Original Article

# Energy requirements in top-level DanceSport athletes

ANDREA ZANCHINI [1], MARCO MALAGUTI [2]

[1] *Faculty of Sport and Exercise Sciences, University of Bologna, Bologna, Italy*
[2] *Department of Life Quality Studies, University of Bologna, Bologna, Italy*

## ABSTRACT

Zanchini, A., & Malaguti, M. (2014). Energy requirements in top-level DanceSport Athletes. *J. Hum. Sport Exerc., 9*(1), pp.148-156. Dancesport is a sport of recent history: recognition by the IOC as Olimpic discipline came in 1997. Scientific literature on this new sport is almost nonexistent. The purpose of this study is for define the energy expenditure and the intensity of the two main dancesport disciplines (latin-american and standard dances) in top-level athletes and verify characteristics and differences of these two dance genres. Twenty dancers, 10 male and 10 female (10 couples,), aged between 19 and 31 years, have been enrolled in this study. 5 couples were latin-american dancers while 5 couples standard dancers. Athletes were asked to wear a metabolic holter (Sensewear Armband)for 25 hours and to perform a training session and a simulated competition to record BMR (Basal Metabolic Rate), DEE (Daily Energy Expenditure), TEE (Training Energy Expenditure), MET (Metabolic Equivalent) and PAL (Physical Activity Level). Statistical analysis reveals no differences between the two dance disciplines, our results suggest that dancesport is a moderate/heavy activity that requires a strong energy expenditure. Athletes involved in continuous training programs show a vigorous Physical Activity Level. **Key words**: LATIN-AMERICAN DANCING, BALLROOM DANCING, ENERGY EXPENDITURE, TRAINING ENERGY EXPENDITURE.

**Corresponding author.** University of Bologna, Via San Vitale 15 – 40100, Bologna Italy.
E-mail: andrea.zanchini2@studio.unibo.it
Submitted for publication December 2012
Accepted for publication September 2013
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

**doi:10.4100/jhse.2014.91.15**

## INTRODUCTION

Dealing with the theme of sport dance from a rigorous and scientific point of view is, to date, particularly difficult, because the scientific literature on this discipline is almost nonexistent. So far, generic nutritional rules and indications, "borrowed" from other sports, have been applied to dancers. To our knowledge only one study by Clarkson et al. (2003) have investigated the relationship between nutrition and ballet. More recently other Authors have drown the guidelines for ballet dancers nutrition (Koutedakis et al., 2004; Twichett et al., 2009). Given that it is not known if there are any energy consumption differences among ballet, Standard dances or Latin-american dances, according to Clarkson et al. the energy requirements for a ballet training is among 188,28-209,2 kJ/Kg/b.w. for women and 209,2-230,12 kJ/Kg/b.w. for men.

Recentely the Dance Italian Federation Medical Comitee has published a study on DanceSport physiological aspects, in particular, they have investigated the VO2 max in top-level athletes (Bria et al., 2011). This study concluded that both aerobic and anaerobic methabolisms are strongly activated. Beside this findings, the energy requirements for DanceSport training or competition have still to be fully investigated.

In this study we have evaluate top-level dancer energy expenditure during both training and a simulated competition.

DanceSport represents the couple dance transposition into a sport discipline, with specific rules and competitions. Athletes are divided, in different levels from amateur to professional. Since 1995 the Italian National Olympic Committee has recognized DanceSport as an official sport discipline. DanceSport is becoming a popular discipline all over the world and in 1997 it has been officially recognized by the International Olympic Committee (IOC) (WDSF; ARISF). Actually DanceSport includes many different disciplines: Ballroom (Waltz, Tango, Wiennese Waltz, Foxtrot, Quickstep), International Latin (Samba Chachacha Rumba Paso doble Jive), Caribbean (Salsa, mambo, merengue, bachata, rueda), Ten Dance (Waltz, Tango, Wiennese Waltz, Foxtrot, Quick step, Samba, Cha cha cha, Rumba, Paso doble, Jive), Argentine tango (Tango, Vals, Milonga), Hustle (Disco fox, Disco swing), Jazz/swing dance (Jive jazz, Rock & roll, Acrobatic rock & roll, Boogie-woogie, Swing, Mix blues, Lindy hop).

Competitions are organized according the different discipline types, during each competition athletes have to perform many different dances, each dance lasts between 90 and 120 seconds and different dances are performed at very short intervals, thus requiring a strong recovery capacity. A performance model for DanceSport has still to be investigated and defined, however, according to Delise et al. (2005) DanceSport should be considered a dynamic activity that require an heavy cardiac workload, and from a methabolic point of view, it involve both aerobic and anaerobic pathways, as Bria et al. (2011) have recently demonstrated. A top-level dancer must have both conditional and coordinative skills. With regard to conditional skills a key role is played by resistance training, joint mobility and movement speed. Coordinative skills as well flexibility, and speed are essential to reach a top-level performance. So a typical dance-sport training session has to stimulate all this skills.

## METHODS

Subjects. Twenty dancers, 10 male and 10 female (10 couples) were enrolled in this study. Athletes was between 19 and 31 years old, mean (± SD) age for male was 25,2 ± 3,4 years and 23,7 ± 3,9 for female. Ten dancers (5 couple) were top-level latin-american dancers (Samba, Cha cha cha, Rumba, Paso Doble,

Jive) and the other 5 couples were top-level standard dancers (Waltz, Tango, Wiennese waltz, Foxtrot, Quickstep). Athletes have been divided in four groups of five dancers each: Latin American male dancers (L.A. Male), Latin American female dancers (L.A. Female), Standard male dancers (Std. Male) and Standard female dancers (Std. Female). Weight and height has been measured by using a precision balance and stadiometer. Body Mass Index (BMI) of each subject have been calculated as ratio between weight (Kg) and high2 (m2). The study was approved by the Research Ethics Committee of our institution. Informed consent was obtained pursuant to law from each subject.

Energy Expenditure evaluation. Basal Methabolic Rate (BMR), Daily Energy Expenditure (DEE), Training Energy Expenditure (TEE) of all subjects have been estimated, Metabolic equivalent (MET) of each dance for all subject have been evaluated by a Sensewear ArmBand metabolic holter as previously reported (Mafra et al., 2009).

All athletes were asked to wear the methabolic holter for 25 hours to record data on BMR, DEE, TEE. Senswear ArmBand is known to significantly underestimate energy expenditure during the first 10-30 minutes of activity (Brazeau et al., 2011), to worm up the ArmBand and to avoid any underestimation, data collected during the first hour of activity have been discarded.

Physical Activity Level (PAL) of all athletes have been calculated as ratio between DEE and BMR as reported by FAO/WHO/UNU (2001).

Exercise session. During the training session that lasts for 6 hours, dancers perform both technical exercises (4 hours), designed to correct or refine technical movements and skills, and two repetitions of a competition simulation (2 hours), where standard dancers performed two sequences of Waltz, Tango, Wiennese Waltz, Foxtrot and Quickstep, while latin American dancers two sequences of Samba, Cha cha cha, Rumba, Paso Doble and Jive. During the technical training athletes focused on a specific movement repeated many times at different execution speed; during the competition simulation, athletes had to perform at the rhythm and the intensity of a competition.

*Statistical Analysis*

All values are reported as means ± SD. To check whether difference are statistically significant, given the small sample sizes and the independence of samples, we adopted the Kruskal-Wallis non-parametric test which is statistically informative despite the small number of subjects in each group. The Kruskal–Wallis test is based on the null hypothesis that all the sub-populations have the same distribution function. To test for potential significant differences between the groups the one-way ANOVA test, followed by Bonferroni's post-test has been performed (Prism 5, GraphPad Software Inc., San Diego, CA, U.S.A.). Values of $p<0.05$ were considered as statistically significant.

## RESULTS

BMI of all subjects divided between dancers of Latin American dance (L.A.) and dancers of Standard dance (Std) and according their gender is shown in Figure 1.

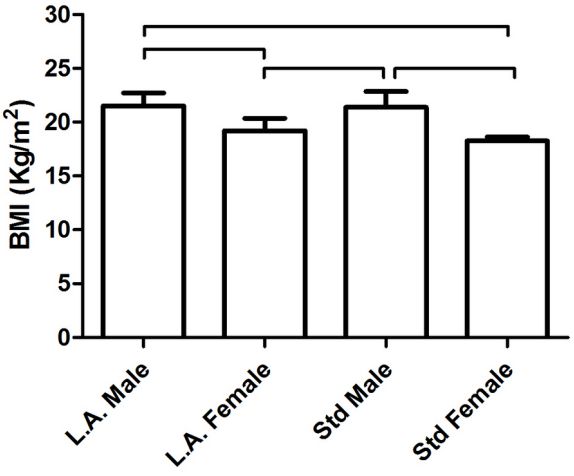
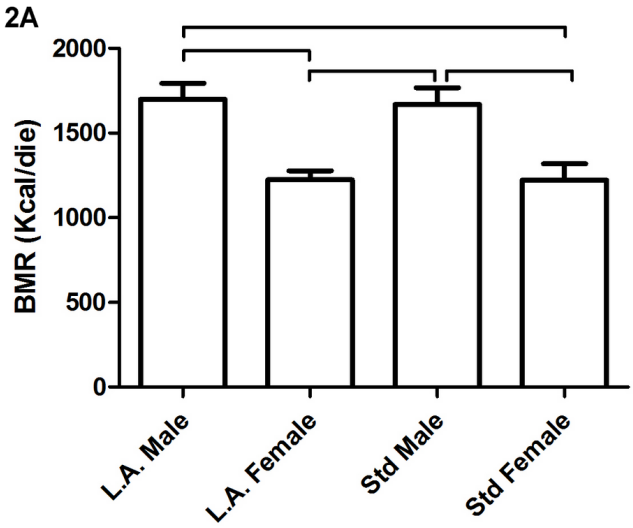



***Figure 1.*** *BMI of all athletes divided according gender and DanceSport discipline. Each column represents mean ± SD. Data were analyzed by Kruskal-Wallis test followed by one-way ANOVA and by Bonferroni's test as post-test: bars identify columns statistically different, p<0.05*

Statistical analysis reveals no differences between male and between female among the two dance disciplines. As expected significant differences are observed between male and female. All male are to be considered normal weight whereas Std Female are slightly under weight as often happen in female dancers and in all those sports where choreography play a key role in the final performance judgment.

BMR, DEE and PAL are shown in Figure 2A, 2B and 2C respectively. Statistical Analysis reveals no differences between dancers involved in the two disciplines whereas male show both higher BMR and DEE with respect to female. However, even though male and female have a different DEE, in term of PAL they do not show any significant difference as shown Figure 2C. As clearly reported in the FAO/WHO/UNU Expert Consultation (FAO/WHO/UNU 2004; SINU 1996), PAL higher than 2 identify a vigorously active or extremely active lifestyle.



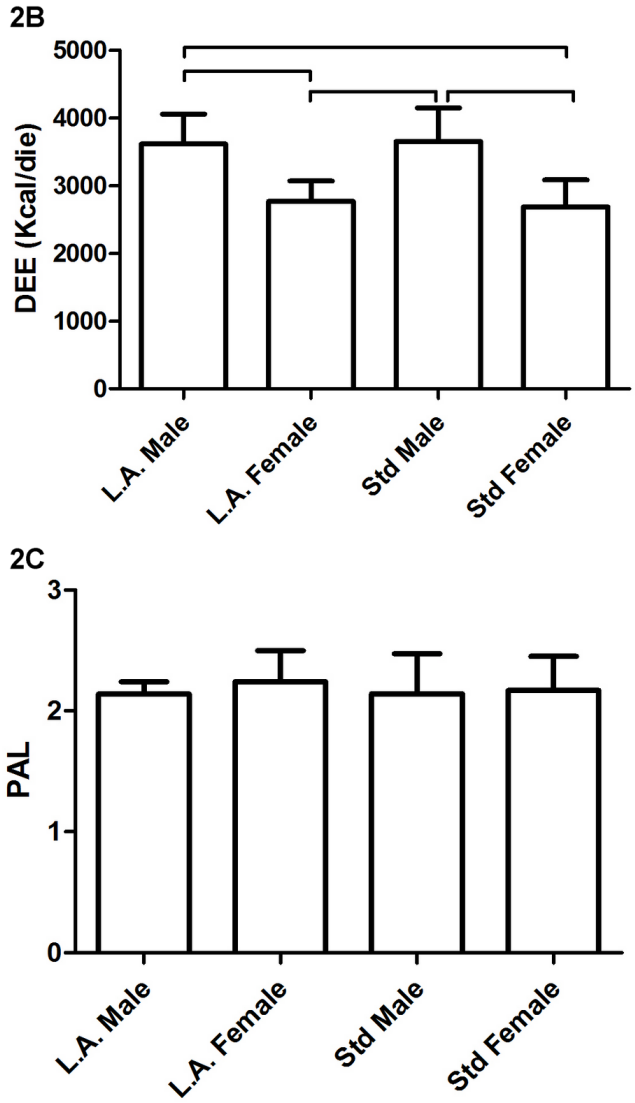



***Figure 2.*** *BMR (Figure 2A), DEE (Figure 2B) and PAL (Figure 2C) of all athletes divided according gender and DanceSport discipline. Each column represents mean ± SD. Data were analyzed by Kruskal-Wallis test followed by one-way ANOVA and by Bonferroni's test as post-test. Bars identify columns statistically different, p<0.05.*

Figure 3A, represent the energy expenditure x h-1 required by training, statistical analysis reveals an higher TEE for male with respect to female but no differences are detected between dancers of the same gender involved in different disciplines. Figure 3B shows the mean intensity, reported as MET (Kcal/kg/h), maintained by dancers during the 4 hours of technical training. Our data clearly show that dance technical training is a moderate intense activity and statistical analysis reveals a slight difference between male standard dancers and Latin American dancers. Figure 3C represent the maximal intensity reached during the competition simulation, reported as MET (Kcal/kg/h), for each dance comprised in the two dance disciplines, Latin American dance and Standard dance, statistical analysis show that all dances with the exception of Foxtrot reach very high intensity pecks.

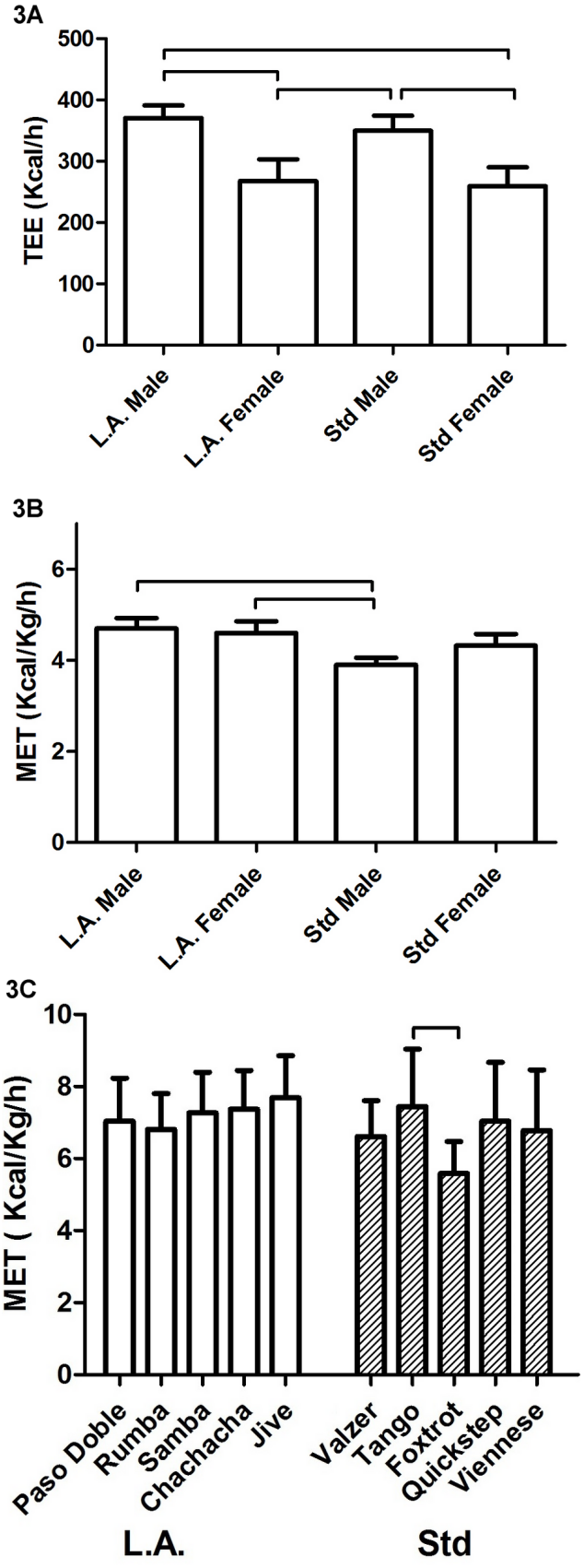


***Figure 3.*** *TEE (Figure 3A), mean intensity, maintained by dancers during the technical training, (Figure 3B) and maximal intensity, reached by athletes during the competition simulation, (Figure 3C) of all athletes divided according gender and DanceSport discipline. Each column represents mean ± SD. Data were analyzed by Kruskal-Wallis test followed by one-way ANOVA and by Bonferroni's test as post-test. Bars identify columns statistically different, p<0.05*

## DISCUSSION

Since September 1997 DanceSport has become part of the Olympic movement, but up to now, only few studies have been carried out to define a clear performance model for this sport. In our study we investigated the DanceSport energy requirements in a group of Italian top-level athletes. Our data allow to classify DanceSport as a moderate/high intensity sport, that requires high daily energy expenditure, as reported in Figure 2B. Data reported in Figure 3 show that PAL, during a training day, can easily overwhelm the value of two; it is well documented that PAL>2 identify a vigorously active or extremely active lifestyle11. Unfortunately most dancers are not often monitored for their nutritional and dietetic habits and for their caloric intake and this can at least partially explain why female dancers are often underweight as our data on BMI show (Figure 1). It is well known that BMI <18.5 is associated with underweight. Moreover, given their high energy expenditure, sportdancers need to be supported by nutrition specialists to avoid malnutrition not only in term of calorie intake, but also in term of micronutrient; to our opinion this issues has to be taken in great account considering the increasing number of people that participate and compete in DanceSport.

Our study has compared data from dancers involved in the two main DanceSport disciplines Latin American dance and Standard dance, no differences have been detected between the two disciplines in term of energy requirement as shown in Figure 4. In term of intensity male standard dancers seem to perform, during the training, at an intensity level slightly lower than that found in Latin American dancers, this can be due to the difference between technical movements performed during this phase of the training session.

Bria et al. (2011) have recently demonstrated that DanceSport is an alternate physical activity that involves both aerobic and anaerobic metabolisms, Authors have also shown that dancers can reach very high VO2 peaks, this finding are in agreement with our results and these data can support the hypothesis that DanceSport can reach very high energy demand.

To better classify the DanceSport a possible approach is to compare our data on intensity required by this activity with those required obtained on other sport activities. In this field researches published by Ainsworth et al. represent the benchmark, in these papers Authors have classified many different activities according to their intensity level based on the rate of energy expenditure expressed as MET (Ainsworth et al., 1993; Ainsworth et al., 2000). Table 1, that reports data from Ainsworth, shows values, expressed in MET, of some sport activities divided into light activities (values up to 3MET), moderated (between 3 and 6MET) and Hard/Vigorous activities (above 6 MET). In this study dance, specifically ballroom, is shown to require an energy expenditure between 3 and 4,5 MET. Our data allow to consider DanceSport training as a moderate activity comparable to activities such as table tennis, golf and non-competitive basketball or tennis doubles, whereas DanceSport competition has to be considered as an intense activity comparable with non-competitive soccer and ski, tennis and volleyball.

***Table 1.*** *Reports data from Ainsworth.*

| ***Light (<3MET)*** | | ***Moderate (3 – 6MET)*** | | ***Hard/Vigorous (>6MET)*** | |
|---|---|---|---|---|---|
| ***Activities*** | ***MET*** | ***Activities*** | ***MET*** | ***Activities*** | ***MET*** |
| Walking, slowly | 2 | Windsurf | 3 | Walking, briskly | 6,3 |
| Playing music | 2 – 2.5 | Ballroom (slow) | 3 | Skiing | 7 |
| Playing | 2.5 | Volleyball (recreational) | 3 – 4 | Soccer (recreational) | 7 |
| Billiards | 2.5 | Tai Chi | 4 | Volleyball (competitive) | 8 |
| Playing darts | 2.5 | Table tennis | 4 | Beach Volley | 8 |
| Fishing | | Golf | 4.3 | Tennis (singles) | 8 |
| | | Ballroom (fast) | 4.5 | Jogging (5mph) | 8 |
| | | Badminton | 4.5 | Basketball (competitive) | 8 |
| | | Basket (noncompetitive) | 4.5 | Swimming (fast treading) | 8-11 |
| | | Tennis (doubles) | 6 | Skiing (brisk speed) | 9 |
| | | Swimming (recreational) | 6 | Soccer (competitive) | 10 |
| | | | | Running (7mph) | 11,5 |

## CONCLUSIONS

In conclusion our results indicate that DanceSport is a moderate/heavy activity that induce a strong energy expenditure. Athletes involved in continuous training programs show a vigorous Physical Activity Level. This study should be a valid instrument for DanceSport from a nutritional point of view. Nutrition play a key role not only to reach a good sport performance both during training periods and competition, but also to guarantee the maintenance of a good healthy status to the athletes. A better consciousness about energy requirements in DanceSport could be useful to dancers and dieticians to evaluate the best nutrition program for athlete's performance, and to fitness coach to program a specific training for this discipline.

## REFERENCES


1. Ainsworth, B.E., Basset, D.R., Emplaincourt, P.O., Haskell, W.L., Irwin, M.L., Jacobs, D.R., Leon, A.S., O'Brien, W.L, Schmitz, K.H, Strath, S.J, Swartz, A.M, & Whitt, M.C. (2000). Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sport Exer*, *32*(9), pp. 498-516.
2. Ainsworth, B.E., Haskell, W.L., Jacobs, J.R., Leon, A.S., Montoye, H.J., Paffenbarger, R.S., & Sallis, J.F. (1993). Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sport Exer*, *25*, pp.71-80.
3. ARISF association. Retrieved from http://www.arisf.org/news/members (accessed 26 November 2011).
4. Arkouche, W., Cleaud, C., Deleaval, P., Fouque, D., Jolivot, A., Mafra, D., Perrot, M.J., Rognon, S., Teta, D., & Thevenet, M. (2009). New measurements of energy expenditure and physical activity in chronic kidney disease. *Journal of Renal Nutrition*, *19*(1), pp.16-9.
5. Athanasios, J., & Koutedakis, Y. (2004). The dancer as a performing atlete. *Sports Med*, *34*(10), pp.651-661.
6. Bettini, R., Caselli, G., D'Andrea, L., Delise, P., Giada, F., Guiducci, U., Notaristefano, A., Pelliccia, A., Penco, M., Proto, C., Spataro, A., Thiene, G., Villella, A., & Zeppilli, P. (2005). Cardiological guidelines for competitive sports eligibility. *Italian Heart Journal*, *6*(8), pp.661-702.

7. Brazeau, A.S., Karelis, A.D., Lacroix, M.J., Mignault, D., Prud'homme, D., & Rabasa-Lhoret, R. (2011). Accuracy of the SenseWear Armband™ during ergocycling. *Int J Sports Med*, *32*(10), pp.761-764.
8. Bria, S., Bianco, M., Faina, M., Galvani, C., Palmieri, V., & Zeppilli, P. (2011). Physiological characteristics of elite sport-dancers. *J Sport Med Phys Fit, 51*(2), pp.194-203.
9. FAO/WHO/UNU. Human energy requirements: Principles and Definitions. Report of a Joint FAO/WHO/UNU Expert Consultation. Available online at ftp://ftp.fao.org/docrep/fao/007/y5686e/y5686e00.pdf (accessed 26 November 2011).
10. Food and Agriculture Organization of the United Nations. 2004. Retrieved 15 October 2009. Available online at http://www.fao.org/docrep/007/y5686e/y5686e07.htm (accessed 26 November 2011).
11. IADMS (2003) Clarkson, P. & IADMS Education Committee. Nutrition Fact Sheet: Fueling the Dancer. Retrieved from http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=2 (accessed 26 November 2011).
12. Koutedakis, Y., Twitchett, E.A., & Wyon, M.A. (2009). Physiologic fitness and professional classical ballet performance: a brief review. *J Strenght Cond Res*, *23*(9), pp.2732-2740.
13. SINU association. Retrieved from http://www.sinu.it/larn/LARN%2096-%20Energia-%20figure%20e%20tabelle.pdf (accessed 26 November 2011).
14. WDSF media guide. DanceSport. Retrieved from http://www.worldDanceSport.org/About/Olympic/Part_of_the_Olympic_Movement (accessed 26 November 2011).