

## THE EDUCATIONAL DIMENSION OF DANCE TEACHING: ASSESMENT PROCEDURES AND POSSIBLE APPLICATION OF TECHNOLOGICAL INSTRUMENTS

Carmen Palumbo<sup>1</sup>, Giuseppe Baldassarre<sup>1</sup>, Romeo Vastola<sup>1</sup>,  
Maurizio Sibilio<sup>1</sup> and Nadia Carlomagno<sup>2</sup>

<sup>1</sup> Department of Human, Philosophical and Educational Sciences, University of Salerno, Italy

<sup>2</sup> Faculty of Science of Formation, University 'Suor Orsola Benincasa', Naples, Italy

Review paper

### Abstract

Classical ballet peculiarity, both for the different performance patterns and for the training methods between male and female, requires studies and researches that highlight such differences at metabolic and functional level. Our research was aimed at studying a possible link between energy consumption on practice of classical ballet technique, using as sample the students of the ballet of Teatro San Carlo in Naples, and highlighting any significant differences between males and females. The experimental research has been previously established by the joint action among researchers of the University of Salerno in collaboration with the staff of the teaching management of the dance school, who have promoted and shared the aim of the research. This pilot study has sought to highlight possible differences in terms of energy consumption by professional classic ballet students. The study of the energy consumption by the examined subjects has allowed examining possible relations between energy consumption and the practice of classic ballet and in relation to BMI and in general.

**Keywords:** Physical activity (PA), Energy expenditure (EE), Calorimeter, Physical activity assessment.

### Introduction

Classical ballet is a specific style of theatrical dance, that uses an "academic technique", which was codified by the masters of "Académie Royale de Danse", founded in 1661 in Paris by French King Louis XIV, with the intention to develop the basic principles and fix the terminology of choreography art (Testa, 2005). Classical ballet underwent pick-up in 1735 with "The Russian Imperial Academy"<sup>3</sup>, which gave rise to Ballet Russe, and to Vaganova teaching method, from the dancer and teacher Agrippina Vaganova<sup>4</sup>. Vaganova method is still the technique on which the dancer academic construction should be based. Italy gave its share to the academic technique evolution by Carlo Blasis<sup>5</sup>, a dance theorist, author of "Traité élémentaire, théorique, et pratique de l'art de la danse" in which he tests movement. This work is still a good academic didactic handbook. French, Russian and Italian academic general guidelines are the present datum point as for Italian school of dancing both *Lyric Corporations* and Italian Dancing Academy. The program is based on a curriculum with eight courses, in which the students have to study both dance and subsidiary subjects, such as solfeggio, music, history, dance history, P.E.,

athletics grounding, modern dance, character dance, Spanish dance, repertoire, pas de deux and physio- technique. Propaedeutics students formation starts with an hour and half daily work for three days a week, first course students continue with an hour and half daily work for five days a week, and seventh and eighth course students have three hours daily work for six days a week. The lesson is structured in two steps: the first step includes barre exercises, which gradually aid articulation mobility, foot and legs strength, bodily movements and coordination; the second step includes exercises to be performed in the centre, including new elements from allegro to tours, aplomb, elevation in jumps, and ballon. This training requires to the students very hard physical activities which become more difficult over the years. Training programme provides, from the second year study, different technical activities between male and female, who during the seventh and eighth level, have to reach the excellence of technical and executive perfection. The difference is made by specific activities for male and female dancers: such as the study of the jumps for men and the study of the pointe for women.

<sup>3</sup> Sergej Pavlovič Djagilev, (Selišči, 31 March 1872 – August 1929) was a Russian art critic, patron, ballet impresario and founder of the Ballets Russes, from which many famous dancers and choreographers would later arise. Diaghilev was a pioneer in adapting these new musical styles to modern ballet.

<sup>4</sup> Agrippina Yakovlevna Vaganova (Russian, 6 July, 1879 – 5 November, 1951) was an outstanding Russian ballet teacher who developed the Vaganova method - the technique which derived from the teaching methods of the old Imperial Ballet School. It was Vaganova who perfected and cultivated this form of teaching the art of classical ballet into a workable syllabus. Her *Fundamentals of the Classical Dance* (1934) remains a standard textbook for the instruction of ballet technique. Her technique is one of the most popular techniques today.

<sup>5</sup> Carlo Blasis (4 November 1797 – 15 January 1878) was an Italian dancer, choreographer and dance theoretician. He is well known for his very rigorous dance classes, sometimes lasting four hours long. Blasis was born in Naples. He was the first who published an analysis on the ballet techniques in 1820, in a work named *Traité élémentaire, théorique, et pratique de l'art de la danse* ("Elementary Treaty on the Art of the Dance, theory and practice").

The performance required for dance, the great technical demand and training methodologies have brought dance close to the sport activities. Dancers can largely benefit from such a specific movement practice which, if practised since young age allows to obtain both an armonic muscle development and a remarkable development of articular mobility, making muscles tonic and elastic, improving heart functions and metabolism (Morris, Van de Wetering, De Rooij & Sabapathy, 2009). Classical ballet peculiarity, both for the different performance patterns and for the training methods between male and female, requires studies and researches that highlight such differences at metabolic and functional level. Our research was aimed at studying a possible link between energy consumption on practice of classical ballet technique, using as sample the students of the ballet of Teatro San Carlo in Naples, and highlighting any significant differences between males and females. The primary purpose of this study was to assess energy expenditure during specific physical activities in young dancers, directed to professionalism and to put professional dance in a broader context of physical activity of young people, showing possible differences. The research aims to evaluate the significance of any differences between males and females with regard to TEE (Total Energy Expenditure), PAD (Physical Activity Duration), AEE (Active Energy Expenditure) and MET. Chiefly the research has evaluated the differences in TEE and AEE in relation to the weight of the subjects examined, and finally the significance on Average-MET between males and females in relation to the weight values.

## Methods

### *Procedures*

The experimental research has been previously established by the joint action among researchers of the University of Salerno in collaboration with the staff of the teaching management of the dance school, who have promoted and shared the aim of the research. The methodological procedure envisaged: 1) A specific Memorandum of Understanding between the above mentioned institutions, 2) The sharing between the research group of the University of Salerno and the teachers of San Carlo Theater of the aims of the use of the instrument which has been chosen for a descriptive study of the observed sample. The area of application involved a simple detection and statistical analysis of the relationship of physical activity / energy, in order to determine a possible assessment of energy balance in young subjects trying to analyze the effectiveness of the sport of professional type (classical ballet). The actions performed the school for the realization of the experimental phase were: 1) preparation of an integrated plan Ballet School of San Carlo Theater - University to share the aims of the research, methodologies and procedures, 2) preparation of an information grid collect data on age, anthropometric data, the dietary habits, lifestyles and the type of sport performed by students;

3) measurement energy consumption of the students during the lesson, using a portable multi-sensor monitoring system (calorimeters).

It seems worthwhile to note that the sharing of the research project has provided a first opportunity for comparison among researchers, teachers and the school principal to discuss the organizational and executive aspects of the research and to obtain specific information related to the athletic training of the observed subjects and a later meeting with the students to obtain personal information, anthropometric characteristics (parameters of structure, age, sex, height), and mostly relating to lifestyle (alcohol, smoking, outdoor life) and food habits (quantity and type of eaten meals per day with scores of fats, proteins, carbohydrates and sugars made arrangements with any abuse). The information obtained allowed the research team to have a clear picture of through which to place the type of observed and analyzed in a training category of medium / high intensity.

### *Sample*

The research was conducted using a sample of 10 students of the seventh and eighth year of the course. 10 subjects were examined (four men, six women) aged about 19 years old. They took part in a lesson lasting about one hour in two phases of different intensity. A first phase (lasting 20 minutes) with exercise of moderate intensity and a second phase (lasting about 40 minutes) with more intense exercises and activities that require a strong coordination, as well as propensity to leap high speed work.

The second part of the lesson required, as it is normal in the last degrees of study of the Lyric Foundations, the use of pointe shoes for women in a number of years of touring and big jumps and the structuring of numerous combinations of jumps, batteries and tour en l'air for men.

### *Instruments*

The research group has analyzed energy consumption through a practical and immediate analysis system: the Body Media Body Monitoring System, which uses the SWA multi sensor, which can be worn on arms by sampled subjects without interfering in the execution of sport gestures. The Armband has continuously recorded a range of physiological body data which have been analysed and show the energy consumption by the subjects during the proposed tasks. Sampled subjects wore the Sense Wear Armband on their right arm and energy consumption has been estimated by InnerView, a software which minimizes errors due to subjective interferences during data collection and processing.

Measure units used to assess caloric consumption are kcal and METs (Metabolic Equivalent of Task), which show the amount of energy used during task compared to that used in relax and are based on oxygen consumption in relax (METs = kcal/kg/h).

Table 1. P-value M-F

TEE	PAD	AEE	Steps_no	Average MET
0,0001	0,3182	0,0031	0,0820	0,0042

On the basis of results as shown on the p-value table below, we noticed:

1. Differences between male and female subjects are not meaningful as for Physical Activity Duration and step number. Step number refers to calorimeter wearing arm swings. Such results show that no difference can be assessed as for the use of arms by students of a 7<sup>th</sup> and 8<sup>th</sup> ballet class as well as for the lesson duration even if it is different for male and female subjects in the same class. The difference between male and female is significant as for Total Energy Expenditure (TEE), Active Energy Expenditure (AEE) and average MET. It is worth noting that differences in TEE and AEE become not relevant if values are rebased on weight. So, consequently:

a. Heavier male subjects (with a stronger physical structure) have a higher TEE and AEE.

b. Lower TEE and AEE can be found in lighter female subjects (with a slimmer structure).

2. Difference on average MET is significant also rebasing values on weight. Contrary to TEE/weight and AEE/weight, average MET is in favour of female subjects, showing no relation to body weight.

## Discussion and Conclusion

This pilot study has sought to highlight possible differences in terms of energy consumption by professional classic ballet students. The study of the energy consumption by the examined subjects has allowed to examine possible relations between energy consumption and the practice of classic ballet and in relation to BMI and in general. Results highlight following conclusions about correlations between measured quantities:

1. AEE is strongly positively correlated to WEIGHT, HEIGHT, BMI and TEE;

2. Average consumed MET is strongly inversely correlated to WEIGHT, HEIGHT, BMI and TEE;

3. WEIGHT and BMI are inversely correlated to PAD.

## Possible inferences on the data measured

Analysis of the data showed, therefore, a significant difference in energy consumption in terms of the Mets, between males and females: the latter had a significantly greater expenditure of men at work. Between males and females are significantly different the TEE, the AEE, and the MET, in the sense that the TEE and the AEE of the males are significantly higher than those of females, while the average MET of females are significantly higher than those of males. The results, in contrast with expectations, open new perspectives for research on the causes of the difference in terms of number of Mets of energy expenditure in relation to gender and physical activity. The study revealed, in relation to the small sample size, an interesting fact which calls for further research on differences in quality of motor performance that are performed by males and females, highlighting any biomechanical implications, analyzing factors such as speed enforcement, the acceleration of muscle movements and characteristics of the commitment.

This study involves the use of appropriate equipment acquisition, comparison, copy and complete analysis of the key positions taken during the proposed activity. More specifically, will be used: 1) an optoelectronic system acquisition cameras with a software to play for the qualitative examination, 2) a software system for playback and motion analysis of key issues, analysis of the trajectories for the understanding of human movement through subdivision thereof, the management of biomechanical data. The use of such tools will allow for greater accuracy in the collection of data useful for the conduct of research by giving it more credibility.

Table 2. Correlations between measures

	Weight	Height	BMI	TEE	PAD	AEE	Steps	Avg MET
Weight	-	0,96	0,99	0,87	-0,31	0,92	0,15	-0,73
Height	0,96	-	0,92	0,92	-0,15	0,90	0,25	-0,80
BMI	0,99	0,92	-	0,83	-0,39	0,91	0,12	-0,69
TEE	0,87	0,92	0,83	-	-0,07	0,92	0,52	-0,70
PAD	-0,31	-0,15	-0,39	-0,07	-	-0,06	0,55	0,35
AEE	0,92	0,90	0,91	0,92	-0,06	-	0,45	-0,51
Steps_no	0,15	0,25	0,12	0,52	0,55	0,45	-	-0,03
Avg MET	-0,73	-0,80	-0,69	-0,70	0,35	-0,51	-0,03	-

## References

- Basso, A. (2005). *L'arte della danza e del balletto*. Torino: Utet (5, pp. 395.).
- Bland, J.M., & Altman, D.A. (1986). Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet*, 1, 307–310.
- Campbell, K., Crocker, P., & McKenzie, D. (2002). Field evaluation of energy expenditure in women using TriTrac accelerometers. *Med Sci Sports Exerc*, 34(10), 1667–1674.
- Chen, K., & Bassett, D. (2005). The technology of accelerometry-based activity monitors: current and future. *Med Sci Sports Exerc*, 37(Suppl. 11), 490–500.
- Delsarte, F. (1994). *Le leggi del teatro*. Roma: Bulzoni.
- Franklin, E., (1996). *Dynamic alignment through imagery*. London: Human Kinetics Europe.
- Fruin, M.L., & Rankin, J.W. (2004). Validity of a multi-sensor armband in estimating rest and exercise energy expenditure. *Med Sci Sports Exerc*, 36(6), 1063–1069.
- Harr, D. (1977). *Teoria dell'allenamento*. Roma: Società Stampa Sportiva.
- Hendelman, D., Miller, K., Baggett, M.C., Debold, E., & Freedson, P. (2000). Validity of accelerometry for the assessment of moderate intensity physical activity in the field. *Med Sci Sports Exerc*, 32(Suppl. 9), 442–449.
- Kostrovickaja, V. S. (1986). *100 Lezioni di danza classica dal I all'VIII corso*. Roma: Di Giacomo Editore.
- Lohman, T.G. (1986). Applicability of body composition techniques and constants for children and youths. *Exerc Sport Sci Rev*, 14(1), 325–357.
- Macchi, C., Molino-Lova, R., & Cecchi, F. (2008). *Attività fisica dieta e salute*. Firenze: Le Lettere (pp. 19-20).
- Morris, N.R., Van de Wetering, A.W., De Rooij, M., & Sabapathy, S., (2009). *Sensitivity of an armband device for measuring changes in energy expenditure during exercise*. ATS (American Thoracic Society) *Am J Respir Crit Care Med*, 179, A3846.
- Parisi, M., & Rigatti, D. (1998). *Danza e balletto*. Milano: Jaca Editore (pp. 15).
- Sachs, K. (2006). *Storia della danza*. Milano: Il Saggiatore.
- Testa, A. (2005). *Storia della danza e del balletto*. Roma: Gremese Editore.
- Vaganova, A. (1934). *Il metodo Vaganova. I principi fondamentali del balletto classico*. Roma: Di Giacomo Editore.

---

## EDUKACIJSKA DIMENZIJA UČENJA PLESA: OCJENA POSTUPAKA I MOGUĆE PRIMJENE TEHNOLOŠKIH INSTRUMENTA

### Sažetak

Osobitost klasičnog baleta, i za različite obrasce izvedbe kao i za trenajne metode između muškaraca i žena, zahtijeva studije i istraživanja koji će osvijetliti takve razlike na metaboličkoj i funkcionalnoj razini. Ovo istraživanje je ciljalo na moguću poveznicu između potrošnje energije u vježbanju tehnike klasičnog baleta (uz angažman studenata baleta Teatro San Carlo u Napulju) i osvijetljavanja bilo kakve značajne razlike između muškaraca i žena. Istraživanje je prethodno utemeljeno zajedničkom akcijom između istraživača Sveučilišta Salerno u suradnji s osobljem menadžmenta učenja plesne škole, koji su zajedno promovirali i dijelili ciljeve istraživanja. Ovo pilot istraživanje je tražilo osvijetljavanje mogućih razlika u terminima energetske potrošnje kod studenata profesionalnog baleta. Istraživanje potrošnje energije kod ispitivanih studenata dopušta utvrđivanje mogućih relacija između potrošnje energije i vježbanja klasičnog baleta u odnosu na BMI i općenito.

**Ključne riječi:** tjelesna aktivnost (PA), potrošnja energije (EE), kalorimetar, ocjena tjelesne aktivnosti

---

Received: October 04, 2011

Accepted: May 26, 2012

Correspondence to:

Prof. Maurizio Sibillio, Ph.D.

University of Salerno

Department of Educational Sciences

Via Ponte Don Melillo. 84084 Fisciano, Italy

Phone: +0039 089964416

E-mail: msibillio@unisa.it