ANTHROPOMETRIC AND FUNCTIONAL CHANGES AND THEIR RELATIONSHIP AFTER TWO-YEAR AEROBIC GYMNASTICS TRAINING

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Annotation: *The submitted study presents the results of 2-years observation of selected anthropometric (body height, body weight, BMI, fat mass and active body mass) and functional parameters (heart rate, systolic and diastolic bl ood pressure and QRSmax at rest and after loading) in the group of aerobic gymnastics juniors. We detected significant changes of all observed anthropometric parameters during two-years training. Moreover, functional characteristics of the heart rate and systolic blood pressure after load as well as the maximum QRS vector at rest and after load, were also significant altered. Applying the pair correlation function and regression analysis, we evaluated individually the mutual relationship of all observed parameters. Statistically significant correlation was found between the maximum spatial QRS vector (QRSmax at rest and even after the load) and the body weight, body mass index (BMI), fat mass and active body mass (ABM).*

Keywords: *aerobic gymnastics, sports training, junior female competitors, anthropometric and functional characteristics.*

INTRODUCTION

Aerobic gymnastics currently belongs in its physical structure and exercise shape to coordination difficult, aesthetic and technical disciplines with energy coverage from anaerobic glycolytic system. Developing sports performance here, as well as in other sports, limits the level of specific fitness and coordination skills in a mutual harmony with a rational technique of the movements and shapes of different workout difficulty. Specific sports performance is presented by competition set, creation of which is under specific rules of the International Gymnastics Federation [1, 4].

Detailed analysis of changes in basic motoric, functional and anthropometric parameters from the field of aerobic gymnastics couching completely absents in the current literature. Research in this area is rare and uncompleted [1]. Therefore in our study we focused on the basic values and changes of anthropometric and functional parameters of aerobic gymnastics competitors.

METHODOLOGY

Selected group consisted of 12 girls - junior category competitors. Average age of the group at the beginning of the study was 14.08 ± 1.19 years [13 – 17 years]. Probands completed a regular sports training (120 minutes 5 times per week) for 2 years (092003 – 122005). We measured selected anthropometric (body height, body weight, BMI, fat mass and active body mass (ABM)) and functional parameters (heart rate (HR), systolic and diastolic blood pressure (BPs, BPd) and QRSmax amplitude [1] at rest and after load). Data were collected regularly, every 12 weeks. Afterwards we tested the relationship between anthropometric and functional parameters by correlation and regression analysis. For statistical significant results we considered difference at the level less than 0.05.

RESULTS

During 2 years of the study the anthropometric parameters continuously increased (Table 1). However, in comparison with the general population of girls in appropriate age [3, 4], our probands achieved only under-average level during whole study. On the contrary, our results were consistent with studies oriented to sport gymnastics [5, 8]. Since aerobic gymnastics is based on continuous high intensity movements, a subtle figure is an advantage for a competitor. During 2 years of the study the fat mass increased (1.42 ± [2.30] %) (Table 1). These differences are in line with fat mass increase in gymnastics [6]. The fat mass of our probands was at the lower limit of optimal range during the monitoring, or below this optimal range, compared to the general population of girls in the appropriate age [5]. This might be due to different speed of biological aging, or other ontogenetic specifics of probands. In sport training, ABM increases since fat mass and body weight are stable or decreasing. [2]. This trend was not confirmed in our probands.

HR decrease at rest and also after load is considered to be an evidence of good fitness of athletes [6]. It is considered as a sign of adaptation of the cardiovascular system. However in some gymnastics [2, 3, 6, 5] HR after load is decreased and this was confirmed also in our study of aerobic gymnastics [1]. This might be due to the fact that aerobic gymnastics achieve maximal HR during the performance [2]. BPs at rest decreases due to long-term systematic physical load [2], what was confirmed also in our results. BPs at rest in our study corresponded with the results of Štulrajter [6], although it was higher compared to other studies [6, 2]. Unfortunately, we could not compare BPs data after load directly with other studies because BPs was not measured in them. We are aware of only one study in the literature [3], which showed similar mild increase of BPs after two years of gymnasts’ sports training. We detected similar mild increase of BPd at rest even after load during the monitoring period. Detected BPd increase at rest is comparable with the results published by others [7, 2].

QRSmax at rest in our study, was higher in all age categories compared with results of Regecová - Andrásyová [1]. In practice, there are still missing standards for QRSmax in general population as well as athletes at this age. From a logical point of

view, we may only assume that the QRSmax at rest and after load was decreased due to aerobic sports training and may be also a reflection of the initial phase of myocardial remodeling. Applying the pair correlation and regression analysis, we evaluated the relationships of all individually selected anthropometric and functional parameters. Our data confirmed significant ($p < 0.05$) negative relationship between QRSmax at rest and the body weight, BMI, fat mass, ABM, respectively [1]. Similar results were also found between QRSmax after load and body weight ($p < 0.01$), ABM and BMI ($p < 0.05$). The linear relationship between BP and body height is less obvious with age [2]. On the other hand the relationship between BP and BMI/ fat mass, as described by Regecová et al. [2], has been not confirmed. These data demonstrate the load specificity in aerobic gymnastics and particularly adaptive response to the load. Our results indicate the necessity of simultaneous evaluation of anthropometric parameters together with electrocardiograms and vector-cardiograms. These relationships should be taken into account primarily in early adulthood period.

CONCLUSION

Our results showed that anthropometric and functional changes caused by aerobic training load are clear progressive, what is different compared to other sports. Quantitative extent of the changes of functional parameters between the measurements is in most cases only marginal. Our data confirm that the training load components are closely related, and number of factors including the intensity and specific targeting of sports training in different periods of the training program affects the changes in anthropometric and functional parameters. Since the studies testing training load in aerobic gymnastics are very rare and specific and does not provide an adequate objective comparison for our results, our study offers basic and original view to the relationships between functional and anthropometric parameters, as well as describes alterations of selected parameters after load in the group of youth aerobic gymnasts.

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