

Somatotype comparative study between spanish and brazilian young females dancers

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Received: 19.01.2015

Accepted: 01.06.2015

Summary

Not much is known about the influence of dance in the morphological and anthropometrical development of young dancers. Therefore, the purpose of this study was to obtain and compare the somatotype of two groups: one group of classical ballet dancers, from Porto Alegre, Brazil, and the other group including spanish dancers and classical ballet dancers, from Cordoba, Spain, trying to draw a parallel between these two groups, comparing and relating the data. We evaluated 110 young female dancers: 60 from Cordoba Conservatory of Dance, Cordoba, Spain, and 50 from private dance schools in Porto Alegre, Brazil. Trying to reach the objectives of the study, data collection was developed by a cross-sectional study. In addition to the individual identification variables, age variable and nationality, this study measured anthropometric variables, based on the ISAK protocol, and calculated the somatotype according to the Heath-Carter method. Descriptive statistical methodology and the "Student t test" was used to analyze and compare the data. The two groups present the dominance of the mesomorphic component, determining the prevalence of muscle mass. Regarding the somatotype no significant statistical differences were found between spanish and brazilian young female dancers.

Key words:

Somatotipo. Danza. Child.

Estudio comparativo del somatotipo de niñas-bailarinas cordobesas y porto-alegrestenses

Resumen

Casi no se conoce la influencia de la danza sobre el desarrollo morfológico y antropométrico de niñas que la practican. Así, el objetivo de este estudio es obtener y realizar comparaciones entre el somatotipo de niñas-bailarinas pertenecientes a la ciudad de Porto Alegre (RS), Brasil, y de la ciudad de Córdoba (CO), España, practicantes de ballet clásico y danza española, intentando establecer un paralelismo entre estas dos poblaciones, comparando y relacionando los datos obtenidos. Fueron evaluadas 110 niñas-bailarinas: 60 cordobesas, estudiantes del Conservatorio de Danza de Córdoba, España, y 50 porto-alegrestenses, estudiantes de academias de ballet clásico de la ciudad de Porto Alegre, Brasil. Intentando atender a los objetivos del estudio, la recogida de datos fue desarrollada por abordaje transversal. Además de las variables de identificación del individuo, de las variables edad cronológica y nacionalidad, el presente estudio comprende las informaciones antropométricas referentes al somatotipo, mediante la medida de varios bloques de parámetros antropométricos, siguiendo las indicaciones del protocolo de la ISAK. El somatotipo fue calculado según el método de Heath-Carter. Para el tratamiento estadístico de los datos se utilizó la estadística descriptiva y el Test t de Student ($p < 0.05$). Los resultados sugieren el predominio del componente mesomórfico en el somatotipo de los dos grupos estudiados, determinando el predominio de la masa muscular. Todavía, no hubo diferencias significativas entre las niñas-bailarinas cordobesas y las porto-alegrestenses en el somatotipo.

Palabras clave:

Somatotipo. Danza. Niñas.

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Introduction

Classical ballet has long been considered a highly developed art form involving specific corporal aesthetics and technical archetypes. Through trial and error, and advice from highly experienced teachers, these standards have been developed and passed on for many centuries, from the very outset right up to today¹. Professional dancing demands an ever-increasing degree of rigour and better results. Only recently, the scientific community has recognised that classical ballet is just as physically active and requires an equal amount of physical preparation as high-level sporting activities².

Dance can be very beneficial for the girls that practice it. It develops rhythm, coordination and flexibility, among other physical qualities, as well as being very educational in many aspects. However, if it is not well regulated it may cause numerous physical injuries^{3,4}, postural problems⁵, illnesses such as anorexia⁶, and amenorrhoea problems⁷⁻¹¹.

The influence of dance on the morphological and anthropometrical development of girls that practice it – young female dancers – is still widely unexplored. The range of literature available in this field is practically inexistent; it is very difficult to find studies carried out on this particular demography. Upon researching databases, only one study performed on girls practicing classical ballet was found, and none were found for girls practicing Spanish dance.

Therefore, monitoring the morphological development of girls studying dance is extremely important, in order to quantify, classify and thus achieve better results. It should also be recognised that the modifications that occur in the bodies of young female dancers are further conditioned by physical, social and cultural factors, and others such as diet and the physical constitution of each individual (genetic make-up)^{12,13}.

The objective of this study is to obtain and carry out comparisons between the somatotype of young female dancers from the city of Porto Alegre (RS), Brazil, and dancers of classical ballet and Spanish dance from the city of Cordoba (CO), Spain, with the aim of drawing a parallel between the two demographics, comparing and linking the data obtained between the two groups and the different ages.

Material and method

Subjects

The research was carried out at the Cordoba Conservatory of Dance, Spain, where data was taken regarding the somatotype of 60 young female dancers from Cordoba, aged between 10 and 13, average age 11.50 ± 0.94 , height 145.51 ± 8.63 cm, weight 37.98 ± 6.98 kg, practicing classical ballet for an average of 5 hours a week and Spanish dance for 3 hours a week. After this, data was collected from 50 young female classical ballet dancers from Porto Alegre, of the same age as the previous group, average age 11.12 ± 1.00 , height 147.87 ± 9.26 cm, weight 38.78 ± 8.03 kg, practicing classical ballet for an average of 4 hours a week in the main ballet academies in Porto Alegre, RS, Brazil. The Cordoba group of young female dancers corresponded to 43% of the total population of the Cordoba Conservatory of Dance, and the Porto Alegre dancers corresponded to 8% of the total academies in Porto Alegre, the sample total being 110 subjects.

The age range of between 10 and 13 years was chosen due to the great importance of studying girls that practice dance at these early ages. There are very few large-scale comparative studies available in this field, and those available have a much more restrictive measurement protocol. We believe that a carefully studied sample may act as a reference group, sometimes considered as a prototype sample.

We chose the Cordoba Conservatory of Dance for its standing as an official school that follows a unique methodology and trains both teachers and dancers based on Organic Laws established by the Ministry of Education and Science (MEC) governing the General Education System in Spain (LOGSE), making it the most homogeneous and best monitored sample group. With regards to the selection of ballet schools in Porto Alegre, two schools were chosen for this study: one medium-sized and one small, both with high acclaim and well-reputed both in Porto Alegre and within the State of Rio Grande do Sul.

To proceed with the data collection, authorisation was requested from the Head of the Cordoba Conservatory of Dance and the owners of the Dance Academies in Porto Alegre to allow the study to be performed. The Centres that participated in the study were also asked to send a letter to the students' parents explaining the type of assessment concerned as well as an authorisation request allowing their daughters to be assessed, by means of a consent form in accordance with the ethical codes applied to research on people, under the 1975 Helsinki Declaration principles. We performed the study on the girls whose parents signed the consent form allowing them to participate in the study. The girls whose parents did not give their permission were not allowed to participate in the study.

Collecting data

A cross-cutting approach was developed regarding data collection. The technical team went to the Dance Schools, where they proceeded to set up all the materials and resources needed for measurement, in a room. The room temperature was controlled with heating or ventilation, ensuring that it was comfortable so that the girls would be relaxed.

The girls were assessed either before or after class; they were called to come half an hour before class started, or to stay a while after class given that many of the teachers did not give the girls permission to leave while their classes were underway.

During the assessment, first of all their identification details were taken. Next, the anatomical reference points were marked using a dermatographic pencil, with the girls adopting the anatomical position (standing with the palms of their hands facing forwards) and finally came the assessment with measurements taken of the study variables.

As well as the identification variables of the individuals, of the chronological age and nationality variables, this study included anthropometric data regarding the somatotype, by measuring various blocks of anthropometric parameters, such as: body weight (kg), height (cm), skin folds (mm), muscular perimeters (cm), and bone diameter (cm). The subjects were always measured on the right-hand side of their bodies, following the instructions of the ISAK (*International Society of the Advancement of Kinanthropometry*).

Materials and instruments

The materials and instruments used to take the data were:

- File-form (Proforma) designed based on the file created by the *Kinanthropometric Research Associates* from the *Simon Fraser University*, for the Montreal Olympic Games.
- Dermographic pencil to mark the anatomical reference points on the subject.
- Sesimax 130 weighing scale with 100gr precision.
- Aluminium Broca's Plane.
- Box or bench for anthropometry, 50x40x30 centimetres.
- Wall-mounted height-rod with 1mm precision.
- Slimguide model skin-fold calliper with 0.5mm precision.
- 1cm thick retractable metal sesmometer, with a mm scale.
- Flexible metal anthropometric tape.
- "Berfer" compass with an error of 0.5 cm, with two round-ended rods and the lower section displays the measurement in cm. It is used to substitute the anthropometer when measuring large diameters.
- "Berfer" pachymeter used for measuring small bone diameters. It has two curved rods ending in two flat surfaces allowing for a firm application on bone points. Given that the scale is displayed in mm, it has a magnifying glass to enhance the reading. The measurement is given in cm and the precision in millimetres.

Analysis of the Somatotype

One of the ways of studying the form and composition of the body is the somatotype, which gives us a more general overview of an individual's morphological characteristics. Although each of the components may be studied separately, the somatotype must be analysed as a whole so as to keep the information in context¹⁴. The somatotype or biotype is the current configuration of the individual that may change over the course of their life for different reasons or factors. It is always expressed numerically, and in this order: Endomorphic, Mesomorphic, and Ectomorphic¹⁵. Endomorphic is the term that comes from Endoderm, corresponding to Kretschmer's *Pyknic* body types, dominated by fat and the digestive tract (the morphological type of Sancho Panza). Mesomorphic comes from the term Mesoblast, corresponding to Kretschmer's Athletic type, dominated by the muscular-skeleton component. Ectomorphic comes from the term Ectoblast, corresponding to Kretschmer's *Leptosomic* type, typically longilinear and weak (morphological type of Quijote). This type predominantly conveys relative linearity (prevalence of height over weight).

The somatotype was determined by the Heath-Carter Anthropometric Method or Somatotypic Cineanthropometry. The numeric values of the three somatotype components were calculated using the Heath-Carter method (1990)¹⁵.

Statistical analysis

For the statistical handling of the data, SPSS for Windows version 6.0 was used. The descriptive statistic was used (calculation of the average and standard deviation) and a comparative study was also carried out among the two groups of young female dancers (from Cordoba and Porto Alegre), using the Student T Test ($p < 0.05$) to detect the presence of statistical differences between the girls and also between age groups.

Results

Table 1 displays the results of the average, standard deviation and p value of the somatotype values of the Young Cordoba Female Dancers (YCFD) and the Young Porto Alegre Female Dancers (YPAFD).

Table 2 displays the results of the average, standard deviation and p value of the somatotype values of the Young Cordoba Female Dancers (YCFD) and the Young Porto Alegre Female Dancers (YPAFD) by age.

Upon analysing the values of the somatotypes for the various ages and nationalities, it can be observed that the total number of young female dancers studied present a balanced mesomorphic somatotype (3-4-3), as with the Cordoba and Porto Alegre dancers combined (Table 1) and just the group of 13-year old Cordoba dancers (Table 2). The groups of 10-year olds from Cordoba and Porto Alegre revealed an endo-mesomorphic somatotype (Table 2). The Cordoba dancers aged 11 and 12 years presented an ecto-mesomorphic somatotype, as did the 11-year old dancers from Porto Alegre (Table 2). The 12-year old Porto

Table 1. Average, standard deviation (SD) and "p" value of the somatotype components of the young Cordoba and Porto Alegre female dancers.

	YCFD (n=60) Average±SD	YPAFD (n=50) Average±SD	Total (n=110) Average±SD	p
Endomorphy	3.29 ±1.03	3.59 ±1.01	3.43±1.03	0.13
Mesomorphy	4.32± 0.87	4.14 ±0.82	4.24±0.85	0.28
Ectomorphy	3.25±1.14	3.57±1.08	3.40±1.12	0.14

Table 2. Descriptive study of the somatotype components of the young Cordoba and Porto Alegre female dancers by age.

	YCFD 10 years Average ± SD	YPAFD 10 years Average ± SD	P	YCFD 11 years Average ± SD	YPAFD 11 years Average ± SD	P	YCFD 12 years Average ± SD	YPAFD 12 years Average ± SD	P	YCFD 13 years Average ± SD	YPAFD 13 years Average ± SD	P
Endomorphy	3.71±1.25	3.74±0.88	0.94	3.15±0.96	3.39±0.11	0.44	3.07±0.74	3.46±0.80	0.34	3.26±1.04	4.06±1.61	0.29
Mesomorphy	4.79±0.60	4.49±0.71	0.22	4.21±0.92	4.09±0.80	0.68	4.12±0.72	3.90 ±0.76	0.56	4.03±1.00	3.75±1.12	0.64
Ectomorphy	2.87±1.02	3.23±0.82	0.28	3.39±1.17	3.71±1.29	0.40	3.56±1.38	3.87±1.08	0.60	3.18±1.05	3.50±1.15	0.61

Figure 1. Somato-chart of the Young Cordoba Female Dancers.

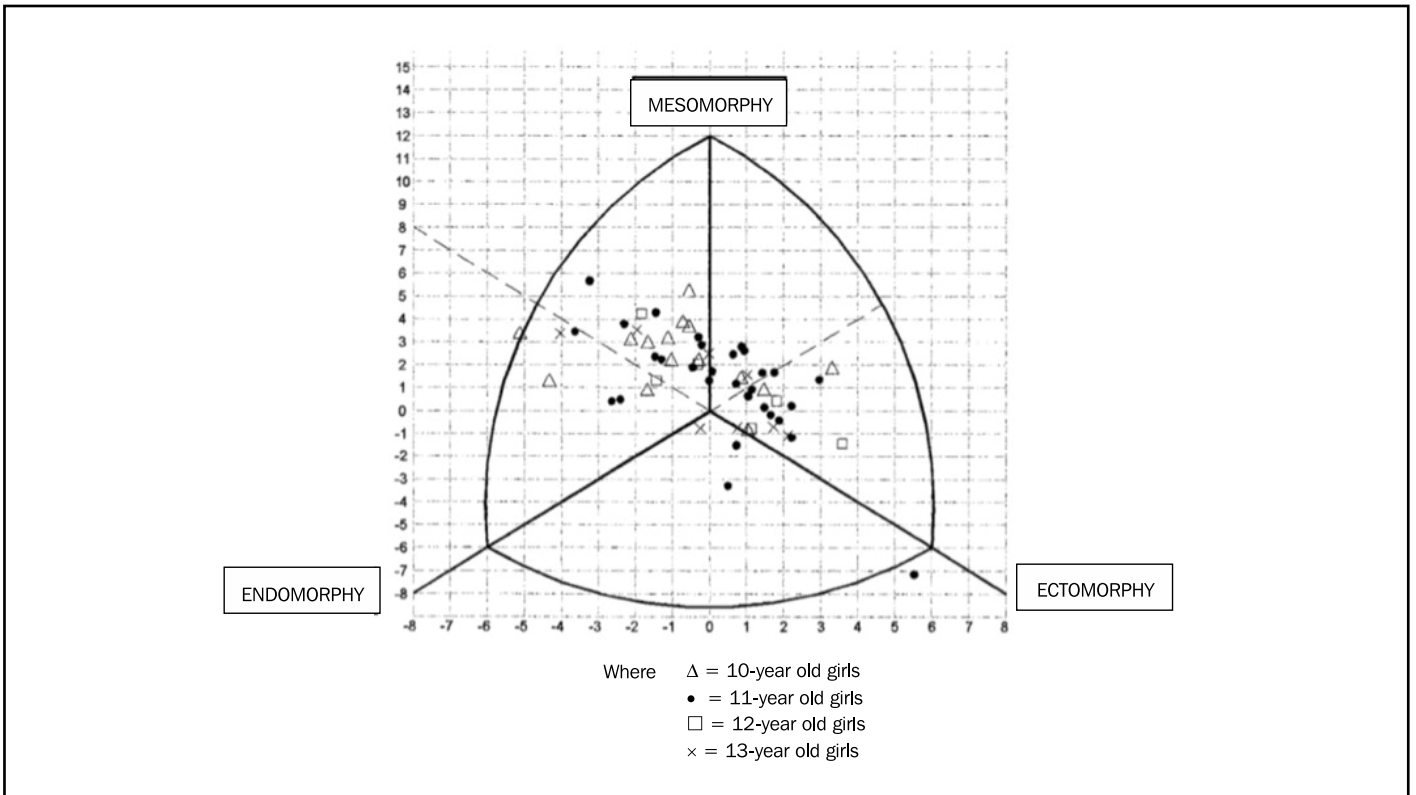
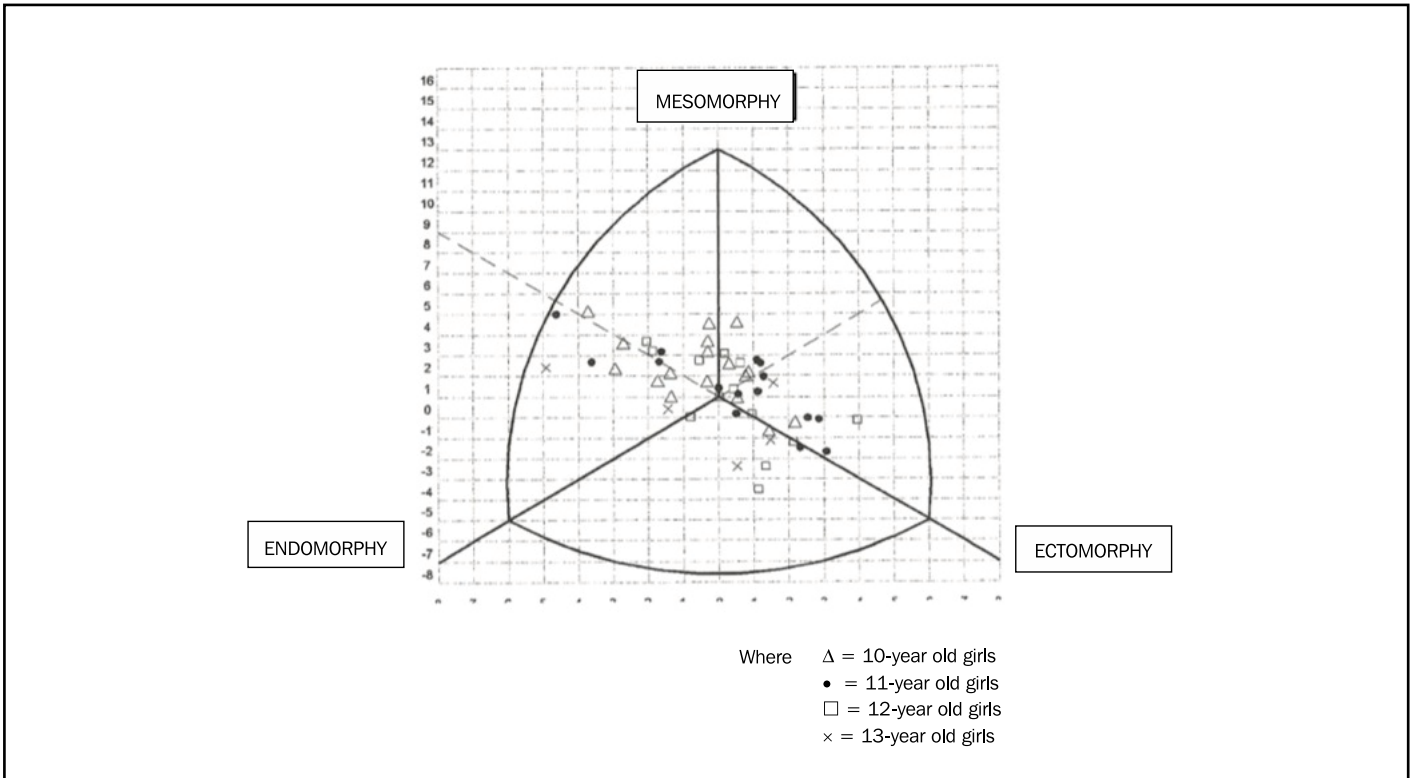


Figure 2. Somato-chart of the Young Porto Alegre Female Dancers.



Alegre group presented a mesomorphic-ectomorphic somatotype, as the mesomorphic and ectomorphic were the same and endomorphic was less; and the 13-year olds presented a meso-endomorphic somatotype (Table 2).

The p values indicate that no statistical differences were found between the young Cordoba and Porto Alegre female dancers in any of the somatotype components (Tables 1 and 2).

Figures 1 and 2 present the somato-charts of all the young Cordoba and Porto Alegre female dancers. The majority of the young female dancers from the two groups are positioned in the endo-mesomorphic, balanced mesomorphic and ecto-mesomorphic areas, predominantly featuring mesomorphic components.

Discussion

Upon performing a comparative study of the somatotypes of the two study groups, no significant statistical differences were found. Probably, the fact there are no differences is due to the rigorous training schedules and diets followed by the young female dancers, both in Cordoba and Porto Alegre, as well as the selection process they undergo to be accepted in the Cordoba Dance Conservatory. In the case of the Porto Alegre Academies, there is no entry selection process, as they are private academies. However, as the majority of girls enter at a very young age (between 3 and 5 years old), by the age of 10 a selection process has already been performed, as the girls that are still dancing are those that have resisted the rigorous training and demands put on them by their teachers in terms of keeping a very thin body type required to be a dancer⁸.

Overall, the young Cordoba and Porto Alegre female dancers presented a balanced mesomorphic somatotype (Table 1). The prevalence of the mesomorphic component determines the domination of muscle mass in the majority of the groups, with the exception of the Porto Alegre 12-year old group, where there is a balance between the mesomorphic and ectomorphic components, and the Porto Alegre 13-year old group in which there is a prevalence of the endomorphic component (Table 2).

In the bibliography consulted there are very few studies that determine values for the somatotype of girls practicing classical ballet. Only the Claessens *et al.* (1987)¹⁶ study was found, which determined the somatotype of North American classical female ballet dancers, of a similar age to those in this study (between 11.8 and 13.5 years old), undergoing 13 hours of training a week, also using the Heath-Carter Method.

Vásquez Cabrera *et al.* (2007)¹⁷ also carried out a cross-cutting study of the somatotype of 38 professional Chilean dancers (16 men and 22 women), using the Heath-Carter Method, in which they established that the predominant somatotype of the female dancers was ectomorphic. These results are similar to the finding of the Claessens *et al.*¹⁶ study, but they differ from the majority of the data taken from the female dancers in this study.

Betancourt *et al.* (2008)¹⁸ also studied the somatotype of professional dancers using the Heath-Carter Method, using subjects from the *Ballet Nacional*, *Danza Nacional* and *Folclórico Nacional* companies in Cuba, with ages between 18 and 40 years. The somatotype of the

ballet dancers was on average ecto-mesomorphic, and the most strongly represented somatotypical categories were balanced ectomorphic (50%), and ecto-mesomorphic (40%). These results are similar to those found among the Cordoba female dancers aged 11 and 12 years, and the 11-year old Porto Alegre dancers (Table 2), in which the average displayed is also an ecto-mesomorphical somatotype.

Twitchett *et al.* (2008)¹⁹ studied the somatotype of 42 classical ballet students (31 women and 11 men) using the Heath-Carter Method, with the aim of establishing possible associations between the somatotype, the percentage of body fat and the nature of injuries. The study revealed a balanced mesomorphical somatotype, just as with the young female dancers studied (Table 1) and the group of 13-year old Cordoba dancers (Table 2).

Liiv *et al.*²⁰ compared the anthropometric, somatotypical and aerobic capacity variables of three groups of dancers (classical, contemporary and sporting dance). The results of the study indicate that there is a statistical difference between dance styles in endomorphy and mesomorphy, given that contemporary dancers have a greater muscle mass than classical ballet dancers, whilst sporting dancers are heavier and bigger. The authors conclude that the dancers of these three dance styles differ in somatotype, but they were not able to confirm that this was due to the type of training and/or selection. These results do not meet those found in this study, given that despite the different practices of the two dance styles (classical and Spanish dance), the young female dancers studied present a similar somatotype, and therefore there were no significant differences.

The doctoral thesis by Sanchiz Minguéz (1989)²¹ was the only work found in the literature encountered containing data regarding adult Spanish dancers. In this study the female dance group studied was formed of 12 dancers, in different modalities and with high technical levels, between 27.6 years \pm 59.6 years of age. The average somatotypical values found, calculated using the Heath-Carter Method, were similar to those encountered in the young Cordoba and Porto Alegre female dancer groups that presented a predominantly mesomorphical component (Table 2).

Just as there is no homogeneity in the results of the cited studies, in general they establish a somatotype with a prevalent mesomorphic or ectomorphic component, determining a prevalence of the muscular-skeleton component (mesomorphic) and linearity (ectomorphic) in the dancers. This physical type is ideal for classical ballet, as the ballerina must be thin and longilinear to be able to express lightness and agility when executing the movements of this dance. In this respect, classical ballet attracts girls with specific body structures and features, requiring exceptional thinness^{17,22}.

We would like to highlight that the data collected in this study may be used by dance teachers so they can deal with physical morphology aspects of young female dancers, with the objective of suggesting a suitable calorific intake for their students, so that they can maintain a high-level of performance and health, whilst remaining able to preserve the conventional figure of a talented dancer. The tables presented for each age and nationality may also be useful as references for future studies and for clinical applications.

Another noteworthy fact is that when comparing the results of the young female dancers studied with groups of young sedentary fema-

les, we came across a study carried out by Guedes & Guedes (1999)²³, performed upon 1,180 children and teenagers from the municipal of Londrina, Paraná, Brazil. In general, the somatotype of young Cordoba and Porto Alegre female dancers overall is different to the school-aged girls studied by Guedes & Guedes (1999)²³, because among the young female dancers from this study there was a predominantly mesomorphic component, with lesser and equal values for the endomorphic and ectomorphic components. This may be due to the training regime to which the young Cordoba and Porto Alegre dancers are subjected, which leads to the appearance of a more developed muscle mass, something that does not occur among the school-aged girls studied by Guedes & Guedes (1999)²³.

It is also important to highlight that this is the first time young Cordoba and Porto Alegre female dancers have been studied, achieving the quantification of somatotypical components, given that in scientific literature there are no studies featuring these characteristics.

Conclusions

After analysing the results obtained, comparing and discussing them, we can conclude that there were no significant differences in the somatotype of the two groups of young Cordoba and Porto Alegre female dancers studied, or in the age groups.

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