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Article · December 2016

DOI: 10.4103/2468-838X.196084

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Impact of fat mass distribution body shapes on muscles strength and the joints pain

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Abstract:

Our study focuses on fat mass distribution body shapes type as measured to determine their effect on skeletal muscle strengthening lumbar extensors (upper and lower limbs) where our background confirms that every girl has a natural body type of rectangle, apple, pear, or hourglass. It is good for her to know which type of body shape she is, so she can learn what exercises to do, whereas similar studies suggest that it is much better to challenge weight problems with exercise and dietary measures before resorting to figure shaping. For this purpose, our study was carried out with a total of thirty students, females listed in the Institute of Physical Education and Sport, University of Mostaganem, aged between 20 and 23 years; their homogeneity was based on age, sex, and academic specialty, classified based on the body mass index (BMI) into two groups (normal and overweight) and based on their body shape's type into three groups (9 pear shape, 10 rectangle shape, and 11 hourglass shape) as a protocol experimental to examine the impact of fat mass distribution body shapes type on lumbar extensor strength. Based on our data analysis, we confirm that the pear and the rectangle shape affect the strength lumbar extensors due to body weight distribution which increases the risks relating to the skeletal muscles. Weight gain is a factor contributing to the weakness of skeletal muscles. However, the body shape explains the anomalies of the distribution of fat mass and BMI risk observed in our sample in the lower and upper part of the body recorded by the values of Killy test and endurance of trunk, the case of the pear and the rectangle shape back pain, which are consisting in excess of the body fat distributed in comparison with less percentage of muscle mass. Whereas this difference can affect the pelvic position.

Key words:

Body shapes, joints pain, muscles strength, students in physical education and sports

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Submission: 06-08-2016
Accepted: 02-11-2016

Individual evaluation standard and comprehensive evaluation system are specially established to further build an accurate evaluation system so as to perfect the body shape model.[1] From the proof, where Lluch S, Lluch E. confirmed that every girl has a natural body type – Rectangle, Apple, Pear, or Hourglass.[2] Our interest in this modest study examines the impact of the adipose accumulation which favors women in the lower body, including hips.[3] The excess of the body fat in women reduces muscle bone and other lean body mass tissues.[4] Therefore, Willett confirms the use of percent body fat as the criteria for assessing body mass index (BMI) may be inappropriate[5] whereas Ditmier confirms that the amount of body fat (or adiposity) includes concern for both the distribution of fat throughout the body and the size of the adipose tissue deposits,[6] which result in the joint stiffness and pain along with a decline in mobility and stability due to the body composition excessive as restriction of motion simply to move and stretch in certain positions according to Bradley and Brzycki.[7]

From the proof that body shape is a critical task of multicellular morphogenesis, "Despite its importance, there is not a systematic understanding about how body shape is developed and maintained."[8]

The present study aimed to explore, on the one hand, optimal shape predictor of physical performance where limited studies investigating the association between body shape and physical performance,[9] and on the other hand, based on body shape index (a body shape index [ABSI]) to predict the lumbar extensor risks.[10] However, the similar studies

How to cite this article: Mohammed Z, Ali B, Idris MM, Hamzaoui H, Messaliti L. Impact of fat mass distribution body shapes on muscles strength and the joints pain. BLDE Univ J Health Sci 2016;1:81-8.

agree that body shape index (ABSI) has been used for years to determine body composition, including healthy,[11] as the weight, which is one of the most commonly used body shape index, that can reflect the degree of human body symmetry and shape characteristics and too much weight to the human body joint problems.[12]

Based on the confirmation that the skeletal problems in women return to the body shape,[13] the muscle fatigue and joint pains are related to the index body composition.[14]

Our intervention in this study is based on the fat mass distribution body shape (body form) as a shape of the subject's silhouette,[15] appropriate to the way in which bodies may be kept healthy and free from disease.[16] Where the body image physical appearance is the properties (size, shape, and Weight).[17] From that, our hypothesis is based on body fat distribution within the body parts as the aura of fat shock[18-21] where our aims are to determine the variables influencing muscle strength and joint pain based on the appearance (body form) in sports women.

Methods

Design of the study

This study was a descriptive design study inspired by the study "The Relationship between Cross Sectional Area and Strength of Back Muscles in Patients with Chronic Low Back Pain," [Figure 1][22] which recorded the assessment of 7 men and 21 women using the body shapes type as morphological parameters tests and strengthening lumbar extensors (upper and lower) as physiological stress parameters tests; in our case, we used thirty women as sample and skeletal muscle tone field test where Müller (1840) described that skeletal muscle tone is prolonged and tireless contraction of muscles ensures maintenance of a certain posture of the body [Figure 2].[23] However, Selkowitz *et al*. confirm that 70%–95% of adults will suffer from low back pain at some time during their lifetime.[24] For this purpose, all participants were tested by field test in the same conditions by a specialized team.

Procedure

The study was approved by the Laboratory OPAPS Institute of Physical Education and Sports Department, Sport Training, University of Mostaganem. Thirty female students from physical education and sports with mean age group of 21.83 ± 1.11 years, mean height of 156.23 ± 7.22 cm, mean weight of 58.10 ± 4.45 kg, mean BMI of 23.91 ± 2.58 kg/m^2, ABSI index of 0.03 ± 0.003 [Table 1] were randomly selected according to the following criteria.

Inclusion criteria

All participants are female student's registered in the Institute of Physical Education and Sports University Mostaganem for the year 2014–2015 in the same growth characteristics: age, physical performance, and quality of life [Figure 3].[25]

Exclusion criteria

All participants who are volunteers were evaluated based on field tests within the same conditions and procedure, which they were based on save and baseline measurements where our background confirms that the reduction of lumbar flexion-extension range of motion starts at around 50 years of age.[26]

Morphological parameters

A body shape index (ABSI) calculator

Body shape index (BSI) is a metric for assessing the health implications of a given human body height, mass, and waist circumference (WC).Whereas similar studies confirm that the BSI a better indicator of the health risks of excess weight than the standard BMI according to the formula for calculating is:[27]

$$ABSI \equiv \frac{WC}{BMI^{2/3}\ height^{1/2}}$$

Where the body shape index (ABSI) is based on WC adjusted for height and weight,[28,29] as new method for determining the health effects of body fat.

Physiological stress parameters

Test of Biering-Sorensen: Isometric for evaluating endurance of trunk extensor

In the prone position, the legs are fixed subject to the anterior superior iliac spines by straps at the ankles and hips, upper body with no support. The arms are crossed on his chest and the hands rest on his shoulders. The test measures the hold time of the sternum of the female above a virtual horizontal line extending.[30,31]

Killy test for evaluating Isometric knee extensor endurance

The subject pressed his back against the wall. Hips, knees, and ankles are flexed to 90°. The arms are crossed on his chest, hands resting on the shoulders. The test measures the length of maintained sitting without a chair leaning control wall.[30,33]

Body type calculator

This body type calculator tells you which are your body shape and waist to hip ratio using the bust, waist, and hip measures. You can discover more on this subject below the form.

The bust measurement is the circumference of the bust at the fullest part of the breasts while keeping the tape measure snug but not tight.

The waist measurement is the circumference of the narrowest point of the torso, which is often just above the belly button.

The hip measurement is the circumference of the largest part of the hips, with the most prominent curve.[35]

Once you know your dimensions, you can quickly use the body type calculator and find out whether you have an apple, a pear, a banana, or an hourglass type. This can help you know how your body shape or show you which is the health risk level associated with your dimensions.[37] We agreed these sources based on indications that the shape calculator online at metaboliceffect.com/me-shape-calculator will help you.[38]

Statistical analysis

Statistical analysis was conducted using the SPSS software version 20.0 (IBM Corporation, Armonk, NY, USA). Independent *t*-test, ANOVA least Significant Difference (LSD), and Pearson

Table 1: The analysis of variance and average differences based on the body type shape and body mass index class

Based on body shape	*n*	Mean±SD	*F*	Significant	Based on BMI class	*n*	Mean±SD	Levene's test		*t*	Significant
								F	Significant		
Age											
Pear	9	21.33±1.22	1.34	0.279	Normal	21	22.05±1.02	1.40	0.25	1.65	0.11
Rectangle	10	22.10±0.99									
Hourglass	11	22.00±1.09			Overweight	9	21.33±1.22				
Total	30	21.83±1.11									
Weight											
Pear	9	61.22±4.08	4.05	0.03	Normal	21	56.76±3.99	0.03	0.86	−2.79	0.01
Rectangle	10	57.40±4.90									
Hourglass	11	56.18±3.06			Overweight	9	61.22±4.09				
Total	30	58.10±4.45									
Height											
Pear	9	150.55±5.17	8.72	0.001	Normal	21	158.67±6.65	0.73	0.40	19.43	0.00
Rectangle	10	155.60±6.80									
Hourglass	11	161.45±5.37			Overweight	9	150.56±5.17				
Total	30	156.23±7.22									
BMI											
Pear	9	27.03±1.79	44.19	0.000	Normal	21	22.58±1.46	0.29	0.59	12.72	0.00
Rectangle	10	23.67±0.63									
Hourglass	11	21.58±1.25			Overweight	9	27.03±1.80				
Total	30	23.91±2.58									
ABSI											
Pear	9	0.025±0.004	40.62	0.000	Normal	21	0.04±0.00	0.85	0.36	12.56	0.00
Rectangle	10	0.035±0.003									
Hourglass	11	0.037±0.002			Overweight	9	0.03±0.00				
Total	30	0.0326±0.005									
BMI risk											
Pear	9	1.06±0.11	47.13	0.000	Normal	21	0.82±0.04	10.83	0.00	9.08	0.00
Rectangle	10	0.85±0.031									
Hourglass	11	0.78±0.026			Overweight	9	1.06±0.11				
Total	30	0.89±0.13221									
Waist size											
Pear	9	28.44±5.54	11.88	0.000	Normal	21	35.90±2.79	3.32	0.08	9.78	0.00
Rectangle	10	35.60±3.63									
Hourglass	11	36.18±1.88			Overweight	9	28.44±5.55				
Total	30	33.66±5.09									
Endurance of trunk											
Pear	9	1.09±0.14	32.85	0.000	Normal	21	1.40±0.07	0.79	0.38	10.11	0.00
Rectangle	10	1.41±0.073									
Hourglass	11	1.39±0.077			Overweight	9	1.09±0.14				
Total	30	1.31±0.173									
Killy test											
Pear	9	1.08±0.15	24.51	0.000	Normal	21	1.40±0.09	0.24	0.63	10.93	0.00
Rectangle	10	1.41±0.084									
Hourglass	11	1.39±0.11			Overweight	9	1.08±0.15				
Total	30	1.30±0.18									

BMI=Body mass index, ABSI=A body shape index, SD=Standard deviation

correlations were used for comparing the variables chosen in this study. $P < 0.05$ was considered statistically significant.

Results

Baseline characteristics of the participants are presented in Table 1. According Levene's test for equality of variances, our sample is homogeneous in all variables, except in BMI risk. Where those results explain that overweight increase the stress joints pain and conducted to osteoarthritis in the near future.[39]

- Based on the calculi of ANOVA body shape (rectangle, hourglass, pear), the age is not significant at level, $P \leq 0.05$, which confirms that the differences observed in this study did not report the age growth characteristics whereas the other variables chosen to study are significant at level, $P \leq 0.05$

- Based on BMI (normal weight and overweight), our results confirm that the age is not significant in the opposite of other variables
- Based on ANOVA and LSD present in Table 2, we confirm that the body shape type is able to determine the effect of index body composition at level, $P \leq 0.05$, in the majority of comparisons.

These differences return to the body fat distribution is confirmed by the calculi of independents *t*-test, which is statistically significant for the benefit of normal body gain in all the comparisons.

- Based on its differences, we agreed with Haviland *et al*. that woman bodies (pear–rectangle) produce relatively more androgenic than hourglass-shaped.[40] Whereas Kasper *et al*. mention that this could occur through peripheral fat's role in converting androgens to estrogens or through leptin production in adipose tissue[41]
- Through Table 3, we agree that all the correlations calculated are strong significant at the P =0.01 level (two-tailed). Based on the correlation, BMI and Killy test and endurance of trunk are strongly negative whereas ABSI is strongly positive. We confirm the risk relative to BMI based on the correlation BMI risk which is strong negative.

From the proof, as our case study, we agree that hourglass is the best physical profile with less risk relative to the BMI, followed by rectangle. Whereas the pear is fewer physical profile that risks more relative due to level of body fat distribution as the class BMI.

In conclusion, based on class BMI, our results confirm that weight gain is a factor contributing to the weakness of the skeletal muscles. However, the body shape explains the anomalies of the distribution of fat mass and BMI risk observed in our sample in the lower and upper part of the body recorded by the values Killy test and endurance of trunk. Whereas pear pain consists in excess of the body fat distributed due to percentage of muscle mass. This plays an important role in supporting the lumbar spine and pelvis.[42]

Discussion

The most important finding of our study concerns body types shape appearance (body form), which is able to determine the impact of overweight on lumbar extensor strength due to level of the distribution and the nature of the mass body

Table 2: The multiple comparisons least significant difference of variables based on the types body shape

Dependent variable	Body shape (I)	Body shape (J)	Mean difference (I-J)	Significant
BMI	Pear	Hourglass	−5.45354*	0.000
		Rectangle	−2.09609*	0.001
	Hourglass	Pear	5.45354*	0.000
		Rectangle	3.35744*	0.000
	Rectangle	Hourglass	2.09609*	0.001
		Pear	−3.35744*	0.000
ABSI	Pear	Hourglass	0.01167*	0.000
		Rectangle	0.00238	0.080
	Hourglass	Pear	−0.01167*	0.000
		Rectangle	−0.00929*	0.000
	Rectangle	Hourglass	−0.00238	0.080
		Pear	0.00929*	0.000
Endurance of trunk	Pear	Hourglass	0.30545*	0.000
		Rectangle	−0.01555	0.717
	Hourglass	Pear	−0.30545*	0.000
		Rectangle	−0.32100*	0.000
	Rectangle	Hourglass	0.01555	0.717
		Pear	0.32100*	0.000
Killy test	Pear	Hourglass	0.31000*	0.000
		Rectangle	−0.01600	0.750
	Hourglass	Pear	−0.31000*	0.000
		Rectangle	−0.32600*	0.000
	Rectangle	Hourglass	0.01600	0.750
		Pear	0.32600*	0.000
BMI risk	Pear	Hourglass	−0.27384*	0.000
		Rectangle	−0.06473*	0.030
	Hourglass	Pear	0.27384*	0.000
		Rectangle	0.20911*	0.000
	Rectangle	Hourglass	0.06473*	0.030
		Pear	−0.20911*	0.000

*The mean difference is significant at the P=0.05 level. BMI=Body mass index, ABSI=A body shape index

Table 3: The correlations of the variables chosen in this study

	BMI	ABSI	Endurance trunk	Killy test	BMI risk
BMI					
Pearson correlation	1	−0.820**	−0.633**	−0.601**	0.958**
Significant (two-tailed)		0.000	0.000	0.000	0.000
ABSI					
Pearson correlation	−0.820**	1	0.679**	0.663**	−0.836**
Significant (two-tailed)	0.000		0.000	0.000	0.000
Endurance of trunk					
Pearson correlation	−0.633**	0.679**	1	0.954**	−0.638**
Significant (two-tailed)	0.000	0.000		0.000	0.000
Killy test					
Pearson correlation	−0.601**	0.663**	0.954**	1	−0.598**
Significant (two-tailed)	0.000	0.000	0.000		0.000
n	30	30	30	30	30
BMI risk					
Pearson correlation	0.958**	−0.836**	−0.638**	−0.598**	1
Significant (two-tailed)	0.000	0.000	0.000	0.000	
n	30	30	30	30	30

**Correlation is significant at the P=0.01 level (two-tailed). BMI=Body mass index, ABSI=A body shape index

which is better correlated to changes in body weight where this relationship is consistent with the level relative risks of BMI and ABSI. However, our results line with confirmation that:

- The ideal female body – curvy or hourglass-shaped[43]
- Achieving an hourglass or V shape is not possible when belly fat is elevated[44]
- The ideal shape changed from the hourglass curve to a more[45]
- Hourglass-shaped women have less cylindrical and androgen than the other shapes[46]
- The impacts strengthening lumbar extensors and appearance body forms are required to strengthen bones where the overweight can be a stress on bones.[47]

From that our findings, we come to confirm the results of the similar studies that BMI reflecting mostly total body fat differs in its relationship to metabolic variables whereas the ABSI depicts fat distribution and relative risk healthy according to our results concerned BMI relative risk.

Based on the proof, we agreed the confirmation that types of body shape determine the risk in skeletal muscle tone based on strengthening lumbar extensors and appearance body forms.[48,49] However, these risks are due to changes results in increased BMI values which negatively affects the body' joints in middle age and can greatly influence the activity and endurance.[50] Based on these results, we confirm that the ABSI is the important measure to determine the health risk.[51] For the BMI relative risk, we agreed that individual with a higher BMI risk a higher level of adiposity and lower muscle lipoprotein lipase activity.[52] Results which consist with pear type shape, followed by rectangular the case of the test practiced in the current study. From the above, we agreed in terms of female body that the individual with a pear body type is broader in the lower half of the body.[53] While rectangle shape bust and hips are basically the same circumference based on the description of Keiser and Garner.,[54] Cook *et al*. confirm that the rectangle needs waist.[55] In terms of storage grease, we agreed that the circumference must be adjusted to the BMI class to obtain an estimate fat distribution.[56] However, the ABSI and BMI calculate in the current study, as a relative health risk, confirmed that lower body adiposity are challenges training process for any female due to the estrogen stimulates lipoprotein lipase activity, causing fat to accumulate in the hips, buttocks, abdominal and breasts.[57]

Conclusion

Our study evaluated the impact of body type shapes body forms on risk strengthening lumbar extensors among female students in physical education and sports based on two surrogate measures: morphological parameters (BMI and ABSI) and physiological stress parameters (isometric endurance of trunk extensor and isometric knee extensor endurance) to determine the effective type of shape developed on skeletal muscle strength due to appearance body forms.

On the plan *morphologique*

We confirm that the body type is categorized in human body in 12 super-specific types based on the quote of Faust *et al*. and Flaherty that the most are listed in five basic body shapes[58,59] as the hourglass, the inverted triangle, the rectangle, the apple, and the pear. However, our sample is categorized as hourglass, pear, and rectangle.[60] Our results confirm the impact of the body shapes as a risk factor for chronic diseases,[61] which return to the bad distribution of body fat where our background confirms that the pear shape come in tops of the list, followed by apple shape and rectangular shape. Based on that, we confirm that people who carry excess weight below the waist (on hips, thighs, and buttocks) have a pear shape,[62] the rectangle body shape has shoulders and hips that are about the same width and a waistline that does not vary more than a few inches,[63] while the rectangles need waist definition.[55] From the proofs, we agreed the recommendation that our girls' students must develop their type body shape based on the rule of less curvaceous shape with a smaller bust and hips.[64] Cabot and Cooper confirm that the body shaping diet is a revolutionary approach to dieting and weight loss that addresses the needs of your particular body type.[65]

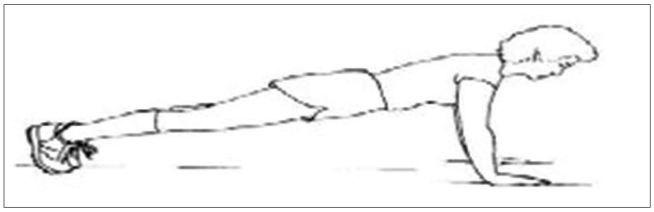

Figure 1: *The plank position on stable surface*[32]

Figure 2: *The test chair Killy*[34]

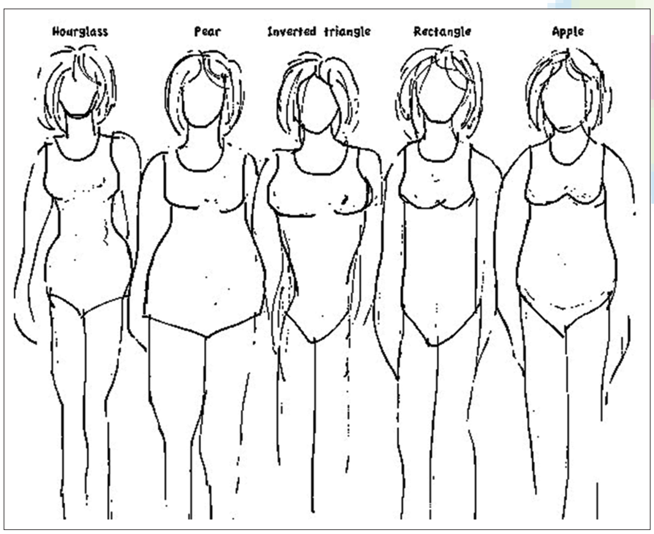

Figure 3: *Body shapes types*[36]

On the plan physiological stress

Our findings support our hypothesis that the overweight associated to the changes in body composition affects skeletal muscle performance. However, our results confirm that the hourglass is most adapted to effort in the opposite of the other body shape type where the level of BMI required maximum endurance of trunk torque.[66,67]

On the plan risk relative to body mass index

Our findings support our hypothesis where the overweight associated with the changes in body composition affects body joints performance. However, our results line with the confirmation of that being overweight can also have an impact on your joints.[68,69]

In general, our findings support that body weight does not convey how much body fat you have or where it is stored the strongest.[70] While the body weight alone cannot be used to estimate health risk,[71] Kim and Kim confirm that body type is the relationship of human body shape to body size, where the form of muscle and bone is more prominent with the less body fat.[72]

Acknowledgment

We would like to thank all the students who volunteered for the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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