

Image Analysis of Ideal Antropometric Percentage Proportion of Men Artistic Gymnastic Apparatus

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Abstract—The apparatus number gymnastics branch is one that requires the right posture composition to support its best performance. This study is to describe the composition of the ideal posture of artistic gymnastics for male numbers through Image / Image analysis. Descriptive research method with post facto research design using regression analysis techniques, the subjects of the study were world gymnastics athletes champion number tool who competed in the International Gymnastics Championship, which amounted to 150 champion gymnasts each apparatus from various time frames. The instrument used is software (UNG) Real Size Image containing anthropometry image analysis. The results showed that there was a positive correlation $r = 0.341$ medium category between percentage variables anthropometric length proportion (head, neck, arms, togok, limb) world men artistic gymnast towards the final score. The influence of anthropometric percentage variables is 11.6%. and predicted by indicated from the significance level with sig $0.03 < 0.05$ yielding formula $Y = 13.54 + 0.28 \text{ head} - 0.029 \text{ neck} - 0.033 \text{ body} - 0.004 \text{ arm} + 0.047 \text{ legs}$. (Head, neck, body, arms, legs are percentages of body size comparison with height). Conclusions, there is a significant anthropometric effect on the performance of gymnastics athletes.

Keywords — *anthropometry, ideal Posture, Gymnast world*

I. INTRODUCTION

Anthropometry is a distinctive characteristic of each individual. The essence of Anthropometry is also a collection of numerical data that shows the size, shape, and strength of humans [1]. Some scientists study anthropometrics, among others, about; Anthropometry is related to nutritional status [2][3], Physical activity is also closely related to anthropometry [4]. Anthropometric relations with appearance and movement skills include soccer athletes[5] basic motion skills[6], swimming athletes [7]gymnastics athletes[8][9] In general it is concluded that there are certain sports that require anthropometric advantages to support optimal movement skills and appearance.

One sport that requires high skills and a variety of movements is artistic exercise, where movement in artistic gymnastics requires the practice of long motion repetitions / exercises to achieve perfection of motion[10][11]. That is what causes the coach takes a long time to score gymnastics

athletes to the peak level of approximately 8 to 10 years or more. In that range, it takes a lot of energy, mind and time to sacrifice. In order for training to be on the right track and get optimal results expected, attention must be paid to all barrier factors. One decisive factor is the identification of gymnasts' talents regarding anthropometrics. Physical factors of gymnasts are unique and can clearly be identified as having high physical characteristics and weighing 30% lower than normal, good posture, coordination and more strength [12]. Even some scientists who examined ideal physical factors for gymnasts mention age 6-8 years and achievement levels have certain anthropometric characteristics, regarding height, limb length and arms [13]. Characteristics of 9-11 year old gymnasts [14] good posture and certain physical characteristics will benefit gymnasts in their appearance.[15] [16].

In Indonesia identification of gymnast talent in some areas, especially Central Java, still uses natural methods commonly called traditional approaches, meaning that in this approach the coach or trainer does not distinguish the quality of prospective athletes. Less gifted gymnast seeds are still maintained to keep practicing until natural selection causes him to be unable to attend training anymore. [17] write that the cause of athletes out of training is not only incompatibility with sports but career development in the sport. Natural selection benefits from the seeds of athletes who are less talented to get health, experience to compete and courage with this gymnastics training. But the weakness of this system is that the coach is not efficient in delivering his athletes as champions, because it requires a long training time.

On the other identification of talent can use Scientific selection. This method looks at and identifies based on coaching theory by paying attention to aspects of forming athletes early on [18]. Scientific selection begins with measurements of anthropometry, posture, physical conditions, genetics, fitness, mental and basic techniques that are truly measurable to obtain superior seeds that are ready to be trained early so that at the peak of appearance they can be achieved at the golden age. The benefits of identifying talent using scientific selection will shorten training time for selected young athletes. To be able to read athlete's giftedness, current standards are needed. These

standards are essentially the results of research regarding the characteristics of successful athletes and champions in the sport. These characteristics can be in the form of anthropometric data such as the rhythmic gymnastic [19], psychological data such as women's gymnast psychology [20], physical data of champion gymnasts [8] and so on. Research on the characteristics of Olympic athletes is really needed to compare and determine the extent to which conditions or situations can be generalized[21] [22] . This is very interesting for the writers to see and observe Olympic athletes. Artistic Gymnastics is a gymnastic that has rules for each instrument, appearance, difficulty in moving and other rules in writing and is recorded by the International Federation of Gymnastic (FIG). The appearance of a gymnast will be judged by a jury based on the agreed Code of Point FIG. The movement listed on the Code of Point is a movement element that matches the clump and the factor of difficulty in movement. In the men's artistic gymnastics the number of the competition consists of 6 numbers, namely floor, vault, pommel horse, ring, single bar, parallel bar male gymnast who gets the highest score and has perfect movement with difficulty in motion highest is entitled to first place. The apparatus in which male artistic gymnastics is matched has a specification of the underlying dominant motion, for example the number of wristbands based on balance, holding strength and swing. The number of Apparatus bars is parallel, which is based on the support of the shaft shoulder and hand as the foundation.[23] Research on the characteristics of champion specialist male gymnasts in the number of hanging devices such as rings, single bars and pedestal-based devices such as parallel bars and pommel horses is still rare.

Based on the background of the problem and the theoretical study as mentioned above, this study focuses on the anthropometric image analysis of champion male gymnasts specializing in the international level of art gymnastics championships from 2000 to 2019

This study wants to answer the problems, namely:

1. Based on data analysis Image is there an effect percentage variable size proportion (height, weight, arm length, togek, limb) of the male gymnast on the final score?
2. What is the proportion of the ideal body size for a specialist men artistic gymnast apparatus?

This research aims to knowing whether there is an influence of percentage variable size proportion (head, neck,body, arm, limb) of the male gymnast on the final score and Describe and describe the proportion of ideal body size for male gymnast specialists.

This research is very important to do because the results of this research are expected to provide benefits:

a. For the general public

The results of this study can be used as a source of information about the anthropometric influence of gymnasts on the appearance of the final results of the gymnastics race.

b. For coaches of men's artistic gymnastics coaches

The results of this study can be utilized for evaluating gymnast scouting specialists, especially specialization apparatus, considering the ideal body proposition so that in terms of anthropometry it gives an advantage in training athletes towards peak performance.

II. MATERIALS AND METHODS

The method used in this study is a survey method with *ex post facto* research design. The design is appropriate for finding the cause, the changing phenomenon that occurs regarding the anthropometry of the world's male gymnasts, the number of Apparatus in the Olympic game through image analysis. to be able to achieve the objectives of the research, the following is the procedure for collecting data by researchers:

- 1) Manage research permits.
- 2) Identification of subjects, populations and research samples.
- 3) Preparation of instruments using Real Image Size Software (UNG)
- 4) Recruitment and training of data collection teams.
- 5) Collecting data on Olympic gymnast athletes elite in each Apparatus number
- 6) Analysis of data, to determine the effect of percentage variable size proportion (head, neck,body, arm, limb) on the final score and describe the proportion of ideal body size for male gymnasts, number specialists apparatus.

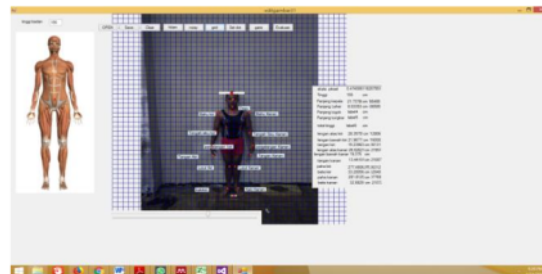


Figure 1: UNG Software Application (Real Size Image)

Activities at the data analysis stage include: (1) checking the collected data again; (2) grouping the anthropometric data and score for each variable. (3) enter the statistical data analysis of inferential statistical analysis, namely analysis of regression to find out how much influence using SPSS 21. (4). Determine the composition of anthropometric proportions of ideal male gymnasts.

III. RESULTS AND DISCUSSIONS

The sample of this study was 150 gymnasts who competed in several Artistic gymnastics championships namely Euros AA, Stuttgart TQ, American Cup in 2019. The UNG software application has logical validity and content can measure the length of anthropometrics with a very good level the average value of 9.6 from sports experts

and information technology experts with the reliability of the results of test measurements and retest of 0.89 in the high category.

The following are the details of the men's artistic gymnast anthropometrics on the entire number of instruments recorded on the images recorded on the channel YouTube.Com is as follows:

TABLE I. DESCRIPTIVE ANTHROPOMETRIC STATISTICS FOR ALL SAMPLES OF WORLD GYMNASTS.

	N	Minimum	Maximum	Mean	Std. Deviation	Normalitas Sig. f	Homogenitas sig
High (Cm)	150	147.00	186.00	166.4133	6.28003	0.12	0.263
Head (presentage)	150	14.00	30.00	22.3867	2.74604	0.192	0.57
Neck (presentage)	150	4.00	14.00	7.9800	2.05126	0.02	0.24
Body (presentage)	150	36.00	57.00	43.9533	3.14810	0.08	0.464
Leg (presentage)	150	78.00	110.00	92.2133	5.12212	0.453	0.276
upper arm (presentage)	150	17.00	38.00	26.7600	4.50008	0.014	0.01
Forearm (presentage)	150	18.00	31.00	25.0133	1.97633	0.02	0.214
Thigh (presentage)	150	42.00	69.00	49.3267	3.81360	0.177	0.493
Calf (presentage)	150	29.00	47.00	37.2667	3.40877	0.277	0.739
Valid N (listwise)	150						

In the table above, it can be seen that gymnasts have certain characteristics where the average height of 166.4 cm where the criteria for moderate height while normality and homogeneity if the significance is more than 0.05 can be said to be normal and homogeneous. Percentage of body parts with height is seen that is very closely related to the effect with 96% read while the relationship with the value is only seen 11.6% of its effect to be seen and can be predicted as follows:

TABLE II. TEST OF ANTHROPOMETRIC EFFECTS ON HEIGHT AND VALUE

Y	N	R	R square	Sig. F	Predicts
Height	150	0.985	0.96	0.00	$Y = 9.120 + 1.316 \text{ head} + 1.341 \text{ neck} + 1.552 \text{ body} + 1.634 \text{ limb} + 0.098 \text{ upperarm} + 0.042 \text{ forearm}$
Value	150	0.341	0.116	0.03	$Y = 13.54 + 0.28 \text{ head} - 0.029 \text{ neck} - 0.033 \text{ body} - 0.004 \text{ arm} + 0.047 \text{ limb}$

The anthropometric effect on each Apparatus on values shows a positive relationship. Each ideal form of gymnast number Apparatus has an influence between 19% to 68% of the appearance shown by the value. However, based on table 3 below, anthropometrics at apparatus is not a good prediction of value because it shows all the qualifications of sig. $F > 0.05$.

TABLE III. ANALYSIS OF ANTHROPOMETRIC EFFECTS ON APPEARANCE OF ATHLETES TOOL.

Apparatus	Amount Gymnast	R	Rsquare	Sig.F
Floor	32	0.444	0.197	0.684
Pommel Horse	26	0.553	0.284	0.698
Pararel Bar	27	0.273	0.284	0.578
High Bar	26	0.678	0.460	0.145
Rings	23	0.671	0.450	0.266
Vaulting Table	16	0.827	0.683	0.209

The percentage of the length of the body members of the world gymnast to height varies with each instrument in the sixth artistic. This shows that the proportion of gymnasts in each Apparatus is different. In line with opinion that in some morphology gymnasts have similarity characteristics and

differences that influence their movements. Shown in table 4 below:

TABLE IV. DESCRIPTION OF PERCENTAGE OF PROPORTION OF BODY MEMBERS TO WORLD GYMNAST BODY HEIGHT EACH APPARATUS

	Floor		Pommel Horse		Pararell Bar		High bar		Rings		Vaulting Table	
	Mean	Std. Dv	Mean	Std. Dv	Mean	Std. Dv	Mean	Std. Dv	Mean	Std. Dv	Mean	Std. Dv
High (Cm)	166.0	7.52	168.	5.37	166.85	4.73	168.92	5.52	164.69	5.02	162.12	7.71
Head (presentage)	14.67	.912	14.23	1.24	13.28	1.65	11.95	1.38	12.34	1.56	13.62	.98
Neck (presentage)	4.32	1.07	4.69	1.11	5.05	1.32	5.50	1.09	4.71	1.37	4.26	.944
Body (presentage)	54.36	3.20	55.36	2.27	55.33	1.60	57.25	3.24	55.48	2.50	52.80	3.31
Leg (presentage)	26.53	1.79	26	2.61	26.33	2.48	26.60	1.43	25.95	1.91	26.31	2.09
upper arm (presentage)	17.31	2.33	14.67	1.37	16.34	1.81	15.66	2.33	12.29	1.43	16.99	1.75
Forearm (presentage)	15.00	1.01	14.23	1.24	15.03	1.24	14.85	1.31	15.17	.93	15.19	1.23
Thigh (presentage)	29.60	2.77	29.77	1.99	29.25	1.85	30.33	1.80	29.60	2.513	28.10	2.2
Calf (presentage)	22.30	2.15	22.33	1.79	22.77	1.89	21.81	1.8	22.70	2.37	21.70	2.28
Value	14.430	.267	14.63	.412	14.67	.30	14.28	.26	14.60	.332	14.72	.25
Valid N (listwise)	32		26		27		26		23		16	

The dominant pattern of motion in each apparatus in artistic gymnastics varies greatly based on the characteristics of the gymnastics Apparatus. [24] The dominant flooring apparatus involving the legs and feet will be different from the pommel horse apparatus which involves a lot of the shoulder and arm for its circular motion. Paracetristic anthropometric gymnasts on certain Apparatus numbers will lead to efficient and effective movements.[25][26]

IV. CONCLUSION

In this study answer the following:

- That there is a positive correlation $r = 0.341$ medium category between percentage variables anthropometric length proportion (head, neck, arms, togok, limb) Men world gymnasts towards the final score. The influence of anthropometric variables is 11.6%. The results can be predicted by showing the significance level with $sig < 0.05$.
- That the proportion of gymnast body size is ideal for Apparatus number specialists varies but can be described the characteristics of certain anthropometric percentages as shown in table 4 above.

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