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The Aryl Hydrocarbon Receptor (AhR) Level Based on Age and Clinical Type of Melasma

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ABSTRACT

Introduction: Melasma is the most common pigmentation condition on the face due to excessive melanin production and release. The main predisposing factor for melasma is UV exposure. Aryl Hydrocarbon Receptor (AhR) is a ligand-dependent transcription factor that regulates the expression of a very large number of target genes in humans. Facial hyperpigmentation is increased in people living in air-polluted areas with particulate matter$_{2.5}$ ($PM_{2.5}$) concentrations. Dioxin compounds contained in $PM_{2.5}$ can activate AhR signaling. This study aims to determine the aryl hydrocarbon receptor (AhR) level based on age and clinical type of melasma.

Methods: This study was an observational study with a cross-sectional design of 30 women with melasma at Prof. CPL Hospital. This study was conducted after obtaining ethical clearance from the Research Ethics Commission of the University of North Sumatra and has obtained permission from the research field of Prof. Chairuddin Panusunan Lubis Hospital. All subjects underwent history taking, physical examination, dermatological examination, and blood sampling to assess AhR levels by ELISA test. Data were analyzed with Chi square test to assess AhR levels based on age, and to assess AhR levels based on clinical type of melasma with Kruskal Wallis test.

Results: This study shows that the majority of melasma age is 41-50 years with the highest mean AhR level is 882,61 ng/mL, while the lowest AhR level is in the age range of 20-30 years with a mean of 271,5 ng/mL. Chi square test showed that there was a significant relationship between AhR levels and age ($p < 0,001$). The highest mean AhR levels in melasma subjects were centrofacial type with a mean of 795,50 ng/mL, while the lowest mean AhR levels were found in melasma subjects with malar type with a mean of 623,36 ng/mL. The Kruskal Wallis test showed that there was no significant difference in AhR levels based on the clinical type of melasma ($p = 0,930$).

Conclusion: That increased the age, the highest AhR levels. The highest average AhR level was centrofacial type of melasma. There was no significant difference in AhR levels based on the clinical type of melasma.

Keywords

Melasma, Aryl hydrocarbon receptor, AhR, Clinical type, Age

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INTRODUCTION

Healthy skin defines as clear and bright skin. Skin consists of several components, one of them is the natural pigment melanin. Melanin plays a role in the formation of skin, hair and eye color, thus determining our race and phenotype appearance. In darker skin types, there is an increase in melanin production and secretion, resulting in hyperpigmentation such as melasma.[1] Melasma is one of the most common cosmetic complaints. Epidemiologically, melasma is more common in pigmented phenotypes such as East Asians (Japan, Korea, and China), Indians, Pakistanis, Middle Easterners, and Mediterraneans.[2] The prevalence of melasma in

Southeast Asia is 40% of women and 20% of men.[2] Research by Jusuf et al. at H. Adam Malik Medan General Hospital in 2012-2015 showed an increase in the prevalence of melasma from 78,85% in 2012, 83,78% in 2013, 66,67% in 2014 and 87,5% in 2015.[3] UV light is the main causative factor for melanogenesis, which activates AhR and induces the expression of well-recognized AhR target genes.[4] Esser et al. in their study explained that AhR signaling mediates particulate matter$_{2.5}$ ($PM_{2.5}$) and increases transcription of cytochrome p450 family 1 subfamily a member 1 (CYP1A1) in melanogenesis effects.[5] The aim of the study was to determine the aryl hydrocarbon receptor (AhR) level based on age and clinical type of melasma.

METHODS

This study was conducted after obtaining ethical clearance from the Research Ethics Commission of the University of North Sumatra and has obtained permission from the research field of Prof. Chairuddin Panusunan Lubis Hospital. This study was an observational study with a cross-sectional design of 30 women with melasma. All subjects underwent history taking, physical examination, dermatologic examination, and blood sampling to assess AhR levels by ELISA test. Data were analyzed with the Chi square test to assess AhR levels based on age, and to assess AhR levels based on clinical type of melasma with the Kruskal Wallis test.

RESULTS

This study shows that the majority age of melasma is 41-50 years old with the highest mean of AhR level was 882,61 ng/mL, while the lowest AhR level is in the age range 20-30 years old with a mean 271,5 ng/mL (table 1). Table 2 shows the highest mean of AhR levels in melasma subjects, namely, centrofacial type with a mean 795,50 ng/mL, while the lowest of AhR levels were found in melasma subjects with malar type with a mean of 623,36 ng/mL.

Table 1. Profile of subjects based on age and AhR levels.

Age	AhR levels in subjects		p
	n	Mean (ng/mL)	
20 – 30 years	2	271,5	<0,001*
31 – 40 years	7	365,28	
41 – 50 years	21	882,61	

*Chi square

Table 2. Clinical type of melasma with AhR levels.

Clinical type of melasma	AhR levels in subjects			p
	n (30)	Mean	SD	
Centrofacial	18	795,50	678,82	0,930*
Malar	11	623,36	493,67	
Mandibular	1	366		

*Kruskal Wallis

After testing the hypothesis, a p value of 0.048 was obtained from the Chi-square test, indicating that the relationship between tumor size and type of seizure was statistically significant ($p < 0.05$). This indicates that tumor size has a significant influence on the type of seizures experienced by patients, with larger tumors being more likely to cause generalized seizures.

DISCUSSION

This study shows that the majority of melasma age is 41-50 years with the highest mean AhR level is 882,61 ng/mL, while the lowest AhR level is in the age range of 20-30 years with a mean of 271,5 ng/mL. Sample test

using Chi square test showed that there was a significant relationship between AhR levels and age ($p < 0,001$) (Table 1). This study showed that the higher the age, the higher the AhR levels. Research by Jusuf, Putra, Maghdalena. with the most age groups 31 - 40 years and 41 - 50 years, this age is an age that increases the risk of melasma.[6] Research by Achar et al. found that the average age of onset of melasma was 29.99 years, with an age range between 11 years and 49 years.[7]

Table 2 shows the highest mean of AhR levels in melasma subjects, namely, centrofacial type with a mean 795,50 ng/mL, while the lowest of AhR levels were found in melasma subjects with malar type with a mean of 623,36 ng/mL. The Kruskal Wallis test showed that there was no significant difference in AhR levels based on the clinical type of melasma ($p = 0,930$). The most common clinical pattern is centrofacial type followed by malar type and then mandibular type as observed in various studies in India, Brazil, and Indonesia.[8,9] In line with the study conducted by Jusuf et al. showed that centrofacial pattern is the most dominant pattern.[3] Research by Jin et al. found that AhR has been identified as a factor activated by dioxin, a component of $PM_{2.5}$ that has recently been found to disrupt skin barrier function, skin immunity, and skin pigmentation.[10,11] Aryl hydrocarbon receptors are involved in several homeostatic processes in the skin, and also mediate melanoblast to melanocyte maturation resulting in melanogenesis.[5] Studies in human populations have also revealed that there is a significant relationship between the degree of skin hyperpigmentation and blood levels of polychlorinated biphenyls (AhR ligands).[12]

CONCLUSION

The study of melasma patients on AhR levels showed that patients with melasma at the age of 41 - 50 years old have the highest average AhR levels. It can be concluded that increased the age, the highest AhR levels. The highest average AhR level was centrofacial type of melasma. There was no significant difference in AhR levels based on the clinical type of melasma.

DECLARATIONS

None

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

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COMPETING INTERESTS

The authors declare that there is no conflict of interest in this report.

AUTHORS' CONTRIBUTIONS

R.D., N.K.J., and I.B.P. gave substantial contributions to the conception or design of the work in acquisition, analysis, or interpretation of data for the work. R.D., N.K.J., and I.B.P. had a part in article preparing for drafting or revising it critically for important intellectual content. R.D., N.K.J., and I.B.P. gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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