

# PHYSIQUE AND BODY COMPOSITION OF GIRLS PRACTISING CONTEMPORARY DANCE

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## Abstract

**Introduction.** Physique and body composition are often explored in sport-related research. This is due to the fact that morphological features can be useful for determining a person's predispositions for practising a given type of physical activity. Dance, as any other sports discipline, has an impact on the physique and motor skills of those who practise it. Most research concerning the physique and body composition of dancers conducted so far has focused on persons practising ballet or competitive ballroom dancing. Investigating these issues in contemporary dancers is a new field of study. The aim of the current study was to examine the physique and body composition of girls aged 14-17 years practising contemporary dance. **Material and methods.** The study involved 23 girls who trained contemporary dance twice a week for 2 hours. The participants of the study had been training since the age of six. Basic anthropometric measurements were performed. Body composition was analysed based on parameters measured using a Tanita body composition analyser. **Conclusions.** The analysis found that girls training contemporary dance were characterised by a leptosomatic physique. BMI values in both younger and older contemporary dancers indicated that their weight was normal. Compared to girls who did not practise any particular type of sport, contemporary dancers had a lower weight, a lower body water percentage, and a lower body fat percentage. The dancers were also characterised by a greater circumference of the waist, hips, arm, and chest compared to untrained peers.

**Key words:** physique, body composition, contemporary dance

## Introduction

Physical activity is considered to be one of the most important factors determining health and physical fitness [1]. Regular physical exercise not only causes a decrease in the amount of fatty tissue, an increase in muscle mass, and a strengthening of the bones and joints, but also an increase in heart muscle mass, a reduction in blood pressure, a decrease in heart rate, and a slowing of respiratory rhythm [2, 3].

One of the most popular types of physical activity is dance. The therapeutic benefits of engaging in this traditional form of movement, which has been practised for centuries, have been reported for several years. Garbacik and Węgrzyn [4] describe choreotherapy, that is treatment involving dance and its elements, as one of the forms of movement therapy. The therapeutic function of dance consists in the fact that it enhances one's motor coordination, general physical condition, body image, and mood and well-being, as well as improving body awareness [4, 5, 6]. A study conducted by a research group from the Faculty of Medicine at the University of Rzeszów showed that choreotherapy can have a significant impact on stimulating development in the emotional and social spheres in children with psycho-motor retardation [7].

Apart from impacting the psychological sphere, dance also has a positive influence on the physical sphere. As any other

sports discipline, physical activity related to dance can alter the body, that is one's figure, physical fitness, and motor skills [8, 9, 10].

Many authors have explored issues having to do with physique and body composition. Krakowiak et al. [11] examined athletes who practised short-distance running and established that the body type that dominated among them was the mesomorphic type. Similar results were obtained regarding the body types of judoists [12]. On the other hand, research performed by Kozłowska et al. [3] on a group of female junior combat sports athletes showed that they had a leptosomatic body type. This was also observed in Pilewska et al.'s [14, 15, 16] research, where a group of dancesport athletes practising different styles were examined: most dancers had slim bodies. Artistic gymnasts were classified as having a slender body type, as well, in a study by Poliszczuk et al. [17]. Nowacka-Chiari [18], who compared the physique of young female swimmers with that of persons who did not train any sports, found that girls practising swimming had specific physical features. In a study of basic auxological parameters of students of physical education, Smolarczyk et al. [19] found that these young people were characterised, among others, by a greater body height and weight compared to the general population. Another group of young persons practising sports whose physique has been analysed is volleyball players: Pezala et al.'s [20] study involved a group of 14-year-old

female players. Moreover, Pietraszewska et al. [21] investigated the amount and distribution of body fat in professional soldiers and police officers. Their analysis showed that police officers had a higher body fat level and a greater tendency for abdominal obesity compared to professional soldiers.

As far as research concerning dancers is concerned, Pilewska et al. were some of the authors who examined their physique. Pilewska et al.'s [15, 22] research involved male and female dancers of the Latin style who were highly trained. Similar research was conducted using bioelectrical impedance on a group of professional dancers from a dance school in Athens by Greek researchers [23]. Researchers from Serbia, on the other hand, used bioelectrical impedance to determine BMI values and body fat levels in a group of female ballet dancers [24]. The physique and body composition of female dancers practising ballet were also studied by Mihajlović et al. [25], and body fat percentage was examined in 112 female ballet dancers aged 15 years and 33 male ballet dancers aged 18 years by researchers from Houston [26]. Moreover, a group of researchers from the University of Zagreb carried out a study exploring the physique and body

composition of 15 soloists and 15 members of the corps de ballet from the Croatian National Theatre Ballet [27].

Since most of the research concerning physique and body composition involving dancers conducted so far has examined dancers practising ballet or dancesport, carrying out such analyses in contemporary dancers is a new area of investigation in the field. The aim of the current study was thus to examine the physique and body composition of girls aged 14-17 years practising contemporary dance.

## Material and methods

The research was conducted in June 2016 on a group of 23 girls aged 14-17 years. The subjects participated in regular contemporary dance classes, held twice a week for 2 hours. As the dancers had been dancing since the age of six, they were divided into two age groups: the younger one, consisting of dancers aged 14-15 years ( $n = 12$ ), and the older one, composed of dancers aged 16-17 years ( $n = 11$ ). The following anthropometric parameters were measured: height; weight; sitting height; waist, hip,

**Table 1.** Anthropometric indices of girls practising contemporary dance

Index	Classification	Formula
BMI* (3-18 years)	Underweight: < 5th percentile	[Weight in kg/height <sup>2</sup> in m]
	Normal weight: 5th-85th percentile	
	Overweight: 85th-95th percentile	
	Obesity: > 95th percentile	
Rohrer index (classification based on Kowalewska)	Leptosomatic type: $x-1.22$	[Weight in g/height <sup>3</sup> in cm] x 100
	Athletic type: 1.23-1.43	
	Pyknic type: $1.44-x$	
Marty index	Small circumference: $x-39.0$	[Chest circumference at height xi in cm/height in cm] x 100
	Average circumference: 39.1-45.6	
	Large circumference: $45.7-x$	
Skerlj index	Thin: $x-32.4$	[Thigh circumference/height] x 100
	Of medium build: 32.5-36.7	
	Corpulent $36.8-x$	
Pignet index	Very strong: $x-9.9$	Height – [chest circumference at rest + weight]
	Strong: 10-15.9	
	Good: 16-20.9	
	Weak: 21-30.9	
	Very weak: 31-35.9	
Chest to hip circumference ratio	Poor: 36-x	[Chest circumference/hip circumference] x 100
	Masculine proportions: 91.8-98.4	
	Feminine proportions: 76.6-84.6	
Oeder index	Intermediate proportions: 84.7-91.7	[Actual weight/theoretical weight] x 100
	Very poor: $x-83$	
	Poor: 83.01-87.53	
	Medium: 87.54-96.57	
	Good: 96.58-101.1	
	Very good: 101.11-x	

\* BMI was assessed using percentile growth charts designed based on data representative of the population of youth and children in Poland. The data were collected during the OLAF and OLA projects, coordinated by the Children's Memorial Health Institute, in the years 2007-2012.

thigh, and arm circumferences; as well as chest circumference at rest and during maximal inspiration and expiration. Body composition was analysed based on the following parameters measured using a Tanita MC-980 Body Composition Analyzer: BMR (Basal Metabolic Rate in kcal), FAT (body fat amount in % and kg), FFM (fat-free mass), and TBW (total body water). Based on the values of the parameters, the following anthropometric indices were calculated: the Body Mass Index (ratio of weight to height), the Rohrer index (assessing body type), the Marty index (assessing chest circumference), the Skerlj index (ratio of greatest thigh circumference to height), the Pignet index (assessing body build using chest circumference, weight, and height), the chest to hip circumference ratio, and the Oeder index (assessing nutritional status) [28]. Owing to the fact that all the subjects in the study were female, the classifications presented in Table 1 refer to women only.

The data collected in the study were presented in tables. Arithmetic means, standard deviations, and coefficients of variation were calculated. The statistical significance of the differences between the values obtained for the two age groups was then measured using ANOVA.

## Results

Table 2 shows the values of particular parameters of physique and body composition recorded for the participants of the study, divided into two age groups. The study showed that the

weight of the girls in the two groups was similar and only slightly higher in the case of the older group (51.4 kg for girls aged 14-15 years and 51.9 kg for those aged 16-17 years). A similar observation was made for height (162.3 cm for the younger group and 164.2 cm for the older group) and sitting height (82.6 cm and 85.8 cm for the two groups, respectively). Minor differences were also noted in the measurements of waist, hip, thigh, and arm circumferences. However, an analysis of the results for these parameters showed that younger girls were characterised by a higher waist (71.5 cm) and arm (25.9 cm) circumference than older ones (68.5 cm and 25.7 cm, respectively). The differences were statistically significant only when it came to sitting height.

The highest differences between the two age groups were observed with regard to weight. When it comes to BMI values, younger girls were characterised by higher values of this parameter (19.5) than older ones (19.2). Girls aged 14-15 years also had higher values of the coefficient of variation. An additional analysis showed that the differences in the BMI values of the two groups were statistically significant.

The values of the Rohrer index recorded for the two groups showed that regardless of the age group, the girls were characterised by a leptosomatic physique. The results obtained for the Skerlj index were similar: based on the values of 31.8 (for girls aged 14-15 years) and 31.6 (for those aged 16-17 years), the subjects could be classified as thin. As far as the Pignet index is concerned, it amounted to 29.7 for younger girls and 31.3 for older

**Table 2.** Physique and body composition of girls practising contemporary dance with respect to the two age categories

Variables	Age: 14-15 years					Age: 16-17 years					d	p
	x	s	v	min	max	x	s	v	min	max		
Weight	51.4	7.4	14.3	36.9	62.7	51.9	5.8	11.2	41.4	61.9	-0.5	0.854
Height	162.3	6.3	3.9	150.0	172.0	164.2	6.8	4.1	153.0	179.0	-1.8	0.505
Sitting height	82.6	3.3	4.0	78.0	88.0	85.8	3.4	4.0	79.0	92.0	-3.2	0.032*
Waist circumference	71.5	6.4	9.0	60.0	84.0	68.5	3.9	5.7	63.0	73.0	3.0	0.187
Hip circumference	92.2	6.0	6.6	78.0	99.0	93.2	4.2	4.5	88.0	99.0	-1.0	0.649
Thigh circumference	51.6	4.1	7.9	43.0	56.0	51.9	2.7	5.3	47.0	57.0	-0.3	0.825
Arm circumference	25.9	2.9	11.1	21.0	30.0	25.7	1.3	5.2	23.0	27.0	0.2	0.844
BMI	19.5	2.3	11.8	15.4	23.0	19.2	1.4	7.2	16.4	21.3	0.2	0.784
BMR (kcal)	1387.6	82.7	6.0	1208.0	1495.0	1397.8	77.4	5.5	1288.0	1553.0	-10.2	0.763
Fat percentage	22.3	6.3	28.5	11.7	28.8	17.1	4.2	24.6	8.6	22.8	5.1	0.034*
Fat mass (kg)	11.8	4.4	37.5	4.9	16.7	9.1	2.9	32.4	3.6	13.0	2.7	0.104
FFM	39.6	4.0	10.0	30.4	46.0	42.8	3.3	7.8	37.8	49.9	-3.2	0.049*
TBW percentage	29.0	2.9	10.0	22.3	33.7	31.4	2.4	7.7	27.7	36.5	-2.4	0.048*
Rohrer index	1.20	0.1	11.9	0.9	1.4	1.17	0.1	8.3	1.0	1.4	0.0	0.603
Marty index	50.0	3.1	6.3	45.9	55.3	49.4	3.1	6.4	45.8	55.6	0.6	0.630
Skerlj index	31.8	2.2	6.9	28.7	35.0	31.6	1.5	4.7	29.6	33.5	0.1	0.861
Pignet index	29.7	10.8	36.3	14.3	47.0	31.3	7.5	24.0	18.6	42.6	-1.6	0.690
Chest to hip circumference ratio	88.2	4.1	4.7	82.6	96.7	86.9	3.2	3.7	83.9	93.4	1.2	0.437
Oeder index	85.8	9.7	11.3	70.0	104.5	83.9	7.4	8.8	70.2	95.6	1.9	0.601

\* statistically significant differences at the level of  $p = 0.05$ .

ones, which means that the former had a weak physique and the latter had a very weak one.

Body proportions were assessed by means of the chest to hip circumference ratio. Higher values of this parameter were found for the younger group (88.2). Thus, the proportions of the bodies of the 14- to 15-year-olds who participated in the study were more masculine than those recorded for older girls; in the latter group, this parameter amounted to 86.9, indicating more feminine proportions.

Chest size was assessed based on the Marty index. The results of the measurement showed that the participants, regardless of age, were characterised by a large chest circumference. At the same time, it was noted that 14- to 15-year-olds had somewhat higher Marty index values (50.32) than older girls.

The body composition analysis showed that younger girls had more body fat, that is 11.8 kg, which accounted for 22.3% of their weight. In the group of older girls, the FAT index was 9.1 kg, that is 17.1% of their weight. In both cases, the values recorded were within the normal range. As far as the FFM (fat-free mass) index is concerned, it was higher in older girls, in whom it amounted to 42.8 kg. In younger girls, on the other hand, fat-free mass was 39.6 kg. Similar observations were made in the analysis of TBW (total body water) values: these values were higher in older girls (42.8) than in younger ones (29.0).

The value of BMR (basal metabolic rate) was somewhat higher in the older group than in the younger one, and it amounted to 1397.8 kcal and 1387.6 kcal, respectively. Finally, when it comes to the Oeder index, according to the classification of Nowicka, the participants had a poor nutritional status. This was observed for both age groups, although younger girls had slightly higher values of this parameter.

## Discussion

Morphological features have been the subject of research for many years. Physique and body composition depend not only on age, gender, or race but also on the level of physical activity. Many researchers who explored the impact of physical activity on the development of the human body have found that adequate levels of physical activity can impact the process of growth and development [29, 30].

In the current study, length parameters, such as height and sitting height, were the greater, the older the participants were. The same observations were made regarding weight. The results of the study were compared with those of the research performed by Nowak [31] on a group of untrained girls from the Subcarpathian region in Poland. A comparative analysis of the results of her study and the current one showed that there were no major differences in height between girls who did not train any sports and contemporary dancers [31]. The mean values for height in the girls from the Subcarpathian region were 161.9 cm (14-year-olds), 162.5 cm (15-year-olds), 164.5 cm (16-year-olds), and 164.7 cm (17-year-olds), whereas those for the contemporary dancers were 162.3 cm (14- to 15-year-olds) and 164.2 cm (16- to 17-year-olds). When it comes to weight, the results of the two studies were different. Dancers had a lower weight compared to their untrained peers. In the group of dancers aged 14-15 years, mean weight was 51.4 kg, whereas in the non-dancers in the other study, it was 52.3 kg (14-year-olds) and 54.1 kg (15-year-olds). As far as older dancers are concerned, the mean value of this parameter for the 16- to 17-year-olds in our study amounted to 51.9 kg, whereas in untrained girls, it was 55.4 kg (16-year-olds) and 56.3 kg (17-year-olds) [31].

The analysis of the BMI values recorded in the current study showed that contemporary dancers from both age groups were characterised by normal weight. Similar findings were obtained for male and female ballet dancers from the Croatian National Theatre Ballet [27]. On the other hand, BMI values that were significantly lower than normal ones were noted by Serbian researchers who studied a group of 30 female ballet dancers: according to the classification of BMI levels, 50% of those ballet dancers were underweight [24]. Low BMI values were also found for female ballet dancers examined in the research performed by Dutch and Finnish researchers, who found significantly lower BMI values in dancers than in the control group (18.9 vs. 21.3, respectively) [32].

Slightly lower BMI values were observed in our female contemporary dancers than in untrained girls examined in the research carried out by Perenc et al. [33] and Burdukiewicz et al. [34]. In the group of 16- and 17-year-old girls from Rzeszów, BMI values were 21.1 and 24.3, respectively [33], whereas in our study, the mean value for the older group amounted to 19.2. Likewise, 16- and 17-year-old girls from Wrocław were characterised by higher BMI values compared to contemporary dancers in the older group in the current study [34].

The measurements of circumferences in the group of contemporary dancers showed that younger dancers had larger circumferences of the waist and arm than older girls. An analysis of the results of the measurements of thigh and hip circumferences, however, showed that these values were higher in 16- to 17-year-olds. Compared to the untrained population from Wrocław, contemporary dancers were characterised by significantly higher circumferences of the waist, hips, and arm. In the case of thigh circumference, only untrained girls aged 16 and 17 years had higher values of this parameter than our subjects [34].

The dancers' physique was also assessed based on the Rohrer index, using Kowalewska's classification. Our subjects were found to have a leptosomatic physique. Similar results were obtained by Pilewska in a study involving a group of Latin style dancers. Approximately 60% of the dancers had a leptosomatic physique, whereas the remaining 40% had an athletic one [22]. A leptosomatic physique was also observed in female standard style dancers [16]. However, a comparison of Rohrer index values obtained for contemporary dancers with those of untrained girls from Rzeszów [31] revealed that our dancers had a slightly lower value of this parameter. Mean values of the Rohrer index in the comparative group were 1.23 (14-year-olds), 1.26 (15-year-olds), 1.24 (16-year-olds), and 1.26 (17-year-olds) [31]; on the other hand, in the group of younger dancers in the current study, this value amounted to 1.20, and in the older group, it was 1.17. Similar observations were made when comparing the results of our study with those obtained by Burdukiewicz et al. [34]. This means that contemporary dancers had more slender bodies than their untrained peers.

Different conclusions were reached by Lourens, who investigated the body type of ballet dancers with respect to the number of hours they spent training. Her study showed that over 1/3 of dancers who trained more than 10 hours per week had an endomesomorphic body type, while those who trained less than 10 hours per week tended to have an endoectomorphic one [35].

The subjects' physique was also examined using the Pignet index, which is calculated based on chest circumference, weight, and height. Based on the values of this index, younger girls were characterised by weak physique and older ones by a very weak one.

The results of the measurement of chest circumference showed that the dancers examined in the study had large chests. The chests of contemporary dancers were much larger than those of their untrained peers who were involved in the study carried out by Burdukiewicz et al. [34]. Our findings are probably due to the influence of regular physical activity on the respiratory system.

Body composition consists of fat-free mass (FFM) – that is the mass of the muscles, organs, and bones – and fat mass. In the current study, the amount of fat-free mass was the highest in older dancers (42.8 kg). Dancers from this age group were also characterised by a smaller amount of fat mass (17.1%). Similar research regarding body composition performed using bioelectrical impedance was carried out among professional dancers from a dance school in Athens; the mean amount of fat-free mass in the bodies of the Greek dancers was 42.6 kg, and the body fat percentage was 19.4% [23]. Different results, however, were recorded by researchers from Houston who examined the body composition of 15-year-old female ballet dancers and 18-year-old male ballet dancers: their analysis showed that the mean body fat percentage was 20.1% in female dancers and only 14.5% in the group of male dancers [26]. Other research showed that the level of body fat in male dancers depended on the role they played in the ballet group. A study involving 15 soloists and 15 members of the corps de ballet from the Croatian National Theatre Ballet revealed that soloists were characterised by a significantly lower fat mass and a greater amount of fat-free mass compared to the latter group [27].

Burdukiewicz et al. [36] examined the body composition of, among others, 14- and 15-year-old girls. One of the parameters that were measured was the amount of body fat. Compared to the results obtained for untrained girls in that study, the contemporary dancers in the current study had considerably less fat mass. The amount of fat mass in our dancers was 22.3% (14- to 15-year-olds), whereas in the comparative group, it was 26.5% (14-year-olds) and 28.0% (15-year-olds) [36]. As far as the FFM index is concerned, it was on a similar level in both dancers and untrained persons. In the 16-year-olds from Łódź, the FFM value was 43.0 kg, while in the older dancers in our study, it amounted to 42.3 kg [37].

Apart from fat-free mass and fat mass, it is also worth examining the total amount of water in the body (TBW). The norm for women aged 15-30 years ranges from 47% to 57%. The analysis of the amount of water in the bodies of our subjects showed that both age groups had a level of body water that was too low (29% in 14- to 15-year-olds and 31.4% in 16- to 17-year-olds). These results indicating that contemporary dancers did not consume enough water contrasted with those reported for their peers, as untrained 16-year-olds were found to have 54.6% of water in their bodies by previous authors [37].

### Conclusions

1. According to the results of the current study, girls practising contemporary dance are characterised by a leptosomatic physique. Based on the Skerlj index, they could be classified as thin.
2. We found that compared to girls who did not practise this sports discipline, contemporary dancers were characterised by a lower amount of fat mass; greater circumferences of the waist, hips, and arm; as well as a larger chest circumference.
3. Regardless of the age group, the dancers in the study had an abnormally low level of body water.

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