Artykuł opublikowany w: Environment and wellness in different phases of life, red. W. Tuszyńska-Bogucka, NeuroCentrum 2010; 211-237
Published in: Environment and wellness in different phases of life, red. W. Tuszyńska-Bogucka/ Ed: NeuroCentrum 2010; 211-237

Grzegorz Przybylski[1], Ryszard Pujszo[2], Małgorzata Pyskir [3]
Jerzy Pyskir [4], Małgorzata Bannach [5]

[1]Department of Respiratory Medicine and Tuberculosis, Nicoalus Copernicus University, Collegium Medicum in Bydgoszcz
[2]Study Center for Physical Education and Sport, Kazimierz Wielki University in Bydgoszcz
[3]Department of Rehabilitation, Nicoalus Copernicus University, Collegium Medicum in Bydgoszcz
[4]Department of Biophysics, NicoalusCopernicus University, Collegium Medicum in Bydgoszcz
[5]Department of Nursing and Obstetrics, Nicoalus Copernicus University, Collegium Medicum in Bydgoszcz

Corresponding author: Pujszo Ryszard Ph.D.
e-mail: rychu54@interia.pl

Spirometry as one of wellness indicators female students of Kazimierz Wielki University in Bydgoszcz

Spirometria jako jeden ze wskaźników dobrostanu fizycznego studentek Uniwersytetu Kazimierza Wielkiego

Abstract

Last years it has been observed substantial deterioration of physical fitness of young people, especially girls. One of the most important aim of physical education departments is to improve student's physical condition resulting in improvement of wellness. Initial analysis of student's fitness is a very important information source for planning work of physical education departments. That is why it is very important to find a set of independent parameters, which, if measured, could give the reliable initial diagnosis of student's physical efficiency. The measurements of such parameters could give the base for further monitoring of students wellness. It was undertook to analyze the anthropometric data, the chest mobility and results of spirometric measurements for the group of healthy female students of Kazimierz Wielki University in Bydgoszcz. The carried out data analysis did not reveal strong relationships between spirometric parameters and percentage content of fat, chest mobility and the mass of examined students. It seems that the examined parameters can exemplify independent wellness indicators of students beginning to study at the university.

Monitoring of given parameters during studies can give information allowing sports departments to evaluate their work.

Key words: wellness, spirometry, content of fat, BMI

Streszczenie

W ostatnich latach badania wskazują na spadek aktywności fizycznej młodzieży, zwłaszcza nastoletnich dziewcząt. Jednym z zadań stawianych na uczelni przed studium wychowania fizycznego i sportu jest aktywna praca na rzecz poprawy sprawności fizycznej a przez to dobrostanu studentów. Wstępna analiza kondycji fizycznej studentów stanowi bardzo ważne źródło informacji dla zaplanowania pracy komórek odpowiedzialnych za kształcenie ruchowe na wszystkich typach wyższych uczelni. Dlatego też bardzo ważne jest znalezienie grupę niezależnych parametrów, których pomiar pozwoli na postawienie rzetelnej wstępnej diagnozy wydolności fizycznej i będzie mógł stanowić bazę do dalszego monitorowania dobrostanu studentów. Podjęto próbę analizy danych antropometrycznych, ruchomości klatki piersiowej oraz wyników badań spirometrycznych w grupie zdrowych studentek Uniwersytetu Kazimierza Wielkiego w Bydgoszczy. Przeprowadzona analiza wyników nie wykazała silnych zależności pomiędzy parametrami spirometrycznymi a procentową zawartością tkanki tłuszczowej, ruchomością klatki piersiowej czy masą badanych studentek. Wydaje się, że badane parametry mogą stanowić niezależne wskaźniki dobrostanu studentek rozpoczynających naukę na uczelni. Ich monitorowanie w trakcie przebiegu studiów może dostarczać informacji pozwalających na ewaluację pracy jednostek odpowiedzialnych za kształcenie sportowe studentów.

Słowa kluczowe: BMI, tkanka tłuszczowa, dobrostan, spirometria

Introduction

It is said that recently physical efficiency of young people has worsened. It is observed the increasing frequency occurring of obstructive pulmonary diseases and also musculoskeletal system illnesses. The worse mobility of bones and joints system the higher risk of injuries. Continues deterioration of physical efficiency of young people as a consequence of lack of physical activity let predict a great probability of occurring bones or joints diseases in future life stages. The next very serious consequence can be observed in early 40-ties – cardio respiratory failure. Experienced coaches and teachers maintain, that many teenagers, especially girls, do not like physical activities. It is worth noticing that the number of sick leaves allowing students not to take part in physical education classes is still growing. Too little activity, long hours with computer, increasing consumption can lead to obesity and further to deterioration of respiratory efficiency or musculoskeletal system illnesses. It seems to be necessary to make efforts to prevent described tendency. To start real action and encourage young people to larger physical activity it is necessary to create basics for proper planning of work of physical education departments. To achieve this aim the special instruments for assessment of initial students wellness should be created. That's why the aim of this work is to attempt of assessment the physical efficiency of female students of Kazimierz Wielki University in Bydgoszcz by analyzing examined parameters. Basics anthropometric parameters as well as percentage content of fat and parameters from spirometic tests were measured and analyzed.

Material and methods

In investigations conducted in December 2009 took part 39 volunteers - female students of Kazimierz Wielki University in Bydgoszcz. Students of physical education faculty were excluded from the research. Because of many hours per week of obligatory movement activities their results could probably be different. All measurements were done in the Kazimierz Wielki University grounds in the morning. There was a spacious, ventilated gym of temperature about 20 ^{0}C. All examined volunteers declared a good physical form, lack of earlier illnesses of respiratory system and undisturbed physiological state. For all examined students the measurements of body mass and height, percentage content of fat were conducted. The content of fat was measured using device produced by OMRON. Next the circumferences of chest during inspiration and expiration were measured. Finally the spirometric tests were done. The examined parameters were: vital capacity (VC), forced volume vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), peak expiratory flow (PEF). The forced expiratory volume in one second % of vital capacity (FEV_1/VC), called Tiffeneau index, was calculated. In the research the spirometer Microlab ML 3500 was used. The predicted values of all parameters were read from tables [7] and calculated [9]. Measured spirometric parameters were calculated per unit of body mass. All examined volunteers declared their sport activities per week. Ten of them spent 2-9 hours on optional, that is non-obligatory in curriculum, physical activity in recreation form.

To assess the degree of chest movement it is proposed to apply index calculated from the formula:

$$R = \frac{O_{\max} - O_{\min}}{O_{\max}} * 100\%$$

Where:

R – chest movement index

O_{max} – maximal chest circumference during inspiration

O_{min} – minimal chest circumference during expiration

There are many ways for determine predicted values of spirometric parameters . The most popular are tables given by Quanjer, officially adopted by the European Respiratory Society (ERS) [7].They are also sets of predictions equations given by different authors [1-3,7-9]. In this work there were used following equation:

VC = 4,66*H – 0,026*A – 3,28

FVC = 4,43*H – 0,026*A – 2,89

FEV_1 = 3,95*H – 0,025*A – 2,60

Tiffeneau index = -0.19*A + 89.10

PEF = (5.50*H – 0.030*A – 1.11)*60

Where

H – height in meters

A – age in years

It is important to emphasize, that predicted values determined in different ways were very similar, obtained differences were order a few percents.

Statistical analysis of all measurements data were done by means of Statistica 5.0 and Microsoft Office Excel 2003 software.

Results

In the examined group of 39 female students of age 19-26 (+/- 1,5) the body mass have changed in range 40 – 112,5 kg with standard deviation of 11,7 kg□□ height range was 154 -181cm with standard deviation of 1cm□□The body mass index BMI in the group of 38 students have changed in range of 16.0 – 25 kg/m^2. The only one person's BMI index had magnitude 39 kg/m^2 because of big body mass. There were not data of masses from range 74

– 112kg and BMI from range 25 – 39 kg/m^2. That is why the further analysis of data is limited to 38 students. The preliminary analysis of obtained results of measurements showed the differences in tendencies of parameters changing and relationships between parameters in group of inactive students comparing with training recreation. Therefore the next parts of analysis were performed not only in the whole group, but also separately for training recreation and physically inactive groups. The anthropometric data of examined female students shows Table I.

Table I. The anthropometric data of examined students with division for training recreation and inactive groups.

Number	Body mass (kg)	Range of masses (kg)	Height (m)	Range of heights (m)	Age (years)	Range of ages (years)
N = 38	57,1 ± 7,7	40 -74,1	1,65 ± 0,06	1,54 -1,81	21,3 ±1,6	19,3 - 26,5
training recreation N = 10	54,1 ± 7,1	42 - 67,1	1,61 ± 0,04	1,54 -1,68	22,3 ± 2,0	20,0 - 26,5
inactive N = 28	60,0 ± 7,8	40 - 74,1	1,70 ± 0,05	1,58 -1,81	21,3 ±1,3	19,3 - 25,5

The next table shows the BMI index and percentage content of fat of examined students.

Table II. The values of BMI and percentage fat content of the examined students with division for practicing movement recreation and non-training groups.

Number	BMI (kg/m^2)	Range of BMI (kg/m^2)	percentage fat content	Range of percentage fat content
N = 38	20,8 ± 2,16	16,0 - 25,0	7,0 ± 4,5	9,3 - 23,8
training recreation N = 10	20,7 ± 1,9	17,7 - 24,6	16,7 ± 3,6	12,1 – 22,0
inactive N = 28	21,5 ± 2,3	16,0 - 25,0	17,60 ± 5,3	5,5 - 23,8

The shown tables indicate that values of Body Mass Index in group of examined female students of Kazimierz Wielki University in Bydgoszcz hold in standard range. There are no statistically significant differences between groups. It is important to remember that in described research took part only volunteers. There was only one person with great value if BMI index. It can be supposed, that the lack of overweight and obese students does not result from lack of those students at the university. Probably overweight and obese students do not like physical activities and are ashamed of taking part in investigations of wellness. The difficulties with assembling a group with values if BMI Index from range 25 - 39 to make impossible to draw conclusions from high BMI range.

The average percentage fat content of the investigate students 17.0 % is the low value comparing with predicted 18-24% for adult women.

In the next tables there are shown ranges of changes of chest movement index and measured spirometric parameters in the examined group of students.

Table III. The values of chest movement index R, vital capacity (VC) and vital capacity per unit of body mass (VC/mass) of examined students with division for training recreation and inactive groups.

Number	R (%)	Range of R (%)	VC (dm^3)	Range of VC (dm^3)	VC/mass (cm^3/kg)	Range of VC/mass (cm^3/kg)
N = 38	6,82 ± 1,94	2,2 - 10,59	3,73± 0,44	2,73 - 4,66	6,60 ± 0,75	5,15 - 7,91
training recreation N = 10	8,44 ± 1,63	4,76 - 10,59	3,74 ± 0,37	3,14 – 4,20	6,97 ± 0,63	6,08 - 7,91
inactive N = 28	5,99 ± 1,91	2,20 -8,89	3,72 ± 0,46	2,73 - 4,66	6,36 ± 0,76	5,15 - 7,87

Table IV. The values of spirometric parameters: forced expiratory volume in 1 second (FEV_1), forced volume vital capacity (FVC), peak expiratory flow (PEF) and forced expiratory volume in one second % of vital capacity (Tiffeneau index) of the examined students.

Number	FEV_1 (dm^3)	Range of FEV_1 (dm^3)	FVC (dm^3)	Range of FVC (dm^3)	PEF (dm^3/min)	Range of PEF (dm^3/min)	Tiffeneau index (%)	Range of Tiffeneau index (%)
N = 38	3,27±0,33	2,32-3,79	3,58±0,53	2,36-4,61	388±77	244 -559	88,1± 7,5	68,6-102,2
training N = 10	3,22±0,22	2,85-3,52	3,44±0,63	2,36-4,29	404±78	262 -559	86,4±5,4	75,0 – 90,8
inactive N = 28	3,29±0,37	2,32-3,79	3,60±0,49	2,36-4,61	382±77	244 -517	94,2±8,1	68,6-102,2

Data analysis

Using given earlier method the predicted values of spirometric parameters were determined. In table V the values of parameters obtained by students expressed as percents of predicted value are shown.

Table V. The values of spirometric parameters: vital capacity, forced expiratory volume in 1 second, forced volume vital capacity (a) and peak expiratory flow of the examined students group expressed as percents of predicted value (b).

(a)

Number	FEV_1 measured predicted	Range of FEV_1 measured predicted	FVC measured predicted	Range of FVC measured predicted
N = 38	96,3±9,9	72,2 -111,4	91,6±12,1	64,2 -112,2
training recreation N = 10	100,1±5,1	92,7 -108,1	93,2±14,4	69,3 -110,4
inactive N = 28	94,8±9,8	72,2– 111,4	90,9±11,4	64,2 -112,2

(b)

Number	PEF measured predicted (%)	Range of PEF measured predicted	VC (%) measured predicted	Range of VC (%) measured predicted
N = 38	87,8±17,9	54,5-130,2	96,4±9,9	77,1-115,5
training recreation N = 10	95,2±19,3	58,3 -130,2	102,2±7,5	93,2 -113,9
inactive N = 28	85,6±17,0	54,5 -117,5	94,2±9,9	77,1 -115,5

It should be here emphasized that in the examined group of female students the measured value of forced expiratory volume in 1 second lower than 85% of predicted one was observed in 5 from 38 students. It is 13% of total group. All the students with the lowest values of examined parameter belong to inactive group. In the practicing recreation group all measurements were similar to predicted values. Taking this fact into consideration it can be notice, than students with the lowest values of FEV_1 are 18% of inactive group, what seems to be worried big part of these students.

Data analysis of forced volume vital capacity in examined group of students revealed that 9 from 38 examined students, that is 24% , have obtained results of 15% worse that predicted ones. In this case two students belong to practicing group and 7 of them are not physically active.

The values of peak expiratory flow lower more than 15% than predicted was been obtained in 11 of examined female students, what is 29% of all group. If notice, that there were examined only volunteers and none of them have declared to de in bad mood or having chronic diseases, the obtained results are disturbing. It is possible that with the female students of Kazimierz Wielki University in Bydgoszcz every third obtains results much lower than predicted for their age and height.

All the students have obtained the Tiffeneau index very similar to predicted values.

There was very small group of examined students who have obtained values of spirometric parameters higher that predicted (from 2-5 persons in all group for all investigated parameters). It also should be noticed, that there was not observed, that practicing movement recreation student more often have obtained bigger than predicted results than non-active students.

Continuing data analysis the values of spirometric parameters per unit of body mass were determined. The results are shown in table VI.

Table VI. The values of spirometric parameters: forced expiratory volume in 1 second, forced volume vital capacity and peak expiratory flow per unit of body mass of examined students group.

Number	FEV_1/mass (cm^3/kg)	Range of FEV_1/mass	FVC/mass (cm^3/kg)	Range of FVC/mass	PEF/mass ($dm^3 \cdot min^{-1}$	Range of PEF/mass ($dm^3 min^{-1} kg^{-1}$)
N = 38	58,1 ± 8,3	39,0-73,6	63,0 ± 9,7	40,0 - 83,1	6,9 ± 1,6	4,4 -10,3
training recreation N = 10	60,2 ± 7,0	47,0-71,8	63,6 ± 8,8	47,0 - 75,3	7,6 ± 1,6	4,4 -10,3
non-training N = 28	56,4 ± 8,7	39,0-73,6	61,7 ± 10,2	40,0 - 83,1	6,5 ± 1,5	4,5 -10,2

Continuing data analysis there were searched relationships between all measured parameters. To show the found relationships the results are shown on graphs.

The preliminary analysis of relationships between parameters allows to observe very interesting difference in the dependence of percentage fat content on the body mass of examined students. In the group of inactive female students percentage content of fat linearly increases with increasing of mass body. In the investigated range of masses there was obtained relationship:

percentage fat content = 0,545* mass – 14,93

with coefficient $R^2 = 0{,}642$. The described dependence is illustrated in Figure 1.

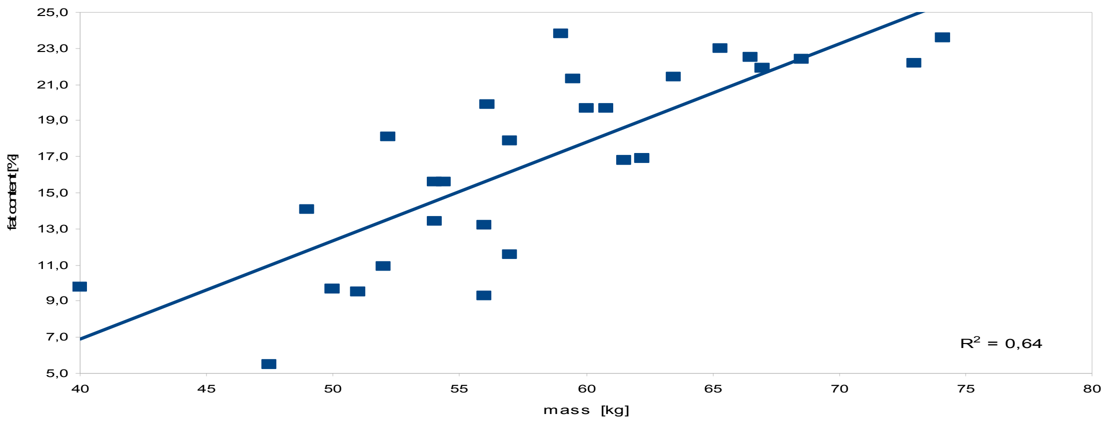


Figure 1. The dependence of percent content of fat on body mass of inactive female students of Kazimierz Wielki University in Bydgoszcz.

Similar graph prepared for physically active female students does not point for existing dependence between analyzed parameters. The best obtained fit gives coefficient $R^2 = 0{,}10$. It should be here emphasized that the range of change percent content of fat in group of training recreation is smaller than in group of inactive students.

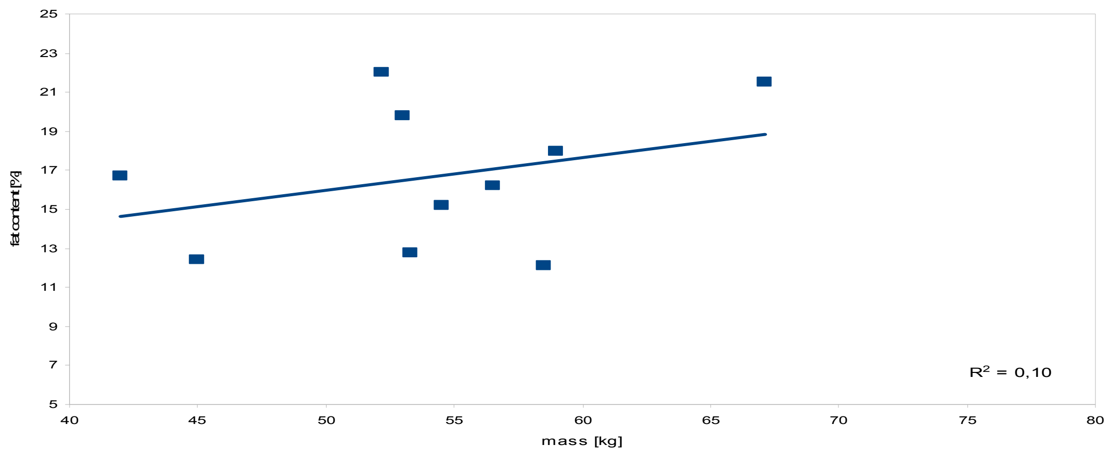


Figure 2. The dependence of percent content of fat on body mass of practicing movement recreation female students of Kazimierz Wielki University in Bydgoszcz.

The presented data analysis suggests, that in the group of training movement recreation students even if the body mass increases than it is not correlated with the fat content. It suggests that in this group the increasing mass of the body should be connected wit increasing of mussels mass.

Later in the analysis of the results it was sought a dependence of the chest movement index R on body mass, BMI and body fat content. It was noted that for all the students together could not be find a correlation between those parameters. However, after distribution of students in a group of training recreation and physically inactive it can be observed an interesting relationship.

Figures 3 and 4 show the value of chest movement index as a function of BMI for the groups of students, respectively inactive and practicing sport.

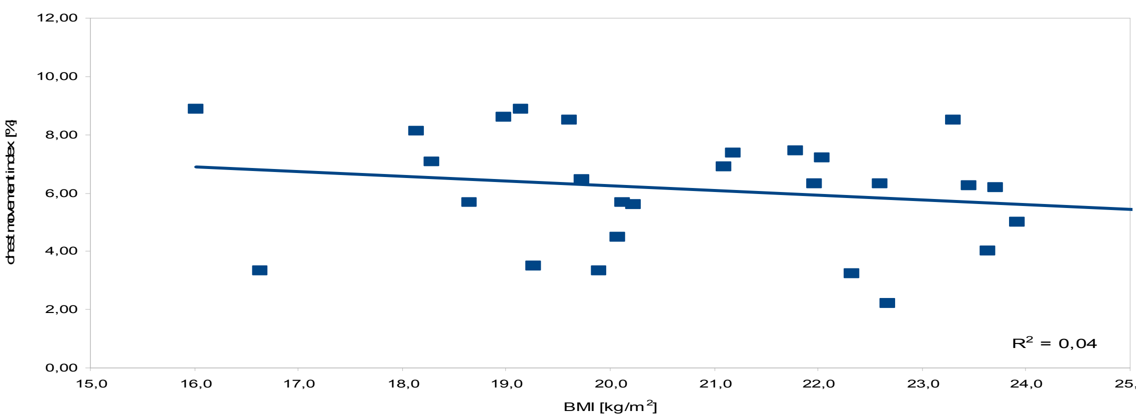


Figure 3. The dependence of chest movement index on BMI of physically inactive female students of Kazimierz Wielki University in Bydgoszcz.

The data are randomly scattered, attempting to search for any dependence gives the results of coefficient $R^2 = 0.03$.

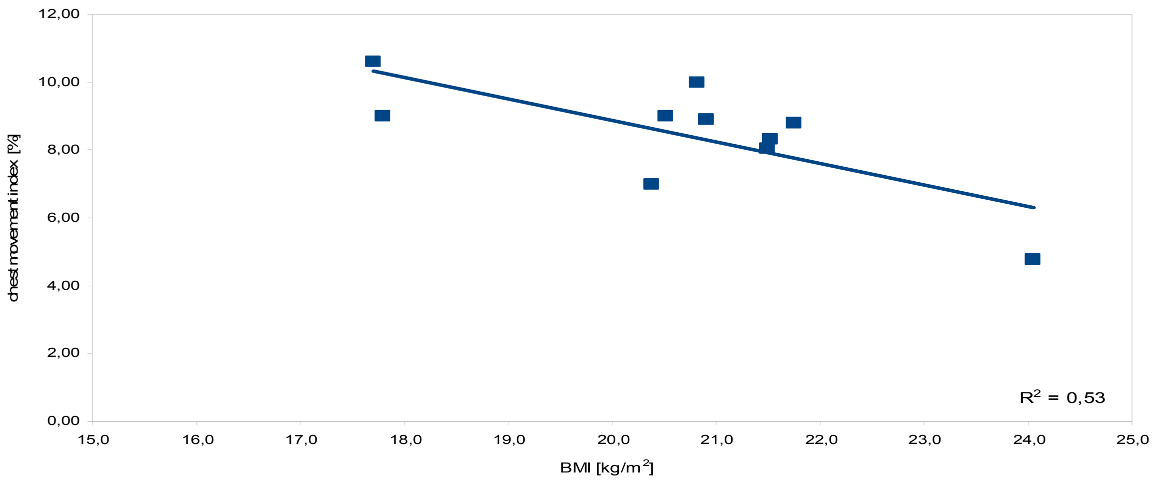


Figure 4. The dependence of chest movement index on BMI of training recreation female students of Kazimierz Wielki University in Bydgoszcz.

It should be noted that the value of chest movement index in this group is of about 30% higher than the values obtained by the students physically inactive. The differences are statistically significant at $p = 0.05$. In the group of active students is observed the linear dependence chest movement index on BMI. In the investigated range of BMI the calculated level of correlation equals $R^2 = 0.53$. The dependence is decreasing and shows that each 2 kg/m^2 increasing in BMI decreases chest movement index of more than 1%:

$$R = - 0,633 \cdot BMI + 21,5$$

Similar trends can be observed by analyzing the relationship between chest movement index and the percentage content of fat. Analysis all the group gives a correlation of $R^2 = 0.222$. After dividing the group by student training and physically inactive, it can be seen that in the physically inactive group there is no relationship between the tested parameters. However, in a group of students practicing movement recreation it is observed decreasing linear relationship described by the equation $y = - 0.308x + 13.57$ with a coefficient of $R^2 = 0.477$. It is shown in Figure 5.

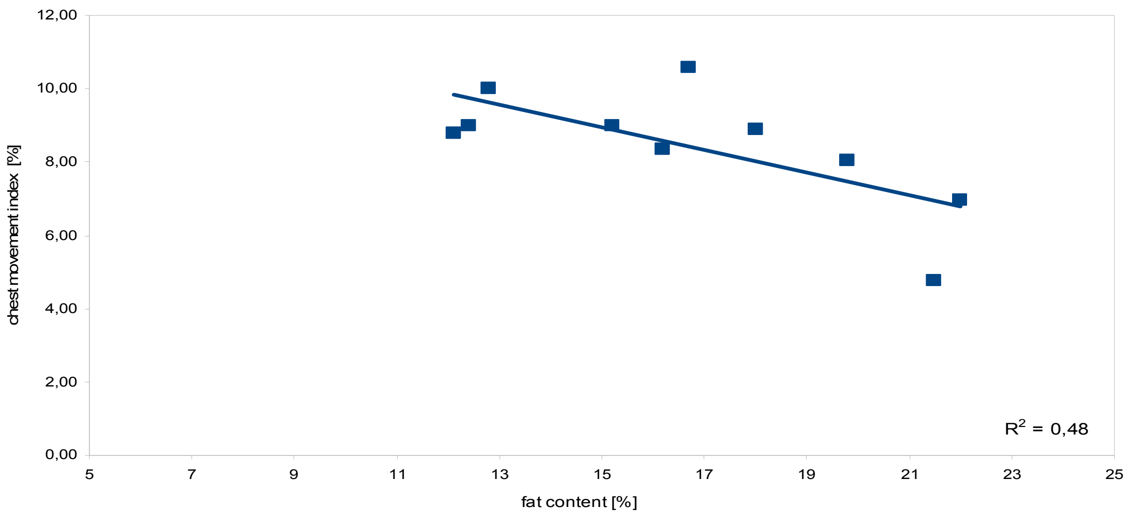
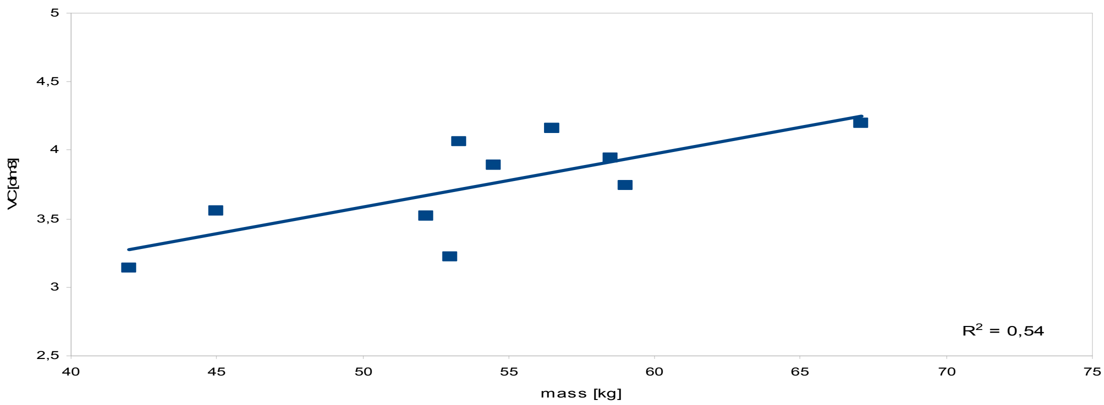
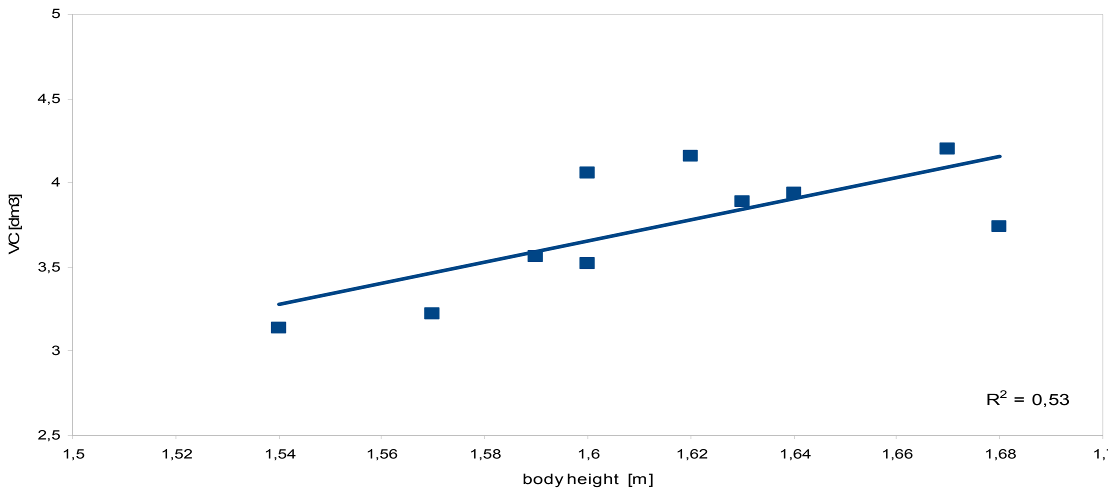


Figure 5. The dependence of chest movement index on percent content of fat of training recreation female students of Kazimierz Wielki University in Bydgoszcz.

In the next part of the measurements analysis it was attempted to find correlations of spirometric parameters with anthropometric data, body fat content and the chest movement index in the examined students group. No correlation was found between vital capacity and either the percentage fat content or chest movement index (R^2 from 0.03 to 0.3). The results indicate a relationship vital capacity with mass of students, note that the relationship is stronger among training students: $R^2 = 0.54$ comparing with $R^2 = 0.34$ value obtained in the group of inactive students. In the active group it is also observed correlation vital capacity with height ($R^2 = 0.53$), while in the inactive group could not be observed relationship between these parameters. Described dependences illustrates Figure 6(a) and (b).



(a)



(b)

Figure 6. The dependence of vital capacity on mass (a) and body height (b) of training recreation female students of Kazimierz Wielki University in Bydgoszcz.

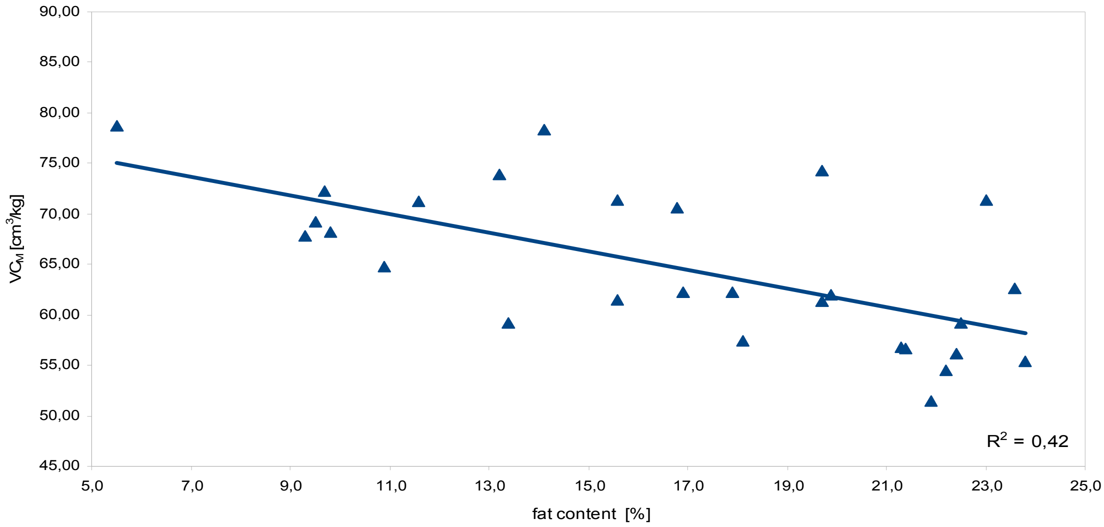
After the calculation of vital capacity examined students per unit of body mass (VC_M) it was received a decreasing relationship between VC_M and percent content of fat. Once again it was proved that the analysis in the whole group gives a weaker correlation (R^2 = 0.32) than calculated by dividing students for active and physically inactive. In the group of inactive students it was obtained relationship:

VC_M = - 0,92 % fat + 80 with R^2 = 0,42

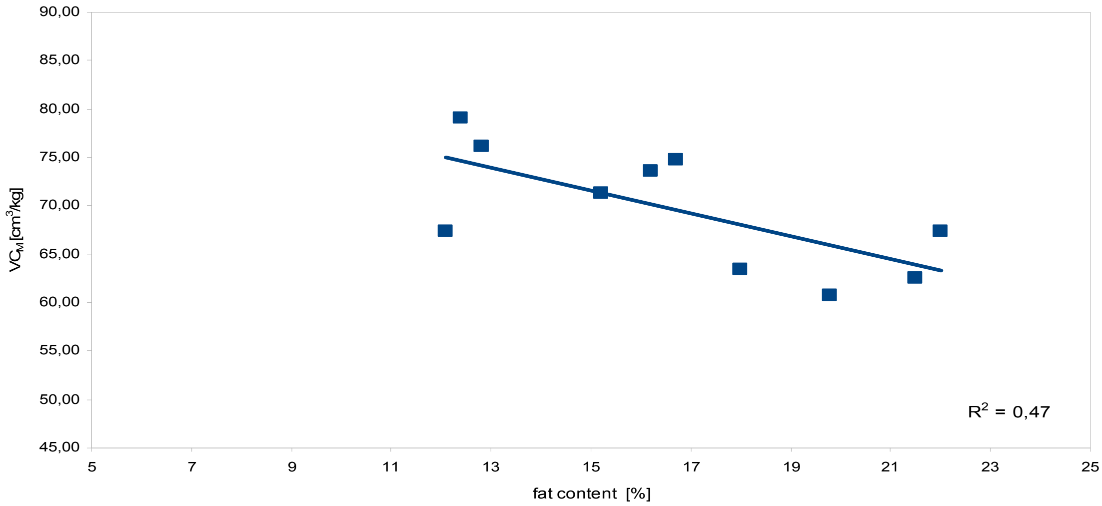
while in training recreation group:

VC_M = -1,18 % fat + 89 with R^2 = 0,47

The dependences are shown in Figure 7 .



(a)



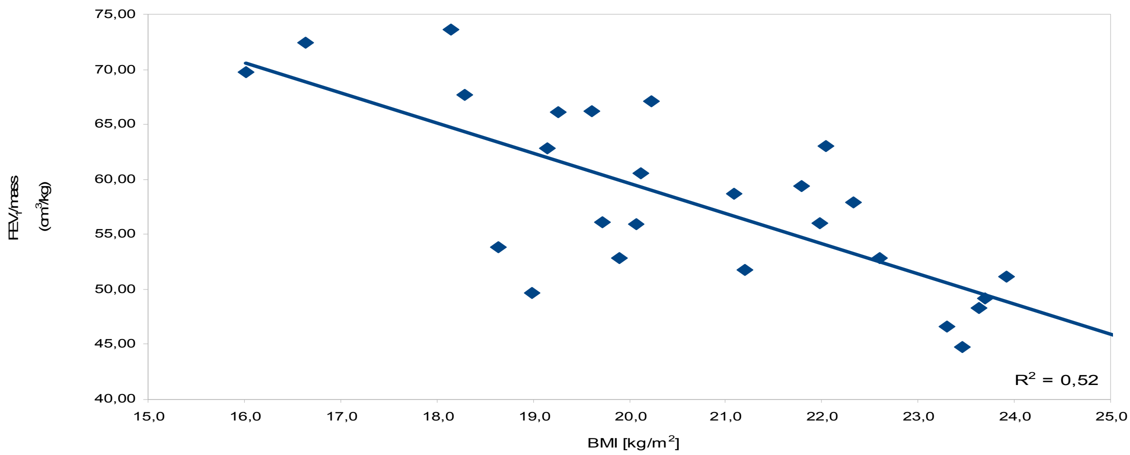
(b)

Figure 7. The dependence of vital capacity per unit of body mass on percent content of fat of inactive (a) and training recreation (b) female students of Kazimierz Wielki University in Bydgoszcz.

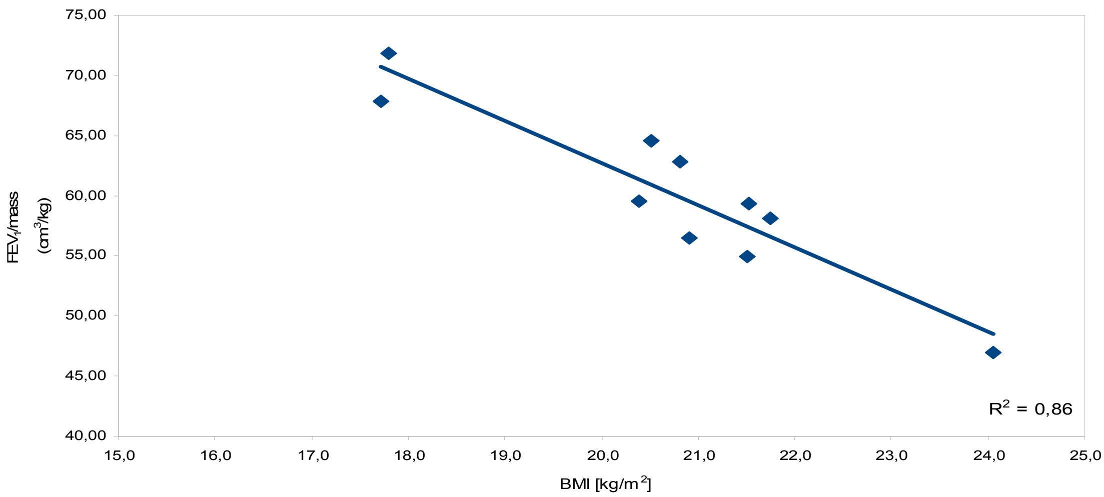
Increasing the fat content affects the reduction of lung vital capacity per unit of body mass, although this decreasing is faster in a group of students physically active.

Searching for a correlation between forced expiratory volume in 1 second (FEV_1) and anthropometric parameters did not give positive results. This means that the forced expiratory volume in 1 second may be an independent, a new parameter that could serve as a wellness indicator.

Forced expiratory volume in 1 second calculated per unit mass (FEV_1/mass) were found to correlate with the BMI of the examined students. In both subgroups it was received a decreasing dependence with the values of the R^2, respectively, 0.52 in inactive and 0.86 in practicing movement recreation students. Described relationships are shown in Figure 8.



(a)



(b)

Figure 8. The dependence of forced expiratory volume in 1 second per unit of body mass on BMI of inactive (a) and training recreation (b) female students of Kazimierz Wielki University in Bydgoszcz.

The investigated parameter also shows a high correlation with the chest movement index among physically active students. With the increasing of chest movement index value the forced expiratory volume in 1 second per unit of body mass also increases with the R^2 for this relationship equal 0.60. It is shown in Figure 9.

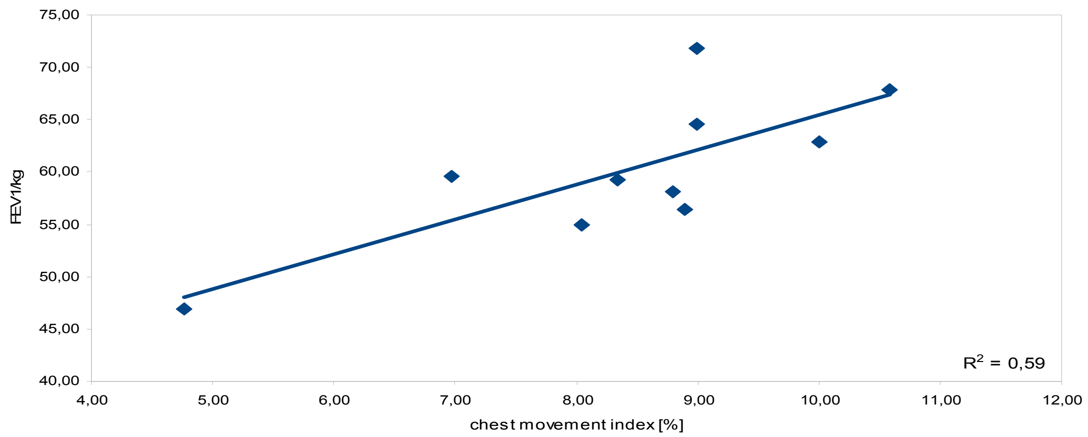
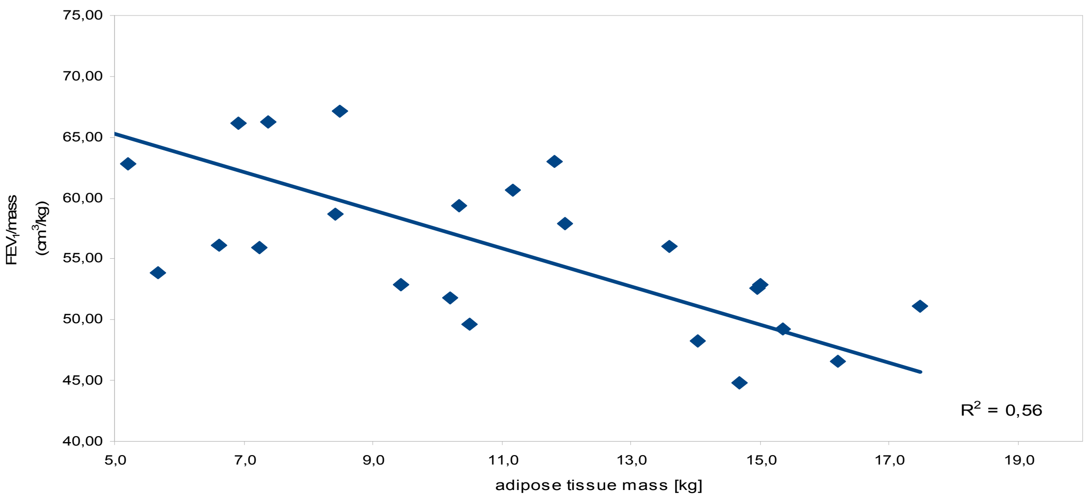
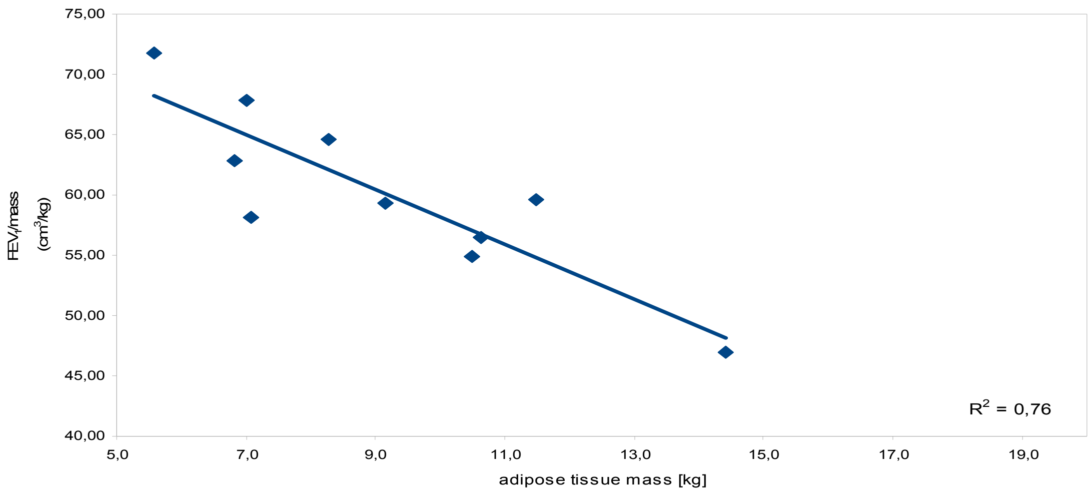


Figure 9. The dependence of forced expiratory volume in 1 second per unit of body mass on chest movement index of training recreation female students of Kazimierz Wielki University in Bydgoszcz.

Forced expiratory volume in 1 second per unit of body mass shows a strong relationship with the mass of adipose tissue of examined students, and the correlation among active students is a clearly stronger. R^2 in physically inactive group was 0.56 while in the training group was 0.75. In both groups, the increase in fat mass reduces the forced expiratory volume in 1 second per unit of body mass. Described dependence is shown in Figure 10(a) and (b).



(a)



(b)

Figure 10. The dependence of forced expiratory volume in 1 second per unit of body mass on the mass of adipose tissue of inactive (a) and training recreation (b) female students of Kazimierz Wielki University in Bydgoszcz.

Forced volume vital capacity inactive students did not correlate with anthropometric parameters. In the group of physically active students it was found an average correlation with body mass at $R^2 = 0.47$. This is illustrated in Figure 11.

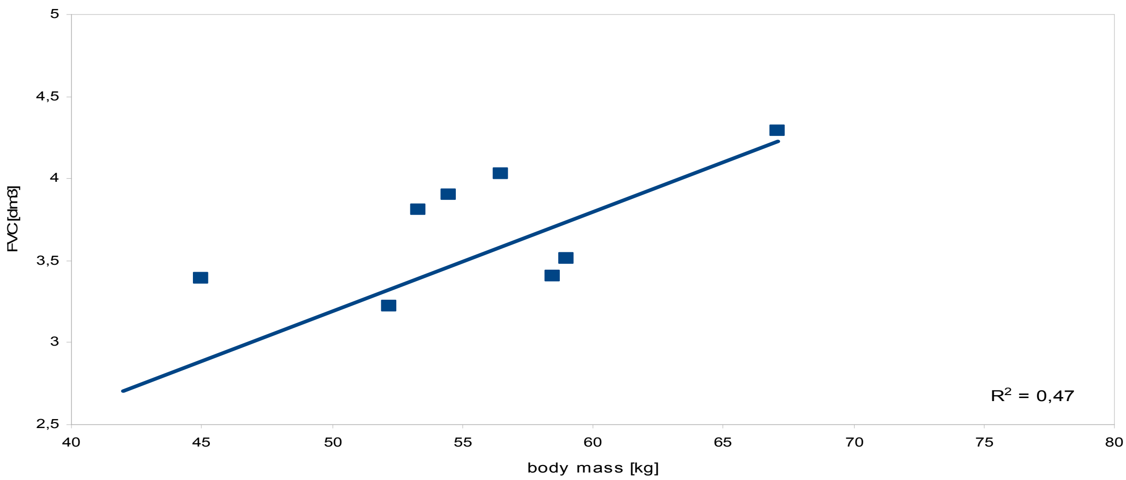


Figure 11. The dependence of forced volume vital capacity on the body mass of training recreation female students of Kazimierz Wielki University in Bydgoszcz.

The investigated parameter calculated per unit of body mass shows an average correlation with the average BMI among students physically inactive. This is shown in Figure 12.

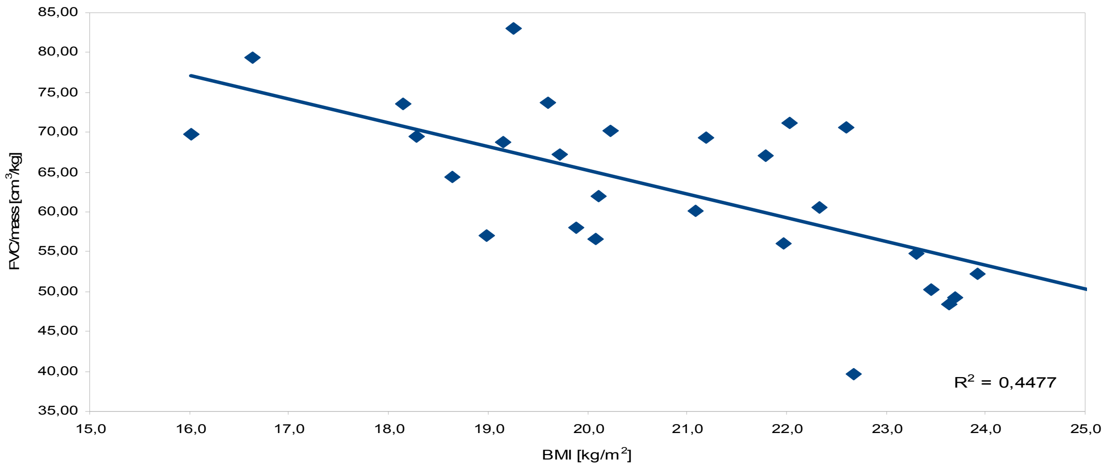


Figure 12. The dependence of forced volume vital capacity per unit of body mass on BMI of inactive female students of Kazimierz Wielki University in Bydgoszcz.

No other correlations forced volume vital capacity, also converted per unit of mass with other investigated parameters were found. Due to the lack of strong dependence of forced volume vital capacity on the anthropometric parameters, it seems that the measurement of FVC provides additional information and may serve as a next independent indicator of physical fitness of students. Another independent parameter in the assessment of efficiency of female students seems to be the peak expiratory flow, since it was not found a correlation between this parameter even converted per unit body mass and any of the anthropometric parameters. Tiffeneau index shows a correlation with BMI only in the group of training recreation students. This relationship is shown in the Figure 13.

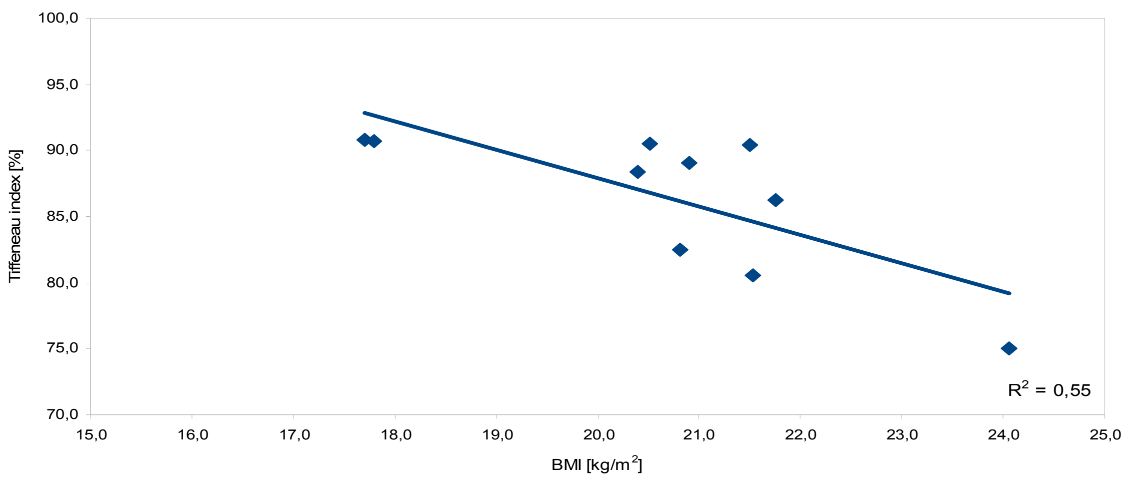


Figure 13. The dependence of Tiffeneau index on BMI of physically active female students of Kazimierz Wielki University in Bydgoszcz.

The above considerations seem to indicate that the spirometric parameters provide qualitatively new information about the wellness of the examined group because it was not found regularly strong dependence of all parameters on anthropometric data. The next step was to check whether the investigated spirometric parameters are independent of each other. It turned out that there is a strong correlation forced expiratory volume in 1 second (FEV_1) and vital capacity VC (with $R^2 = 0.54$) like also between forced volume vital capacity (FVC) and vital capacity VC (at $R^2 = 0.83$) among the physically active students. The above dependence shows Figure 14. It was also observed the relationship between FEV_1 and FVC at $R^2 = 0.53$, both in the entire examined group, as well as in both subgroups of students.

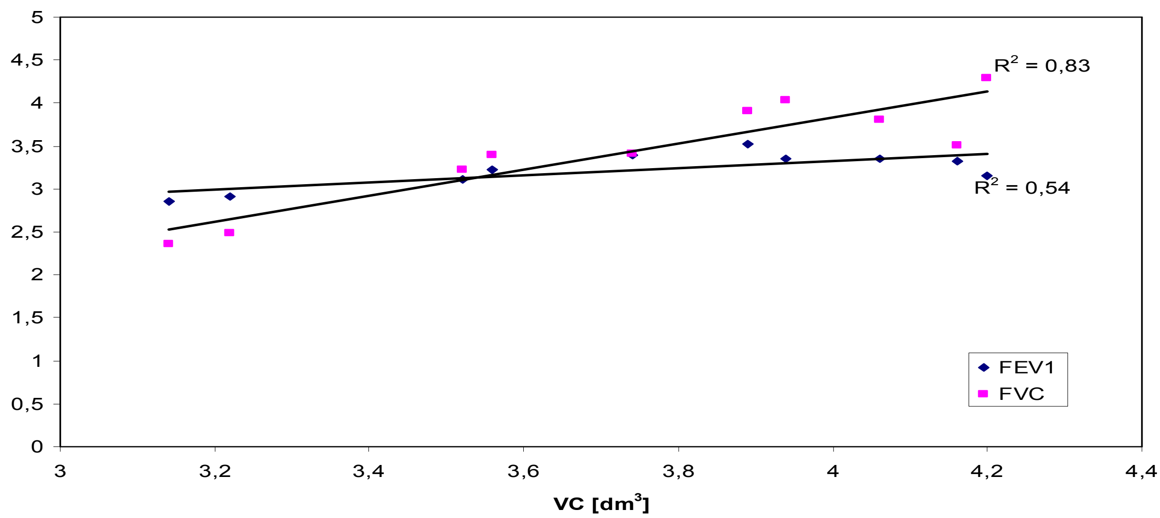


Figure 14. The dependence of forced volume vital capacity and forced expiratory volume in 1 second of physically active female students of Kazimierz Wielki University in Bydgoszcz.

The next figure shows a low but statistically significant correlation ($R^2 = 0.40$) percentage of predicted value forced expiratory volume in 1 second (FEV_1 measured / predicted) as a function of forced expiratory volume in 1 second per unit of body mass (FEV_1/mass). Figure 16. indicates the high statistical relationship ($R^2 = 0.54$) between forced volume vital capacity as a percent of predicted value (FVC measured / predicted) on the forced volume vital capacity per unit of body mass (FVC/mass). Figure 17. indicates the high statistical relationship ($R^2 = 0.74$) between peak expiratory flow as a percent of predicted value (PEF measured / predicted) on the peak expiratory flow per unit of body mass (PEF/mass).

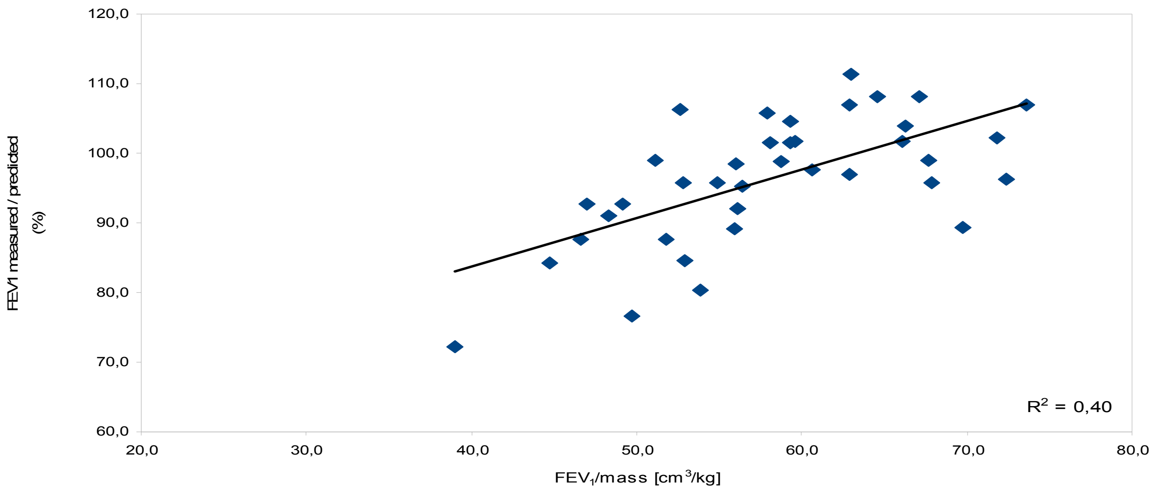


Figure 15. The dependence of forced expiratory volume in 1 second as a percent of predicted value on the forced expiratory volume in 1 second per unit of body mass of all examined female students of Kazimierz Wielki University in Bydgoszcz.

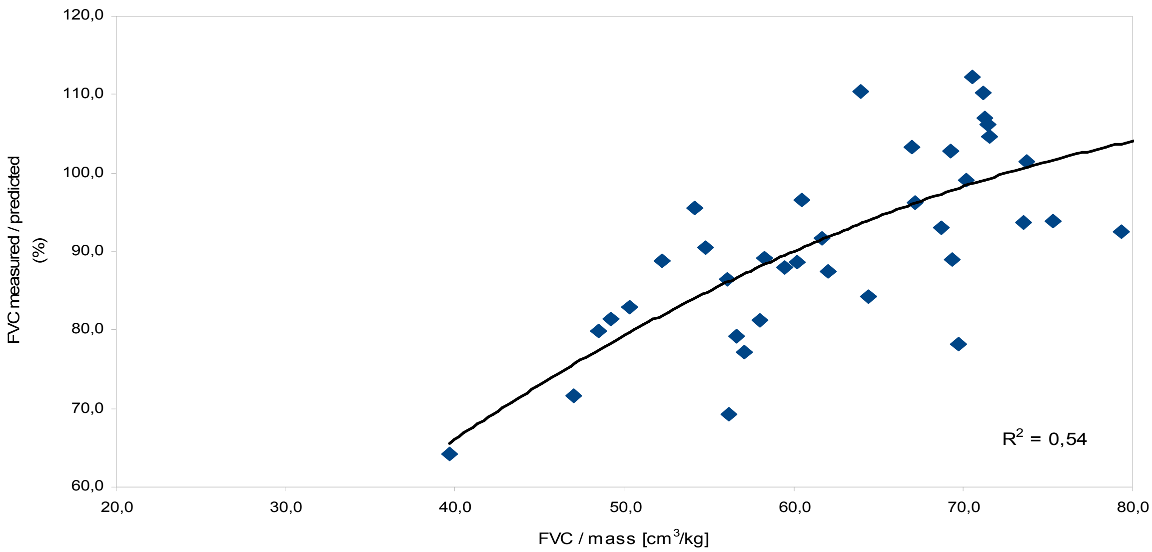


Figure 16. The dependence of forced volume vital capacity as a percent of predicted value on the forced volume vital capacity per unit of body mass of all examined female students of Kazimierz Wielki University in Bydgoszcz.

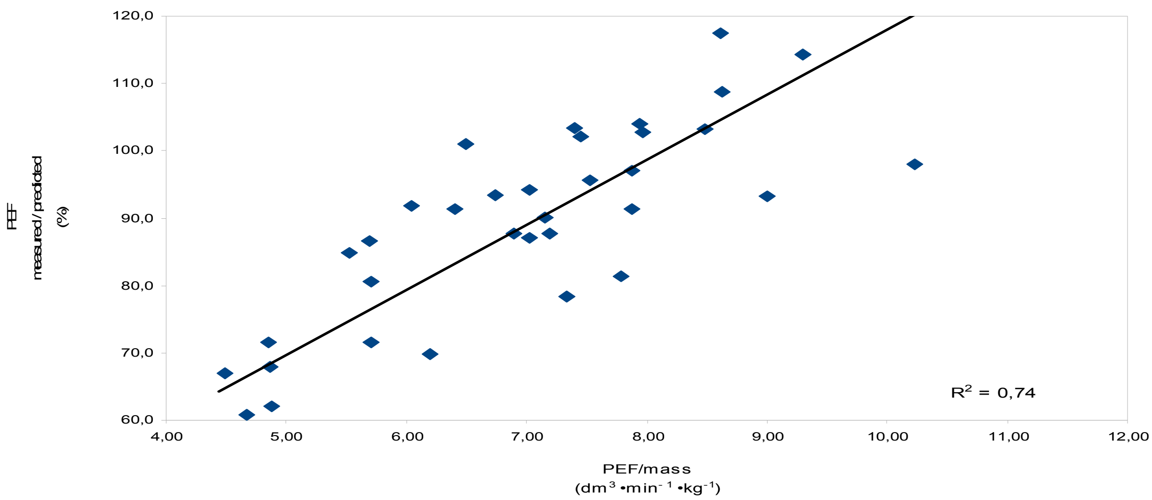


Figure 17. The dependence of peak expiratory flow as a percent of predicted value on the peak expiratory flow per unit of body mass of all examined female students of Kazimierz Wielki University in Bydgoszcz.

Discussion and conclusions

The human body consists i.a. of necessary to perform vital functions muscle tissue, of could act as supporting functions bones and of adipose tissue, which except a positive role has a tendency to over-aggregation and then is a ballast in the functioning of a whole organism.

Oxygen delivered through the lungs is transported from the alveoli to the individual cells of the human body which participates in the fundamental life-sustaining and proper functioning of the whole body reactions. If the amount of fat is too big, part of the oxygen is used in the functioning of these cells, which automatically reduces oxygen delivery to other cells. It may reduce the efficiency of oxygen operation during intensive physical exercise, or immediately after regeneration [4]. Obese people consume more oxygen compared with those of normal fat content, since more body mass requires more energetic effort during the organism operation [6]. It should be noted also that the mobility of the chest and thus an opportunity to take a deep inspiration and expiration as well as change the volume of air exhaled in a short period of time (eg 1 sec.) affects the amount of oxygen delivered in a single breath, which then results in the content of oxygen in cellular processes [4]. Respiratory efficiency, as well as the human physiological efficiency in the ontogeny, may change for the better in the application of appropriate exercises but may deteriorate in the event of bad habits, sedentary lifestyle or illnesses and injuries [5]. It is known that the vital capacity is anatomically conditioned and does not show a direct connection with the maximum oxygen threshold (V02 max), which describes the human's ability to continue large and long-term efforts. In some investigations, for example, obese women achieved from 80 to 95% of the normative value while their maximum oxygen threshold was from 2.8 to 2.9 ml / min. what is the result of strongly deviating from the normative [6].

Detailed analysis of measurement quantities shows that the relationships between the investigated parameters in the group of physically inactive are different than in the practicing movement recreation female students of Kazimierz Wielki University in Bydgoszcz. Inactive persons increase body mass by excessive accumulation of adipose tissue. There is not observed this effect among students physically active. Parameter clearly differentiating active and inactive female students is chest movement index. Training, if only movement recreation causes a marked increase of this parameter. In a period of increased demand for the oxygen supply to the tissues the increased mobility of the chest can satisfy those needs, of course, mainly in active people. In this group the natural consequence of effective training is the improvement chest mobility.

The values of spirometric parameters obtained by the examined students did not reveal common relationships on the anthropometric parameters. It may mean that the spirometric parameters give new information on the students' wellness. Repeating spirometric measurements during the study may provide with additional data concerning the improvement or deterioration of students' wellness.

There was no observed correlation between the chest movement index and spirometric parameters. This fact suggests that the chest movement index is the parameter independent on such parameters as forced expiratory volume in 1 second (FEV1), forced volume vital capacity (FVC), peak expiratory flow (PEF). There are currently no available normative values for chest movement index. However, it is worth to attempt extensive research to determine the standards because of the simplicity of measuring this parameter - even in situations when an access to spirometer is difficult.

What may be disturbing is the fact that it was found a relatively great number of students revealed the values of spirometric parameters at a level which was lower than predicted by more than 15%. In the case of peak expiratory flow almost 30% of students achieved a value lower than 15% of the predicted.

These findings lead to disturbing suspicion, that the appearance of the obstructive pulmonary disease - bronchial asthma is highly probable in the near future. In this particular case the stress background of the disease may be taken into consideration. The screening tests of the overactive bronchitis often use strain as a trigger of bronchospasm. This observation may be a motivation for further in-depth research in this area. However, it can be concluded that at the time of the increasing epidemiologically obstructive bronchitis diseases, the group of students with the lowest values of PEF could be included into the groups of high risk of bronchial asthma occurrence.

The results showed that the examined parameters may be indicators of the wellness of students. In order to plan training or physical education classes better similar tests could be carried out on a larger scale, and the results obtained by students could be monitored during their further studies. To gain more detailed conclusions students with high mass and high BMI values should be invited to take part in the research. It seems that this is potentially a group that being encouraged to increase their physical activity may achieve the greatest improvement of wellness.

References

1. Brändli O, Schindler C, Leuenberger PH, et al. Re-estimated equations for 5th percentiles of lung function variables. Thorax 2000;55:173–174
2. Degens P, Merget R. Reference values for spirometry of the European Coal and Steel Community: time for change. Eur Respir J. 2008 Mar;31(3):687-8
3. Hankinson JL, Odencrantz JR, Fedan KB. Spirometric reference values from a sample of the general US population. Am J Respir Crit Care Med 1999; 159: 179-187.
4. Kozłowski St., Nazar K. „Wprowadzenie do fizjologii klinicznej", PZWL, Warszawa. (1996).
5. Mucha R., Pasek J., Sieroń A., „Wpływ ćwiczeń oddechowych na wskaźniki spirometryczne u pacjentów we wczesnym okresie po wybranych zabiegach kardiochirurgicznych" Balneologia Polska 2/ 2007
6. Olszanecka-Glinianowicz M., Zahorska-Markiewicz B., i in. Wydolność fizyczna otyłych kobiet Endokrynologia t.2 nr 1 s.1-4 Via Medica 2006.
7. Quanjer PH, et al. Lung volumes and forced ventilatory flows. Report Working Party Standardization of Lung Function Tests, European Community for Steel and Coal. Official Statement of the European Respiratory Society. Eur Respir J 1993;6: Suppl. 16 5–40
8. Standardized lung function testing. Report Working Party. Bull Eur Physiopathol Respir 1983;19: Suppl. 5 1–95

9. Standardized lung function testing. Official statement of the European Respiratory Society. Eur. Respir. J. Suppl 1993;16:1-100
10. Walla Gabriela, Chorąży Marek, Saulicz Edward, Żmudzka-Wilczek Ewa, Musialik Grzegorz; Wpływ wyczynowego uprawiania sportu na zachowanie się niektórych parametrów spirometrycznych; Ann. Acad. Med. Siles. 2000:44/45 s.83-90