



THE DIFFERENCE OF ANTHROPOMETRIC CHARACTERISTICS BETWEEN ELITE AND NOVICE BODYBUILDERS IN THAILAND

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Accepted for Publication: February 9, 2022

Published: March 25, 2022

DOI: 10.17309/tmfv.2022.1.14

Abstract

Research purpose. This study aim to compare anthropometric characteristics between elite and novice bodybuilders.

Materials and methods. Twenty bodybuilders consisted of 10 elites and 10 novices were recruited. Percent body fat, segmental lean mass, and segmental fat mass were measured by bioelectrical impedance analysis device. Other measure includes circumference of body segment and body height.

Results. Results of the study indicated that significant differences were found in term of upper arm (flexed) circumference, upper arm circumference, and chest circumference, with the elite were bigger than the novice. Elite bodybuilders also had significantly lower body fat percentage, with better segmental lean mass of right arm, left arm, and trunk. Interestingly neck, arm, waist, hip, thigh, and calf circumferences were not significantly different between groups. Similar insignificant differences were also found in body mass index, segmental lean mass of right leg and left leg, segmental fat mass of left and right arm, trunk, and left and right leg. With regards specifically to group of bodybuilders that participated in this study, the non-significant differences variables may indicated area that can be improved in term of training in both elite and novice. The variables with significant differences may indicate the area that may have been over-emphasize by the elite group, which may also contributed to their better (winning) performance.

Conclusions. As a conclusion, the results also corresponds well with bodybuilding judging criteria, where one of it such as size (circumference) may be similar, but bodybuilders with lean and well define body will be in the winning group.

Keywords: bodybuilding, anthropometry, lean body mass, balance, winning criteria.

Introduction

The science of anthropometric is the study of differences in the body variations in both athletic and general population. Anthropometric study could be performed by simple or high technology methods of data collection (Lee et al., 2019; Santos et al., 2004; Sterkowicz-Przybycień et al., 2011). It can be used for athletes' selection as coaches have to consider the basic body structure that suit with their sport and thus could contribute to the athletes' success in the future (Radu et al., 2015; WD et al., 1996). Some body composition has also been

found to be correlated with physical fitness in athletes (Hoffman et al., 2018; Radu et al., 2014). At the same time, body compositions are very important for some sports. For example, bodybuilding in which the decision of winning or losing in the competition must be based on physical characteristics body proportions that meet the scoring and judging criteria.

Understanding differences or similarities between elite and novice level bodybuilders will be the fundamental basis for coaches and fitness trainers in prescribing appropriate physical training program. Typically the main reason for the elite group of athletes were classified as "elite" are when their sports specific performance is much higher than other group of athletes, with their performance experience is much longer (years of participation). However, certain part of their physical may or may not be similar to the begin-

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ners. This may apply to anthropometry too. Bodybuilding competitions determine winning or losing mainly based on the size, muscularity, symmetry conditioning level of the muscle, posing ability and stage presentation (Gaines, 2001; Kardani & Rustiawan, 2020). Basic anthropometry of the bodybuilders thus becoming highly important, as the body will be trained into winnable characteristics with anthropometry as one of main factors that influence performance (Cevallos et al., 2017; Latella et al., 2019).

The method of measuring body composition in the component of body fat percentage, fat free mass, and mineral density in bodybuilders were studied in difference methods (Lichtenbelt et al., 2004). Girth measurement was also conducted to assess the change of body segment in bodybuilders as well (Hartgens et al., 2001; Kajaba et al., 1966). However, the body composition of an elite and novice bodybuilders, especially the details of body symmetry such as body fat percentage, lean mass, fat mass, and segmental circumferences which are important to the results of the competition has not yet been investigated. Therefore, the objective of this study is to investigate anthropometric characteristics between elite and novice bodybuilders.

Materials and methods

Study participants

The sample groups were recruited in this research consisted 10 Thai national bodybuilding athletes (Elite bodybuilders) (age 31.4 ± 7.34 years) with 10.20 ± 4.61 years of bodybuilding experience (3 world champion, 5 Asian champion and 2 Southeast Asia champion) and 10 new training bodybuilders (Novice bodybuilders) (age 22.2 ± 2.20 years) with 3.00 ± 0.81 years' experience in bodybuilding. All subjects had read the statement and signed informed consent prior participation in this study. This study was approved by the institute ethical review board of Chandrakasem Rajabhat University (No. 006/2563).

Instrumentation

Percent body fat, segmental lean mass, and segmental fat mass were measured by bioelectrical impedance analysis (BIA) technique using 50 kHz Accuinq model BC360 (Kim et al., 2018; Yang et al., 2018). Circumference of body segment was collected using measuring tape, with the body height was measured using stadiometer.

Data collection

Before standing on the foothold electrodes of each measuring device, the subjects' palms and soles were cleaned with electrolyte tissues; their ID, height, age, and gender were keyed in, and body weight was automatically calculated. They stood in an anatomical position for the measurement with their arms open and at an angle of about 30 degrees away from their body position was held until the end of the measurement, and, if not necessary, they were forbidden from speaking or moving during the process. Each calculation took approximately 2 minutes. After that, circumference measurement was conducted using girth measurement technique by Norton and Olds (1996).

Statistical Analysis

Data normality was analyzed using Shapiro – Wilk test before comparison of mean between groups. Descriptive statistics (mean and standard deviation) and inferential statistic (Independent t-test) were used to analyze the mean difference between the groups. Significant level was set at < 0.05 .

Results

Table 1 showed the physical characteristics of both elite and novice bodybuilders involved as participants in this study. Elite bodybuilders age, weight, height and experience means were 31.40 ± 7.33 years, 81.33 ± 7.90 kg, 170.20 ± 7.23 cm, and 10.20 ± 4.61 years respectively. While novice bodybuilders were 22.20 ± 2.20 years, 77.27 ± 11.38 kg, 170.10 ± 5.76 cm, and 3.00 ± 0.81 years respectively.

Table 1. Characteristics of subjects

Characteristics	Elite bodybuilders		Novice bodybuilders	
	Mean	SD	Mean	SD
Age (years)	31.40	7.33	22.20	2.20
Weight (kg)	81.33	7.90	77.27	11.38
Height (cm)	170.20	7.23	170.10	5.76
Experience (years)	10.20	4.61	3.00	0.81

Table 2 showed the body composition data of both elite and novice bodybuilders. It can be seen that body fat percentage of elite bodybuilders ($17.56 \pm 3.70\%$) was significantly less than novice bodybuilders ($20.99 \pm 3.06\%$) at $p < 0.05$. While the segmental lean mass of right arm, left arm, and trunk of elite bodybuilders (4.28 ± 0.54 kg, 4.58 ± 0.72 kg, and 29.69 ± 3.37 kg) were significantly greater than novice bodybuilders (3.74 ± 0.41 kg, 3.79 ± 0.53 kg, 26.41 ± 3.05 kg) at $p < 0.05$ respectively. However, body mass index, segmental lean mass of right leg and left leg, segmen-

Table 2. Body composition data of elite and novice bodybuilders

Variables	Elite bodybuilders		Novice bodybuilders		t	p
	Mean	SD	Mean	SD		
BMI (kg/m ²)	28.03	1.59	26.65	3.21	1.21	0.24
Percent Body Fat (%)	17.56	3.70	20.99	3.06	-2.25	0.03*
Segmental Lean Mass (kg)						
Right Arm	4.28	0.54	3.74	0.41	2.52	0.02*
Left Arm	4.58	0.72	3.79	0.53	2.78	0.01*
Trunk	29.69	3.37	26.41	3.05	2.27	0.03*
Right Leg	11.96	1.31	10.96	1.20	1.78	0.09
Left Leg	12.00	1.41	10.76	1.26	2.05	0.06
Segmental Fat Mass (kg)						
Right Arm	0.86	0.20	0.98	0.25	-1.22	0.23
Left Arm	0.84	0.20	0.99	0.25	-1.45	0.16
Trunk	7.28	1.54	8.37	2.04	-1.34	0.19
Right Leg	2.59	0.53	2.98	0.72	-1.38	0.18
Left Leg	2.62	0.55	2.98	0.71	-1.27	0.21

* Significant difference ($p < 0.05$)

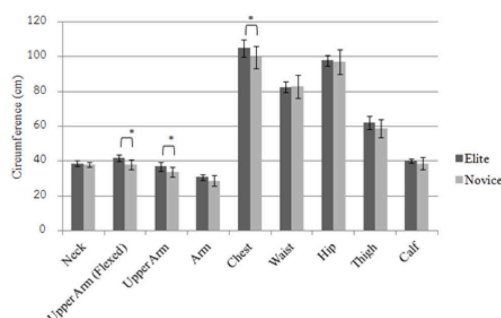


Figure 1. Body segment circumference

tal fat mass of left and right arm, trunk, and left and right leg were not significantly different between both groups.

Figure 1 showed the body segment circumference of both elite and novice bodybuilders. It was found that the upper arm (flexed) circumference, upper arm circumference, and chest circumference of elite bodybuilders (41.75 ± 1.84 cm, 37 ± 2.59 cm, and 104.95 ± 4.79 cm) were significantly greater than novice group (38 ± 2.66 cm, 33.9 ± 2.83 cm, and 99.75 ± 6.32 cm) at $p < 0.05$ respectively. However, neck, arm, waist, hip, thigh, and calf circumferences were not significantly different between groups.

Discussion

The aim of this study was to compare the anthropometric characteristics between elite and novice bodybuilders. In bodybuilding, it is the objectives of the athletes to develop lean body mass, muscle definition and good posing presentation. This lean body mass need to be symmetrical balanced in all parts.

Based on the World Health Organizations guidelines, it can be seen here that both elite and novice bodybuilders got more than 25 kg/m^2 of BMI, which mean that both groups are overweight. However, for this kind of sport, BMI cannot become the indicator in terms of their health risk. This is due to the BMI that is only based on body mass and weight, without taking care of what the mass is made up of. Consistently lifting weights will cause their muscle to grow and thus increase their mass. Thus, it is not shocking to for bodybuilders to have BMI of more than the normal level because some of study on body composition among bodybuilders higher than that level (Gaines, 2001; Lichtenbelt et al., 2004; Silva et al., 2003). For the comparison, it was found that the BMI is slightly higher for the elite group. This was obviously due to the body mass that is greater in elite group. To say the elite group to have more health risks is inappropriate, because it can be seen the elite group body mass is contributed by greater muscle mass while at the same time lesser fat percentage.

Next, we look at body fat percentage. It was found that elite group got significantly lower body fat percentage compared to the novice group. This is usual, as long term training will cause the fat percentage to drop. However, one of the main concern is the value of the body fat percentages. 17% for elite and 20% for novice are actually high for both athletes. This findings could be attributed to the current condition during data collection, which is during off-season due to the Covid-19 pandemic. Previous study has indicated

that within 1-weeks prior competition, significant fat loss for desirable lean body by bodybuilders is achievable and typically done, thus making this percent of body fat acceptable during the time of this data collection (Bamman et al., 1993). Regardless of this, more study need to be conducted on the effects of Covid-19 pandemic to their training activities.

For the segmental lean mass, elite group possessed significantly greater right arm, left arm and trunk muscle mass. No significant differences in term of segmental lean mass of right leg and left leg. This could reflect on the need of extra upper body training for the novice bodybuilders. Asymmetrical value of overall body part or limbs is highly important for bodybuilding, and this study has clearly pinpoint one of the weaknesses within this group of bodybuilders, which is lack of asymmetry between upper and lower limb. This may be caused by over emphasized on upper limb during training. Over emphasized on upper limb or upper body abnormalities is not surprising among bodybuilders, which also known as upper cross syndrome as mentioned by Daneshmandi, Harati, and Fahim Poor (2017). A lot if training in years could differentiate the elite with the novice. But as clearly seen here, even the elite are in need to increase their lower limb training.

For the segmental fat mass is related to muscle definition. Elite bodybuilders were no significant differences of segmental fat mass of the left and right arm, trunk, and left and right leg when compare to novice group. It may effect from their similar training program during pandemic Covid-19. However, muscle definition phase need to be in the program before competition period. It is well known that to burn off fat as much as possible lead to improve muscle separation, striation, and definition (Bompa et al., 2012).

For the body segment circumference, it was found that the upper arm (flexed), upper arm, and chest circumference of elite bodybuilders were significantly greater than novice group but nearly elite bodybuilders in Brazilian on flexed biceps and calf circumference (Silva et al., 2003). Some segment circumference of elite group in this study was also found slightly greater than the study of Gaines (2001). Therefore, the elite group of bodybuilders would have a bigger proportion of their body segment, especially their upper body. Not only segment circumference, but also muscle definition and symmetry are another important factor that has been defined as a key bodybuilding competition factor (Gaines 2001). In novice group, the flexed biceps circumference and calf circumference of this study were lesser than beginning bodybuilders before and after three months of off-season period resistance training among beginning bodybuilders (Tykhorskyi et al., 2018). This is just another finding that is in line with the findings of segmental lean. More muscle mass means more size of the muscles, thus contribute to the more circumference. However, neck, arm, waist, hip, thigh, and calf circumferences were not significantly different between groups. This could be contributed to the fact that muscle at the neck, arm and waist has their own limitation to grow. For hip, thigh and calf, this is in line with what has been found at the segmental lean.

Conclusions

In conclusion, the perception is that elite bodybuilders will be having better significant differences with novice. But

the findings of this study indicated overall, the elite may have better body definition but lacking glaringly proper asymmetry similarly with the novice. Further studies are suggested to focus more on caused and solutions for the prevailing non-asymmetrical issues of bodybuilder's community, regardless of their seniority or level or participation.

Acknowledgement

We would like to thank Chandrakasem Rajabhat University for supporting the research grant and Thailand Bodybuilding and Physique Sports Association (TBPA) for allowing athletes to participate in this research project.

Conflict of Interest

The authors declare no conflict of interest.

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РІЗНИЦЯ АНТРОПОМЕТРИЧНИХ ХАРАКТЕРИСТИК МІЖ ЕЛІТНИМИ БОДІБІЛДЕРАМИ ТА ПОЧАТКІВЦЯМИ В ТАЙЛАНДІ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 5 с., 2 табл., 1 рис., 22 джерела.

Мета дослідження. Це дослідження спрямоване на порівняння антропометричних характеристик між елітними бодібілдерами та початківцями.

Матеріали та методи. У дослідженні брали участь двадцять бодібілдерів: 10 елітних і 10 новачків. Відсоток жиру в організмі, сегментарну худу масу та сегментарну масу жиру вимірювали за допомогою приладу для аналізу біоелектричного імпедансу. Інші показники включають окружність сегмента тіла та зріст тіла.

Результати. Результати дослідження показали, що були виявлені значні відмінності в термінах окружності плеча (згинання), окружності плеча та окружності грудей, при цьому елітні були більші, ніж новачки. Елітні бодібілдери також мали значно нижчий відсоток жиру в тілі, з кращою сегментарною худю масою правої руки, лівої руки та тулуба. Цікаво, що окружність шиї, рук, талії, стегон, стегон і литок істотно не відрізнялася між групами.

Подібні незначні відмінності також були виявлені в індексі маси тіла, сегментарній м'язовій масі правої ноги та лівої ноги, сегментарній жировій масі лівої та правої руки, тулуба та лівої та правої ноги. Що стосується конкретно групи бодібілдерів, які брали участь у цьому дослідженні, то несуттєві відмінності змінних можуть вказувати на область, яку можна покращити в термінах тренувань як елітних спортсменів, так і новачків. Змінні зі значними відмінностями можуть вказувати на область, на якій, можливо, була надто акцентована елітна група, що також могло сприяти їх кращому (переможному) показнику.

Висновки. Результати відповідають критеріям оцінювання бодібілдингу, де один із них розмір (окружність), може бути схожим, але бодібілдери з худим і добре вираженим тілом будуть у групі-переможці.

Ключові слова: бодібілдинг, антропометрія, нежирна маса тіла, баланс, критерії виграшу.

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Cite this article as: Sukwong, T., Chinnasee, P., Prajongjai, V., Chinnasee, C., Nadzalan, A. M., & Mohamad, N. I. (2022). The Difference of Anthropometric Characteristics Between Elite and Novice Bodybuilders in Thailand. *Teoriâ ta Metodika Fizičnogo Vihovannâ*, 22(1), 101-105. <https://doi.org/10.17309/tmf.2022.1.14>

Received: 7.01.2022. Accepted: 9.02.2022. Published: 25.03.2022

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