

The Facial Width-To-Height Ratio is Unrelated to Aggressive Behaviour in Indonesian People

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ABSTRACT

As a channel of non-verbal communication, faces can give information such as mate attraction, intelligence, and aggressivity. Aggressivity is a character to dominate, protect position, and fight over resources. Several aggressive behaviours in humans are, for example, anger, hostility, physical aggression, and verbal aggression. Previous studies in western society showed that aggressivity could be perceived from the faces. We tested 100 Indonesian males ranging from 19-51 years old to fill out the Buss-Perry Aggression Questionnaire (BPAQ) to measure the aggression scale. The mean of their BPAQ scales (total aggression, anger, hostility, physical aggression, and verbal aggression) were 72.44 ± 10.84 , 17.37 ± 3.97 , 21.38 ± 4.53 , 18.97 ± 4.65 , 14.72 ± 2.68 , respectively. The average facial photograph was generated based on the min-Q1 (Low Aggressivity (LA)) and Q3-max (High Aggressivity (HA)) BPAQ scale. Next, the aggressivity of averaged LA and HA faces was evaluated by raters. The raters consisted of 145 males and 213 females randomly recruited, ranging from 17 to 67 years old. The facial width-to-height (fWHR) ratio between the average faces of the Low-Aggression face and the High-Aggression face was insignificant. This study concluded that Indonesian people could not perceive aggressivity in their faces.

1. Introduction

As a channel of non-verbal communication, faces can give information such as mate attraction, intelligence, and aggressivity (Lefevre and Lewis 2014; Trébický *et al.* 2013; Rhodes *et al.* 2007; Zebrowitz *et al.* 2002; Zebrowitz and Rhodes 2004). In addition, it has been proved that people could make correct inferences about others' characters and behavioural tendencies based on certain signals reflected on the face (Carré and McCormick 2008). In this study, we only focused on aggressivity. Aggressivity is a character to dominate, protect position, and fight over resources (Anholt and Mackay 2012; Herrenkohl *et al.* 2007; Taylor and Jose 2014). This behaviour is commonly found in animals, including humans and is used to dominate, protect position in society, and challenge to gain resources (Taylor and Jose 2014). Several human aggressive behaviours include anger, hostility, physical aggression, and verbal aggression (Buss and Perry 1992). Demographic factors could

influence aggressive behaviour, such as age, ethnicity, level of education, occupation, and income (Chang and Lyons 2012; Foshee *et al.* 2001; Harris and Knight-Bohnhoff 1996; Halpern *et al.* 2001; O'Keefe 1998; Roberts *et al.* 2006; Vuoksima *et al.* 2021).

Previous studies in western society showed that aggressivity could be perceived from the faces. The aggressive individual had a higher facial width-to-height (fWHR) ratio, thinner lips, wider chin, more prominent eyebrows, and wider nose than non-aggressive individuals (Lefevre and Lewis 2014; Stirrat and Perrett 2010; Trébický *et al.* 2013). Several studies perceived men with larger fWHR as less trustworthy, unethical behaviour, exploitation, and cheating; CEOs with superior financial achievement (Haselhuhn and Wong 2012; Stirrat and Perrett 2010; Wong *et al.* 2011). Regardless of the association between fWHR and aggressive behaviour, several studies have found, for example, that men with higher fWHRs are greater fighters, less trustworthy, more probably to deceive others, and less possible to die from contact violence (Haselhuhn and Wong 2012; Stirrat and Perrett 2010; Stirrat *et al.* 2012; Trébický *et al.* 2013). Men use that behaviour to

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approach mating selection in women. Women must choose long-term partners with social status and income potential to gain surpass access to financial resources and increase mobility (Valentine and Li 2012). When selecting a long-term mate, women invest significant time and resources.

However, there has been no study regarding perceived aggressivity in non-western society until today. Therefore, we would like to identify if aggressivity could be perceived in male faces in non-western societies, specifically Indonesian society. Currently, we address the questions to test whether aggressivity could be perceived on the face or not by conducting quantitative research.

2. Materials and Methods

This study was conducted from January to March 2021, and the tools used were Sony A6400 (Focus >55 mm) camera, a tripod, and green background.

2.1. Respondents

The respondents were 100 Indonesian males whose facial photographs were taken. Their age ranged from 19 to 51 years (Mean age = 27 years, s.d. = 6.33 years), and they were recruited in ITERA (Table 1). The respondents also meet the following criteria not obscured by bangs, neutral expression, not having a beard and moustache, facing the camera, and standing one meter from the camera.

2.2. Raters

Raters were the individuals who perceived the facial images of participants. The raters in this study consist of 145 males and 213 females randomly recruited in ITERA and areas around Lampung. Their ages varied between 17-67 (Mean age males = 27 years, s.d. = 8.19 years; females = 26 years, s.d. = 7.98 years) (Table 2).

2.3. Ethical Permission

The Ethics Committee approved the study of the IPB University (No.: 365/IT3.KEPMSM-IPB/SK/2021), and the methods were carried out following the approved ethical approval. All participants were informed about the study and provided the informed consent form before taking part in this study.

2.4. Aggressivity Measurement

Respondents were asked to answer the Buss-Perry Aggression Questionnaire (BPAQ) (Buss and Perry 1992). It is a self-assessment questionnaire to assess the aggression of an individual, which has been widely used in many previous studies (e.g., Bolam *et al.* 2014; Diamond *et al.* 2005; Gerevich *et al.* 2007; Paulhus *et al.* 2018; Reyna *et al.* 2011; Williams 2021). This

questionnaire consists of 29 questions to measure aggression and is divided into four scales: physical aggression, verbal aggression, anger, and hostility. The respondents were asked to answer this question using a Likert scale between 1 to 5 (1 means strongly disagree and five means strongly agree). Then, the total aggression

Table 1. Demographic data of respondents

| | Variables | N | Percentages (%) |
|--------------------|------------------------------|-----|-----------------|
| Age | Males (27.00±6.33 years old) | 100 | 100 |
| | Javanese | 53 | 53.00 |
| Ethnicity | Lampung | 14 | 14.00 |
| | Sundanese | 8 | 8.00 |
| | Malay | 7 | 7.00 |
| | Minangkabau | 6 | 6.00 |
| | Others | 12 | 12.00 |
| | Lecturer | 17 | 17.00 |
| Occupation | Staff | 23 | 23.00 |
| | Undergraduate student | 16 | 16.00 |
| | Cleaning service | 18 | 18.00 |
| | Security | 26 | 26.00 |
| Level of education | Junior high school | 2 | 2.00 |
| | Senior high school | 62 | 62.00 |
| | Level 3 diploma degree | 2 | 2.00 |
| | Bachelor's degree | 17 | 17.00 |
| | Master's degree | 11 | 11.00 |
| | Doctoral degree | 6 | 6.00 |
| Income (Rp.) | <500,000 | 5 | 4.76 |
| | 500,001-700,000 | 7 | 6.67 |
| | 700,001-1,000,000 | 57 | 54.29 |
| | 1,000,001-3,000,000 | 30 | 28.57 |
| | 3,000,001-5,000,000 | 1 | 0.95 |
| | 5,000,001-7,000,000 | 5 | 4.76 |

N = Number of respondents

Table 2. Demographic data of raters

| | Variables | N | Percentages* |
|--------------------|------------------------|------|--------------|
| Sex | Males | 145 | 40.50 |
| | Females | 213 | 59.50 |
| Ethnicity | Javanese | 135 | 37.70 |
| | Lampung | 49 | 13.68 |
| | Sundanese | 30 | 8.37 |
| | Minangkabau | 28 | 7.82 |
| | Batak | 22 | 6.14 |
| | Others | 94 | 26.25 |
| Occupation | Undergraduate students | 166 | 46.37 |
| | Academic Staff | 51 | 14.24 |
| | Lecturer | 44 | 12.30 |
| | Employee | 15 | 4.19 |
| | Security | 12 | 3.35 |
| | Others | 70 | 19.55 |
| Level of education | Elementary school | 2 | 0.55 |
| | Primary high school | 12 | 3.35 |
| | Senior high school | 200 | 55.86 |
| | Diploma's degrees | 12 | 3.35 |
| | D1-D4 | | |
| | Bachelor's degree | 75 | 20.95 |
| | Master's degree | 45 | 12.56 |
| Doctoral degree | 12 | 3.35 | |

Table 2. Continued

| | Variables | N | Percentages* |
|-----------------|----------------------|------|--------------|
| Income (Rp.) | <500,000 | 80 | 22.34 |
| | 500,001-700,000 | 55 | 15.36 |
| | 700,001-1,000,000 | 39 | 10.89 |
| | 1,000,001-3,000,000 | 82 | 22.90 |
| | 3,000,001-5,000,000 | 65 | 18.15 |
| | 5,000,001-7,000,000 | 14 | 3.91 |
| | 7,000,001-10,000,000 | 11 | 3.07 |
| >10,000,001 | 12 | 3.35 | |

N = Number of raters

scale (Overall) was calculated by summing the score of physical aggression, verbal aggression, anger, and hostility. All the respondents were asked by offline interview. From this calculation, we got minimum, Q1 (1st Quartile), Q2 (2nd Quartile), Q3 (3rd Quartile), and maximum values. Based on those values, we categorized minimum to Q1 values as a low-aggression group, while Q3 to maximum values as a high-aggression group. Meanwhile, Q1 to Q3 values were classified as a normal group and not included in the analysis. This grouping would be used as the basis of "Photograph Grouping," which will be explained in detail in the next section.

2.5. Facial Photographs

The 100 male facial photographs were captured using a Sony A6400 camera (focus >55 mm). The respondents were asked to stand up 1 meter away from the camera in front of a green background. Their faces showed neutral facial expressions and were perfectly oriented toward the camera (Nila *et al.* 2019; Trébický *et al.* 2013).

2.6. Photograph Standardization

All the photographs were aligned to the same level of eye points horizontally. The horizontal lines represent the distance between the left and the right bizygomatic width from the facial boundary on the left to the right. Then, the vertical lines represent the distance from the upper lip's highest point to the eyelids' highest point. In addition, the facial width-to-height ratio was calculated as width divided by height (Stirrat and Perrett 2010) using a template line (Figure 1) in Adobe Photoshop 2020 version 21.1.3.

2.7. Digitizing Photograph

Photograph digitizing aimed to acquire the face coordinates and was conducted using Psychomorph software (Rowland and Perrett 1995; Tiddeman *et al.* 2001). A total of 178 coordinates were obtained by manually delineating the face characteristics, such as an outline of the head, eyes, eyebrows, forehead, nose, jaw, lips, cheeks, and chin (see Sutherland 2015; Figure 2). Then, the digitized photographs from every group were averaged with Psychomorph software (Rowland and Perrett 1995; Tiddeman *et al.* 2001).



Figure 1. Photograph standardization template line



Photograph reproduced with permission
Figure 2. Digitizing photograph by psychomorph

2.8. Photograph Grouping

The photographs were grouped based on the total aggression score of BPAQ, described earlier in the Aggressivity Measurement section. Then, we created an imaginary face from the average face coordinate of the group member using Psychomorph software for each low-aggression group and high-aggression group (Rowland and Perrett 1995; Tiddeman *et al.* 2001).

2.9. Face Image Aggression Level Perception Measurement

Each rater was asked to assess the imaginary faces created in Figure 2. Each of them was shown by 2 facial photographs: the low-aggressive (minimum and Q1 score of BPAQ) and the high-aggressive (Q3 and maximum score of BPAQ). To test whether aggressivity was perceived on the face, each rater was asked to choose which one she/he thought was the most aggressive between two averaged photographs Low-Aggression face (LA face) and High-Aggression face (HA face). Female raters were asked an additional question, which one would they choose as a long-lost spouse?.

2.10. Respondents Model Building

The linear model was used to see the influence of the demographics data (age, ethnicity, occupation, level of education, and income) on self-declared aggressivity measured by BPAQ. The total aggression scale was set as a response. Meanwhile, age, ethnicity, occupation, level of education, and income were predictors. First, we did a collinearity test to see the independence of each predictor (Dormann *et al.* 2013). The collinearity between predictors was tested by calculating variance inflation factor (VIF) values by setting the threshold = 10 (Gareth *et al.* 2013). The result demonstrated perfect collinearity between occupation and level of education, so the occupation predictor was excluded from the GLM analysis. Then, we conducted the step test to determine the optimum model based on the Akaike Information Criterion (AIC) value (R Core Team 2021). The selected model was a model with the smallest AIC (Bozdogan 1987). The model was validated with k-fold cross-validation by setting the k = 10 with the 'boot' package (Canty and Ripley 2021; Davison and Hinkley 1997). The final model was obtained after the simplification process. The linear model could be used if the difference in delta value between the total aggression model and the sample is less than 6%. All data analysis was conducted using R software version 4.0.5 (R Core Team 2021).

2.11. Raters Model Building

A linear model was used to determine the factors influencing the rater's preference for a spouse choice with similar methods in the previous section. This model also analyzed the Rater's tendency to choose between the two groups of aggressive faces using Chi-square. The responses used were total aggression scale and mate choice, while the predictor used was sex (for aggression male face).

3. Results

3.1. BPAQ Statistical Descriptive

The resulting mean of their BPAQ scales (total aggression, anger, hostility, physical aggression, and verbal aggression) are shown in Table 3. Each variable fell within the BPAQ standard score (Buss and Perry 1992): Total aggression (29-145), anger (7-35), hostility (8-40), Physical aggression (9-45), Verbal aggression (5-25) (see Table 3).

This study wants to confirm the previous studies of fWHR, as explained in the Introduction. Then, we conclude the association between BPAQ scales and facial width-to-height ratio (fWHR). These results score for Overall, Physical aggression, Verbal aggression, Anger, and Hostility were tested in the Shapiro-Wilk test. The results of the test indicated that BPAQ does not associate with fWHR statistically in Shapiro-wilk test p-value scores (Table 4).

3.2. Demographic Factors Affecting Aggression Scale on Male

This study demonstrated that males with a low-aggression score have a higher level of education (Bachelor's Degree, Master's Degree, and Doctoral Degree) than males with a high-aggression score. This result was obtained from the final model = glm (Total aggression~as.factor(Education)) (see Table 5).

3.3. Photograph Grouping based on Aggression Scale

The average facial photographs of 22 respondents, each of low (min-Q1) and high aggression (Q3-max), were constructed based on the Total Aggression scale (shown in Figures 3A and B). The facial width-to-height (fWHR) ratio between the average faces of the Low-Aggression face and the High-Aggression face was insignificant.

3.4. Aggressive Face Choice

This study demonstrated that male raters have no specific trend in choosing aggressive

Table 3. Statistical descriptive BPAQ

| Statistic variable | Minimum | Q1 | Q2 | Mean ± SD | Q3 | Maximum |
|---------------------|---------|-------|-------|-------------|-------|---------|
| Total aggression | 47.00 | 65.75 | 71.50 | 72.44±10.84 | 78.25 | 98.00 |
| Anger | 10.00 | 15.00 | 17.00 | 17.37±3.97 | 20.00 | 32.00 |
| Hostility | 10.00 | 18.75 | 22.00 | 21.38±4.53 | 24.00 | 32.00 |
| Physical aggression | 12.00 | 16.00 | 19.00 | 18.97±4.65 | 21.00 | 36.00 |
| Verbal aggression | 9.00 | 13.00 | 15.00 | 14.72±2.68 | 16.00 | 21.00 |

Table 4. Association between BPAQ and fWHR

| Indicators | BPAQ ~ fWHR | | | | |
|------------|-------------|---------------------|-------------------|--------|-----------|
| | Overall | Physical aggression | Verbal aggression | Anger | Hostility |
| R | 0.067 | 0.092 | -0.13 | -0.025 | 0.16 |
| p-value | 0.52 | 0.38 | 0.22 | 0.81 | 0.12 |

Table 5. Education factors influencing aggression scale on male

| | Estimate | Std. Error | t-value | p-value |
|--------------------------------|----------|------------|---------|------------|
| (Intercept) | 87.000 | 7.544 | 11.532 | <2e-16 *** |
| as.factor (senior high school) | -13.355 | 7.665 | -1.742 | 0.085 |
| as.factor (diploma degree) | -11.500 | 10.669 | -1.078 | 0.284 |
| as.factor (bachelor's degree) | -16.588 | 7.976 | -2.080 | 0.040 * |
| as.factor (master's degree) | -18.909 | 8.202 | -2.306 | 0.023 * |
| as.factor (doctoral degree) | -19.167 | 8.712 | -2.200 | 0.030 * |

*p<0.05; significant value

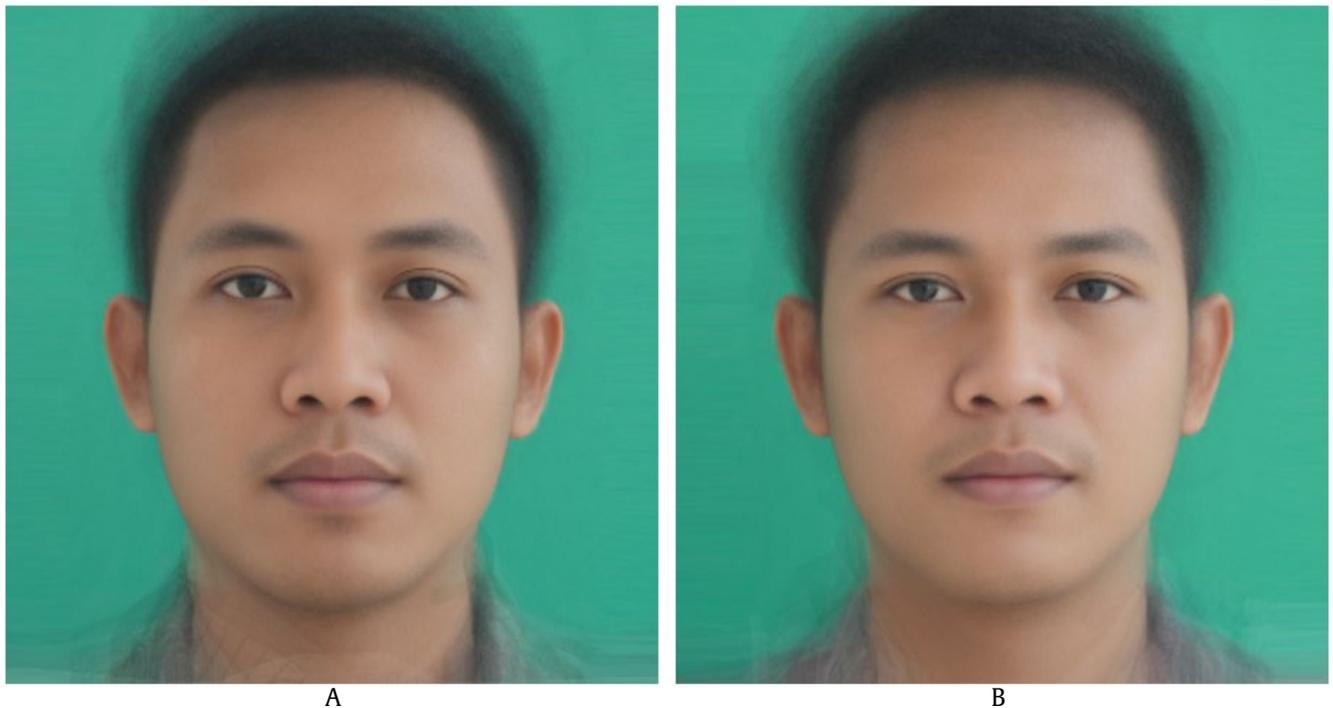


Figure 3. (A) The average of the low-aggression face. (B) The average of the high-aggression face based on the total aggression scale

faces (X-squared = 2.10, df = 1, p-value = 0.147; Table 6). This result also demonstrated that males could not discriminate between the low and high aggressive faces. Age, especially older age, the variable was a significant effect on

aggressive choice (p<0.05). However, as males and females get old, they prefer High-BPAQ faces to Aggressive ones (Linear model, p-value = 0.0362). Meanwhile, females perceived a low-aggressive (LA) face as a high-aggressive (HA) face

Table 6. Raters tendency test towards aggression of face and mate choice

| Chi-square | Aggression face | | Mate choice | |
|------------|-----------------|---------|----------------|---------|
| | X ² | p-value | X ² | p-value |
| Male | 2.103 | 0.147 | - | - |
| Female | 7.218 | 0.007 | 3.6981 | 0.05447 |

The total aggression scale in our study (Table 3) was lower than the previous study by Lefevre *et al.* (2014); Table 1). It seems that other environmental factors also cause aggression

(X-squared = 7.222, df = 1, p-value = 0.007; Table 6). This result also indicated that female raters could detect aggression levels between two photographs. No demographic factors affected the rater's LA and HA face choices. These results were obtained by calculating the final model: glm (Aggressive~Age, family = binomial); Intercept, estimate = -1.302, p-value = 0.009; Age, estimate = 0.034, p-value = 0.063.

3.5. Mate Choice

In general, raters did not have a specific trend in choosing a particular face as a spouse (X-squared = 3.574, df = 1, p-value = 0.059; Table 6). However, the linear model results demonstrated that the HA face was chosen more as a spouse by younger women (Intercept, estimate = -0.116, p-value = 0.021). Only age influenced female raters' mate choice. These results were obtained by calculating the final model: glm (Matechoice~Age+as.factor (Education), family = binomial; Intercept, estimate = 2.869, p-value = 0.012; Age, estimate = -0.1164, p-value = 0.209; Diploma Degree-Bachelor's Degree-Master's Degree-Doctoral's Degree, estimate = 1.028, p-value = 0.085).

4. Discussion

In the previous study, male and female raters could perceive aggression (Třebický *et al.* 2013). However, we declare that Indonesian people in this study could not perceive aggressivity on faces. The facial width-to-height ratio (fWHR) between the LA and HA faces in this study was not significantly different. Moreover, female raters perceived LA face as HA face, even though the low and high aggression scores were statistically different. This result implies that the similarity of fWHR between the average of the LA and HA faces in this study affects the rater's aggressivity perception. Thus, they had difficulty discriminating between low and high aggressivity levels. However, previous studies in western society showed that faces were associated with high aggressivity, and hence the aggressivity could be

perceived on their face (Christiansen and Winkler 1992; Carré and McCormick 2008; Haselhuhn *et al.* 2015; Třebický *et al.* 2013). Furthermore, in Asian society, there was no relationship between facial WHR and self-reported aggressive behaviour with BPAQ assessment for either sex in Turkish University Students (Özener 2012).

This study also found that increased age in males and females would prefer a high-aggression face to an aggressive face. The main reason that older adults have more experience in life may cause see their faces differently (Kiiski *et al.* 2016).

Females did not have a specific trend in choosing aggressive faces for a mate. However, the linear model demonstrated that as women age, they prefer to choose a low-aggressive partner as their spouse. In long-term relations, females prefer males with high intelligence, education, and trustworthiness (Kenrick *et al.* 1990; Regan 1998; Regan and Berscheid 1997). Increased age of individuals conforms to increased commitment, faithfulness, and parenting skills (Boothroyd *et al.* 2007)

Moreover, this study showed that people with a higher level of education had low-aggression scores. This finding followed the previous research, which showed that people with a higher level of education were trained to control themselves better than those people with a lower level of education (Harris and Knight-Bohnhoff 1996). Higher self-control would reduce aggression levels (Denson *et al.* 2012). However, controlling emotion is essential to avoid aggression, such as anxiety and anger (Berking *et al.* 2014; Hsieh and Chen 2017; Robertson *et al.* 2012).

In summary, Indonesian people in this study could not perceive aggressivity in their faces. People with a higher level of education had a low-aggression score. Furthermore, no demographic factors influenced the rater's choice of aggression. Furthermore, we suggest that further study needs to consider self-declaration of aggressivity. We also recommend adding more samples to confirm the results of the study.

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