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Facial Aging Pattern of the Javanese Population in Indonesia: Contributions for Age Progression Analysis in Forensic Arts

Pola Penuaan Wajah pada Populasi Jawa di Indonesia: Kontribusi terhadap Analisis Progresi Usia pada Seni Forensik

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Abstract

The pattern of facial aging helps put the perception of age into face approximation from the skull, making the face more recognizable to the next of kin. The objective of this study is to determine the facial aging pattern of Javanese people in Indonesia. This study utilized the descriptive quantitative method to identify the highest frequency of the facial aging pattern variables according to its prominence (0 = Not visible; 1 = Slightly visible; and 2 = Clearly visible). This study involved 50 male and 50 female samples of the Javanese population. Each sexed samples were divided into two age-based groups: 40-44 and 45-49. The wrinkles on males and females aged 40-44 are mostly slightly or not visible. In the 45-49 age group, the wrinkles are visible on the forehead, eyes, and cheeks. Sex differences are found in the forehead and cheek grooves, with males having deeper wrinkles. Premature aging of the male samples might be caused by longer working hours and heavier smoking habits. Aside from sex and gender, ancestry also contributes to a unique aging pattern of the Javanese, differentiating them from other populations. The complex interaction between both sociocultural and biological factors is significant in forming a certain pattern of facial skin aging in different populations and sexes. Aside from its theoretical contribution to studies on human biological variations, this study can be referenced to depict more accurate and appropriate facial features in forensic cases that require facial approximations, especially those involving the Javanese people and the general Indonesian population.

Keywords: age; biological diversity; population group differences; sexual dimorphism; skin wrinkling

Abstrak

Pola penuaan wajah dapat membantu ahli antropologi forensik untuk mempersepsikan usia saat mengaproksimasi wajah dari tengkorak, membuat wajah seseorang menjadi lebih mudah dikenali oleh orang-orang terdekatnya. Tujuan dari studi ini adalah untuk menentukan pola penuaan wajah pada populasi Jawa di Indonesia. Studi ini menggunakan metode kuantitatif deskriptif untuk mengidentifikasi frekuensi tertinggi dari variabel-variabel pola penuaan pada wajah berdasarkan kedalaman kerutannya (skor 0 = Tidak terlihat; 1 = Mulai terlihat; dan 2=

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Sangat terlihat). Studi ini melibatkan 50 sampel laki-laki dan 50 sampel perempuan berketurunan Jawa. Kelompok sampel berbasis jenis kelamin ini kemudian dikelompokkan kembali berdasarkan usianya: 40-44 tahun dan 45-49 tahun. Kerutan wajah pada laki-laki dan perempuan berusia 40-44 tahun cenderung mulai terlihat atau belum terlihat sama sekali. Pada kelompok usia 45-49 tahun, kerutan-kerutan mulai muncul pada dahi, mata, dan pipi. Perbedaan berbasis jenis kelamin ditemukan pada pola kerutan di dahi dan pipi, dengan laki-laki menunjukkan kerutan yang lebih jelas. Penuaan dini pada sampel laki-laki dapat disebabkan oleh waktu kerja yang lebih lama dan kebiasaan merokok yang lebih parah. Selain perbedaan berbasis jenis kelamin dan gender, faktor keturunan juga berkontribusi terhadap pola penuaan populasi Jawa yang membedakannya dengan populasi lain. Interaksi kompleks antara faktor-faktor sosiokultural dan biologis berperan signifikan dalam membentuk pola penuaan kulit wajah pada berbagai populasi dan jenis kelamin manusia. Selain berkontribusi terhadap perkembangan studi variasi biologis manusia, studi ini dapat dijadikan referensi untuk menggambar fitur wajah dengan lebih akurat pada kasus-kasus forensik yang membutuhkan aproksimasi wajah, terutama kasus yang melibatkan orang-orang Jawa dan populasi Indonesia secara umum.

***Kata kunci**: usia; keanekaragaman hayati; perbedaan kelompok populasi; dimorfisme seksual; pengerutan kulit*

Introduction

Facial skin aging is a natural and inevitable biological process experienced by every human. It is caused by both intrinsic and extrinsic factors. The intrinsic factors are caused by mechanisms within the human body itself and are mostly regulated by genetics, such as anatomy, hormones, physiology, fat storage, and antioxidant capacity. The extrinsic factors, on the other hand, are caused by sociocultural behaviors and the environment surrounding the human body, including smoking habits, humidity, occupation, alcoholism, and exposure to ultraviolet light (Alaydrus & Jauhari, 2024; Keaney, 2016; Mesa Arango et al., 2017).

Aging is known to cause changes in a human's physical features and function. Elders have already reached their peak in developing their biological organs and their functions. Aging experienced by elders is called "senescence" and changes will appear in the form of declination (Alaydrus & Jauhari, 2024). Their organs will slowly deteriorate, including their skin. As a result of said deterioration, one might expect clinically visible changes in their skin as they age, which might include skin wrinkles, skin dryness, and elastosis (Chalise, 2019). Based on such changes appearing in a human's skin, a pattern can be observed. This pattern of how skin ages on the face has come in handy in many situations (Taylor, 2000).

Grooves appear on major parts of the face, starting from the forehead, eyes, cheeks, mouth, and chin. Therefore, details added to a person's face can impact other people's perception of recognizing them. From a person's grooves, another person or software might estimate their age because more grooves appear as people get older. Once found, the facial aging pattern can help

make age estimations more accurate. This notion is applicable in both forensic sciences and bioarchaeology (Bhat & Patil, 2016; Georgopoulos et al., 2018).

In forensic art, facial aging patterns are significant to use as a reference for facial reconstructions since they might predict an individual's unique facial characteristics. Concerning the law, unique patterns used in facial reconstructions might increase the probability of an individual's identification, whether it is a potential suspect, a wanted criminal, or an unidentified victim. Every detail matters in this process. Therefore, adding specific skin patterns might increase a person's recognition and familiarity with those who met or knew the unidentified person (Gupta et al., 2015; Schmidlin et al., 2018; Windhager et al., 2019).

A few cases solved with the aid of facial reconstruction have proved how significant this process is. In 1920, an unknown artist successfully reconstructed the face of the perpetrators behind a bombing incident. In 1935, a similar facial reconstruction was also carried out to identify Mrs. Isabella Ruxton, who was murdered by her husband, Buck Ruxton. Another case that was solved with the aid of facial reconstruction is Mrs. Marilyn Reese Sheppard's murder in 1995. In 1958, facial reconstruction also revealed the identity of the "Glamor Girl Slayer", Harvey Glatman (Gupta et al., 2015; Taylor, 2000; Wilkinson, 2015).

Considering its importance, it is unfortunate that there has not been a study on the facial skin aging patterns of the Indonesian population, even the Javanese. Javanese is the largest ethnic population in Indonesia, thus increasing its urgency to study this matter. This study aims to describe and analyze the facial aging patterns of the Javanese population in Indonesia, as well as understand the cause of its uniqueness in comparison to other populations, as described in previous works. Hopefully, this study can contribute to advancing the study of human biological variation and forensic facial approximation. In a forensic art and facial approximation context, this study will hopefully be used as a reference in sketching or sculpting unidentified faces with more depth, realistic, and appropriate features relating to their age, sex, and ancestry.

Research Methods

This study was conducted on a sample of 100 Javanese people, consisting of 50 men and 50 women. All subjects are farmers who resided in Madiun Regency, East Java, Indonesia. It is one

of many agricultural regions in Java. The farmers are considered favorable in this study due to their proximity and higher exposure to environmental exposure. Along with minimum interventions to the skin, such as skincare use, the farmers' facial skin features are more expressive and natural.

The subjects signed the given consent form to participate in this research. Then, their chronological ages were recorded based on the information on their identification cards. The respondents of both sexes were divided into two age-based categories: 40-44 and 45-49 years of age. The samples were categorized by age and sex in order to determine the trend within these age and sex groupings. There are, therefore, a total of four groups: males 40-44, males 45-49, females 40-44, and females 45-49.

This study compares data from Taylor's study about the facial aging pattern of 40 to 49-year-old white Americans—published in her book, titled Forensic Art and Illustration.12 Taylor argued that humans start to exhibit significant signs of facial skin aging in their 40s. It is highly significant, considering people aged 20-29 and 30-39 usually exhibit two or three categorical signs of aging, while people aged 40-49 typically exhibit nine categories. Hence, the reason behind such a specific age selection.

The first step of the data collection process is to ask the respondents to fill in questionnaires about their behaviors. The authors inquired about the participants' smoking habits, duration of sleep, working hours, and sun exposure hours. Levels were assigned to smoking habits based on the number of cigarettes consumed per day: Level 0 = 0 cigarettes per day; Level 1 = 1-2 cigarettes per day; Level 2 = 3-4 cigarettes per day; Level 3 = 5-6 cigarettes per day; Level 4 = 7-8 cigarettes per day; Level 5 = 9-10 cigarettes per day; Level 6 = 11-12 cigarettes per day; and Level 7 = 13-14 cigarettes per day. Additionally, the intensity of working hours and sleeping duration per day was scored and categorized as: 1 = 3-4 hours; 2 = 5-7 hours; and 3 = 8-10 hours. Since they also worked in the evening, the rate of sun exposure per day was also classified into three levels: Level 1 = 1-3 hours; Level 2 = 4-6 hours; and Level 3 = 7-8 hours or more. However, it is noteworthy that the length was self-reported as an approximation due to seasonal variations in the individuals' working hours.

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Second, photos of the person with neutral facial expressions were shot with an 8-megapixel Samsung smartphone camera. Then, the groove or wrinkle patterns on the facial skin's surface can be observed in detail. The grooves were defined based on their location, namely in the transverse frontal lines, vertical glabellar lines, transverse nasal lines, superior orbital groove, lateral orbital lines (crow's feet), inferior orbital groove, mentolabial groove (sulcus), and mental fovea (see Figure 1). Afterward, the degree of skin aging was scored based on its expressiveness and classified as: 0 = Not visible; 1 = Slightly visible; and 2 = Clearly visible.

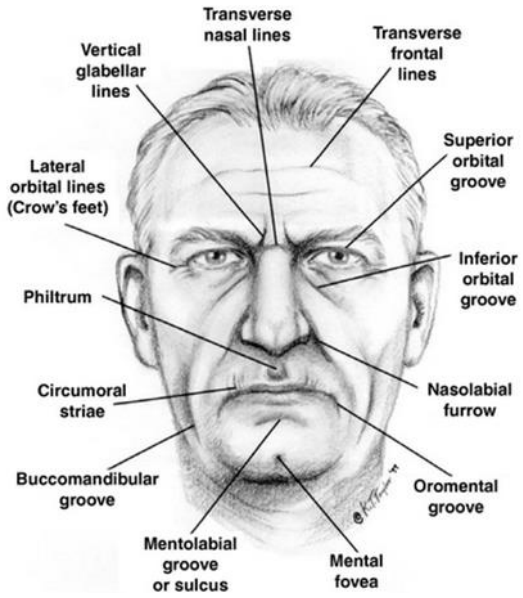

Figure 1.
Markers of facial grooves and wrinkles
Source: Taylor, 2000

The collected data were then statistically analyzed using IBM SPSS Statistics v.26.0. The data were analyzed using descriptive statistics to identify the frequency of each variable's prominence, which was determined by the aforementioned scoring system. The scored skin aging expression is displayed in the form of a distribution frequency table. Meanwhile, respondents' answers are visualized in the form of regular and stacked bar charts.

This study is not free from errors in terms of the age of the participants. The only reliable age of the participants relied on the memory of other participants. The identity cards of the participants do not provide the accurate year of birth because some participants fake their year of birth to access certain facilities at the previous time. Some participants' parents intentionally make their

children's year of birth earlier so that the children will be allowed to marry at an earlier age. This is related to underage marriage traditions that are still performed by many cultures in Java. However, this study attempted to find the participants who claimed they did not fake their year of birth. In addition, they mostly do not know their date of birth, so the age was calculated based on the year of birth.

The list of participants was gained from a communal fieldwork manager of the farmers. The data was taken at the residence of each participant. In addition, this study laid great emphasis on participant agreement by explaining the study's purpose prior to data collection. After consenting to participate in the study, the participants completed a consent form acknowledging that their information would be utilized in this research.

Results and Discussion

Results

This study demonstrates that compared to Taylor's samples (2000), our samples had fewer wrinkles in certain areas and more wrinkles in others. For the buccomandibular lines, the grooves on the forehead and chin of these samples tend to be less developed. In addition, superior orbital grooves are often more evident in our samples. In contrast, the creases observed around the eyes and cheeks of these Asians are consistent with Taylor's research. However, the younger participants in this research have fewer pronounced wrinkles compared to Taylor's study.

Both sexes demonstrate that wrinkles are more apparent in the older samples than in Taylor's. The population's transverse frontal lines are much more pronounced in the older sample group. The percentage of 40-44-year-olds whose wrinkles are "slightly visible" is 82.4% in the 40-44-year-old sample, whereas wrinkles are 84.8% more apparent in the 45-49-year-old group. In females, 66.7% of participants aged 40-44 years old have mild vertical glabellar lines, whereas 75.9% of older patients exhibit distinct vertical glabellar lines (see Table 1).

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Table 1.
. The facial aging pattern of the Javanese population in comparison to the white American population (Taylor's study)

No.	Variables	Taylor's study (aged 40-49)	Male aged 40-44	Male aged 45-49	Female aged 40-44	Female aged 45-49
1.	Transverse frontal lines	Clearly visible	Slightly visible (82.4%)	Clearly visible (84.8%)	Slightly visible (95.2%)	Slightly visible (55.2%)
2.	Vertical glabellar lines	Clearly visible	Clearly visible (70.6%)	Clearly visible (93.9%)	Slightly visible (66.7%)	Clearly visible (75.9%)
3.	Transverse nasal lines	Clearly visible	Slightly visible (76.5%)	Clearly visible (66.7%)	Slightly visible (76.2%)	Clearly visible (58.6%)
4.	Superior orbital groove	Slightly visible	Clearly visible (100%)	Clearly visible (100%)	Clearly visible (100%)	Clearly visible (100%)
5.	Lateral orbital lines (crow's feet)	Clearly visible	Slightly visible (64.7%)	Clearly visible (97.0%)	Slightly visible (57.1%)	Clearly visible (79.3%)
6.	Inferior orbital groove	Clearly visible	Slightly visible (76.5%)	Clearly visible (57.6%)	Slightly visible (85.7%)	Clearly visible (51.7%)
7.	Nasolabial furrow	Clearly visible	Slightly visible (58.8%)	Clearly visible (81.8%)	Slightly visible (66.7%)	Clearly visible (82.8%)
8.	Circumoral striae	Clearly visible	Slightly visible (64.7%)	Slightly visible (75.8%)	Not visible (76.2%)	Slightly visible (86.2%)
9.	Oromental groove	Slightly visible	Not visible (76.5%)	Not visible (72.7%)	Not visible (90.5%)	Not visible (58.6%)
10.	Buccomandibular groove	Not visible	Not visible (41.2%)	Slightly visible (45.5%)	Not visible (57.1%)	Slightly visible (69.0%)
11.	Mentolabial groove (sulcus)	Clearly visible	Not visible (76.5%)	Not visible (66.7%)	Not visible (95.2%)	Not visible (69.0%)
12.	Mental fovea	Not visible	Not visible (88.2%)	Not visible (81.8%)	Not visible (95.2%)	Not visible (86.2%)

Source: Primary data (2024), adapted from Taylor (2000) and Ana (2017)

Males have somewhat more noticeable groove patterns than females. In the 40-44 age category of both sexes, males had clearly apparent vertical glabellar lines, while females had grooves that

were beginning to become evident. In addition, males have prominent early lines of circumoral striae, whereas females do not. This condition also affected the older group, where the transverse frontal lines were clearly visible in males while the grooves were just beginning to appear in females.

The result of this study indicated that smoking is considered a "men's habit" since 82.0% of males and none of the females are active smokers. Although the percentages vary, a considerable number of people smoke more than five cigarettes every day (see Figure 2). Interestingly, males also have more wrinkles than females. Regarding transverse frontal lines, males aged 45-49 had significantly more wrinkles than females of the same age. At age 40-44, the greatest difference between males and females was observed on the vertical glabellar lines, with males exhibiting 70.6% and females just 23.8%. In addition, males aged 40-44 share identical patterns in vertical glabellar lines with females aged 45-49, a condition likely caused by their smoking habits. Another fact is that the buccomandibular groove occurs sooner in males than in females, with 23.5% appearing in 40-44-year-old males, while only 3.4% of older females had begun to develop it. Males between the ages of 40 and 44 also had a deeper buccomandibular groove than females of the same age.

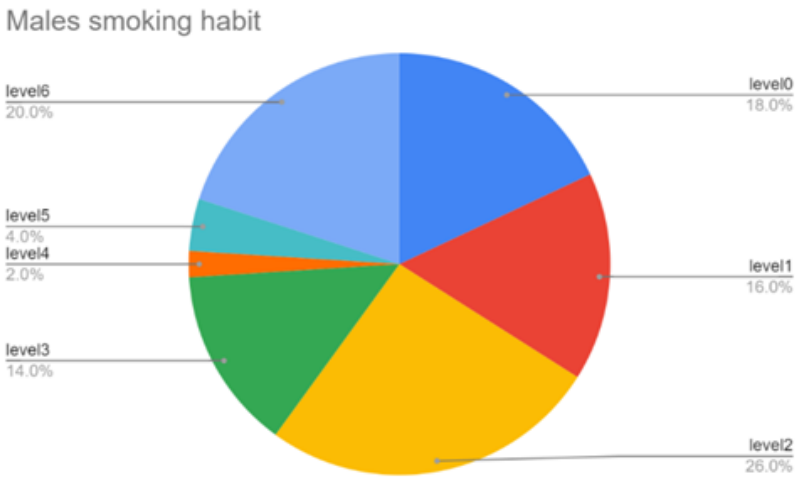

Figure 2.
Smoking habits of male Javanese samples (Level 0 = 0 cigarettes per day; Level 1 = 1-2 cigarettes per day; Level 2 = 3-4 cigarettes per day; Level 3 = 5-6 cigarettes per day; Level 4 = 7-8 cigarettes per day; Level 5 = 9-10 cigarettes per day; Level 6 = 11-12 cigarettes per day; and Level 7 = 13-14 cigarettes per day).
Source: Primary data, 2024

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Males also frequently engage in nighttime social activities, such as hanging out in local coffee shops. Therefore, the females tend to sleep longer. Due to the unfavorable stigmas and prejudices against females who partake in nighttime activities, only male farmers are permitted to work in the field in the evening, making them work relatively longer hours than females. This condition resulted in more severe sleep deprivation found in the male samples (see Figures 3 and 4).

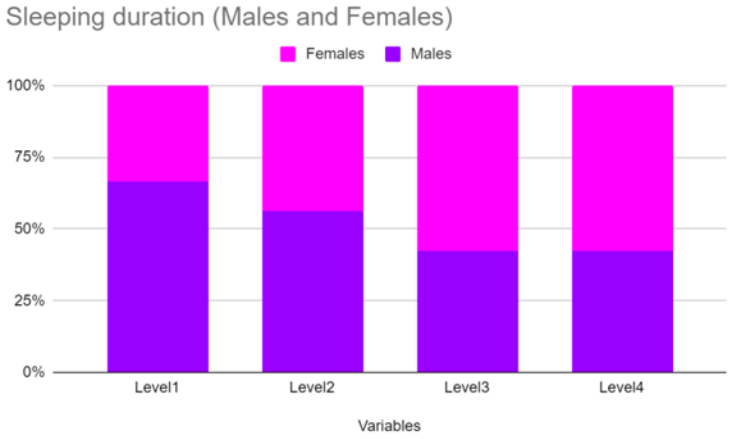

Figure 3.
Sleeping duration levels of male and female Javanese samples. The sleeping duration per day was scored and coded as: 1 = 3-4 hours; 2 = 5-7 hours; and 3 = 8-10 hours.
Source: Primary data, 2024

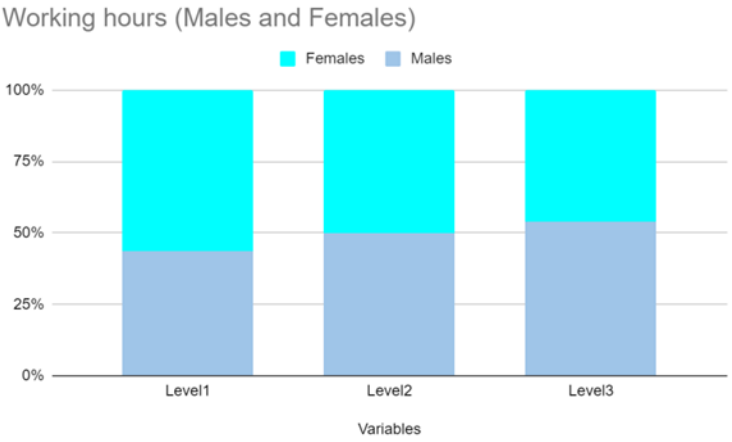

Figure 4.
Working hours of male and female Javanese samples. The working hours per day were scored and coded as: 1 = 3-4 hours; 2 = 5-7 hours; and 3 = 8-10 hours.
Source: Primary data, 2024

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Another external factor of skin aging that should be taken into account is sun exposure levels. The level of sun exposure varies depending on whether they are owners, workers, or both owners and workers. According to the graph, the duration of working hours under the sun for men and women is comparable (see Figure 5). Farmers of both sexes go to the field extremely early in the morning and return to their homes about noon when afternoon prayers begin. During busy seasons, such as planting and harvesting seasons, they will return to the field after lunch and remain there until roughly 05:30 PM, when the afternoon prayer begins.

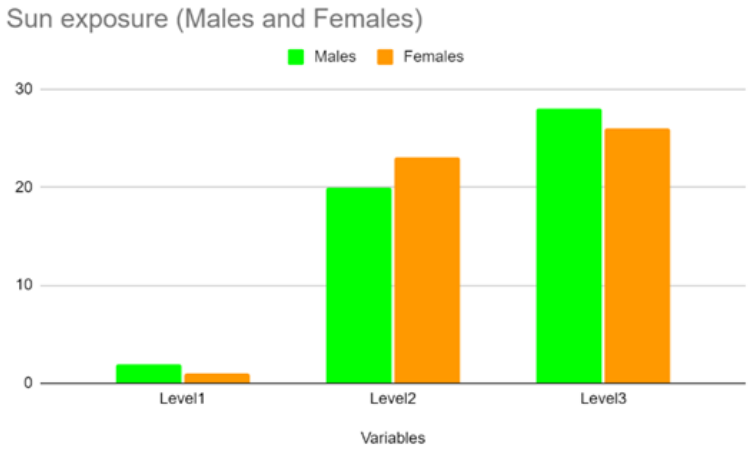

Figure 5.
Sun exposure levels of male and female Javanese samples. The rate of sun exposure per day was classified into three levels: Level 1 = 1-3 hours; Level 2 = 4-6 hours; and Level 3 = 7-8 hours or more.
Source: Primary data, 2024

Discussion

Every person will eventually experience facial skin aging. However, there may be some variation in face aging trends among groups (Alexis & Obioha, 2017; Vashi et al., 2016). Comparative studies were conducted to determine the distinct aging processes of various biogeographic populations. A study revealed that over 30% of black women did not report moderate or severe aging until ages 60 to 79, contrasting with white women who began reporting signs of aging significantly earlier, around ages 40 to 59 (Alexis et al., 2019). Another study indicated that Asian people typically experience wrinkles slower rate compared to white people due to higher melanin content, which provides some protection against photo aging (Lin et al., 2020). Consequently, the difference in skin aging trends between our samples and Taylor's samples supports the findings of prior research.

Compared to European males, the facial aging pattern of black South African males is characterized by the delayed appearance of wrinkles and advanced cheek hollowing, according to research. Similar to the findings of this study, the inferior orbital groove and nasolabial furrow are clearly apparent between the ages of 30–39 and 40–49. Compared to the Javanese samples, the transverse forehead lines and eye wrinkles of South African males become noticeable at a later age (50–59 years old). Approximately 10 to 20 years distinguish the appearance of the buccomandibular groove in Javanese males and black South African males. Black South African males' buccomandibular groove became evident between the ages of 60 and 69, whereas Javanese males' buccomandibular groove became visible between the ages of 45 and 49 (Schmidlin et al., 2018).

The results of the study suggested that the face aging patterns of the Javanese population are more similar to those of the South African population than those of the European population. It suggests that both groups may have comparable internal and extrinsic factors. However, certain grooves were first developed by Javanese people. Theoretically, skin pigmentation generated by melanin concentration and composition might serve as a natural photo protection and prevent the creation of wrinkles (Anwar et al., 2022; Mesa Arango et al., 2017; Vashi et al., 2016). However, further research is necessary to analyze similarities and differences between Javanese and black South Africans who face aging processes.

Noticeably, all samples of both sexes and both groups of ages have supraorbital grooves. This conclusion is peculiar since this groove may be a result of the inherent structure of Asian skin. In addition, it was difficult to ascertain mentolabial sulcus since the teeth and jaw features of Indonesians may differ from those of white Americans (Taylor, 2000).

Aside from ancestry, sex and gender also play an important role in shaping facial anatomy and social behaviors, which both are determinants of skin aging (Keaney, 2016). Previous studies stated that women are more likely to develop wrinkles compared to men. The increase in estrogen, progesterone, and other hormonal factors might have something to do with such a phenomenon (Bravo et al., 2024; Gasser et al., 2021; Lephart & Naftolin, 2022). A study on Korean women discovered that pregnancy and menopause might significantly increase the risk of wrinkles. In addition, more severe wrinkling might be correlated to higher body mass index in

women (Nanzadsuren et al., 2022; Windhager et al., 2019). However, this study did not emphasize analyzing the listed factors.

Despite the fact that females have a higher chance of developing wrinkles, males are more susceptible to premature skin aging due to their greater occupational sun exposure. In light of the fact that male farmers work longer hours and develop wrinkles at a younger age on average, this study may lend credence to this notion. In addition, men are more prone to skip sun protection items such as sunscreen and skincare products. Despite the fact that men's skin is more susceptible to UV damage, males are more likely to acquire sunburns (Hamer et al., 2017; Keaney, 2016). Therefore, premature skin aging in men is not an uncommon thing, especially in the population investigated in this study.

Many studies have found a correlation between smoking habits and aging, usually found in the form of wrinkles (Chalise, 2019). In fact, cigarette smoking is considered to be an independent, additive risk factor that might trigger premature aging. As the skin ages, smoking habits are proven to be associated with accelerated facial skin wrinkling in wider areas (Hamer et al., 2017). Despite white people's higher skin wrinkling risks, a study showed that male and female African Americans are not risk-free from accelerated aging due to smoking habits (Simons et al., 2021). These studies indicate that the smoking habit is an independent and universal variable of premature and accelerated aging.

The reason why smoking might lead to the development of facial wrinkles is that its composition might cause the alleviation of vitamin A levels and facial stratum corneum moisture. Passive and constant exposure to cigarette smoke might also play a factor in premature aging. This means that nonsmokers who are passive smokers can also suffer from accelerated aging (Aithal, 2021; Laksmi et al., 2023; Mitri et al., 2021). However, further study is still required to confirm that notion.

Scientists have adopted the term "smokers' wrinkles" as a facial aging pattern unique to smokers. Smokers' wrinkles on the lateral orbital lines were narrow, dense, and sharp contoured. On the contrary, broad-based, wider, and round-edged wrinkles are commonly found in nonsmokers. In women, wrinkles found in the mouth area are strongly associated with habitual

smoking. In addition to wrinkles, the skin color of smokers differs from that of nonsmokers, whose faces are often lacking a fleshy pink color. The habit of cigarette smoking might also be the causal factor of elastosis in both males and females. In its impact on facial wrinkles, a correlation was found between males and the amounts of cigarettes they smoked, indicating that the development of smokers' wrinkles is dose-dependent (Amer et al., 2018; Fatani et al., 2020; Goodman et al., 2019; Lipa et al., 2021).

In addition, sleep is significant for overall human health. Good sleep quality and duration were associated with human growth and development since multiple biological systems are regenerated or renewed during sleep. Decreased sleep duration was associated with negative health outcomes, both physical and mental issues. To name a few, reduced sleep might increase the risks and severity of obesity, heart disease, diabetes, stroke, depression, and anxiety. In addition, the US Center for Disease Control also stated that poor sleep quality is a public health matter. Reduced sleep duration is closely related to traffic accidents, industrial disasters, and medical errors. Previous studies also explored how premature and accelerated skin aging is closely related to sleep quality (Harry-Hernandez et al., 2020; Oyetakin-White et al., 2015).

Sleep deprivation and poor sleep quality are known to cause accelerated aging in both males and females. A study on Korean women in their 40s revealed that reduced sleep duration negatively impacted the skin in many ways, such as reducing skin elasticity, decreasing skin density, and producing facial wrinkles, all contributing factors to premature aging (Jang et al., 2019). A study in Stockholm, Sweden also confirmed the previous study, stating that more wrinkles and fine lines were found in both males and females with reduced sleep duration. A previous study on female white Americans also discovered that chronic sleep deprivation may accelerate premature aging since intrinsic skin aging signs were found in samples with poorer sleep quality. Meanwhile, the intrinsic skin aging scores are relatively lower in sample groups who have better sleep quality (Oyetakin-White et al., 2015). In conclusion, facial wrinkling caused by sleep deprivation affected both males and females of different ages and different ethnicities. However, specific facial patterns in various ethnicities caused by sleep deprivation are still unknown, since this particular topic is still under-researched.

Research conducted in South Korea revealed an intriguing finding about the timeframe of wrinkle growth. Although there are considerable changes in the visual and surface qualities of the skin, the participants did not develop wrinkles. The researchers hypothesized that chronic sleep deprivation would result in face wrinkling (approximately more than a month). The research revealed that the creation of wrinkles is not an immediate process. When both extrinsic and intrinsic aspects of skin aging are constant, substantial changes may result (Jang et al., 2022; Oyetakin-White et al., 2015).

As anticipated, this study revealed that male wrinkles are more noticeable. Males slept for a shorter period of time than females, thus this is hardly surprising. As a result of insufficient sleep quality, the skin's capacity to recuperate from sun exposure and other external exposure was drastically diminished. Thus, inhibiting the skin's ability to repair and renew (Oyetakin-White et al., 2015). This study revealed that sleep deprivation and its side consequence, premature aging, are a persistent problem among Javanese farmers. Further research is necessary to investigate the aforementioned subject.

On the other hand, female and male farmers have similar working hours which predicts equivalent solar exposure levels. However, males exhibit larger percentages of deeper grooves which showed that other variables could be the ultimate reason for males' rapid aging. Therefore, while sun exposure levels are identical in both sexes, this study did not detect a significant association between the length of sun exposure and the formation of wrinkles. To examine the association between sun exposure and the development of wrinkles in Javanese populations, prospective research on this topic is necessary. Future research must address skin types in addition to ethnicity, as differing skin types within the same ethnicity may result in distinct aging processes. Sun protection practices must also be analyzed because various products may have varying impacts on delaying, renewing, and preventing the formation of wrinkles, hence causing distinct face aging patterns (Doncel Molinero et al., 2022; Pinault & Fioletov, 2017).

Previous studies showed that sun exposure was indeed a contributing factor in aging (Hamer et al., 2017; Mesa Arango et al., 2017; Pinault & Fioletov, 2017). Research highlights that cumulative UV exposure correlates with the severity of photo aging, such as course wrinkles and hyperpigmentation (Burke, 2020). In fact, Keaney (2016) mentioned that approximately 90% of

visible skin wrinkles are caused by sun exposure. Population-wide research in Mongolia confirmed this hypothesis, finding that increased sun exposure could accelerate skin aging (Nanzadsuren et al., 2022). A study in Nepal stated that more severe wrinkles were found in individuals who had more than 1 hour of sun exposure per day compared to individuals with less sun exposure per day (Bhatt et al., 2019).

Sun exposure habits are closely related to sex and gender. Men are known to be more careless in terms of skin protection, generally causing men to age poorer compared to women. Previous studies showed that women are twice as likely to wear sunscreen than men. However, a surge of interest among men in skincare and cosmetics is reported. Positive attitudes toward skincare and sun protection are also rising, presumably caused by increased awareness, societal demand to have healthy skin, and more gender-positive marketing (Chiu et al., 2019; Doncel Molinero et al., 2022; Keaney, 2016; Lee et al., 2015; Pinault & Fioletov, 2017; Zakaria et al., 2021).

Conclusion

The pattern of wrinkles is indeed more visible as people age. The wrinkles on both males and females aged 40-44 are generally at a slight depth and or not visible. On subjects aged 45-49 years old, the wrinkles get deeper on the forehead, eyes, and cheeks area, while other grooves start to emerge. In addition, significant sex differences are found in forehead and cheek grooves, with deeper wrinkles commonly found in males. This research also highlights common patterns that could also arise in males and females of the ages stated. Other than the sex factor, ancestry or biogeographical factors contribute to a unique aging pattern of the Javanese, differentiating them from other populations. The Javanese population in this study is more likely to age slower in comparison to the white Americans described in Taylor's study. The complex interaction between both sociocultural and biological factors is significant in forming a certain pattern of facial skin aging in different populations and sexes.

The facial aging pattern can be applied in doing facial approximation from skulls in forensic cases to give a good age emphasis. For cases in Indonesia or even Southeast Asia, forensic scientists and artists can use this study as a reference for age progression analysis of an unidentified individual. By referencing this study, a facial approximation of Indonesian skulls can be done more appropriately instead of doing it based on intuition or referencing Taylor's

study since as proven in this study, white Americans age differently than the Javanese. In order to formulate a more advanced age impression on the face, future studies should establish a more complex analysis by analyzing the connection between the facial aging pattern variables with daily activities or cultures. Furthermore, future studies should expand this study's framework and conduct it in other populations to document the wide array of human biological diversity in Indonesia.

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