
<td>2 (6.5)</td>
</tr>
<tr>
<td>21 – 30 year</td>
<td>8 (25.8)</td>
<td>14 (45.2)</td>
</tr>
<tr>
<td>31 – 40 year</td>
<td>8 (25.8)</td>
<td>10 (32.3)</td>
</tr>
<tr>
<td>41 – 50 year</td>
<td>4 (12.9)</td>
<td>2 (6.5)</td>
</tr>
<tr>
<td>51 – 60 year</td>
<td>2 (6.5)</td>
<td>3 (9.7)</td>
</tr>
<tr>
<td>&gt; 60 year</td>
<td>1 (3.2)</td>
<td>0</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>27 (87.1)</td>
<td>26 (83.9)</td>
</tr>
<tr>
<td>Female</td>
<td>4 (12.9)</td>
<td>5 (16.1)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary School</td>
<td>1 (3.2)</td>
<td>0</td>
</tr>
<tr>
<td>Junior High School</td>
<td>4 (12.9)</td>
<td>0</td>
</tr>
<tr>
<td>Senior High School</td>
<td>25 (80.6)</td>
<td>8 (25.8)</td>
</tr>
<tr>
<td>University</td>
<td>1 (3.2)</td>
<td>23 (74.2)</td>
</tr>
</tbody>
</table>

### Table 2. The comparison of sebum level with PV.

<table>
<thead>
<tr>
<th>Sebum Level, mg/cm(^2)</th>
<th>PV (+)</th>
<th>Non PV</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 55 mg/cm(^2) (dry)</td>
<td>26 (83.9)</td>
<td>29 (93.5)</td>
<td>0.425</td>
</tr>
<tr>
<td>55 – 130 mg/cm(^2) (normal)</td>
<td>5 (16.1)</td>
<td>2 (6.5)</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.001


chest and back between PV and Non-PV (p=0.916).

**DISCUSSION**

This study was conducted on 31 subjects with PV and non-PV. In this study, most research subjects aged <20-40 years were 24 persons (77.4%). The same result was found in a study conducted by Chandra et al. in Bali. It was found that the most age range suffering from PV was at the age of 11-20 years, amounting to 14 people (38.8%) followed by the age range of 21-30 years as many as six people (16.7%).

The same thing was found in the research conducted by Isa et al. It showed that of the 36 cases of PV, the most cases occurred in the 15-24 years and 25-44 years age groups, as many as 22 people (30.6%).

PV is more common in adolescents and young adults than in the elderly. The highest prevalence of PV was observed in the 20-30 year age group, indicating that the peak of infection coincided when sebum production was highest. Very few cases of PV are found in children younger than ten years old. In addition, it is rarely seen in older adults. In this study, the largest age group, was under 40 years old, where there were pubertal and productive age groups. At that age, the role of hormonal factors and the production of sebaceous glands are very active; hence sebum secretion increases which are associated with an increase in the prevalence of PV.

In this study, most research subjects were male, as many as 27 people (87.1%) in the PV group and 26 people (83.9%) in the non PV group. The same result was found in a study conducted by Heidrich et al., which found that men suffered from PV more than women (i.e., men were 7.1%, while women were 5.1%). Likewise, research conducted by Maghdalena et al. in Medan showed more men than women, namely 43 men (71.7%) and 17 women (28.3%) who suffered from PV. Similar findings were found in a study conducted by Kumar et al. in India on 130 patients with clinical features of PV. The results were that men were more likely to have PV than women, namely 80 men (62%) and 50 women (38%). In another study, it was explained that the prevalence of the disease was higher in male subjects due to increased sebaceous activity in men. In men, androgen hormone levels were higher than in women. Androgens in men stimulate the proliferation of more active sebaceous glands, especially those located on the face, chest, and upper back. Thus, men tend to have more active sebaceous gland proliferation and sebum production compared to women.

With high sebum levels in men in addition to other factors, it is possible for men to have a higher *Malassezia* infection and a higher incidence of PV as well.

The highest number of PV was found at the high school education level, namely as many as 25 people (80.6%), and the least at the tertiary education level, namely one person (3.2%). The same result was found in a study conducted by Abibatou et al. on 200 patients with clinical features of PV. The results showed that the highest education level suffering from PV was in the senior high school education group or equivalent as many as 67 people (33.5%), followed by 60 people (30%) with the education level of junior high school and 19 people (38%) with the education level of elementary school. In this study, it was found that the highest level of education was senior high school compared to other education groups. It could be because higher education levels tend to understand more about health and pay attention to appearance, so they seek treatment or consult a doctor.

In a study conducted by Moallaei et al. in 2017 in Iran, the study was conducted on 189 subjects. This study was conducted utilizing randomly selected subjects. The subjects were then asked to fill out a questionnaire, and a physical examination was done to look for PV skin lesions. The data filled in the questionnaire include demographics, history of skin disorders, causes of disease, previous history of PV, number and type of lesions, sports activities, cosmetics, sunscreen or moisturizers usage, systemic or topical corticosteroids, sweating, having dry or wet skin and exposure to sunlight. Examination with KOH solution and culture on PV subjects was then carried out, grouping PV and non-PV groups and then associating them with the patient’s skin condition, dry, normal, and oily. From this study, it was found that there was no correlation between oily skin and PV.

This study concluded that there was no difference in sebum levels on the chest of PV and non-PV groups. Therefore, it shows that sebum levels are not the main factor causing PV infection. Until now, the author has not found any research that discusses the differences in sebum levels on the chest and back of PV subjects compared to non-PV subjects. This study has the limitation that it is only conducted at one health care center. Different findings may be obtained at different health care centers or in larger-scale studies involving multiple health centers. Therefore, further research is needed involving more significant research subjects.

---

### Table 3. Average sebum level on the chest in PV and non-PV group.

<table>
<thead>
<tr>
<th>Variable</th>
<th>PV</th>
<th>Non-PV</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sebum level on chest (mg/cm²)</td>
<td>20.97 ± 19.20</td>
<td>16.29 ± 13.97</td>
<td>0.338</td>
</tr>
<tr>
<td>Sebum level on back (mg/cm²)</td>
<td>24.13 ± 32.23</td>
<td>21.71 ± 23.70</td>
<td>0.827</td>
</tr>
<tr>
<td>Difference of sebum level on the chest and back (mg/cm²)</td>
<td>22.55 ± 22.96</td>
<td>19 ± 16.27</td>
<td>0.916</td>
</tr>
</tbody>
</table>

*p<0.001*
CONCLUSION
There was no significant difference in sebum levels between PV and non-PV. Indicating other factors are influencing the onset of the disease. Further research is necessary to explore the factors.

ACKNOWLEDGMENTS
We want to express gratitude to the Head of the Department of Dermatology and Venereology of Faculty of Medicine Universitas Sumatera Utara and Universitas Sumatera Utara Hospital.

AUTHOR CONTRIBUTION
All authors have contributed to this research process, including preparation, data gathering, analysis, drafting, and approval to publish this manuscript.

FUNDING
The authors are responsible for all study funding without a grant or any external funding source.

CONFLICT OF INTEREST
The authors declare no conflict of interest regarding the publication of this article.

REFERENCES
