

# Measurement of the Length of Upper Arm as a Predictor of Height of Women Aged 20-40 Years in Jakarta

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**ABSTRACT:** Height is one of the components to determine the nutritional status, in some cases the height shall be determined directly at subjects with a disability (disability) such as limb deformities from birth, patients who use wheelchairs, patients with amputation. Height can be estimated by measuring the length of the upper arm because it is one part of the long bones that are proven to interpret height. This study aims to predict the height by the length of the upper arm in women aged 20-40 years in Jakarta. This study uses secondary data from the Data Monitoring Nutritional Status in Jakarta in 2015 with a sample of 1052 samples. Design analysis of the data used is *crosssectional*. Data processing using correlation and linear regression. The analysis showed the average height of women in Jakarta 152.6 cm. *Confidence Interval* (95% CI) of height is 152.35-152.84. The average length of the upper arm is 31.34. *Confidence Interval* (95% CI) of the upper arm length is 31.19-31.49. correlation test conducted showed a significant relationship (p-value = 0.000) between the upper arm length and height. Model predictions were obtained Height = 106.28+ 1,486 (Upper Arm Length). Thus the length of the upper arm can predict the height.

**KEYWORDS:** Height, length of the upper arm, predicator.

## I. INTRODUCTION

Human Resources (HR) is one important component in achieving the goal of health development. Qualified human resources are needed to improve the health status of the community. The main factor that determines the Human Development Index is education, health, and economy related to the nutritional status of a society (1). Nutrition is one of the main determinants of the quality of human resources. The role of nutrition in the development of human resources has been demonstrated from various studies. Nutritional disorders early in life will affect the quality of the next life (2). Women of childbearing age (WUS) is defined by the Ministry of Health as a woman who is in a period between 15-49 years of age regardless of marital status. Number of WUS in Indonesia in 2010 was 66.3262 million inhabitants. WUS number average reached a third of the total population of a region (3) In women, the physiological indicator of puberty is *menarche*, *age of menarche* is the age where a teenage girl getting first menstrual period. Based on the study, *age of menarche* also play a role in determining adult height. The delay in *age of menarche* allow the growth of the rapid growth of the long bones occur for longer periods before closing the epiphyseal discs due to an increase in estrogen (4). Based on this it is necessary to study the length of the upper arm as a measurement of height pedikator in women.

## II. RELATED WORK

The results of the survey in 2002 in Jakarta obtained prevalence of nutritional problems that less chronic energy on women amount 12.94% (Ministry of Health, 2003) and in 2007 Jakarta is one of the provinces that have a high risk of less chronis energy and its prevalence increases to 16 , 6% in 2007 (5). Lesschronis energy on women closely related to body mass index or nutritional status. A cohort study in women in China showed that body mass

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index (BMI) / nutritional status of women preconceptions / premarital classified as very thin / severely underweight ( $\leq 18.5 \text{ kg / m}^2$ ) will result in the disruption of fetal growth during pregnancy and risk for future having a baby with low birth weight (LBW) two times greater than women who have a BMI / preconception nutritional status to normal category ( $19.8 \leq \text{BMI} < 26 \text{ kg / m}^2$ ) (6).

Height is one of the components to determine the nutritional status, where the assessment of nutritional status is often done calculating the Body Mass Index (BMI) is measured by the ratio of weight (in kilograms) and the square of height (in meters) (7). In some cases the height can not be determined directly on the subject with disability in question is malformed limbs from birth due to abnormal growth including spinal deformities such as scoliosis or in patients who use wheelchairs, patients with amputations and loss of height due to the surgical procedure on the spine (8)

The research that has been done Nath and Krishan Garg (1991), the height can be estimated by measuring the length of the upper arm. Measuring the length of the upper arm is an alternative pengukuran used when the height measurement is not possible because of the length of the upper arm is one part of a long bone that can interpret the height(9). In Indonesia research on the relationship of the upper arm length to height have been done by Kuntoadi (2008) and Amalia (2015). In the study of the humerus bone lengths have a relationship that is directly proportional to height. Both of these studies have differences in the target population.

Kuntoadi study (2008) was performed on a population of Lampung tribe and research Amalia (2015) conducted in populations with male gender in Javanese and Lampung. Research on the estimate or the estimated height by the length of the upper arm still rare in Indonesia. Karl Pearson (12) introduced mathematical calculation of correlation for prediction of stature from measurements of long bones. He mentioned height as an indicator of personal identification that varies with ethnicity age, sex and heredity

### III. MATERIALS AND METHODS

This study is a cross-sectional survey of monitoring of nutritional status at 6 Jakarta Jakarta area covering West, East, North, South, Central, and the Thousand Islands in 2016. Samples are women of childbearing age between 20-40 years old with the number of samples collected as many as 1527 samples covering 6 regions as follows: West Jakarta 264 samples, 265 samples East Jakarta, North Jakarta 246 samples, 260 samples of South Jakarta, Central Jakarta Thousand Islands 257 samples and 235 samples. Sampling was done by using a two-stage cluster by considering the population proportionaal to size. Data were analyzed by univariate and correlation and simple regression.

### IV. EXPERIMENTAL RESULTS

Data analysis in this study starts from descriptive analysis to determine the image of secondary data. Data obtained as many as 1527 samples and then do *drop out* at extreme data and *missing data*. So after the move in 1052 as the data obtained sample to be analyzed. Here are the results of the univariate:

TABLE 1. DESCRIPTIVE ANALYSIS AGE, HEIGHT AND THE LENGTH OF UPPER ARM

Variable	n	Min	Max	Mean	SD	95% CI
Age	1052	22	39	30.8	4:27	30.54-31.06
Height	1052	143.0	162.0	152.6	4:04	152.35-152.84
Length of upper arm	1052	19.0	36.0	31.34	2:48	31.19-31.49

In table 1 can be seen in the descriptive analysis of the age, height and length of upper arm on women of childbearing age in the Jakarta area. Of the 1052 samples of the average age of women of childbearing age in the Jakarta area was  $30.8 \pm 4:27$  with the lowest age of 22 years and 39 years of age supreme *confidence interval* (95% CI) of age is 30.54-31.06.

Average height obtained was  $152.6 \pm 4:04$  cm with a height of 143.0 cm lowest and the highest 162.0 cm. *Confidence Interval* (95% CI) of height is 152.35-152.84. The average length of the upper arm of a 1052 sample of

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women adalh  $31.34 \pm 2:48$  cm in length of the upper arm and the longest the lowest 19.0 cm 36.0 cm. *Confidence Interval* (95% CI) of the upper arm length is 31.19-31.49.

In several studies conducted previously in Indonesia, has obtained some of the average value of the height at the rate of Lampung is  $151.73 \pm 3,776$  cm in the female gender by Kuntoadi (2008), The length of upper arm average is  $31.41 \pm 1,948$  cm.

TABLE 2. DISTRIBUTION OF SAMPLES BY HIGHT, LENGH OFUPPER ARM AND AGE

Height (cm)	n	%
<149 cm	170	16.2
149-151	253	24.0
151-153	194	18.4
$\geq 153$	435	41.4
Total	1052	100.0
Lengh of Upper Arm (cm)	n	%
<30	129	12.3
30-32	363	34.5
32-33	428	40.7
$\geq 33$	132	12.5
Total	1052	100.0
Age (years)	n	%
<27	278	26.4
27-31 years	314	29.8
31-34 years	204	19.4
$\geq 34$ years	256	24.4
total	1052	100.0

Table 2 it can be seen by the frequency distribution of the sample according to height, upper arm length and age. Frequency distribution of heightsof 1052 the sample consisted of four categories determined by quartiles of height and the results obtained category height majority is between  $\geq 153$  cm as many as 435 samples, equivalent to 36% of the total sample, whereas the lowest is the height more of <149 cm as many as 170 people, equivalent to 16.2% of the total sample.

Upper arm length frequency distribution of the 1052 sample consisted of 4 categories and the results obtained are the highest category of the upper arm length is 32-33 cm as many as 428 people, equivalent to 40.7% of the total sample, whereas the lowest is the upper arm length <30 cm as many as 132 people, equivalent to 12.5% of the total sample.

Pearson Product Moment Correlation analysis results obtained  $r = 0.912$  ( $p < 0.000$ ). These results indicate a strong correlation between lengthof upper arm weight height.

In the following figure is a scatter plot between height and length of upper arm.

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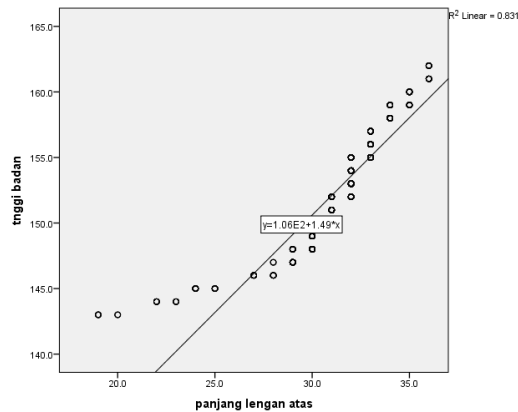


Figure 1. Scatter plot length of the upper arm with height

The results of this correlation is greater when compared to previous studies conducted by Kaur et al. (2011) in 200 men and 200 women in Sri Amritsar, North Indian ( $p = 0.001$ ) with an age range of 17-25 years (10). Physiologically relationship between height can be demonstrated by the growth pattern similarities between the bones of the lower extremities (femur, tibia, and fibulla) which is a constituent component height and upper extremity bones (humerus, radius, ulna). The growth of the upper extremity following the pattern of the lower extremities growth since individuals aged 5 years, steady growth at the age of 5 until the beginning of puberty, when growth accelerated period. *growth spurt* The length of the ulna bone 80% of the length of the humerus bone, the humerus while representing 70% of the length of the femur (11). Regression analysis to predict the height based on length of upper arm following equation:

$$\text{Height} = 106.28 + 1.486 * \text{length of upper arm}$$

In the above equation shows that model having an value of *R-square* 0831 and value-  $p$  0000 significantly and the variation of independent variables (length of upper arm) used in the model is able to explain amounted to 83.1% of the variation of the dependent variable (height, while the remaining 16.9% is influenced by other variables. From the equation above, it can be interpreted that the height of women aged 20-40 years in Jakarta increased 1,486 cm each increment of 1 cm length of the upper arm. Another study stated that sample of children, aged 4.0–6.92 y, there is a statistically significant relationship between upper arm length and stature (13).

## V. CONCLUSION

Results of the analysis concluded that mean of height of women aged 20-40 years in the Jakarta area was  $152.6 \pm 4:04$  cm, the mean of length of upper arm was  $31.34 \pm 2:48$  cm. Analysis of the correlation length of upper arm has a strong association with height The results of simple regression analysis showed a predictive model  $\text{Height} = 106.28 + 1.486 * \text{length of upper arm}$ .

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