©Journal of Sports Science and Medicine (2013) **12**, 716-723
http://www.jssm.org

Research article

Examining Self-Training Procedures in Leisure Swimming

Francois J. Potdevin [1]✉, Clement Normani [1] and Patrick Pelayo [2, 3]
[1] Team Research of Sport and Society (EA 4110), [2] Activity-Muscle-Health Laboratory (EA 4488), Department of Sport Sciences Lille 2 University, and [3] Superior School of Teaching and Education Lille North of France, France

Abstract
This study investigated contents of training sessions from 387 regular swimmers involved in a recreational workout without supervision. We did use multiple correspondences analysis in order to identify self-trained swimmers typology in a sample from a social networking website, focusing on swimming practice. Self-reported parameters (n = 12) were age, gender, practice frequency, supervision in physical activity experiment, main training target, main reason for swimming choice, swimming session duration and distance, most used swimming stroke and material, quality of the training control, and training evolution during a year. Results have highlighted different training strategies and targets according to gender and age. Male strategy consists in performing higher distance (1818.8 ± 644.5 m vs. 1453.0 ± 603.3, $p < 0.05$ for male and female respectively) by using several swim stroke and gears involving upper body muscles (front crawl, pull buoy and paddles). More concerned about duration of their sessions, women are mainly using breaststroke. Backstroke is associated with people aged higher than 50. We also have established a connection between motives according to ages and long term strategies. The main motivation for middle aged people appears to be general health benefits by performing identical swimming session without evolution during a year. People aged from 20 to 30 are divided between an identical swimming session strategy and an increase in distance or in intensity strategy during a year. This population appears to be concerned about a global health benefits and a body shape effects. Suggestions are made to improve swimming practice environment during free time sessions according to the main results.

Key words: Physical activity, strategy, multiple correspondence analysis, leisure swimming.

Introduction

Regular physical activity has long been considered as a main condition for a healthy lifestyle. This idea was recently strengthened with some new scientific evidence linking regular physical activity to a set of physical and mental health benefits (Biddle, 1993; Dishman, 1992; Gill, 1986; Gilroy, 1989; Gruber, 1986; Kesaniemi et al., 2001; King et al., 1989; Vilhjalmsson and Thorlindsson, 1992).

Determinants of sport and physical activity participation in adults are well researched. A lot of studies establish this influenced behavior according to demographic, biological, psychological, behavioral, social, cultural, and physical environmental factors (Bauman et al., 2002; Dishman, 1982; Sallis and Hovell, 1990; Sallis et al., 1992; Sallis and Owen, 1999; Trost et al., 2002). Furthermore, there are many well documented reports about the quantification of physical activity in several fields (work, home activities and sports) according to geographic, social and cultural backgrounds (Bauman et al, 2009; Rutten and Abu Omar, 2004; Sjöström et al., 2006).

Paradoxically, few studies have investigated the qualitative description of training procedures used by people perceived as physically active. To our knowledge, no study aimed to accurately describe what active people do when practicing specific sports or exercises. Yet, this approach could improve practice environment as well as knowledge about the way these people respect their commitment. Specific literature provides a great amount of information about the motives involved in physical activities according to gender and age (Brunet and Sabiston, 2011; Leit et al., 2002; Mc Cabe and Ricciardelli, 2004; Miller et al., 2000) and shows a significant effect of these variables. Therefore, it seems relevant to explore in depth details of training sessions with people practicing regular sports session related to age, gender and motives.

In Europe, 27 % of the population over 15 years old claims to workout without supervision at least once a week during their free time (European Commission Report, 2010). Representing a total of 14 million people in France (Lefebvre and Thiery, 2010), this population could be defined as self-trained people since they are not registered in any social structure. Investigating this specific population appears to be relevant because self-regulatory training such as goal setting or self monitoring progress contributes to keeping them physically active (Dishman, 1982). Among the sports currently practiced in France, swimming is one of the most popular one representing 3 millions of regular self-trained people among female, male, young and older adults (Muller, 2005).

Most research concerning leisure swimming have focused on health benefits such as anthropometric indicators (Cox et al. 2010), effect in blood pressure (Cox et al., 2006; Tanaka et al., 1997), decrease in morbidity risks (Kapplan et al., 1996) or general well being (Huttunen et al., 2004). Determinants in leisure swimming participation have been less investigated. Biernat (2012) corroborated previous studies highlighting the importance of the socio-demographic determinants of active forms of leisure time. Reasons for participating in a regular leisure swimming practice have also been investigated (Hastings et al., 1995) and have shown the importance of fitness, achievement and sociability. To our knowledge, no study has investigated accurately the quantification and the contents of practice in leisure swimmers. Social statistic

Received: 10 July 2012 / Accepted: 02 October 2013 / Published (online): 01 December 2013

Table 1. **Characteristics of the participants.**

	Age (years)				
Gender	**<20**	**[20-30]**	**[30-40]**	**[40-50]**	**>50**
Male (n, %)	14 (3.6%)	80 (20.6%)	91 (23.5%)	38 (9.8%)	10 (2.5%)
Female (n, %)	11 (2.8%)	79 (20.4%)	40 (10.3%)	15 (3.8%)	9 (2.3%)
Total	25 (6.4%)	159 (41%)	131 (33.8%)	43 (13.6%)	19 (4.8%)

researches (Lefebvre and Thierry, 2010; Muller, 2005) and leisure studies (Idefi, 2008) present swimming rates participation among all the physical activities. In epidemiological reports (Bauman et al, 2009; Rutten and Abu Omar, 2004; Sjöström et al., 2006) measures of leisure swimming quantification is often included in aerobic activities such as walking, running or cycling and impair accurate knowledge about self-training procedures in leisure swimming. Furthermore, researches aiming objective measurements by actimetry or accelerometry in order to avoid bias of self-reported data are unable to investigate activity in aquatic environment (Troiano et al., 2008).

Thus, the purpose of the actual study was to describe swimming sessions from regular self-trained swimmers from a quantitative and qualitative point of view. We used accordingly Multiple Correspondences Analysis (MCA, Le Roux et al., 2008) in order to unravel the complex interactions between age, gender and the contents of session variables, and detect typology of self-trained swimmers.

Methods

Participants

387 self-trained adult swimmers (60.2 % of male and 39.8 % of female) accepted the participation in this study. Age and gender are described in Table 1. In order to avoid demographic and seasonal effects (Rifas-Shiman et al., 2001; Wilcox et al., 2000), swimmers were recruited in a specific urban context, during two weeks in Paris (France). In order to examine regular self-trained swimmers only, were excluded from this study swimmers practicing less than once a week, as well as swimmers supervised and coached during their sessions, or the one swimming according for medical purpose.

Measures

All self-reported parameters were age, gender, practice frequency, supervision in physical activity experiment, main training target, main reason for swimming choice, swimming session duration and distance, most used swimming stroke and material, quality of the training control, and training evolution during a year. Age, swimming session duration and distance were quantitatively measured and accordingly coded to a qualitative scale (Table 2). Others parameters were qualitatively evaluated by numerous ordinal and nominal variables. The training control quality was evaluated by the capacity to describe the last swimming session with no specific instruction ("Can you describe your last swimming session accurately?"). Parameters used to code the training control quality into the session description were: the distance, the variety of used swim strokes, the effectiveness of interval set, the control of intensity and the occurrence of recovery period (Mujika, 1998).

Table 2. **Measures self reported and their coding.**

Variables-levels	Modalities coding
1. Age (years) -5	1 = < 20; 2 = 20 to 30, 3 = 30 to 40, 4 = 40 to 50, 5 = >50.
2. Gender-2	1 = male, 2 = female
3. Practice frequency-4	1 = exceptionally*, 2 = monthly*, 3 = weekly, 4 = more than one time per week
4. Supervision in physical activity experiment-2	1 = only at school, 2 = in club
5. Main training target-9	1 = no target, 2 = weight management, 3 = body shape, 4 = sport event planning, 5 = physical fitness, 6 = relaxation, 7 = a complement to other physical activities, 8 = social networks, 9= medical sanction*.
6. Main reason for swimming choice-9	1 = unknown, 2 = lives near the swimming pool, 3 = climate, 4 = habit of practice, 5 = financial cost, 6 = enjoyment, 7 = health benefits by swimming, 8 = social networks, 9 = medical sanction*
7. Swimming session duration (min)-4	1 = unknown, 2 = <30, 3 = 30 to 45, 4 = 45 to 60, , 5 = > 60
8. Swimming session distance (m)-4	1 = unknown, 2 = <1000, 3 = 1000 to 1500, 4 = 1500 to 2000, 5> 2000
9. Swimming stroke more used-8	1 = butterfly, 2 = backstroke, 3 = breaststroke, 4 = frontcrawl, 5 = kickstroke, 6 = armstroke, 7 = combined swim stroke, 8 = other
10. Material most used-7	1= no material, 2 = kickboard, 3 = fins, 4 = pull-buoy, 5 = paddles, 6 = cardio frequency meter, 7 = chronometer, 8 = other
11. Session training control-4 *Notation was performed according the description of last training session. Parameters such as distance, swim strokes, series, intensity control and recovery period are used to code the quality of the control*	1 = no capacity to describe last session, 2 = 1 parameter present in the description, 3= 2 parameters, 4 = 3 parameters or more
12. Training evolution during a year-4	1 = identical training, 2 = identical distance and increased intensity, 3 = increased distance and identical intensity, 4 increased distance and intensity.

* Modalities excluding participants from the analysis, a total of 61 modalities was retained for the study.

Procedures

Participants were recruited through the French website *http://www.nageurs.com.* This website registers more than 1000 weekly visits and focuses on the ability to describe one's own swimming session as well as displaying news about swimming practice in Paris (France). Thus, recruited people from this website could be considered as very concerned about their swimming practice. Before any data collection, ethics consent was granted through the French National Ethics Committee. Once participants logged themselves into the website, they were invited to participate in a study aiming to describe the substance and motives concerning their leisure swimming sessions. An electronic informed consent form was filled in and a confidential username and password were created. Once logged in, participants had access to the online survey. This type of survey method was used since it has a faster response rate, it yields less missing responses, and it provides equivalent scores when compared to paper-and-pencil survey methods (Lonsdale et al., 2006).

Statistical analyses

Distance and duration variables were averaged according to gender and age in order to describe sessions training from a quantitative standpoint. Subjects who responded with unknown duration or distance were excluded from this first analysis. Distance and duration variables were reported according to qualitative scale (see Table 2) and Chi 2 test was performed to assess gender effect on distance and duration session. In the same way, modalities of material used in relation to gender were tested by identical test. The level of significance was set at .05.

A total of 12 variables were considered and the corresponding data were organized according to a Burt table matrix where each row corresponds to one participant, and each column to a variable (Greenacre, 2007). With 387 rows and 12 columns, this matrix has been investigated through the multiple correspondences analysis (MCA). MCA is a multivariate technique of investigation that converts a matrix of data into a graphical display in which matrix's rows and columns are depicted as points (Greenacre and Hastie, 1987; Greenacre, 2006). MCA identifies the common components among multiple variables and label this component as a "factor" corresponding of axis in the low geometric space. All these factors are the result of the common component between or among two or more variables and explain a part of the inertia (variance) of all the data. This geometric data analysis differs from conventional multivariate techniques which distinguish *a priori* dependent variables which then might be explained through different combinations of independent variables. Instead, it inductively proceeds from the Individuals x Variables table. This analysis allows finding out the most informative space modalities, connections between these modalities, empirical situation classes and correspondences between the most informative modalities and these classes.

The total variance is explained by a number of factor axis associated with their contribution to this total variance (eigenvalues, λ). The variances of axes (i.e. eigenvalues) indicate the number of axes to be interpreted in order to provide an adequate summary. These axes separate out responses relationally, concerning each other, permitting us to assess whether or not some stand in opposition. We can subsequently inspect the ordering of this space to determine how individual respondents are located within that space. According to the recommendations of Benzecri (1992), only factor axis with eigenvalues higher than averaged ones (λ_m) are maintained for the analysis. λ_m is calculated according to the formula (1) with N corresponding to the number of variables.

$$\lambda_m = \frac{1}{N} \qquad [1]$$

For each factor axis with λ higher than 0.08 (λm =1/12=0.08), λ have been reevaluated (λ'') according to the two procedures (Benzecri, 1992):

$$\lambda' = (\lambda - \lambda m)^2 \qquad [2]$$

$$\lambda'' = \frac{\lambda'}{\Sigma\lambda'} \qquad [3]$$

For each axis, modalities with high contribution to the axis, variance has been retained for the geometric analysis. High contribution was defined as important when it was higher than 1.6% (1/number of modalities, 61 modalities were retained for the analysis). As a general rule, interpretation of an axis retains at least all the modalities whose contribution exceeds the average contribution. According to Benzecri (1992), the axis interpretation consists in finding out the common dimension between all the data; then specifying contrast between the far right and the far left of the data. The interpretation has to be conducted according two principles. When two modalities from one identical variable are closely plotted, this means that participants characterized by one modality and participants characterized by the other one are similar from all the others variables. When two modalities from different variables are closely plotted, this means that participants characterized by one or the other one are globally similar. Statistics procedures were performed with STATISTICA software.

Results

387 self-trained adult swimmers (60.2 % of male and 39.8 % of female) accepted the participation in this study. Mean distances and durations in relation to age and gender are reported in Table 3. Significant gender effect has been detected for swimming session distance (1818.8 ± 644.5 m *vs* 1453.0 ± 603.3 m, $p < 0.05$, respectively for male and female).

Modalities of material used in relation to gender are presented in Table 4. Significant gender effect has been showed for material used. Kickboard (29.2% *vs* 18.2%) and fins (16.9% *vs* 8.4%) are more used by female swimmers than by males. On the contrary, pull buoy (32.9% *vs* 14.9%) and paddles (9.3% *vs* 1.3%) are more used by male swimmers.

MCA showed that the first factor axis accounts for

Table 3. Mean (±SD) distances and durations of swimming sessions in relation to gender and age.

Gender	Age	Distance (meter)	Duration (min)
Male	<20 years	1839.3 (669.4)	48.8 (6.9)
	20 to 30 years	2003.7 (678.3))	46.2 (7.2)
	30 to 40 years	1924.4 (605.2)	45.7 (9.1)
	40 to 50 years	1676.5 (660.9)	44.3 (9.3)
	> 50 years	1650.0 (615.5)	44.2 (7.9)
	Mean	1818.8 (644.5)	45.8 (8.4)
Female	<20 years	1200.0 (421.6)	45.8 (7.9)
	20 to 30 years	1664.3 (541.6)	45.7 (8.3)
	30 to 40 years	1567.6 (670.9)	44.3 (12.5)
	40 to 50 years	1583.3 (679.2)	40.7 (13.6)
	> 50 years	1250.0 (731.9)	40.7 (13.6)
	Mean	1453.0 (603.3) *	43.4 (9.5)

* $p < 0.05$.

Table 4. Material most used in relation to gender.

	Female (%)	Males (%)
No material	32.5	26.2
Kickboard	29.2	18.2 *
Fins	16.9	8.4 *
Pull buoy	14.9	32.9 *
Paddles	1.3	9.3 *
Cardio frequency	0.0	0.0
Chronometer	5.2	4.9

* $p < 0.05$.

a much larger total variance than the following ones (λ'' = 53% versus 11% and 7.5% for factor 2 and 3 respectively). Thus, only factors 1 and 2 will be considered in the study and represent the focus of this study. Significant modalities contributions to factors 1 and 2 are presented in Table 5.

Factor 1 mainly emphasizes modalities for variables measuring distance (19.9%, "< 1000-m", "from 1000 to 1500-m", ">2000-m"), used swimming stroke (14%, "unknown," "breaststroke", "front crawl"), session duration (13%, "unknown" and "from 30 to 45 min"), gender (8.9%, "males" and "females"), swimming frequency (6.6%, "weekly" and "more one time a week"), material (6.3%, "no material", "pull buoy", "paddles"),

Table 5 . Significant modalities contributions to factors 1 and 2.

Variables-Modalities	Contribution to factor 1 (%)	Contribution to factor 2 (%)
Gender - men	3.4 *	.8
Gender - female	5.1 *	1.3
Age - 20 to 30 years	.4	9.4 *
Age - 40 to 50 years	.0	2.0 *
Age - > 50 years	.9	10.6 *
Practice frequency - weekly	4.5 *	1.1
Practice frequency more than one time per week	2.2 *	.5
Supervision in physical activity experiment - school	2.7 *	3.1 *
Supervision in physical activity experiment - club	1.6	1.9 *
Main target - no target	.0	2.4 *
Main target - body shape	.0	3.9 *
Main target – training for a sporting event	2.7 *	.0
Main reason for swimming choice – financial cost	1.7 *	4.2 *
Main reason for swimming choice - health benefits by swimming	.0	2.8 *
Swimming session duration - unknown	6.7 *	.8
Swimming session duration - from 30 to 45 min	6.6 *	.0
Swimming session distance - unknown	2.4 *	.0
Swimming session distance - <1000 m	5.6 *	3.4 *
Swimming session distance - from 1000 to 1500m	2.6 *	1.3
Swimming session distance - > 2000m	9.9 *	.7
Swimming stroke more used - unknown	3.1 *	.0
Swimming stroke more used - backstroke	.8	11.8 *
Swimming stroke more used - breastroke	5.4 *	.2
Swimming stroke more used - front crawl	5.6 *	.2
Swimming stroke more used - arm stroke	1.2	4.5 *
Material more used – no material	5.6 *	.5
Material more used - pull-buoy	6.6 *	.3
Material more used - paddles	2.0 *	.6
Material more used - chronometer	.0	2.3 *
Session training control - 4	.5	5.0 *
Training evolution during a year - identical training	.0	6.7 *
Training evolution during a year - identical distance and increased intensity	.0	2.3 *
Training evolution during a year - increased distance and identical intensity	.5	2.7 *

* represents modalities whose contribution exceeded the average contribution.

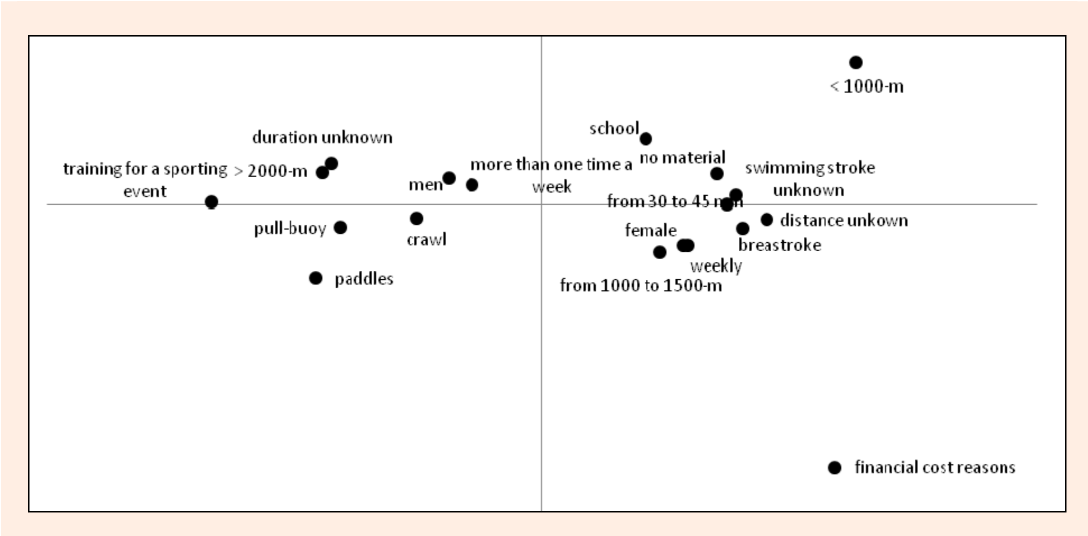


Figure 1. **Modalities whose contribution to factor 1 exceeded the average contribution in a two dimensional plot (factors 1 and 2).**

motivation (2.7%, "training for a sporting event"), training experience (2.6%, "school") and main choice for swimming (1.7%, "financial cost"). All the modalities significantly associated to factor 1 are presented in Figure 1 in a plot of two-dimensional space (axis 1 corresponds to factor 1 and axis 2 corresponds to factor 2). 12 modalities concerned the session content (distance, duration, swimming stroke, and material), 2 for the practice frequency, 2 for the gender, 1 for the main reason for swimming choice, 1 for the main target and 1 for supervision experiment. Together, the 19 modalities contribute to 75.7 % of the variance in axis 1. Factor 2 emphasizes for variables measuring age (22%, "20 to 30 years", "30 to 40 years", ">50 years"), mostly used swimming stroke (16.22%, "backstroke" and "arm stroke"), training evolution (11,7%, "identical training", "identical distance and increased intensity", identical intensity and increased distance"), swimming choice (6.95%, "financial cost" and "health benefits"), main target (6.3%, "no target" and "body shape"), session quality (5.02%, "swimming session control 4"), supervision in physical activity experiment (5%, "school" and "club"), distance (3.43%, "< 1000-m"), and used material (2.27%, "chronometer"). Seventeen modalities were associated with factor 2 contributing together to 75.6 percent of the second axis variance. Figure 2 gives a two dimensional plot, according to the first and second factor axis.

Discussion

The aim of this study was to describe the characteristics of training sessions in self-trained people, in order to identify different practice typologies. 387 self-trained swimmers (60.2 % of male and 39.8 % of female) were recruited during two weeks. This percentage is consistent with previous French study showing males were more committed in leisure swimming than females in the same proportion (Lefebvre and Thiery, 2010). We thus explored how the MCA analysis illustrates the map of swimming session's variables. It is worth noticing that

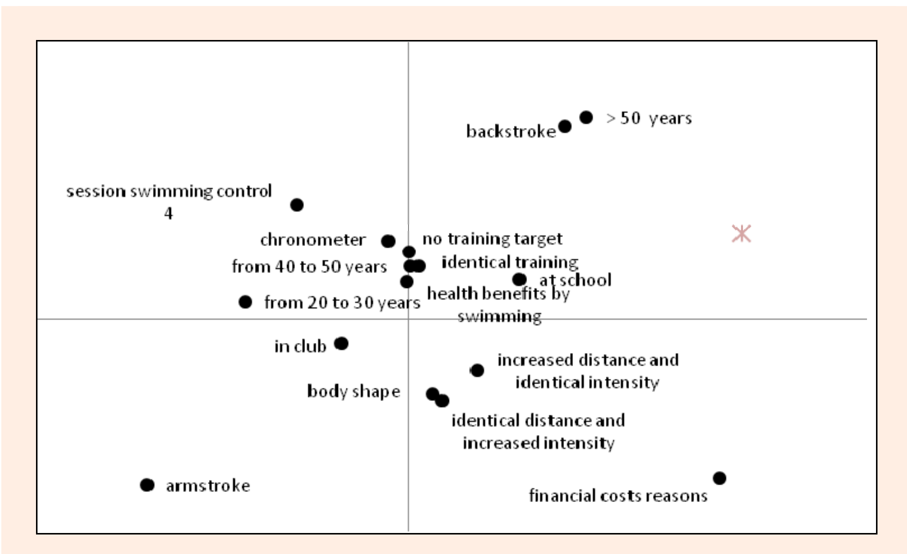


Figure 2. **Modalities whose contribution to factor 2 exceeded the average contribution in a two dimensional plot (factors 1 and 2).**

people participating in this study should be perceived as very concerned about their practice, since recruited via a social network website specialized in swimming.

Interpretation of the axis: Most of the variance in axis1 is accounted by the contents of the swimming session (distance, duration, swimming stroke) and gender, while on the second axis the contribution of age and strategies (evolution of training, training targets and reason for swimming) are dominant. It is worth noticing that axis 2 accounts for only 11% of the total variance. In that way, interpretation has to be purposed with caution.

Axis 1: Effect of gender on the contents of training session. Figure 1 shows the 19 retained modalities for the analysis. It is worth noticing that variables not graphically associated with another one are hardly understandable. Contents of the session and gender modalities represent 62.1% of the variance of this first axis, which could be interpreted as the effect of gender on the contents of the session. Two types of modality are considered to the left of this axis: male and contents of session training. There is an evidence of strategy in terms of distance (the duration is unknown) with exercises involving upper body muscles (front strokes, paddles and pull buoy). In contrast, to the right of the axis are modalities expressing female session training with lower distance, duration consideration and breaststroke involving lower body muscles groups (Holmer, 1974). This geographical plot repartition corroborates the gender effect highlighting than female swimmers used more frequently fins and kickboard whereas males used more paddles and pull buoy. In the same way, it corroborates the quantitative analysis showing that distance is gender dependent, whereas it is not the case for duration. Indeed, for regular swimmers breaststroke is the less efficient swimming stroke (Barbosa et al., 2006) and explains the diminution of distance whereas duration was similar between genders. Nevertheless, it could be hypothesized that for female, breaststroke could be more efficient than front crawl because they can swim longer without being breathless or asphyxiated.

This partition between male and female strategies has been pointed out in many studies measuring motivations in sports practices. For example, females seem to value social incentives more than males (Flood and Hellstedt, 1991; Gill and Overdorf, 1994). Also, weight control and appearance are strong participation motives for this kind of population (Cash et al., 1994; Gill et al., 1996). On the contrary are competition and competence motives being more valued by men (Guilbert et al., 2001). These differences are here in compatibility with the graphic association between “male” and “training for a sporting event” in which front crawl is paramount. Although physical appearance concerns both men and women, females often strive for thinner, lighter figure (Miller et al., 2000), whereas males tend to yearning muscularity with a V body shape (Leit et al., 2002; Mc Cabe and Ricciardelli, 2004). These very general trends appear to be congruent with this first axis and could be taken into account in guidelines for swimmers in proposing specific exercises according body shape targets. Interesting results consist in the control of swimming distance for men and swimming duration for women. These results show two kinds of logic of achievement regarding the training procedures for this sample. Nevertheless, practice frequency is here higher for men (more one time a week) than females (once), and could affect session’s control, especially by “training for a sporting event” associated with the men. However, this result is in concordance with a lot of studies establishing a gender effect with any spent time in physical activity (Koivula, 1999).

Axis 2: Effect of age on training targets: Seventeen modalities were selected contributing together to 75.6 percent of the second axis variance (see Figure 2). There is a continuous position for age modalities from 20 to 50 years, from middle to top of the axis. Thus, this second axis could be interpreted as a mapping of training targets and strategies according to age. On the bottom of the vertical axis are plotted two kinds of a yearly training evolution (increase in distance or in intensity) graphically associated to the body shape target. On the middle of the axis, people from 40 to 50 years old are graphically associated with an identical training session, a high control training (score = 4) and the use of a chronometric control. The main motivation for leisure swimming practice is health benefits without specific target in training. This result is in conformity with previous researches based on motivation theories (Edmunds et al., 2006; Wilson and Rodgers, 2004) as well as data showing that intrinsic motivation and health motives strongly correlate to physical activity behavior in middle-aged people (Trost et al., 2002). These findings suggest that adults and middle-aged ones participate in physical activity for the inherent enjoyment and fun aspects of leisure activity, and/or because it is congruent with their personal values, goals or needs. The identical training throughout the year could be interpreted as the pleasure to repeat a similar session with the purpose of maintaining their physical condition in qualitatively controlling their practice (with a high score in the training control). Nevertheless, more investigations are needed to explore this stability in the session’s contents. People aged from 20 to 30 are plotted between evolution of training (increase in distance or in intensity) and identical session. This population appears to be divided according a global health benefits target (as middle-aged people) and a body shape target (Fogelholm and Kukkonen-Harjula, 2000). It is worth noticing that modalities describing training evolution are not graphically associated with session swimming control. This could suggest a lack of knowledge in the training management concerning this population, whereas a goal as improving their training is obvious. Age higher than 50 years is geographically associated with backstroke, which has been shown as the most economical swim stroke with front crawl (Barbosa et al., 2006) and considered since a long time as the most comfortable technique for the breath (Karpovich, 1939).

Suggestions in improving leisure-swimming environment: Results of this study are referring to a sample of regular recreational swimmers involved in a very concerned practice. Measured distances and durations show a good skill level in the study population sample. These characteristics are the main limitation of the study because most of leisure swimmers are less expert in swimming practice than this sample. Nevertheless, general trends could be considered in order to improve practice conditions. In relation to this study's main results, it could be suggested that swimming gears such as fins, pull buoy, kick board, or paddles could be offered at the owned disposal and proposed with a variety of drills broad via posters or the swimming pool website. Indeed, results showed that 32.5% of females and 26.2% of males (Table 4) didn't use material during swimming sessions. Variety of materials associated with exercises could improve the variety of swimming sessions which is one of parameter for a long term commitment (Franklin, 1988). Results concerning the gender effect on the gears used showed that material could be considered as a "tool" to reach personal training target. Because of the different velocities reported among the participants, straight line could be affected according practice level or material of propulsion used. Wall mounted pace clocks (switched on) could give feedbacks on performances during training, allowing then a better session control which appears very low according to the results of using chronometer (5.2 % and 4.9% for females and males respectively). The swimming pool team could purpose a "training of the day" with regulations according to the level of practice, in order to propose some variety in self-training.

Conclusion

In conclusion, this study extends our understanding of physical active people involved in a leisure swimming practice. To our knowledge, it makes a unique contribution in the investigation of leisure swimming by exploring contents of swimming session by qualitative and quantitative dimensions. Results brought data in relation with distance, duration, and material used, according to gender and age. MCA methodology highlighted different self-training strategies and targets. These strategies have to be taken into account in order to improve practical swimming environment. Studies about quantitative and qualitative contents of leisure physical activity sessions are a necessary complement of studies investigating the social characteristics of active people. Future research could explore larger sample, more representative of the recreational swimmers, in order to improve conditions of free time practice and health educational programs using sport. This could interest the most popular practiced sports throughout industrialized societies such as swimming.

References

Barbosa, T., Fernandes, M., Keskinen, K., Colaço, P., Cardoso, C., Silva, J., and Vilas-Boas J.P. (2006) Energy expenditure in swimming. *International Journal of Sports Medicine* **27,** 894-899.

Bauman, A., Bull, F., Chey, T., Craig, C.L., Ainsworth, B.E., Sallis, J., Bowles, H., Hagstromer, M., Sjostrom, M., Pratt, M. and the IPS Group. (2009) The international prevalence study on physical activity: results from 20 countries. *International Journal of Behavioral Nutrition and Physical Activity* **6,** 21. Available from URL: http://www.ijbnpa.org/content/6/1/21/.

Bauman, A., Sallis, J., Dzewaltowski, D. and Owen, N. (2002) Toward a better understanding of the influences on physical activity. The role of determinants, correlates, causal variables, mediators, moderators, and confounders. *American Journal of Preventive Medicine* **23,** 5-14.

Benzecri, J.P. (1992) *Correspondence Analysis Handbook*. Marcel Dekker, New York.

Biddle, S. (1993) Children, exercise and mental health. *Journal of Sport Psychology* **24,** 200-216.

Biernat, E. (2012) Socio-demographic determinants of participation in swimming amongst working residents of Warsaw. *Journal of Human Kinetic* **32(1),** 175-183.

Brunet, J. and Sabiston, C. (2011) Exploring motivation for physical activity cross the adult lifespan. *Psychology of Sport and Exercise* **12(2),** 99-105.

Cash, T.F., Novy, P.L. and Grant, J.R. (1994) Why do women exercise? Factor analysis and further validation of the reasons for exercise inventory. *Perceptual and Motor Skills* **78,** 539-544.

Cox, K. L., Burke, V., Beilin, L.J. and Puddey, I.B. (2010) A comparison of the effects of swimming and walking on body weight, fat distribution, lipids, glucose, and insulin in older women. *Metabolism* **59(11),** 1562-1573.

Cox, K.L., Burke, V., Beilin, L.J., Grove, R., Blanksby, B.A. and Puddey, I.A. (2006) Blood pressure rise with swimming versus walking in older women: the Sedentary Women Exercise Adherence Trial 2 (SWEAT 2). *Journal of Hypertension* **24(2),** 307-314.

Dishman, R. (1982) Compliance/adherence in health related exercise. *Health Psychology* **1,** 237-267.

Dishman, R. (1992) Psychological effects of exercise for disease resistance and health promotion. In: *Exercise and Disease.* Eds: Watson, R.R. and M. Eisinher, M. Boca raton, Fla: CRC Press. 179-207.

Edmunds, J., Ntoumanis, N. and Duda, J. (2006) A test of self-determination theory in the exercise domain. *Journal of Applied Social Psychology* **36,** 2240-2265.

European Commission Report. (2010) *Physical activity in Europe*. Available from *http://ec.europa.eu/public_opinion/archives/ebs/ebs_334_en.pdf*

Flood, S.E. and Hellstedt, J.C. (1991) Gender differences in motivation for intercollegiate athletic participation. *Journal of Sport Behavior* **14,** 159-167.

Fogelholm, M. and Kukkonen-Harjula. (2000) Does physical activity prevent weight gain: a systematic review. *Obesity Reviews* **1,** 95-111.

Franklin, B. (1988). Program factors that influence exercise adherence: practical adherence for the clinical staff. In: *Exercise adherence: Its impact on public health.* Ed: Dishman, R.K. Champaign: Human Kinetics. 237–258.

Gill, D. (1986) *Psychological dynamics of sport*. Human Kinetics Books, Champaign, IL.

Gill, K. and Overdorf, V. (1994) Incentives for exercise in younger and older women. *Journal of Sport Behavior* **17,** 87-97.

Gill, D.L., Williams, L., Dowd, D.A., Beaudoin, C.M. and Martin, J.J. (1996) Competitive orientations and motives of adult sport and exercise participants. *Journal of Sport Behavior* **19,** 307-318.

Gilroy, S. (1989) The embodiment of power: Gender and physical activity. *Leisure Studies* **8,** 163–171.

Greenacre, M. (2006) From simple to multiple correspondence analysis. In: *Multiple Correspondence Analysis and Related Methods.* Ed: Greenacre, M., and Blazius, J. London: Chapman and Hall. 197-217.

Greenacre, M. (2007) Correspondence Analysis in Practice. Chapman & Hall second edition, London.

Greenacre, M. and Hastie, T. (1987) The geometric interpretation of correspondence analysis. *Journal of the American Statistical Association* **82,** 437-447.

Gruber, J. (1986) Physical activity and self-esteem development in children: A meta-analysis. In: *Effects of physical activity on children.* Eds: Stull, G. and Eckert, H. Champaign, IL: Human Kinetics and American Academy of Physical Education. 30-48.

Guilbert, P., Baudier, F. and Gautier A. (2001) Health barometer 2000, CFES, Paris. (In French).

Hastings, D.W., Kurth, S.B., Schloder, M. and Cyrr D. (1995) Reasons for participating in a serious leisure career: comparison of canadian and U.S masters swimmers. *International Review for the Sociology of Sport* **30(1),** 101-119.

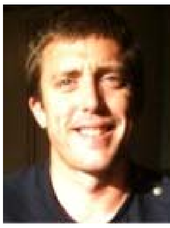
Holmer, I. (1974) Propulsive efficiency of breaststroke and freestyle swimming. *European Journal of Applied Physiology* **33,** 95-103.

Huttunen, P., Kokko, L. and Ylijukuri, V. (2004) Winter swimming improves general well being. *International Journal of Circumpolar Health* **63(2),** 140-144.
Ifedi, F. (2008) Sport Participation in Canada, 2005. Available from URL: http:*//www.statcan.gc.ca/pub/81-595-m/81-595-m2008060-eng.pdf*
Kaplan, G.A., Strawbridge, W.J., Cohen, R.D. and Hungerford, l.R. (1996) Natural history of leisure-time physical activity and its correlates: associations with mortality from all causes and cardiovascular disease over 28 years. *American Journal of Epidemiology* **144,** 793-797.
Karpovich, P.V. (1939) Respiration in swimming and diving. *Research Quartely for Exercise and Sport* **10(3),** 3-14.
Kesaniemi, Y., Danforth, E., Jensen, M., Kopelman, P., Lefebvre, P. and Reeder, B. (2001) Dose-response issues concerning physical activity and health: an evidence-based symposium. *Medicine and Science in Sports and Exercise* **33(6),** 351-358.
King, A., Taylor; C., Haskell, W. and DeBusk, R. (1989) Influence of regular aerobic exercise on psychological health. *Health Psychology* **8,** 305-324.
Koivula, N. (1999) Sport participation: differences in motivation and actual participation due to gender typing. *Journal of Sport Behavior* **22,** 360-376.
Lefebvre, B. and Thiery, P. (2010) *Study of physical activity in France.* Available from URL http://www.sports.gouv.fr/index/communication/statistiques/stat-info/stat-info-68
Le Roux B., Rouanet, H., Savage, M. and Ward A. (2008) Class and cultural division in the UK. *Sociology* **42,** 1049-1071. Available from URL http://soc.sagepub.com/content/42/6/1049.refs
Leit, R., Gray, J. and Pope, H. (2002) The media's representation of the ideal male body: A cause for muscle dysmorphia? *International Journal of Eating Disorders* **31(3),** 334-338.
Lonsdale, C., Hodge, K. and Rose, E.A. (2006) Pixels vs. paper: comparing online and traditional survey methods in sport psychology. *Journal of Sport and Exercise Psychology* **28,** 100-108.
Mc Cabe, M. and Ricciardelli, L. (2004) Body image dissatisfaction among males across the lifespan: A review of past literature. *Journal of Psychosomatic Research* **56(6),** 675-685.
Miller, K., Gleaves, D., Hirsch, T., Green, B., Snow, A. and Corbett, C. (2000) Comparisons of body image dimensions by race, ethnicity and gender in a university population. *International Journal of Eating Disorders* **27(3),** 310-316.
Mujika, I. (1998) The influence of training characteristics and tapering on the adaptation in highly trained individuals: a review. *International Journal of Sports Medicine* **19(7),** 439-446.
Muller, L. (2005) *French Cultural and Sport Participation*. Available from URL http://www.insee.fr/fr/ffc/docs_ffc/donsoc06zu.pdf.
Rifas-Shiman, S., Gillman, M., Field, A., Frazier, L., Berkey, C., Tomeo, C. and Colditz, G. (2001) Comparing physical activity questionnaires for youth seasonal vs annual format. *American Journal of Preventive Medicine* **20(4),** 282-285.
Rütten, A. and Karim Abu-Omar, K. (2004) Prevalence of physical activity in the European Union. *Social and Preventive Medicine* **49(4),** 281-289.
Sallis, J. and Hovell, M. (1990) Determinants of exercise behavior. *Exercise and Sport Sciences Review* **18,** 307-330.
Sallis, J., Hovell, M., Hofstetter, C. and Barrington, R. (1992) Explanation of vigorous physical activity during two years using social learning variables. *Social Science and Medicine* **34,** 25-32.
Sallis, J.F. and Owen, N. (1999) *Physical Activity and Behavioral Medicine*. Sage Publications, London.
Sjöström, M., Oja, P., Hagströmer, M., Smith, B.J. and Bauman, A. (2006) Health-enhancing physical activity across European Union countries: the Eurobarometer study. *Journal of Public Health* **14,** 291-300.
Tanaka, H., Bassett, D.R., Howley, E.T., Thompson, D.L., Ashraf, M. and Rawson, F.L. (1997) Swimming training lowers the resting blood pressure in individuals with hypertension. *Journal of Hypertension* **15(6),** 15(6), 651-657.
Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilerte, T. and Mc Dowell M. (2008) Physical Activity in the United States Measured by Accelerometer. *Medicine and Science in Sports and Exercise* **40(1),** 181-188.
Trost, S., Owen, N., Bauman, A., Sallis, J. and Brown, W. (2002) Correlates of adults' participation in physical activity: review and update. *Medicine and Science in Sports and Exercise* **34(12),** 1996-2001.
Vilhjalmsson, R. and Thorlindsson, T. (1992) The integrative and physiological effects of sport participation: A study of adolescents. *Sociological Quarterly* **33,** 637-647.
Wilcox, S., Castro, C., King, A., Housemann, R. and Brownson, R. C. (2000) Determinants of leisure time physical activity in rural compared with urban older and ethnically diverse women in the United States. *Journal of Epidemiology and Community Health* **54(9),** 667-672.
Wilson, P. and Rodgers, W. (2004) The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. *Psychology of Sport and Exercise* **5,** 229-242.

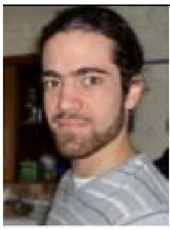
Key points

- Male strategy consists in performing higher distance by using several swim stroke and gears involving upper body muscles whereas women are more concerned about effort duration and use breaststroke in majority.
- The main motivation for middle aged people appears to be general health benefits whereas people aged from 20 to 30 appears to be concerned about a global health benefits and a body shape effects.
- Excepted middle age people, recreational swimmers have low control quality of their session even if they have a good skill level. This suggests to improve health strategy education and swimming pool environment.

AUTHORS BIOGRAPHY



François POTDEVIN
Employment
Department of Sport Sciences Lille 2 University
Degree
PhD
Research interests
Health strategy education by sport and swimming teaching.
E-mail: francois.potdevin@univ-lille2.fr



Clément NORMANI
Employment
Department of Sport Sciences Lille 2 University
Degree
MD
Research interests
Self health strategy education by swimming.
E-mail: clemn@hotmail.fr

Patrick PELAYO
Employment
Department of Sport Sciences Lille 2 University, Dean of Superior School of Teaching and Education Lille North of France
Degree
PhD
Research interests
Physiology and swimming teaching.
E-mail: patrick.pelayo@univ-lille2.fr

✉ **Francois J. Potdevin**
Team Research of Sport and Society Department of Sport Sciences Lille 2 University, France