Vol 6 No 2 Mei 2023

E-ISSN: 2614-5219

ARTIKEL PENELITIAN

The Relationship of Os. Femur with Height influenced by Gender, Race, and Nutrition for Medical Student In Faculty of Medicine University Wijaya Kusuma Surabaya

Ayly Soekanto[1,] Imamir Mudzadadil Alfi Sani[2]

[1,2]Departemen of Anatomi, Faculty of Medicine, Wijaya Kusuma University, Surabaya
[2] Medical Student Faculty of Medical, Wijaya Kusuma University, Surabaya

Email: aylysoekantodr@yahoo.com

Abstract: *Height is an important identity in forensics. Several long bones are known to be used for size estimation, one of which is the femur (Os. Femur). Personal height growth is affected by many factors, including gender, breed, and diet. This study aimed to analyze the correlation of Os length. Thigh height in UWKS medical students is influenced by gender, ethnicity and diet. This study used an observational descriptive analysis approach to conduct a cross-sectional study. Forty-four students from the UWKS School of Medicine participated in the study. Height measurement using Microcotoise, Os. Femoral New Deland with sliding calipers and weights with scales. Data were analyzed using normality test, Pearson correlation test, and simple linear regression test. The results show that there is a positive and very strong correlation between the Os lengths. Femur size, non-Javanese ethnicity, and normal, obese, and obese dietary categories in a male sample. There is now a strong positive relationship between femur length and height in the female sample. Meanwhile, the Os length has no correlation.*
Keywords: *length os femur, height, gender, ethnicity, nutrition*

INTRODUCTION

Height is an important identity in the field of forensics because it can determine a person's identity in some forensic cases only bones remain, so long bones such as the humerus, ulna, radius, femur, tibia, and fibula are measured.[1] In many cases, several studies have proven that there is a relationship between the biometric length of body parts and the length of the human body. It is known that there are several long bones that can be used to estimate height. The femur bone can be used to determine a person's height at the age of 19 to 30.[2]

The femur is also known by the anatomical name, *Os. Femur*, which

E-ISSN: 2614-5219

is one of the long bones of the body. *Os. Femur* is one of the strongest and longest bones in the body. The femur connects the body between *Os. Pelvis* and *patella*. *Os. Femurs* vary in size and morphology within and outside the population. This is caused by differences in environmental conditions, race, and ethnicity. A person's physical activity can also affect changes in the femur due to adaptation and lifestyle. Size variations and morphological variations of *Os. Femur* results from differences in sex, race or ethnicity, and nutrition.[3]

Several studies have found Os. The femur can be affected by gender, namely women and men.[4] This dimorphism can be seen in the morphology of the femur and the diameter of the femoral head, with women having a shorter and taller average height than men.[5] Somatic cell growth is also influenced by race/ethnicity.[6]

Research on femur length can predict a person's height. The methods used to estimate a person's height include anatomical methods (multipliers) and mathematical methods (regression equations) so that they can estimate the length of the femur with body height as a predictor. Therefore the authors are encouraged to conduct research on the long relationship between *Os. Femur* on height in students of the Faculty of Medicine, University of Wijaya Kusuma, Surabaya.

METHODOLOGY

This research is a cross-sectional study with an observational description analysis method. This study involved 44 students of the Faculty of Medicine, Wijaya Kusuma University, Surabaya. The time for collecting research data will begin in September - November 2022. Height measurement with Microcotoise, *Os. Femur* uses the New Deland Sliding Caliper, and the weight uses a scale. Data were analyzed using normality test, Pearson correlation test, and simple linear regression test

RESULTS

This study requires 44 respondents. The research was conducted at the Faculty of Medicine,

E-ISSN: 2614-5219

Wijaya Kusuma University, Surabaya.

Sample Characteristics

Table 1. Frequency Distribution of Gender

Gender	Frequency	%
Male	20	45,5
Female	24	54,5
Total	44	100

Tabel 2. Frequency Distribution of Ethnic/Race

Ethnic/Rase	Frequency	%
Jawa	31	70,5
Outside Jawa	13	29,5
Total	44	100

Measurement Results

Table 3. Frequency Distribution of Nutritional Status

Nutritional status	Frequency	%
Skinny	3	6,8
Normal	14	31,8
Fat	7	15,9
Obesity	20	45,5
Total	44	100

Table 4. Frequency Distribution of Length of Os. Femur Bone

Length of Femur Bone (cm)	Male		Female	
	Frequency	%	Frequency	%
35-39	0	0	2	8,3
40-44	3	15	15	62,5
45-49	9	45	7	29,2
50-54	8	40	0	0
Total	20	100	24	100

Table 5. Body Height Frequency Distribution

Height (cm)	Male		Female	
	Frequency	%	Frequency	%
141-150	0	0	3	12,5
151-160	4	20	14	58,3
161-170	11	55	7	29,2
171-185	5	25	0	0
Total	20	100	24	100

Normality test results using the Kolmogorov-Smirnov test are recommended for large samples (more than 50) while Shapiro-Wilk for small samples (less or equal to 50) (7). Based on this explanation, this study using the Shapiro-Wilk test because the research sample was less than 50. The results of the normality test showed that all tables were normally distributed ($p>0.05$). Thus the correlation test that can be used to test the data is the Pearson test, except for the male group which has a p-value <0.05, then the correlation test

E-ISSN: 2614-5219

that can be used to test the data is the Spearman test.

Table 6. Relationship between *Os. Femur* Bone Length with Height

Group	Variable	Correlation	P
Gender			
Male	OS.Femur bone height	0,884*	0,000
Female	OS.Femur bone Height	0,772	0,000
Overall	OS.Femur bone Height	0,895	0,000
Ethnic/Race			
Javanese	OS.Femur bone height	0,885	0,000
Outside Java	OS.Femur bone height	0,926	0,000
Overall	OS.Femur bone height	0,895	0,000
Nutritional Status			
Skinny	OS.Femur bone Height	0,994	0,071
Normal	OS.Femur bone Height	0,922	0,000
Fat	OS.Femur bone Height	0,832	0,020
Obesity	OS.Femur bone Height	0,916	0,000
Overall	OS.Femur bone Height	0,895	0,000

Description:
* = *Spearman's rho test*

Estimates of height from the length of the femur were obtained through linear regression analysis. The regression analysis will produce an equation that can connect the independent variables with the dependent variable. Linear regression is used if the dependent variable is a numeric variable. Variables that can be included in the linear regression analysis are variables which in the correlative test have a value of p<0.25 (p<0.001).

Table 7. Results of Linear Regression Analysis

Effect	Variable	Coefficient	R Square	SEE	P
Gender					
Male Height	Os. Femur Bone Length	1,490	0,756	2,889	0,000
	Costant	95,604			
Female Height	Os. Femur	1,397	0,521	3,786	0,000

E-ISSN: 2614-5219

Effect	Variable	Coefficient	R Square	SEE	P
Gender	Bone Length Costant	96,835	0,801	3,509	0,000
	Os. Femur Bone Length	1,695			
	Costant	84,852			
Ethnic/Race Javanese height	Os. Femur Bone Length	1,754	0,784	3,851	0,000
	Costant	82,323			
Outside Java	Os. Femur Bone Length	1,565	0,858	2,717	0,000
	Costant	90,625			
Overall Ethnic/Race	Os. Femur Bone Length	1,695	0,801	3,509	0,000
	Costant	84,852			
Nutritional Status Normal	Os. Femur Bone Length	1,728	0,850	2,826	0,000
	Costant	82,481			
Fat	Os. Femur Bone Length	1,637	0,692	4,928	0,020
	Costant	88,543			
Obesity	Os. Femur Bone Length	1,739	0,838	3,372	0,000
	Costant	82,550			
Overal Nutritional Status	Os. Femur Bone Length	1,695	0,801	3,509	0,000
	Costant	84,852			

Based on the table above, a height estimation formula can be made based on the Os. Femur bone length. The formula for estimating height based on Os. Femur bone length can be seen in the table below.

Table 8. Formulation of Height Estimation Based on Os. Femur Bone Length

Group	Formula
Male	Height = 95,604 + 1,490 x (Os. Femur bone length)

E-ISSN: 2614-5219

Female	Height = 96,835 + 1,397 x (Os. Femur bone length)
Overall Gender	Height = 84,852 + 1,695 x (Os. Femur bone length)
Javenese	Height = 82,323 + 1,754 x (Os. Femur bone length)
Outside Java	Height = 90,625 + 1,565 x (Os. Femur bone length)
Overall Ethnic/Race	Height = 84,852 + 1,695 x (Os. Femur bone length)
Normal	Height = 82,481 + 1,728 x (Os. Femur bone length)
Fat	Height = 88,543 + 1,637 x (Os. Femur bone length)
Obesity	Height = 82,550 + 1,739 x (Os. Femur bone length)
Overall Nutritional Status	Height = 84,852 + 1,695 x (Os. Femur bone length)

DISCUSSION

The results of the long correlation research Os. Femur with height in college students shows that there is a significant correlation between the length of the Os bone. The height of the femur in the male sample is very strong. While in the female sample, there is a significant correlation between the length of the Os. The Femur with height with a degree of tightness is strong. This shows that there is a significant correlation between the length of the Os. Femur height in the male sample is higher than that of the female.

In theory, adult males tend to be taller than adult females and also have longer limbs, larger and heavier bones, and larger and denser muscle mass. Adult women tend to be shorter than adult men and have smaller bones and less muscle mass.[8] Several studies have shown that sex differences are related to the age of puberty, the age of puberty in boys occurs two years later than in women, thus providing extra time for growth.[9]

Based on the overall correlation test, it shows that there is aignificant correlation between the length of the femur and body height in the sample

E-ISSN: 2614-5219

as a whole which is influenced by gender with a very strong level of closeness. The longer the bone Os. Femur then height will be higher which is influenced by gender. In line with Brown's opinion, that Os. The femur is influenced by gender, namely women and men. This dimorphism can be seen in the morphology of the femur and the diameter of the femur head, with females having a shorter and taller average height than males

According to research conducted by Rashmi Srivastava, Vinnae Saini, & Rajesh K Rai, femur measurement predictive accuracy for sex starts from 70.5% to 86.3%, by measuring several variables such as bicondylar width, medial femoral diameter, and femoral head where research results show the importance of femur size to determine sex.[10]

Similar results were expressed in a study by Polguj et al. this study which had 90 femur samples using osteometry measurements. The frequency of female and male sex can be seen through the prominent linea aspera because this section is very helpful in determining gender.[11]

The results of the long correlation research Os. The femur and the height of students based on ethnicity/race have the same very strong correlation, 0.885 for the Javanese and 0.926 for the Outer Javanese. These results indicate that the two terms have an equally strong correlation because they are still in the same family so the length of Os. The femur and the height of students based on ethnicity/race have a very strong correlation. According to Soetjiningsih, the growth of somatic cells is influenced by race/ethnicity. The Caucasian/European race has higher somatic cell growth than the Asian race. For example, this can be seen in the growth of British people who are relatively large, and Indonesians who are relatively small.[6]

Research results in Os femur length with the height of students based on nutrition showed that both the normal, fat, and obese categories all had a very strong correlation, while in the thin category, there was no correlation with the length of Os. Femur with height. The strongest correlation was in normal nutritional conditions. This shows that low bone

E-ISSN: 2614-5219

density at a young age can be influenced by various factors including intake of both macro and micronutrients, physical activity, and nutritional status. Osteoporosis is stated to be related to nutritional status, especially with the incidence of obesity, thereby affecting height.[12]

Overall it shows that there is a very strong correlation between the length of Os. Femur with height in UWKS Faculty of Medicine students both in gender, ethnicity/race, and nutrition and the direction of a positive correlation. This means that the longer the bone Os. A person's femur, then his height will also increase.

Prediction of a person's height can be done by finding a special regression. In this study, the regression used is linear regression which aims to find a regression equation that can estimate height through the length of the Os bones. Femur. The results of the regression test showed that the length of Os. Femur height in UWKS Faculty of Medicine students can be influenced by gender, ethnicity/race, and nutrition. However, the regression equation can only be used by the population in this study. This is because the various measurements will be different in various ethnic groups. The results of the linear regression equation found in one ethnic or ethnic group cannot be reused to other ethnic or ethnic groups.

Based on the linear regression equation, it also produces a SEE (Standard Error of the Estimate) value. The SEE value is a good parameter in terms of showing the relationship between the original value and the estimated value. The smaller the SEE value, the more accurate the resulting linear regression equation will be. The results of the study showed that the SEE value for the male sample, and the SEE value for bone length Os. Femur 2.889. For the female sample, the SEE value of bone length OS. Femurs 3.786. This explains that the linear regression equation in the male sample shows more accurate results. For the Javanese, the SEE value for bone length is Os. Femur 3.851, outside of Java, the SEE value of bone length is Os. Femurs 2.717. This

E-ISSN: 2614-5219

explains that the linear regression equation on ethnic/racial samples outside Java shows more accurate results. For normal nutrition, the SEE value of bone length is Os. Femur 2.826, fat, bone length SEE value Os. Femur 4.928, obesity SEE value bone length Os. Femurs 3.372. This explains that the linear regression equation on normal nutritional samples shows more accurate results.

CONCLUSION

The results of the long correlation research Os. Femur to height in students shows that there is a relationship between the length of the Os bone. Femur to height in the male sample using the level of closeness is very strong in ethnic groups outside Java with normal, fat, and obese nutritional categories. While in the female sample there is a relationship between the length of the bone Os. Femur to height with a degree of tightness is strong. In addition, there is no correlation of the length of Os. Femur with height in the thin category.

Overall it can be found that there is a relationship between the length of the bone Os. Femur to height in students of the Faculty of Medicine, University of Wijaya Kusuma Surabaya using a very strong correlation coefficient. Thus the longer the bone Os. Femur, so the height will be higher. In estimating height, it can be used to measure the length of the femur with a linear regression equation in a sample of males, people from the Outer Islands and who have normal nutritional status is more accurate than the sample of women, Javanese people, and those who are overweight and obese.

ACKNOWLEDGMENTS

It is hoped that other researchers will conduct further research on the relationship between Length Os. Femur with the height of the influencing factors. It is also hoped that the institution of the Medical Education Study Program, Faculty of Medicine, Wijaya Kusuma University, Surabaya, can realize that measuring height is one of the forensic anthropology parameters that helps in determining a person's biological profile. According to the

E-ISSN: 2614-5219

forensic field, the length of the upper and lower limbs is proportional to the height. So that in determining height, it can be estimated by measuring the length of the long bones using the regression formula.

REFERENCE

1. Utara Is, Penelitian A, Lubis Mi, Siregar Np, Fakultas M, Universitas K, Et Al. Hubungan Panjang Tulang Tibia Terhadap Tinggi Badan Pada Mahasiswa Dan Mahasiswi FK UISU Angkatan 2018. 2022;21(2):183–91.
2. Suka Astini DAAA, Sana IGNP, Widarsa IKT, Sueta IN, Suwitra IW, Trisna Sumadewi K. Perkiraan Tinggi Badan Berdasarkan Tulang Panjang Usia 17-22 Tahun. WMJ (Warmadewa Med Journal). 2017;1(2):66.
3. Atlas Anatomi Manusia Netter - 7th Edition [Internet]. [cited 2023 May 25]. Available from: https://www.elsevier.com/books/atlas-anatomi-manusia-netter/978-981-4666-93-0
4. Saraswati DL. Variasi Ukuran Dan Variasi Karakteristik Morfologi Femur Laki-Laki Dan Perempuan. 2018 [cited 2023 May 25]; Available from: http://lib.unair.ac.id
5. Wati DA. Journal of Holistic and Health Sciences V o l . 2 , N o . 1 , J a n u a r i - j u n i 2 0 1 8 | 14 Hubungan Rentang Lengan Dengan Tinggi Badan Dalam Menentukan. Journal of Holistic and Health Sciences. 2018;905:14–8.
6. Dahlan MS. Statistika untuk kedokteran dan kesehatan. Jakarta:Epidemiologi Indonesia; 2014.
7. Agung Pratama Siregar IDL. Hubungan Panjang Tulang Femur Dengan Tinggi Badan Pada Suku Batak Di Kelurahan Sudirejo I Kecamatan Medan Kota. J Ilm Simantek. 6(3):1–23.
8. Journal Unair [Internet]. [cited 2023 May 25]. Available from: http://journal.unair.ac.id/JN@pengalaman - masa - pubertas remaja - studi - fenomenologi - di - purwokerto - (the - puberty experience - of - adolescent fenomenology - study - in

E-ISSN: 2614-5219

purwokerto) - article - 4830 - media 37 - category - 3.html

9. Polguj M, Bliźniewska K, Jedrzejewski K, Majos A, Topol M. Morphological study of linea aspera variations - proposal of classification and sexual dimorphism. Folia Morphol (Warsz) [Internet]. 2013 [cited 2023 May 25];72(1):72–7. Available from: https://pubmed.ncbi.nlm.nih.gov/23749715/
10. Ningrum JA, Nurhayati S, Kembang T. Jurnal Cendikia Muda Volume 3 , Nomor 3 , September 2023 ISSN : 2807-3469 Penerapan Pendidikan Kesehatan Pada Ibu Tentang Pengetahuan Tumbuh Kembang Anak Usia Prasekolah (3-6 Tahun) Di Wilayah Kerja Puskesmas Metro Pusat Application Of Health Education . 2023;3(September):364–70.
11. Srivastava R, Saini V, Rai RK, Pandey S, Tripathi SK. A study of sexual dimorphism in the femur among North Indians. J Forensic Sci [Internet]. 2012 Jan [cited 2023 May 25];57(1):19–23. Available from: https://pubmed.ncbi.nlm.nih.gov/21854380/
12. Maulina N, Al Fadhil MF. Estimasi Tinggi Badan Berdasarkan Panjang Tulang Femur Perkutan Pada Mahasiswa Suku Aceh Universitas Malikussaleh. AVERROUS J Kedokt dan Kesehat Malikussaleh. 2018 Nov 5;4(2):27.