

KATARZYNA SEMPOLSKA¹, ROMUALD STUPNICKI²

RELATIVE FAT CONTENT IN YOUNG WOMEN WITH NORMAL BMI BUT DIFFERING IN THE DEGREE OF PHYSICAL ACTIVITY

ANALIZA WSKAŹNIKA WAGOWO-WZROSTOWEGO BMI I ZAWARTOŚCI TŁUSZCZU W CIELE MŁODYCH KOBIET O RÓŻNYM POZIOMIE AKTYWNOŚCI FIZYCZNEJ

¹ Department of Physiology
Academy of Physical Education
Marymoncka 34, 00-968 Warsaw
e-mail: sempa@o2.pl
Head: dr hab. prof. AWF K. Mazurek

² Paweł Włodkowic University College
Płock

Body fat content was determined in 3 groups of women, aged 20-29 years and having normal BMI values, differing in physical activity: low (n=59) and high (n=56) motor activity. Fat content exceeding 25% was found in 44, 32 and 23% of them, respectively. It was concluded that BMI ought not to be used as an indicator of body composition as it does not reflect body fat content

Key words: BMI, body fat content, physical activity, young women

Słowa kluczowe: BMI, zawartość tłuszczu, aktywność fizyczna, młode kobiety

INTRODUCTION

Establishing norms of somatic features, especially of body mass and fat content, is of importance not only for e.g. public health or insurance personnel, but for the society as well. Epidemiological studies have evidenced that increased mortality due to diabetes, cardiovascular or gall bladder diseases, etc., is associated with overweight, resulting from excessive body fat. On the other hand, body mass deficiency is blamed for an increased incidence of gastro-intestinal and respiratory diseases [8, 12]. Body mass is known to tend to increase with age, mainly due to increasing fat and decreasing muscle mass and is accompanied by a reduced motor activity. That process, albeit widespread, is undesirable as a moderate physical activity is one of the key factors enabling maintaining normal body mass [11].

The term "expected body mass" is often used in relation to given sex, age, body height and body proportions. The latter is being widely assessed by applying the *Quetelet's II* index,

known as body mass index (BMI); [2, 9, 12] and used as an indicator of relative body fat content and as the basis for individual medical and dietary recommendations [1].

Polish Institute of Food and Nutrition recommends the classification of *Ferro-Luzzi et al.*, according to which the range of BMI values from 18.5 to 24.9 kg/m² is considered normal, from 25.0 to 29.9 mean overweight, and above 30.0 – obesity (Table I). However, many authors [4, 5, 7, 10] emphasise that BMI ought not to be applied to individual assessment of body fat content and this prompted us to undertake this study.

Table I. Classification of body status by BMI values according to *Ferro-Luzzi et al.* [12]

BMI range	Body status
< 16	Energy deficiency, III rd degree
16.0 – 16.9	Energy deficiency, II nd degree
17.0 – 18.4	Energy deficiency, I st degree
18.5 – 24.9	Normal range
25.0 – 29.9	Obesity, I st degree (overweight)
30.0 – 39.9	Obesity, II nd degree
> 40	Obesity, III rd degree

The aim of the study was to verify the uselessness of BMI as an indicator of body composition of young women differing in the level of their habitual motor activities. It was assumed that the mode of selection of subjects was of no importance as no population characteristics were attempted to establish but the relation BMI – body fat content only.

MATERIAL AND METHODS

Three groups of women, aged 20 – 29 years, volunteered to participate in the study:

1. Low physical activity group (n = 59), recruited at public meetings, e.g. health-promoting picnics or other gatherings at which basic medical examinations and body composition assessment were offered;
2. Medium physical activity group (n = 46), recruited from participants of the fitness clubs and other leisure-time motor activity centres;
3. High physical activity group (n = 57), consisting of female fitness instructor staff, participants of fitness convention.

The eligibility criterion was BMI value within normal limits, i.e. between 18.5 and 24.9.

Anthropometric measurements: Body height was measured with an anthropometer between points *basis* and *vertex* with an accuracy of 1 mm. Body mass was determined with electric medical scales with an accuracy of 0.01 kg.

Body composition: Relative body fat and water contents were determined by infrared photometry by using Futrex-6100/XL device [6].

RESULTS AND DISCUSSION

Somatic characteristics (means \pm SD) of the 3 groups of women studied and the percentages of subjects with above-normal fat content are presented in Table II and the relationship between body fat percent and BMI in Figs. 1 - 3. The upper normal limit of

Table II. Mean values (\pm SD) of somatic features of women studied

Variable \ Physical activity level	Low n = 59	Medium n = 46	High n = 57
Body height [cm]	165.8 \pm 5.8	162.6 \pm 5.9	166.3 \pm 5.2
Body mass [kg]	57.6 \pm 6.7	57.9 \pm 6.2	58.2 \pm 4.6
BMI [kg/m^2]	20.9 \pm 1.7	21.2 \pm 1.6	21.0 \pm 1.4
Relative body fat content [%]	24.6 \pm 3.4	23.5 \pm 2.9	22.9 \pm 2.6
Fraction of fatty subjects [%]	44	33	25

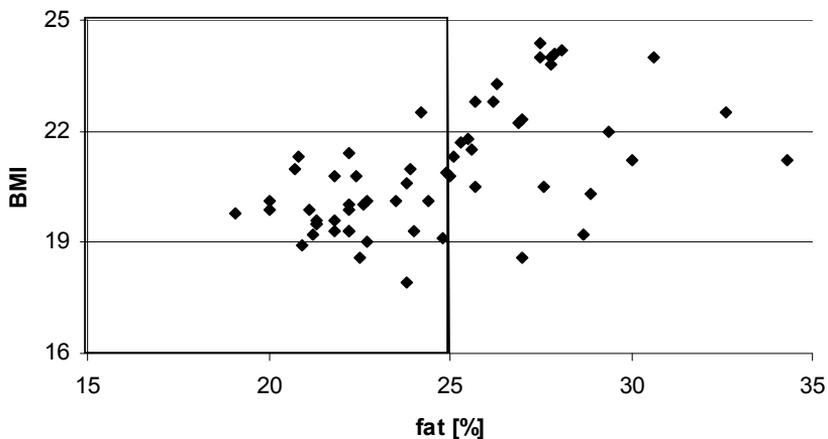


Figure 1. Relationship between body fat content and BMI in low-active women (n = 59) with normal BMI; grey field (up to 25% fat content) represents normal fat content range

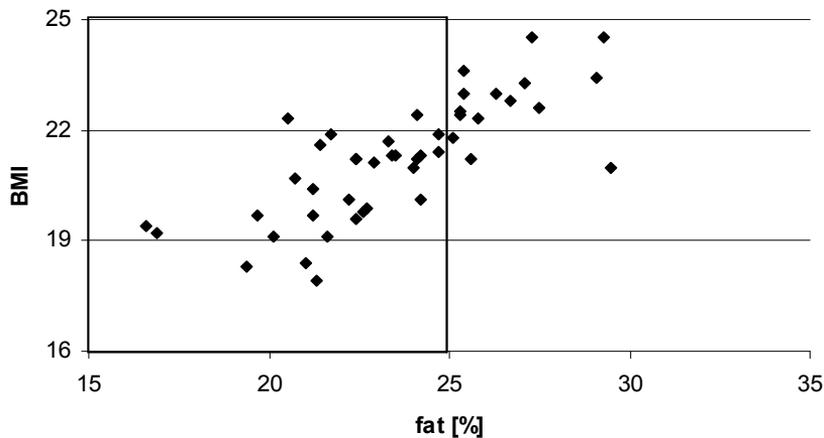


Figure 2. Relationship between body fat content and BMI in moderately active women (n = 46) with normal BMI; grey field (up to 25% fat content) represents normal fat content range

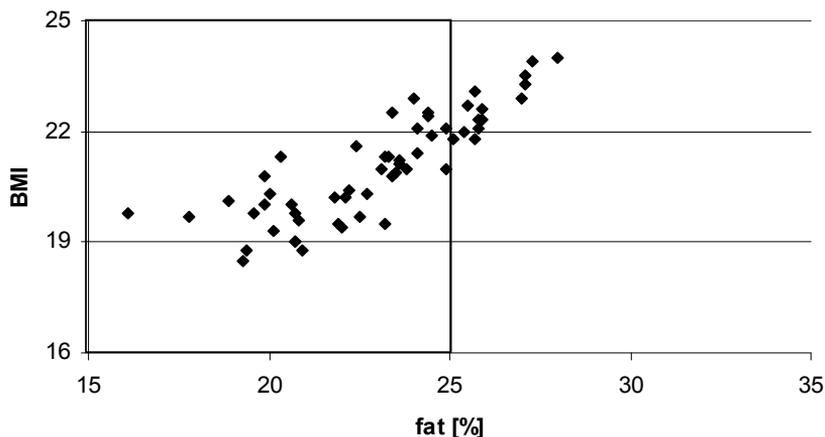


Figure 3. Relationship between body fat content and BMI in high-active women ($n = 57$) with normal BMI; grey field (up to 25% fat content) represents normal fat content range.

body fat content was assumed to be equal to 25% [1] and presented in graphs by a vertical line.

Highest percentage of fatty subjects, i.e. whose body fat content exceeded 25%, was found in the low-activity group and lowest in the high-activity group (44 and 25%, respectively), the trend being significant ($p < 0.05$) by chi-square test.

CONCLUSIONS

A pretty high percentage of young women, whose BMI values were within the accepted normal range, exhibited body fat content exceeding 25% considered as the upper normal limit. Although that percentage of “fatty” subjects decreased with increasing level of physical activities they practiced, it remains fairly high. The presented results support the view that BMI does not, in fact, reflect the body fat percentage and should thus not be used as an indicator of the desired, physiologic body composition. In order reliably assess that latter, relative body fat content ought to be determined together with BMI.

K. Sempolska, R. Stupnicki

RELATIVE FAT CONTENT IN YOUNG WOMEN WITH NORMAL BMI BUT DIFFERING IN THE DEGREE OF PHYSICAL ACTIVITY

Summary

The aim of the study was to evaluate the relationship between BMI and relative body fat content. Three groups of women, aged 20 – 29 years and having normal BMI values, differing in the degree of practiced physical activities were studied: low activity ($n = 59$), medium activity ($n = 46$) and high activity ($n = 56$). Body fat content was determined by infrared photometry (FUTREX). The percentages of

women with excessive fat content (over 25%) from those 3 groups significantly differed and amounted to 44, 32 and 23, respectively. It was concluded that with increasing level of physical activities the percentage of young women with an excessive body fat content, but with BMI within normal limits, decreases. Thus, BMI ought not to be used as an indicator of body composition as it does not reflect body fat content. Individual counselling should be based on both measures, BMI and relative body fat content, taken together.

K. Sempolska, R. Stupnicki

ANALIZA WSKAŹNIKA WAGOWO-WZROSTOWEGO BMI I ZAWARTOŚCI TŁUSZCZU W CIELE MŁODYCH KOBIEC O RÓŻNYM POZIOMIE AKTYWNOŚCI FIZYCZNEJ

Streszczenie

Celem pracy była ocena zależności między wskaźnikiem BMI a procentową zawartością tkanki tłuszczowej (FAT %). Przebadano 162 kobiety z prawidłowym wskaźnikiem BMI o małej i średniej i wysokiej aktywności fizycznej w wieku od 20 do 29 lat. Względna zawartość tłuszczu (FAT%) oznaczono metodą fotometrii w podczerwieni (FUTREX). Jednoczesna analiza BMI i FAT% wskazuje, że u jednej trzeciej młodych kobiet z prawidłowym BMI zawartość tkanki tłuszczowej przekracza zalecaną normę. W poszczególnych grupach (o małej, średniej i wysokiej aktywności fizycznej) odsetki badanych z nadmiarem względnej zawartości tłuszczu wynosiły odpowiednio 44, 32 i 23.

Analiza uzyskanych wyników pozwoliła wysunąć następujące wnioski: Wraz ze wzrostem aktywności fizycznej zmniejsza się odsetek kobiet o prawidłowym BMI a z nadmiarem względnej zawartości tłuszczu. Wskaźnik wagowo-wzrostowy BMI nie powinien być używany do oceny, prawidłowej masy ciała, ponieważ nie odzwierciedla względnej zawartości tłuszczu w ciele. W celu oceny prawidłowości składu ciała należy równocześnie oznaczać BMI i procentową zawartość tkanki tłuszczowej.

The study was supported by DS-70.

REFERENCES

1. ACSM's Guidelines for exercise testing and prescription. 5th Edition, A Waverly Company 1995.
2. Białkowska M., Szostak W. B.: Choice of obesity treatment by the degree of health hazard. Pol. Tyg. Lek., T.L., 1995, Supl.1; 48-50 (in Polish).
3. Classification of overweight and obesity in adults according to BMI. International obesity Task force. www.ietf.org
4. Dudeja V., Misra A., Pandey R.M., Devina G., Kumar G., Vikram N.K.: BMI does not accurately predict overweight in Asian Indians and northern Indians. Br. J. Nutr., 2001, 86, 105-112.
5. Frankenfield D.C., Rowe W. A., Cooney R.N., Smith J.S., Becker D.: Limits of body mass index to detect obesity and predict body composition. Nutrition, 2001, 17, 26-30.
6. Futrex-6100/XL. Technical literature. Body composition Analyzers. Futrex Inc. 2001.
7. Gallagher D., Heymsfield S., Heo M., Jeeb S., Murgatroyd P., Sakamoto Y.: Body Mass Index guidelines: corresponding % fat standards based on three-country study. Int. J. Obes., 1999, 23 Suppl 5, 42.
8. Górska K.: Body mass and mortality. Żyw. Człow. Met., 1996, 3, 267-283 (in Polish).
9. Jackson A.W., Marrow J.R., Hill D.W., Dishman R.K.: Physical Activity for health and fitness. Human Kinetics, 1999, Hong Kong.

10. *Sempolska K., Wit B., Stupnicki R.*: Analysis of the relationship between Body Mass Index and relative fat content. *Annales UMCS Sectio D.*, 2003, 58, suppl 13, 86-90.
11. *Simkin-Silverman L.R., Wing R.R.*: Menopausal increase in body mass. *Med. Dypł.*, 2001, 10 (4), 46-51 (in Polish).
12. *Ziemlański Ś.*: Principles of human nutrition. Instytut Danone – Fundacja Promocji Zdrowego Żywnienia, Warszawa 1998. (in Polish).