# Physical performance of the students of music schools compared with reference values

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## Abstract

**Introduction**. Physical activity is the first method of treatment which prevents a great number of diseases.

**Material and methods**. 393 students from randomly selected music schools in Poland and Germany were qualified for the study. The level of physical fitness was assessed by means of the Eurofit test in each of the schools. The obtained test results were confronted with reference levels.

**Conclusions**

1. The level of the skills specific for musicians was significantly higher as compared with reference values.

2. The level of physical performance among musicians significantly differed from reference values.

## 1. Introduction

Physical activity is the first method of treatment which prevents many diseases through improvement of glucose re-uptake, insulin sensitivity, lipid profile, decreased blood pressure, improvement of blood vessels and protection against obesity. Exercise can be treated as the key therapeutic method which enables to reduce the use of other more expensive methods of treatment. A healthy lifestyle and thus increased physical activity can be a clinically effective and relatively inexpensive way to prevent the rapidly growing incidence of chronic diseases. A health training is a lifelong process consisting in managing of health maintenance and/or

improvement and in the inhibition of involution processes by means of energy-cost-related physical activity almost exclusively for the suggested purposes, and means only struggling with oneself [Drabik 1996].

Nearly 70% of adult Americans either do not do any physical activity or are not active enough. Almost half of young people (12 – 21 years) do not do exercises on a regular basis. Therefore, the question arises: if physical activity is such an effective preventive measure, why is it not popular? Possible explanations include: the word 'exercise' suggests intensive activity related with pain, specialist equipment, a membership in a health and fitness club, etc., still some people may have negative memories of exercises from childhood or adolescence in case of lack of fitness being laughed at by peers, the example of some professionals in the field of healthcare, fitness and spa or trainers leading a sedentary lifestyle [Manu].

A physically fit individual is considered to be someone characterized by a relatively big resource of physical exercises, high efficiency of the respiratory, circulatory, secretion and thermoregulation system, certain regularities of the physique as well as the lifestyle that affirms physical activity [Osiński 1991].

The concept of physical fitness moved from the sports orientation towards the H-RF (health-related fitness) ensures that a greater emphasis must be put on the cardiovascular function, body composition, strength, endurance, and agility of the lower back. These are the features indicated by the researchers of medical issues and physical education as the most important ones for health promotion and reduction of risk factors. These components are determined by means of: the ability to do exercise everyday vigorously and enthusiastically and the condition of features and abilities which indicates a low risk of premature development of diseases and weakening of strength due to low activity. The essential HR-F component is the diagnostics of body functioning and cardiorespiratory efficiency.

The purpose of the study was to determine the level of physical performance in students playing selected musical instruments compared with reference values.


2. **Materials**


393 individuals were recruited from randomly selected music schools in Poland and Germany. All the students who obtained the consent of the legal guardian or parent in case of minors, the direct teacher or school principal and who had been students of a music school for at least one year were allocated for the study. All subjects were divided into classes depending on the

leading instrument and within a class depending on gender, age and the period of playing an instrument. Accordion students accounted for class I, Western concert flute students – class II, grand piano students – class III, guitar students – class IV, violin students – class V, and cello students – class VI. The age of the subjects was determined according to the following rule: if a person was 11 years, 5 months and 28 days old, he or she was allocated for the group of 11-year-old children whereas if a person was 11 years, 5 months and 29 days old, he or she was allocated for 12-year-old students. The fitness analysis considered completed years and months of life in accordance with the requirements specified by Dobosz [3]. Finally, 190 girls (K) and 203 boys (M) were qualified for the statistical analysis. The average age of girls was 14.25 years and the experience of playing an instrument was 7.25 years. In the group pf boys, the figures were 14.44 and 7.40 respectively. The most girls practiced playing the grand piano (44 subjects) and the least girls played the Western concert flute (21 subjects). As for boys, the largest number of them practiced playing the guitar (42 people) whereas the Western concert flute was the least played instrument (23 subjects). Violin female students had the longest experience of playing the instrument (10.2 years) while those who played the flute demonstrated the shortest period (4.6 years). Among boys, these were respectively: the violin (10.2 years) and the Western concert flute (11.94 years).

## 3. **Research method and tools**

The studies were conducted in the period from 10 September to 20 December 2016 by a team of six under the guidance of the author. The research was performed in each of the schools involved in the study using the Eurofit test according to the adopted order [4], Table 1. Following a 5-7-minute warmup under the guidance of a member of the research team, each of the subjects started the first test. The break between tests was not longer than 3 minutes.

Table 1. Type and order of Eurofit tests

| Order of tests | Category | Factor |
|---|---|---|
| 1 | Balance | Balance of the whole body |
| 2 | Agility | Agility |
| 3 | Strength | Explosive strength |
| 4 | | Static strength |
| 5 | Endurance | Strength of body trunk |
| 6 | | Functional strength |
| 7 | Speed | Agility run |
| 8 | | Speed of upper limb movements |
| 9 | Cardiorespiratory efficiency | Cardiorespiratory efficiency |

Source: Mucha [2016]

## 4. Results

The comparison of position parameters with reference values for each age category ensures that the level of real physical performance can be determined for each group [Dobosz], Table 2. The results achieved by the subjects in subsequent tests of the Eurofit test battery were published in the author's previous paper [ XXXX].

Table 2. The significance of differences between Eurofit test results achieved by students of music schools and reference levels in the selected age categories (n) 393

| Gender | Tests of the Eurofit Test Battery | Age (years) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| K (female) | Balance | 0.00068 *** | 0 *** | 0.00791 ** | 0.00714 ** | 0 *** | 0 *** | 0.00027 *** | 0.03624 * |
| | Agility | 0.01189 * | 0 *** | 0.00843 ** | 0.00292 ** | 0 *** | 0 *** | 0.00003 **** | 0.00190 ** |
| | Explosive strength | 0.00072 *** | 0 *** | 0.00903 ** | 0.00384 ** | 0 *** | 0 *** | 0.00004 *** | 0.00241 ** |
| | Static strength | 0.00068 *** | 0 *** | 0.00885 ** | 0.00338 ** | 0 *** | 0 *** | 0.00003 *** | 0.00216 ** |
| | Endurance of trunk muscles | 0.00070 *** | 0 *** | 0.00855 ** | 0.00347 ** | 0 *** | 0 *** | 0.00004 *** | 0.00240 ** |

| Group | Measure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Functional endurance | 0.00072 *** | 0 *** | 0.00885 ** | 0.00377 ** | 0 *** | 0 *** | 0.00004 *** | 0.00241 ** |
| | Agility run | 0.00071 *** | 0 *** | 0.00903 ** | 0.00377 ** | 0 *** | 0 *** | 0.00004 *** | 0.00248 ** |
| | Speed of upper limbs | 0.00071 *** | 0 *** | 0.00897 ** | 0.00367 ** | 0 *** | 0 *** | 0.00007 *** | 0.00248 ** |
| | Respiratory endurance | 0.00103 ** | 0 *** | 0.00832 ** | 0.00360 ** | 0 *** | 0 *** | 0.00004 *** | 0.00240 ** |
| M (male) | Balance | 0.00007 *** | 0 *** | 0.01187 * | 0.00826 ** | 0 *** | 0 *** | 0 *** | 0.00145 ** |
| | Agility | 0.00007 *** | 0 *** | 0.01356 * | 0.02935 * | 0.18754 | 0 *** | 0 *** | 0.00123 ** |
| | Explosive strength | 0.00009 *** | 0 *** | 0.01403 * | 0.00861 ** | 0.00001 *** | 0 *** | 0 *** | 0.00161 ** |
| | Static strength | 0.00009 *** | 0 *** | 0.01198 * | 0.00885 ** | 0.00003 *** | 0 *** | 0 *** | 0.00135 ** |
| | Endurance of trunk muscles | 0.00009 *** | 0 *** | 0.01379 * | 0.00849 ** | 0.00001 *** | 0 *** | 0 *** | 0.00159 ** |
| | Functional endurance | 0.00009 *** | 0 *** | 0.00781 ** | 0.00885 ** | 0.00001 *** | 0 *** | 0 *** | 0.02497 * |
| | Agility run | 0.00015 *** | 0 *** | 0.01379 * | 0.00903 ** | 0.00001 *** | 0 *** | 0 *** | 0.00163 ** |
| | Speed of upper limbs | 0.00009 *** | 0 *** | 0.01403 * | 0.00891 ** | 0.00001 *** | 0 *** | 0 *** | 0.00243 ** |
| | Respiratory efficiency | 0.00013 *** | 0 *** | 0.01198 * | 0.00861 ** | 0.00001 *** | 0 *** | 0 *** | 0.00163 ** |

Source: Author's own research

Legend, Table 2:     Red – High significance of differences (***)

Blue – Medium significance of differences (**)

Green – Low significance of differences (*)

White – insignificant difference

As the above-presented table shows, the results obtained in every age category and test are always significantly different than the established standard levels. A high significance of differences among girls can be also observed in case of balance, functional endurance, agility run, upper limb speed, explosive and static strength at the age of: 11, 12, 15, 16, and 17 years, in case of agility: 12, 15, 16, and 17 years, endurance of trunk muscles: 11, 12, 15, 16, and 17 years, and cardio-respiratory efficiency: 12, 15, 16, 17 years. As far as boys are concerned, significant differences were reported in case of endurance of trunk muscles, functional and cardio-respiratory efficiency, agility run, upper limb speed, balance, and explosive and static strength at the age of: 11, 12, 15, 16, and 17 years, agility: 11, 12, 16, and 17 years. It should be noted that a high significance of differences among both sexes was observed in nearly the same tests. The lack of significance was noticed only in the agility test among 15-year-old boys.

A legend for the figures including box plots, Fig. 1-18.

Black square – reference value of the test for a given age and gender

Red circle – average value obtained in the test and age group by female subjects

Blue triangle – average value obtained in the test and age group by male subjects

The analysis of the results achieved in the balance test revealed that its level tended to increase from 11 to 14 years, then decreased to the value recorded at the age of 12 among girls. As for boys, the level maintained the same except for the age of 14 years, where the number of committed mistakes decreased, Fig. 1, 2.

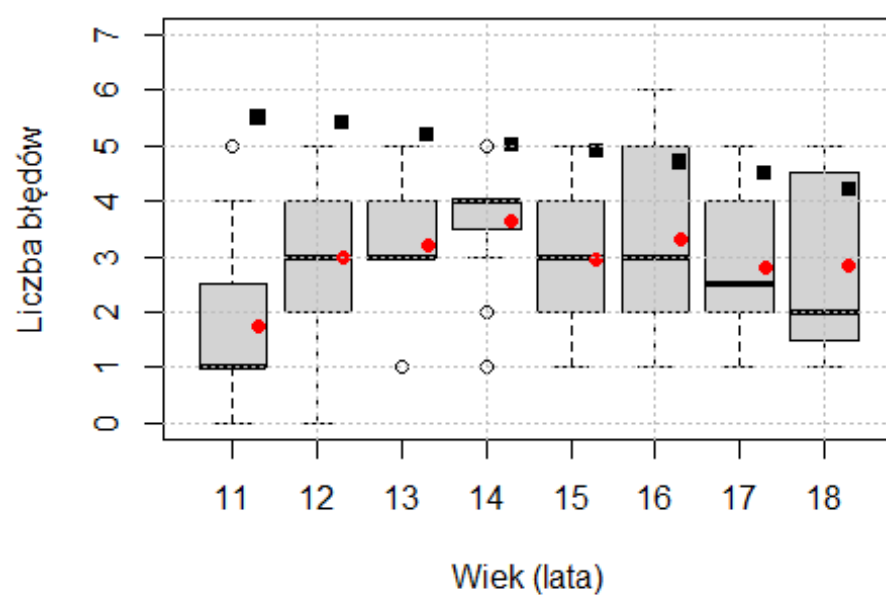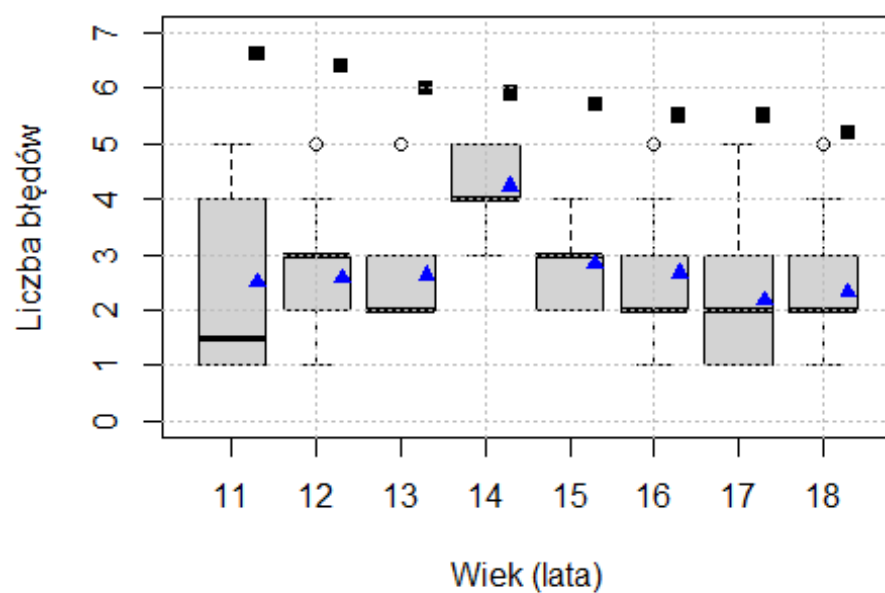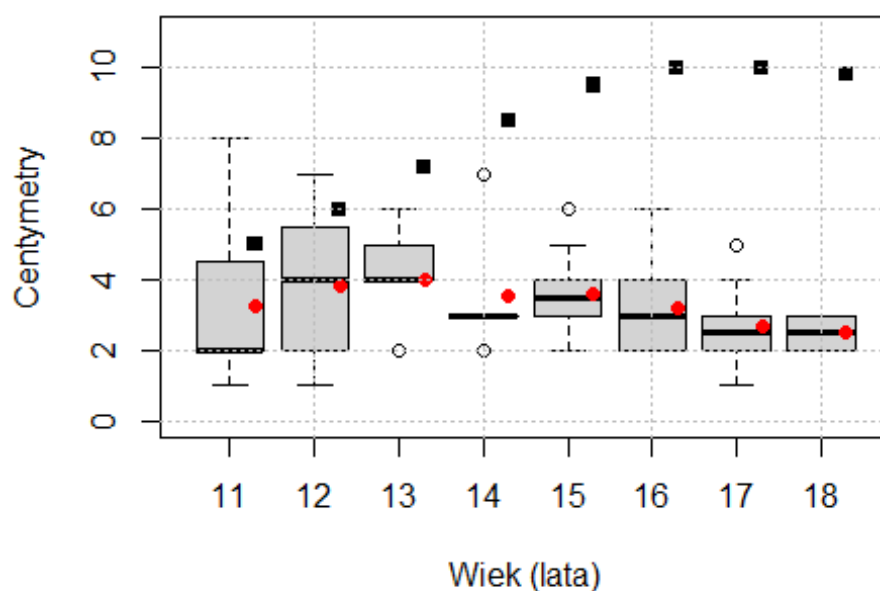Fig. 1. Changes in the level of balance among 11-18-year-old girls (n) 190



Fig. 2. Changes in the level of balance among 11-18-year-old boys (n) 203

The results obtained in the agility test revealed that the levels tended to go up among girls until the age of 13 years, then they decreased achieving lower values than the initial ones. Among boys though, these levels remained the same and did not show any deviations except for the age of 15, where the difference versus reference value was statistically insignificant, Fig. 3, 4.

Fig. 3. Changes in the level of agility among 11-18-year-old girls (n) 190



The levels reported in the explosive strength test among girls did not reveal any significant differences. It should be highlighted that with age the levels tended to differ from reference values among subjects, Fig. 5, 6.

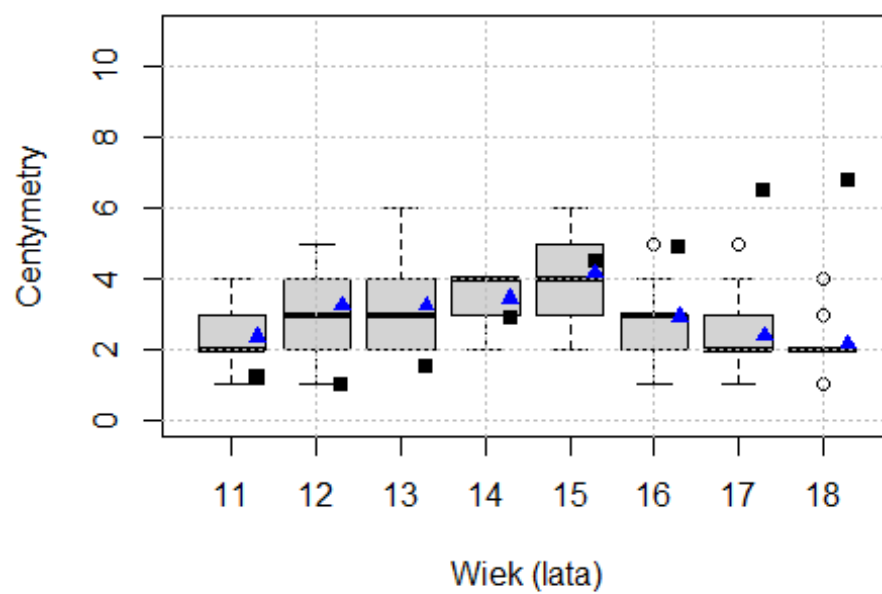Fig. 4. Changes in the level of agility among 11-18-year-old boys (n) 203



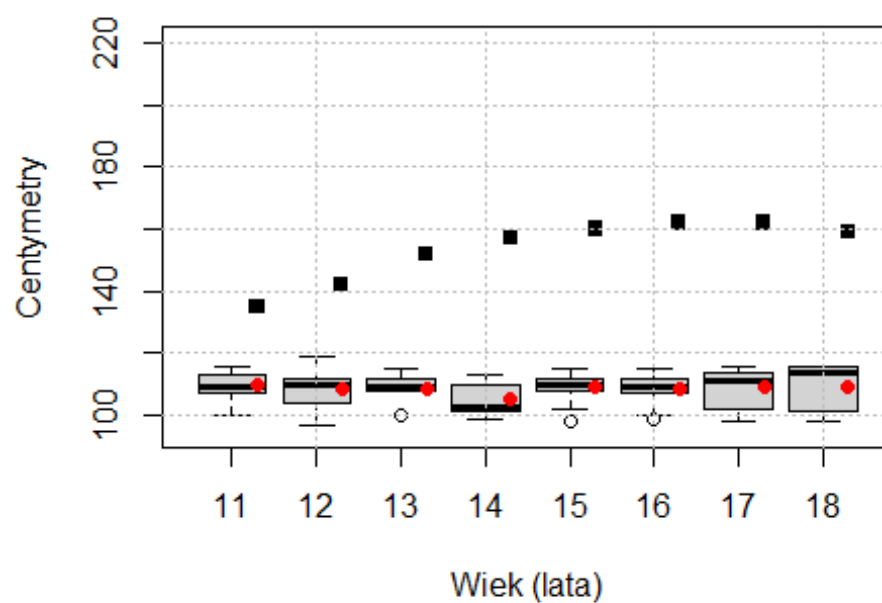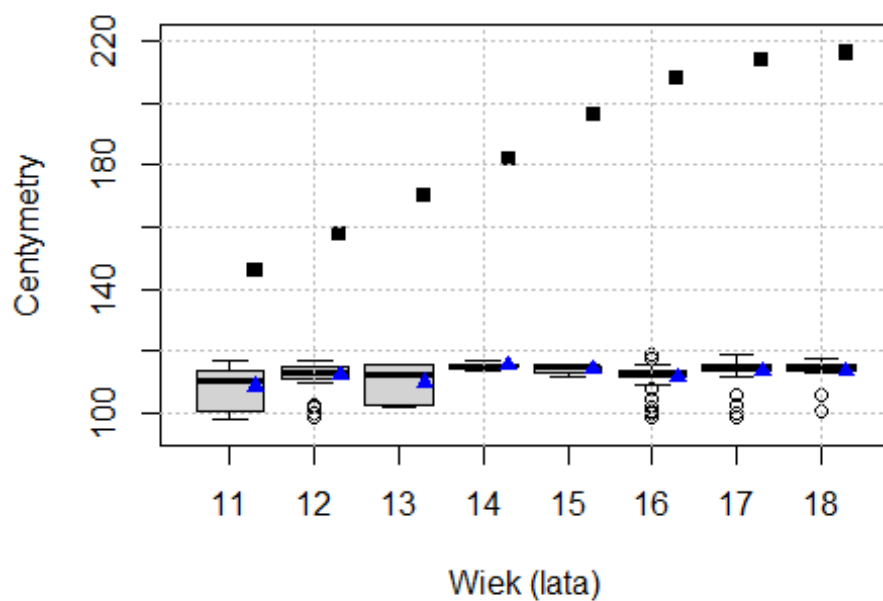Fig. 5. Changes in the level of explosive strength among 11-18-year-old girls (n) 190

Fig. 6. Changes in the level of explosive strength among 11-18-year-old boys (n) 203



The results achieved in the static strength test turned out to be almost parallel in relation to reference levels among girls and boys thus revealing a steady growing tendency, but not higher than reference values. It is noteworthy that the levels were higher in boys than in girls, Fig. 7, 8.

The values reported in the trunk muscle endurance test were very similar and tended to be steady and lower as compared to reference levels, Fig. 9, 10.

Fig. 7. Changes in the level of static strength among 11-18-year-old girls (n) 190
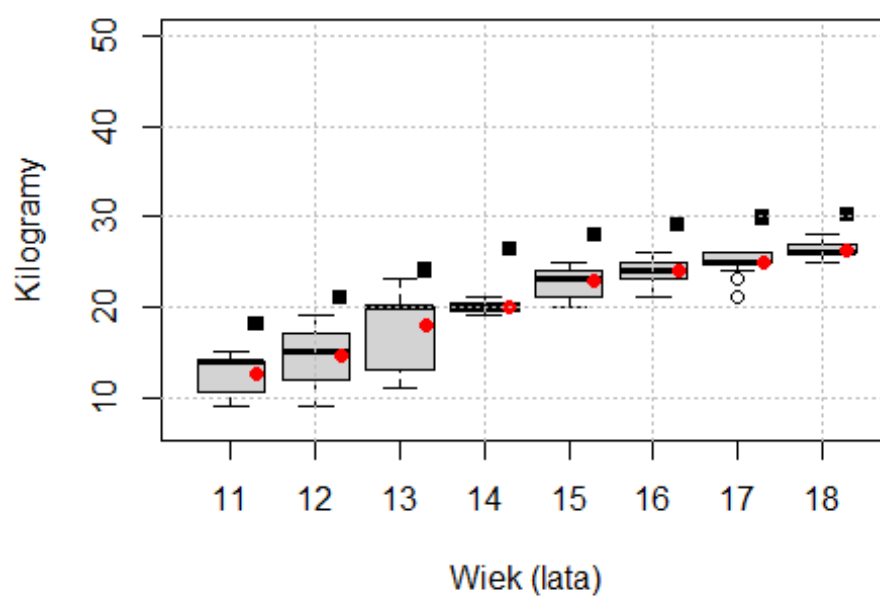


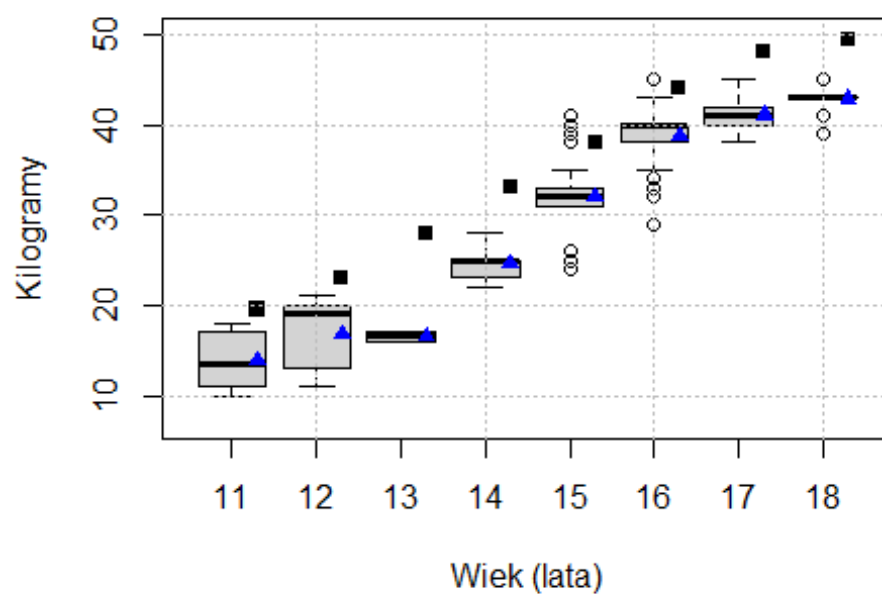Fig. 8. Changes in the level of static strength among 11-18-year-old boys (n) 203

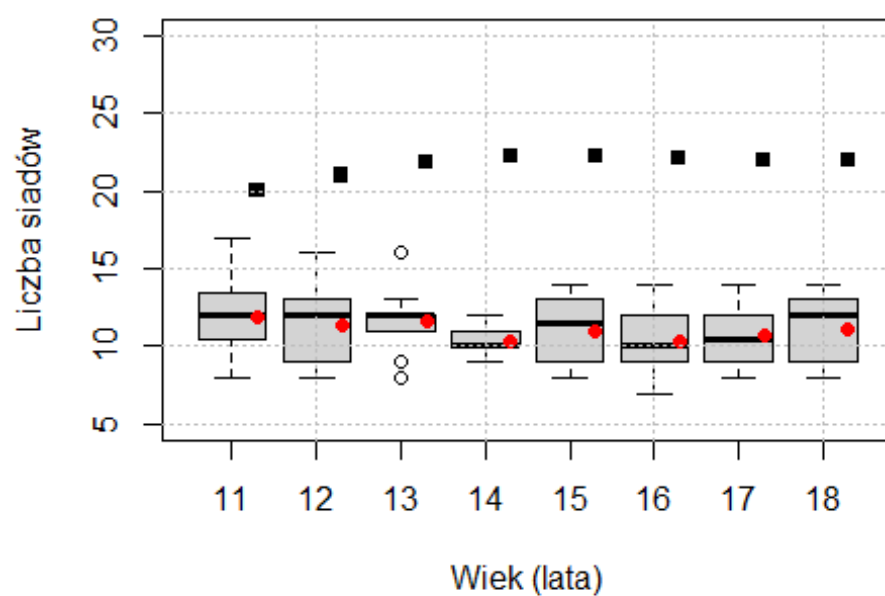Fig. 9. Changes in the level of trunk muscle endurance among 11-18-year-old girls (n) 190
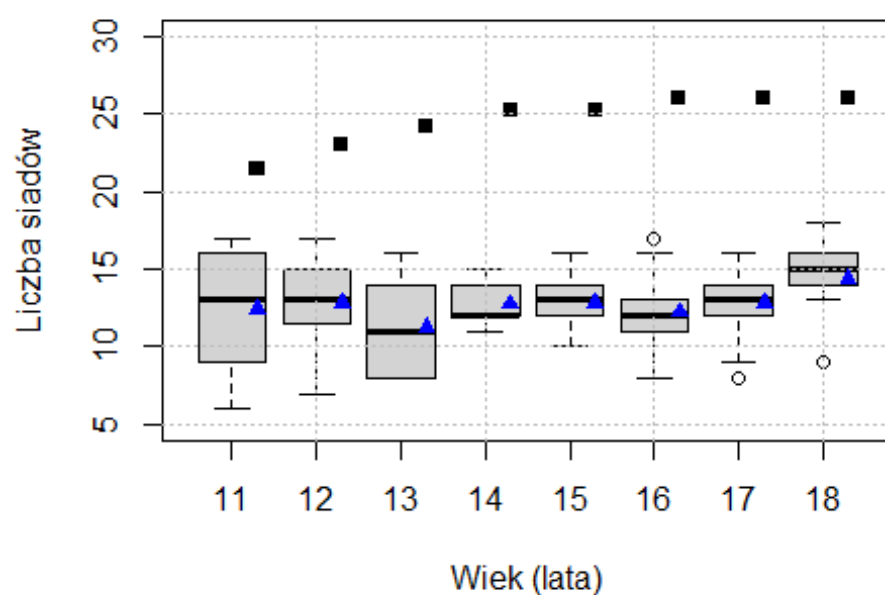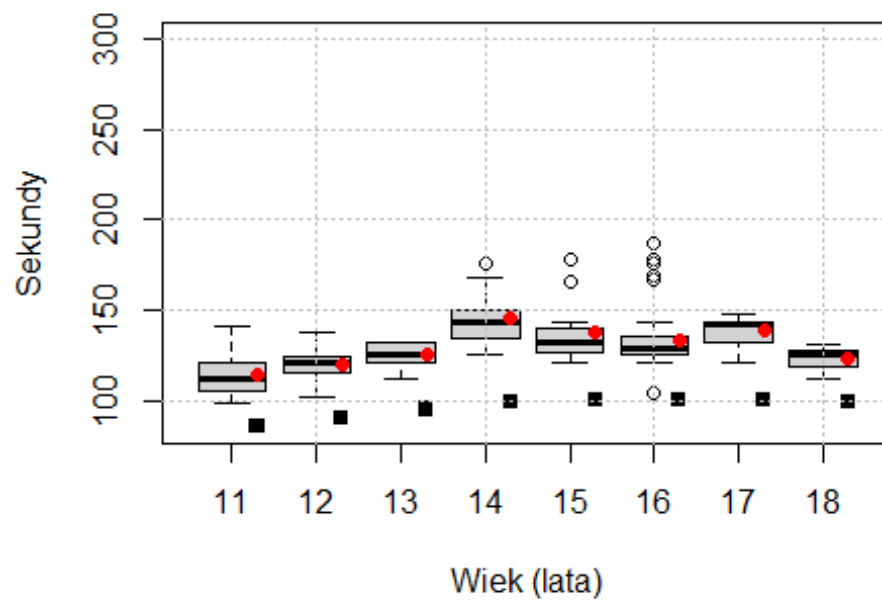
Fig. 10. Changes in the level of trunk muscle endurance among 11-18-year-old boys (n) 203



The results achieved in the functional endurance test turned out to be almost parallel in relation to reference levels among girls and boys, Fig. 11, 12

Fig. 11. Changes in the level of functional endurance among 11-18-year-old girls (n) 190



The levels achieved in the agility run test were parallel in relation to reference values until the age of 15 among girls and until the age of 13 among boys. At an older age, the run time was longer, Fig. 13, 14.

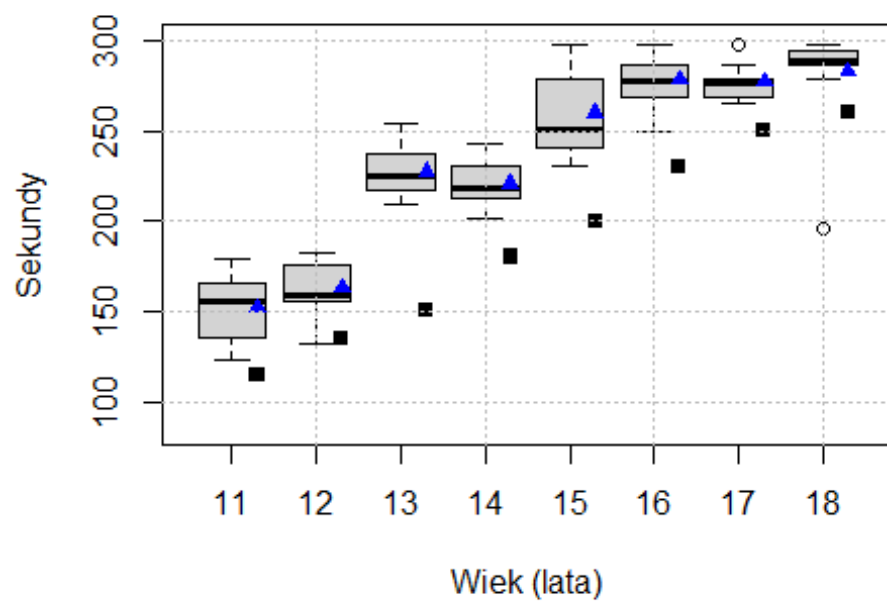Fig. 12. Changes in the level of trunk functional endurance among 11-18-year-old boys (n) 203



Fig. 13. Changes in the level of agility run among 11-18-year-old girls (n) 190
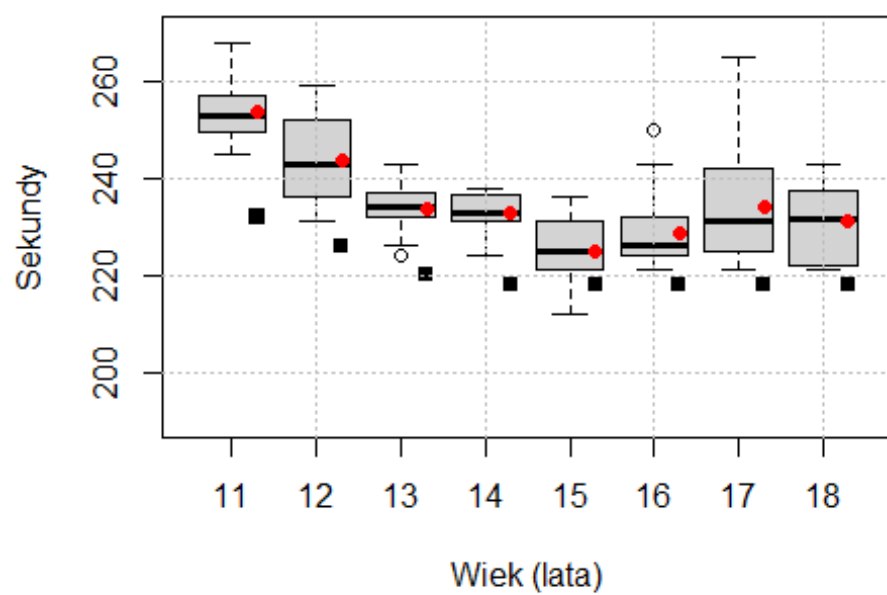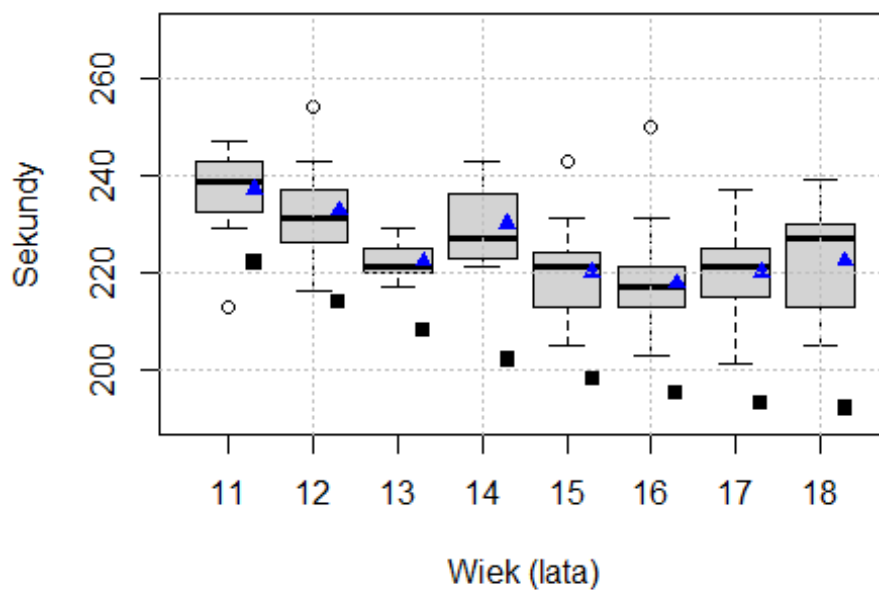
Fig. 14. Changes in the time of agility run among 11-18-year-old boys (n) 203



The levels observed in the upper limb speed test were almost parallel among girls as compared to reference values until the age of 16, representing lower values in relation to the reference ones. After the age of 16, the time increased, Fig. 15, 16.

The results achieved in the cardio-respiratory test were nearly parallel among girls in relation to reference values, always representing lower values. It should be noted that until the age of 14, the time was longer, then revealed slight deviations and finally maintained steady levels. Among boys, a steady growing trend was observed until the age of 16, then stabilization was reported, Fig. 17, 18.

Fig. 15. Changes in the levels of the upper limb speed test among 11-18-year-old girls (n) 190
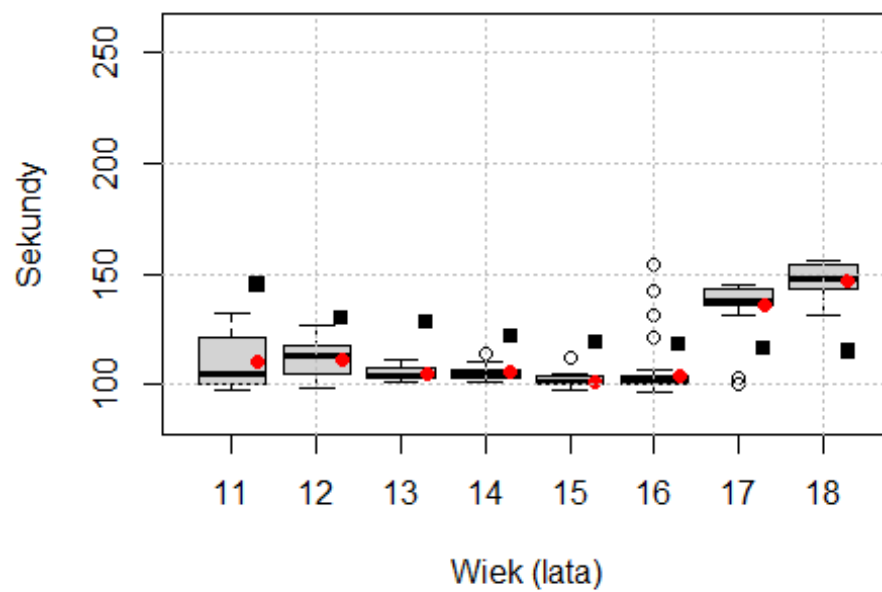


Fig. 16. Changes in the levels of the upper limb speed test among 11-18-year-old boys (n) 203
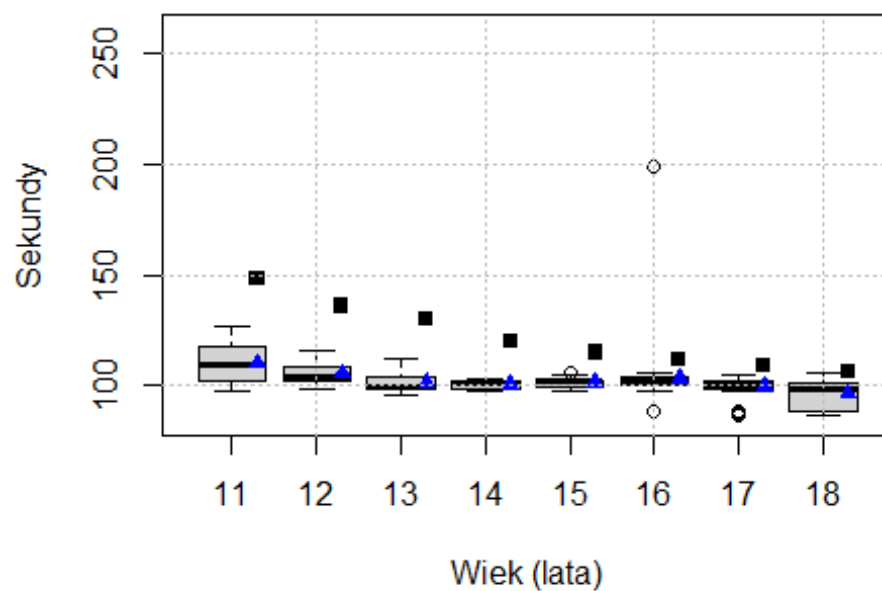
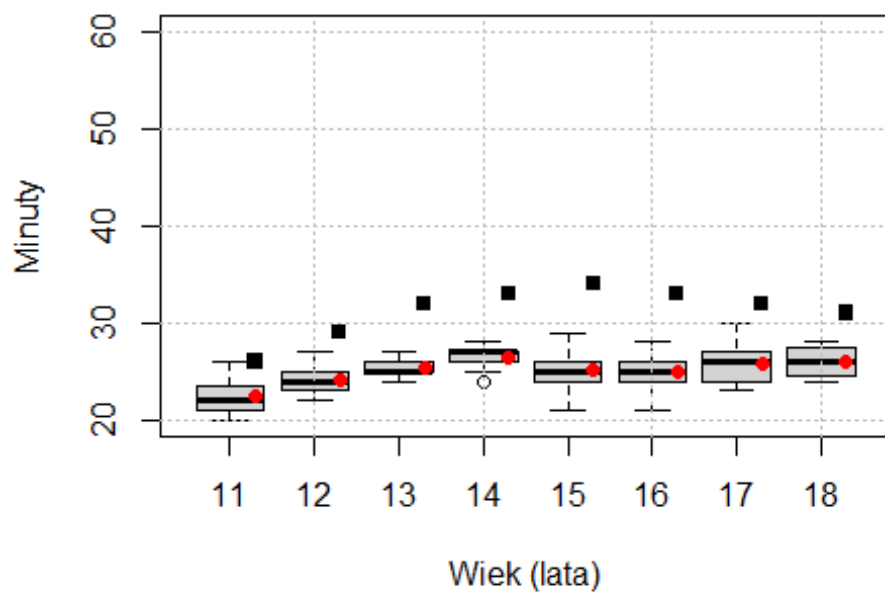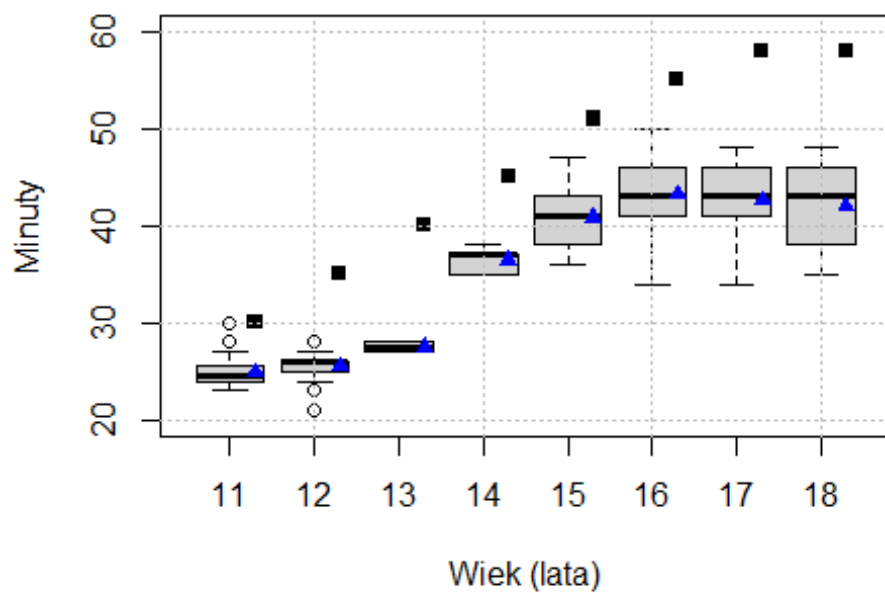Fig. 117. Changes in the levels of cardio-respiratory endurance among 11-18-year-old girls (n) 190



Fig. 18. Changes in the levels of cardio-respiratory endurance among 11-18-year-old boys (n) 203

5. **Discourse**

It should be pointed out that agility levels observed in girls tended to differ from reference values with age, yet, among boys these levels were higher until the age of 14, then tended to decrease. The values of explosive and static strength were the consequence of pursued physical activity as music performance does not require high levels of physical fitness. It should be emphasized though that the level of endurance in every age and gender group was higher than reference values which is connected with the adaptation to the music performance using upper limbs. The time of run in the agility test was longer than reference levels for every age and sex, but tended to be shorter among boys than among girls. Functional endurance revealed a steady decreasing trend among boys and no significant swings were observed in girls. As regards the upper limb speed test, a steady slight falling tendency with lower levels than the reference ones was observed in boys. The cardio-respiratory efficiency results were always higher than the reference levels.

6. **Conclusions**

1. The level of the skills specific for musicians was significantly higher as compared with reference values.
2. The level of physical performance among musicians significantly differed from reference values.

**References**

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