# Clinical Images and Case Reports

**vision publisher**
**Medical Journals**

# Correlation of Body Height and Hand Length Among Batak Toba: a cross-sectional study

Rocky Junevon Simatupang[1], Asan Petrus[2], Juang Pasaribu[3]

[1,2,3]Forensic and Medicolegal Department, Faculty of Medicine, Universitas Sumatera Utara, Medan

**Abstract:**
(1) Introduction: Indonesia, the world's largest archipelagic nation, is known for its diverse landforms and complex geological structure. It lies at the convergence of three major tectonic plates: the Indo-Australian, Eurasian, and Pacific plates. The Indo-Australian plate collides with the Eurasian plate off the coast of Sumatra, Java and Nusa Tenggara, while with the Pacific in the north of Irian and North Maluku. This geographical location can be the cause of various natural disasters such as volcanic eruptions, earthquakes, tsunamis, and so on. Not only natural disasters, crime cases also cause casualties. According to data reported by the Central Statistics Agency, in 2022 there will be 372,965 criminal cases, where bodies are often found in a state of decomposition, heavily damaged or in the form of body parts, sometimes leaving only a few body parts to be examined and identified. (2) Material and Method: This research is an analytical study with a cross-sectional design, with the aim of finding the relationship between the independent variable (hand length) and the dependent variable (body height) in the Batak ethnic group. (3) Result: The length of the right and left hand in men and women has a significant relationship with p-value <0.005 (p = 0.001), with levels of correlation varying from moderate to very strong r = 0.557 – 0.876. (4) Conclusion: Hand length has a relationship with body height with a moderate to very strong correlation level so that hand length can be used as a good predictor of body height.

*Keywords:* Hand length, Body Height, Identification

**Corresponding Author:** Asan Petrus†, Forensic and Medicolegal Department, Faculty of Medicine, Universitas Sumatera Utara, Medan

# INTRODUCTION

Indonesia is known as a maritime country or the largest archipelagic country in the world which has a diversity of landforms. Geologically, Indonesia is an area where 3 large tectonic plates meet, namely the Indo-Australian plate, the Eurasian plate and the Pacific plate. The Indo-Australian plate collides with the Eurasian plate off the coast of Sumatra, Java and Nusa Tenggara, while with the Pacific in the north of Irian and North Maluku. This geographical location can be the cause of various natural disasters such as volcanic eruptions, earthquakes, tsunamis, and so on. Not

only natural disasters, crime cases also cause casualties. According to data reported by the Central Statistics Agency, in 2022 there will be 372,965 criminal cases, where bodies are often found in a state of decomposition, heavily damaged or in the form of body parts, sometimes leaving only a few body parts to be examined and identified.[1]

In 2024, data obtained from DIBI-BNPB that there were 485 disasters with 87 deaths, and in North Sumatra alone until April there were 16 disasters with 37 deaths.[2] The Central Bureau of Statistics, in 2022 stated that there were 372,965 cases of criminality, of which crimes against life (murder) were 854 cases, of which in North Sumatra there were 84 cases.[3]

According to the American Board of Forensic Anthopology, forensic anthropology is the application of science from physical anthropology to the legal process. The main purpose of forensic anthropology is to identify unrecognized victims, determine the cause of death, and provide important information to the authorities in the investigation of a crime or disaster. And to measure the body height of humans for identification purposes, anthropometry is used. [4–6]

Some studies related to palm length with body height, including research by Christanti Sambeka in 2013 at FK Samratulangi University, Manado, research by Nurul Ilmi Rahmatullah in 2018 at PSPD Sriwijaya University, Palembang, research by MD. Asadujjaman in 2019 in Bangladesh and research by Jansen Jakaria in 2022 in the Toba Batak and Sundanese tribes.[7–10]

Research to find the relationship and formula between hand length and body height in the Toba Batak tribe has never been done. This makes researchers interested in conducting research on the relationship between hand length and body height in the Toba Batak tribe so as to get the formula as a contribution of researchers to complement similar research data on tribes in Indonesia.[11,12]

## MATERIALS AND METHODS

The tools used are a Wireles Body Height Meter branded Onemed with a maximum length of 200 cm and a 30 cm digital sliding caliper branded SIGMAT. Body height was measured from the highest point of the head called the vertex to the lowest point which is the heel / floor. The position of measuring body height is taken in a state where the respondent does not wear footwear and stands on a flat place while the back of the head, back, buttocks and heels are pressed against the wall with the head facing straight ahead. Wireles Body Height Meter is placed just above the scalp and against the wall, then the respondent shifts right or left and presses the measuring instrument button then sees the measurement results.

Hand length measurement is carried out after filling in the body height questionnaire data in a way: the correspondent sits quietly with his hands in an anatomical position in extension, then the examiner measures the length of the hand using sliding calipers. The length of the hand was measured from the most distal point on the lateral edge of the radius (wrist), which corresponds to the processu styloideus radii (stylion) with a point on the tip of the middle finger of the hand (dactylion) in the extension position.

## RESULTS

*Descriptive Analysis*

This study involved 56 respondents, consisting of 18 male and 38 female. The age of male respondents ranged from 21-24 years with a standard deviation of 0.84, while females had the same age range with a standard deviation of 0.72.

Male body height ranged from 158-182 cm, with an average of 170.04 cm and a standard deviation of 6.55. Females had a body height between 144.40-166.90 cm, with an average of 156.94 cm and a standard deviation of 4.86.

The righthand length of males ranged from 17.30-19.80 cm, with a mean of 18.63 cm and a standard deviation of 0.62. In females, the right hand length ranged between 15.40-18.60 cm, mean 17.14 cm, and standard deviation 0.81.

Male left hand length ranged from 17.20-19.70 cm, with a mean of 18.65 cm and a standard deviation of 0.69. In females, the left hand length ranged from 15.30-18.70 cm, with a mean of 17.04 cm and a standard deviation of 0.84 (TABLE 1).

**TABLE 1. Descriptive Statistics**

| Sample | | Male 18 | Female 38 |
|---|---|---|---|
| **Age** | Oldest | 24 | 24 |
| | Youngest | 21 | 21 |
| | Mean | 31,7105 | 21,4211 |
| | Standard Deviation | 0,84017 | 0,72154 |
| **Body Height** | Longest | 182 | 166,90 |
| | Shortest | 158 | 144,40 |
| | Mean | 170,0444 | 156,9447 |
| | Standard Deviation | 6,55073 | 4,85658 |
| **RHL** | Longest | 19,80 | 18,60 |
| | Shortest | 17,30 | 15,40 |
| | Mean | 18,6333 | 17,1421 |
| | Standard Deviation | 0,62214 | 0,81394 |
| **LHL** | Longest | 19,70 | 18,70 |
| | Shortest | 17,20 | 15,30 |
| | Mean | 18,6500 | 17,0395 |
| | Standard Deviation | 0,69473 | 0,84455 |

*Normality Test Result*

Based on the Q-Q Plot normality graph image of the Body height and length variables of the right and left hands, most of the data distribution values are located around a straight line, this indicates that the Body height and length data are normally distributed (FIG. 1, FIG. 2 and FIG. 3).
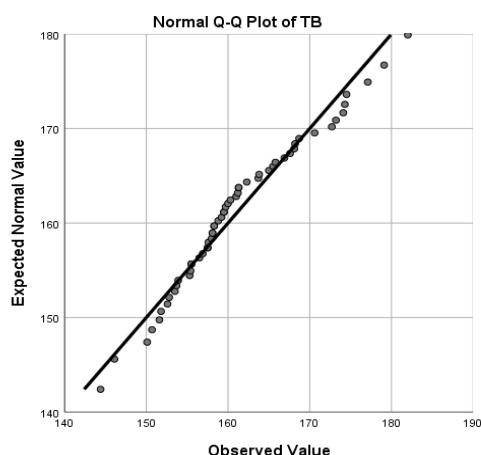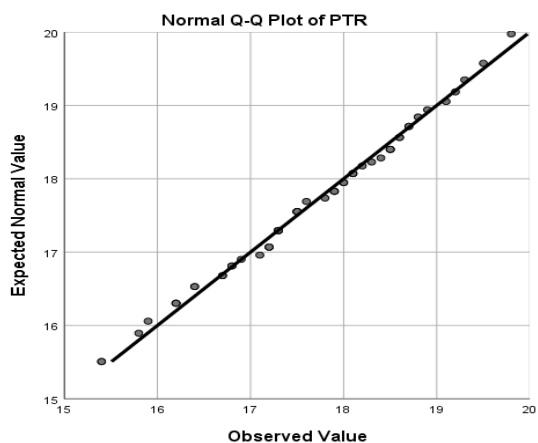


**FIG. 1. Q-Q Plot Normality Graph Body Height (BH)**



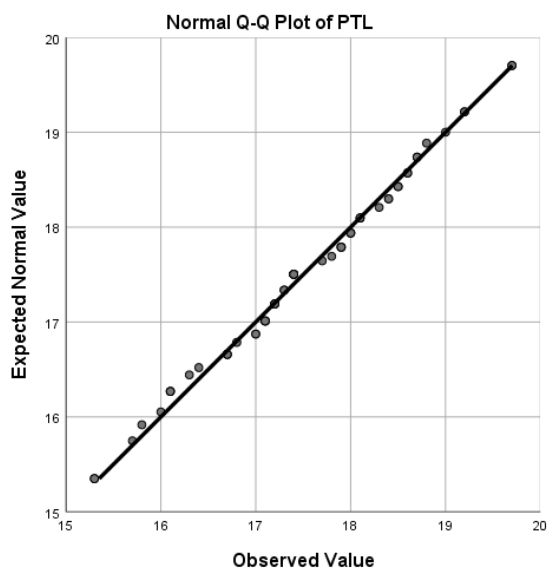**FIG. 2. Q-Q Plot Normality Graph Independent variable right hand length (RHL)**

**FIG. 3. Q-Q Plot Normality Graph Independent variable left hand length (LHL)**

*Correlation Test Result*

It is found that there is a significant relationship between hand length and body height in male and female, with a p-value <0.05 (P = 0.001). Hand length has a very strong correlation value; r > 0.8 (0.815 - 0.835).

Variables that have the strongest correlation if the RHL and LHL variables are found together, where in the correlation test using both variables at once (RHLMF; LHLMF), a very strong correlation was found (r = 0.835).

It can be concluded that the variable RHLMF; LHLMF affects body height by 68.6%. is the most influential variable on body height. And the best level of accuracy in estimating body height with Standard Error of Estimation (SEE) = 4.59320 (TABLE 2).

**TABLE 2. Correlation coefficient (degree of in males and females correlation) of hand length with body height**

| Variable | $R^2$ (%) | SEE | p-value | Correlation(r) |
|---|---|---|---|---|
| RHLMF | 68,2 | 4.62513 | 0,001 | 0,829 |
| LHLMF | 65,8 | 4,79323 | 0,001 | 0,815 |
| RHLMF; LHLMF | 68,6 | 4,59320 | 0,001 | 0,835 |

Notes: SEE (standard error of the estimate), RHLMF (right hand length male and female), LHLMF (left hand length male and female)

*Correlation Test Result for Female*

It is found that there is a significant relationship between hand length and body height in female with a p-value <0.05 (p = 0.001). Hand length has a moderate to strong correlation value (r: 0.557 - 0.614).

It shows the variables that have the strongest correlation if the RHL and LHL variables are found together, where in the correlation test using both variables at once (RHLF; LHLF), a strong correlation was found (r = 0.614).

It can be concluded that the variable RHLF; LHLF affects body height by 34.1%. is the most influential variable on body height. And the best level of accuracy in estimating body height with Standard Error of Estimation (SEE) = 3.94236 (TABLE 3).

**TABLE 3. Correlation coefficient (degree of correlation) of hand length with body height in female**

| Variable | $R^2$ (%) | SEE | p-value | Correlation(r) |
|---|---|---|---|---|
| RHLF | 32.7 | 3,98328 | 0,001 | 0,588 |
| LHLF | 29,2 | 4,08750 | 0,001 | 0,557 |
| RHLF; LHLF | 34,1 | 3,94236 | 0,001 | 0,614 |

Notes: SEE (standard error of the estimate), RHLF (right hand length female), LHLF (left hand length female)

*Correlation Test Result for Male*

It is found that there is a significant relationship between hand length and body height in male with a p-value <0.05 (p = 0.001). Hand length has strong and very strong correlation values; (r = 0.7 - 0.8).

Variables that have a very strong correlation if the RHL and LHL variables are found together, where in the correlation test using both variables at once (RHLM; LHLM), a very strong correlation was found (r = 0.876).

It can be concluded that the RHLM variable affects body height by 74.3%, which is the most influential variable on body height, and the best level of accuracy in estimating body height with Standard Error Estimation (SEE) = 3.32114 as well as the most accurate variable in determining body height using the hand length variable (TABLE 4).

**TABLE 4. Correlation coefficient (degree of correlation) of hand length with body height in male**

| Variable | $R^2$ (%) | SEE | p-value | Correlation(r) |
|---|---|---|---|---|
| RHLM | 74,3 | 3,32114 | 0,001 | 0,871 |
| LHLM | 56,2 | 4,33472 | 0,001 | 0,767 |
| RHLM; LHLM | 73,6 | 3,36566 | 0,001 | 0,876 |

Notes : SEE (standard error of the estimate), RHLM (right hand length male), LHLM (left hand length male)

## DISCUSSION

The longest left hand length in the male respondent group was 19.70 cm, while the shortest was 17.20 cm with a calculated mean of 18.6500 cm with a standard deviation of 0.69473. In the female respondent group, the longest left hand length was 18.70 cm, and the shortest was 15.30 cm. The average length of the left hand in the female group was 17.0395 cm with a standard deviation of 0.84455.

In the normality test, all dependent and independent variable data were normally distributed. So the data continued with the Spearman correlation test. The correlation test results showed that all independent variables were related to body height with a correlation level of "moderate" to "very strong" (r = 0.557- 0.871).

The results of the correlation test of the dependent variable with the independent variable can be concluded that the RHLM variable affects body height by 74.3%. is the most influential variable on body height, and the best level of accuracy in estimating body height with Standard Error Estimation / SEE = 3.32114 as well as the most accurate variable in determining body height using hand length variables.

## CONCLUSION

Based on the results of this study, the formula for estimating body height based on hand length in the Toba Batak tribe is as follows:

1. TB = 44.728 + 6.607 (RHLMF) ± 4.6251

2. TB = 50.657 + 6.305 (LHLMF) ±4.7932

3. TB = 40.549 + 14.580 (RHLMF) - 7.777 (LHLMF) ±4.5932

4.  TB = 96.826 + 3.507 (RHLF) ± 3.98328

5.  TB = 102.320 + 3. 206(LHLF) ± 4.08750

6.  TB = 92.636 + 11.005(RHLF) - 7.297(LHLF) ± 3.94236

7.  TB = -0.780 + 9.168(RHLM) ± 3.32114

8.  TB = 35.210 + 7.230(LHLM) ± 4.33472

9.  TB = -3.316 + 7.748(RHLM) + 1.555(LHLM) ±3.36566

# REFERENCES

1.  Nurhanisah Y. Indonesia Baik. 2024 [cited 2024 Apr 16]. 4.940 Bencana Terjadi di Indonesia Sepanjang 2023. Available from: https://indonesiabaik.id/infografis/4940-bencana-terjadi-di-indonesia-sepanjang-2023

2.  Data informasi Bencana Indonesia(DIBI). DIBI. 2024 [cited 2024 Apr 16]. Badan Nasional Penanggulangan Bencana (BNPB). Available from: https://dibi.bnpb.go.id

3.  Badan Pusat Statistik Sumatera Utara. Badan Pusat Statistik Sumatera Utara. 2024 [cited 2024 Apr 10]. Banyaknya PeristiwaKejahatan/Pelanggaran yang Dilaporkanmenurut JenisKejahatan/Pelanggaran 2019-2021. Available from: https://sumut.bps.go.id/indicator/34/493/1/banyaknya-peristiwa-kejahatan-pelanggaran-yang-dilaporkan-menurut-jenis-kejahatan-pelanggaran.html

4.  Nirmalasari N. Identifikasi & fotografi forensik. 2020.

5.  PUSDOKKES POLRI. Pedoman Tentang Penatalaksanaan Disaster Victim Identification Bagi Polri. Jakarta; 2010. 35–55 p.

6.  Idries AM. Pedoman Ilmu Kedokteran Forensik. Sagung Seto; 2013.

7.  Sambeka C, Tanudjaja GN, Pasiak TF. Hubungan Tinggi Badan Dengan Panjang Tangan Pada Mahasiswa Fakultas Kedokteran UNSRAT angkatan 2013. Ebiomedik. 2015;3(1).

8.  Rahmatullah NI, Suciati T, Septadina IS. Korelasi Tinggi Badan dengan Ukuran Panjang dan Lebar Telapak Tangan pada Subras Deutromelayu. Sriwijaya Journal of Medicine. 2019 Jan 1;2(1):39–45.

9.  Asadujjaman Md, Ali Molla MdB, Al Noman SkN. Stature estimation from hand anthropometric measurements in Bangladeshi population. J Forensic Leg Med. 2019 Jul;65:86–91.

10. Zansen J. Perbandingan Penentuan Formula Tinggi Badan Berdasarkan Panjang Telapak Tangan antara Suku Batak Toba dengan Suku Sunda. [Medan]: Universitas Sumatera Utara; 2022.

11. Kementerian Pendidikan dan Kebudayaan. kemdikbud. 2017 [cited 2024 Mar 14]. Indonesia Kaya : Ilmu Pengetahuan Sosial. Available from: https://banpaudpnf.kemdikbud.go.id/upload/download-center/IPS%20_Modul%201%20_Indonesia%20Kaya_Paket%20B_1563779609.pdf

12. Sherwood L. Human Physiology:From Cells to System. Cengage Learning; 2016.