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Effect of Internet and social networks on knowledge regarding physical activity

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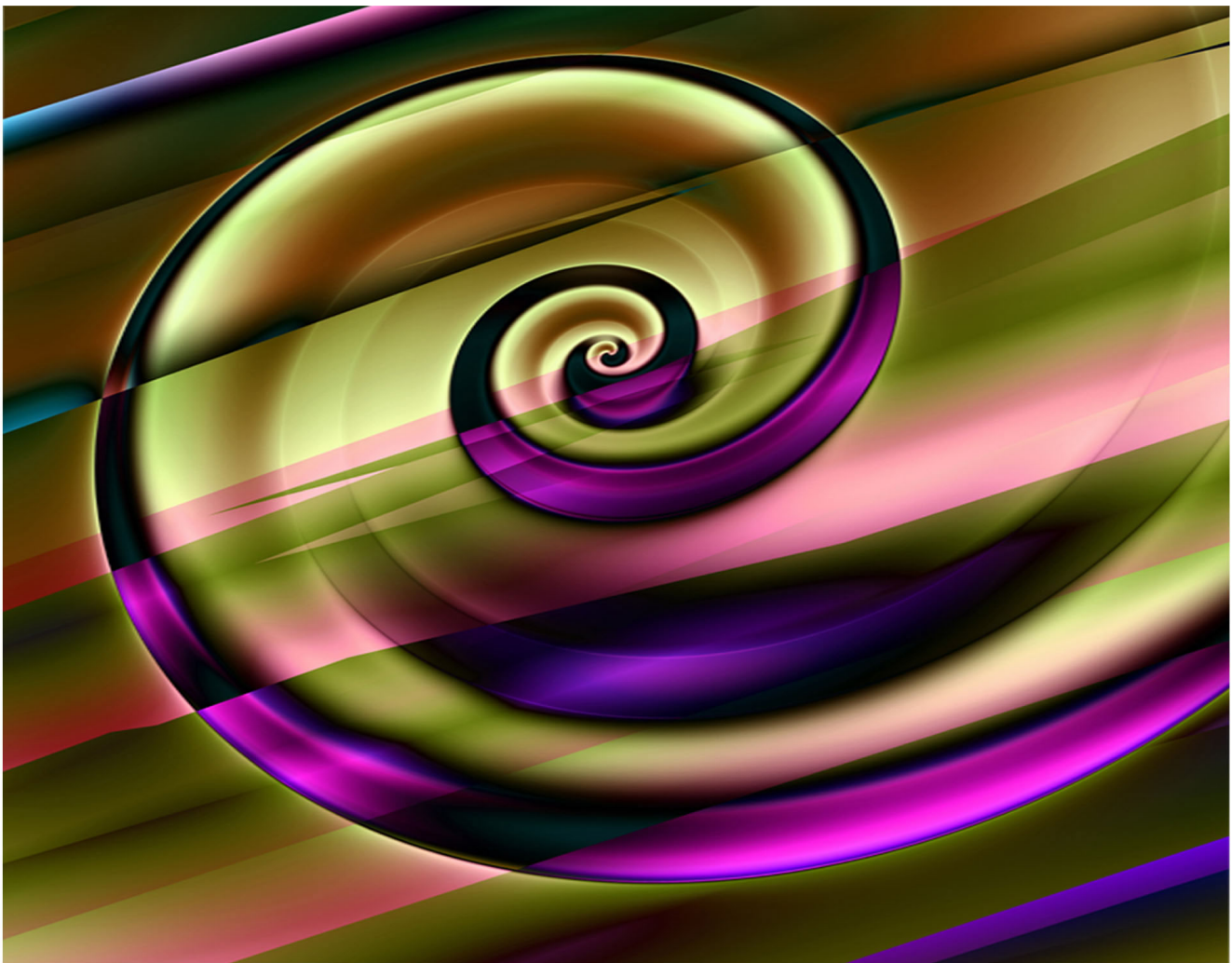
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Effect of Internet and Social Networks on Knowledge Regarding Physical Activity

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Abstract:

Physical inactivity increases the risk of developing several highly prevalent diseases (cardiovascular disease, diabetes, hypertension, some cancers, and obesity). As large proportions of the population are not meeting physical activity guidelines, increasing physical activity (PA) is a public health priority. As such, intervention strategies that can reach many people in a cost-effective manner are desired. Web-based physical activity interventions have shown promising results and will continue to gain importance through growth in Internet access, but little investigation focus the Internet sites and social networks as information sources on PA knowledge and PA level, comparatively of using other (traditional) information sources.

This investigation aims to evaluate differences among the use of Internet sites and social networks and traditional PA information sources, and the influence of each information source on PA knowledge and on PA level.

The study included a randomly recruited sample of 200 subjects (53% males; 47% females), age 31.6 ± 12.6 years old. A survey was designed to (1) identify where people find physical activity-related information, considering age, gender and education differences and (2) compare the influence of each information sources on PA knowledge and PA levels.

Results show that Internet and social networks present the lowest usage as PA information source (21.5 and 5.0% respectively).

The Internet is used as PA information source equally by genders (21.7 males % vs female 21.3%), mainly by and young adults (31.3%), and educated people 31.4%.

Social networks are used mainly by males (6.6% vs female 3.2%), young and young adults (8.3 and 6 %), and equally (and less used) be low and educated people (5.5 and 5.7%).

Looking for PA information in Internet sites no influence nor in PA knowledge nor in PA level, whereas looking for PA information in social networks show no influence on PA knowledge, but present a positive influence on PA level.

This is an important finding, in the sense that the use of social networks as PA information source seems to have a positive impact on embracing an active lifestyle.

Keywords: Internet; Social Networks, Physical activity; Information sources

1 Introduction

Recent data report more than one billion Internet users worldwide, considering that 25% of the world's population had access to the Internet, with estimates of 50% in Europe and 74% in North America (Steele *et al.* 2007; Webb *et al.* 2010). The Netherlands presents the highest Internet penetration rates, together with Australia, the United States, the United Kingdom, and the Scandinavian countries. Portugal presents a 50.7% of Internet Users (Internet World Stats, 2012).

This explosive growth of the Internet caused an increment on use innovative applications, in order to promote healthy behaviours (Crutzen *et al.* 2008; Mitchell *et al.* 2009; Pinheiro *et al.*, 2011) since it presents an opportunity for health professionals to provide interactive, individualized interventions to large numbers of people that match each visitor's unique characteristics, circumstances, beliefs, motivation to change, and behaviour (Brouwer *et al.* 2011).

Regular moderate-intensity PA influences health and well-being, with important role in the prevention of various chronic diseases (cardiovascular diseases, ischemic stroke, hypertension, obesity, diabetes mellitus, osteoporosis, etc.), (Warburton *et al.* 2006; Klavestrand and Vingård 2009), even though, rates of physical inactivity remain high, (about 66% of the European adults are insufficiently active, leading to approximately 600 000 deaths/year, WHO 2006).

Increasing PA is a public health priority in most developed countries (ACSM 2006; WHO 2006), so prevention strategies that include web-based interventions are needed to reach large population segments at reasonable costs (Marks *et al.* 2006; Spittaels *et al.* 2007) so, researchers have focused upon Internet as a means of engaging populations behaviour change to increase PA (Steele *et al.* 2007; Ahern 2007). Internet potentialities should be taking in account to Exercise Promotion Programs, in accordance to Nigg (2003) that points out three technologies potentialities for increase PA levels: a) the proactive recruitment of large populations, b) the individualization of interventions on a large scale, and c) the delivery of activity promoting interventions to large populations via differing channels.

Recent literature (Brouwer *et al.*, 2011) considers that the use of and exposure to the content of Internet interventions may often not be optimal and that visitor engagement in Internet interventions has been found to be lower than initially intended.

Ferney *et al.* (2009) refer previous Internet interventions on PA promote modest increases in PA. Authors consider that overall the effect of these interventions has been low and has declined substantially over time.

Crutzen *et al.* (2008) refer that have been reports about the efficacy of Internet-interventions for increasing PA, nevertheless the actual reach of Internet interventions do not meet expectations, with use of Internet interventions quite low, and when implemented in real life, exposure rates even lower. Authors conclude that in spite of considerable growth of Internet interventions in order to increase PA, the outcome results are far from expected, since exposure rates are extremely low.

Concerning this low exposure rates Brouwer *et al.* (2009) suggest that motivation to change a health behavior and curiosity about the intervention issue were important factors in the decision of adults whether to visit an Internet intervention, while interest in the topic and characteristics of the intervention itself (such as visual appeal, the structure of the web site, the length of the program, the use of web 2.0 contents and the existence of a registration procedure) as factors of importance in the decision to continue the visit.

Regarding the curiosity about the intervention issue, considered a main factor to the success of the intervention, Rice (2006) reported an increase on PA information demand: 35% in December 2002 and

42% in November 2004, concerning the most popular health topics searched for by Internet users. This data reveal a high interest on PA issue, from general population, in opposite to low effect of Internet-based interventions for increasing PA reported. From this contradiction we can infer that *people look for PA information but do not get engaged on special design interventions*.

Webb *et al.* (2010) reported that 30% or more of Internet interventions on PA use only one mode of delivery and the main goal is *provide an enriched information environment*.

Users of these Internet applications can access large amounts of information and choose the time to interact and receive information (Van den Berg *et al.* 2007). Dissemination of information regarding health benefits of PA may promote major adherence to an active lifestyle.

Unfortunately Chalmers (2005) consider that the majority of the exercise information on the Web does not meet the high standards of quality requested and many times are associated with commercial interests, where information is confounded with product promotion. Adams (2010) refers the problem of blending advertising with informative content, considering commercial interest behind information as a major impairment to reliability of web-based information.

Nevertheless, Chalmers (2005) also acknowledge the existence of high quality sites that provide the best sources of introductory exercise information, for free. Most of those sites are associated to universities, research centres, governmental institutions, scientific publishers and others.

Brouwer *et al.* (2009) consider that most of Internet applications that aim to provide information have a static mode of delivery, where information does not change over time, has little interactivity and maintenance, compared to those with commercial background.

This may lead to a bigger problem: “serious” information is much less appealing than commercial one.

Leslie *et al.* (2005) reinforce this idea, referring that websites with PA information may be more ‘passive’ than has been previously assumed and defend the need to discuss with web designers the necessity to make websites more dynamic, to update website material regularly and to make them more appealing and useful to potential users.

Wanner *et al.* (2010) propose that to maximize effectiveness of dissemination information related to PA through Internet applications, it is important for developers to know more about user characteristics and kinds of information they seek and adopt more appealing modes of delivery. Internet potentialities are yet to explore, in this field (Mitchell *et al.* 2009).

Evaluation of effect of Internet and Social Networks exposure in PA

Kefi (2003) refers that IS/IT evaluation is an important investigation issue, with several studies presenting different evaluation perspectives, such as (1) *technical perspective*: monitoring, data quality management, technological viability, risk evaluation; (2) *economic perspective*: assessment of IS/IT contributions to performance, productivity ratios, return over investment ratios, financial auditing; (3) *strategic perspective*: IS/IT value chain, IS/IT-based competitive advantages; and (4) *organizational perspective*: IS/IT contribution to organizational effectiveness, IS/IT-enabled organizational change.

Al-Yaseen *et al.* (2010) consider that IS/IT evaluation can also be considered in terms of the effectiveness of the IT system in situ – what a system actually accomplishes in relation to its stated goals.

New communication technologies may promote PA (King *et al.* 2008) but evaluation their effectiveness (in relation to stated goals) has little investigation (Pinheiro *et al.*, 2011).

Previous evaluation on Internet as an instrument to increase PA comprehended Internet base interventions and information dissemination. Those studies used controlled Internet exposure, in order to evaluate its effects. Effects of Internet exposure in natural settings (the normal use for each individual, excluding specially design interventions where Internet access is controlled) in efforts to change health behaviours gained increasing interest (King *et al.* 2008) since general populations access Internet in “natural setting” situation.

As far as our knowledge, no investigation focuses on evaluating the effect of Internet and Social Networks exposure in natural settings on knowledge retention regarding PA. This is the major objective of present investigation.

From this major objective, specific investigation problems emerged, in order to evaluate the effectiveness of IS/IT on knowledge retention regarding PA and levels of PA:

1. Identification of PA main information sources
2. Relation of PA information sources with age range, gender and education
3. Relation between knowledge on adequate PA for health benefits and different information sources
4. Relation on PA level with different information sources

2 Methods

This study used a survey specifically designed to evaluate the investigations questions previously established. This survey was applied during first trimester, 2010, on interview form (Pinheiro *et al.*, 2011).

2.1 Participants

The study included a randomly recruited sample of 200 subjects (53% males; 47% females), age 31.6 ± 12.6 years old. All interviews were conducted face to face, on public places from all over Portugal, in the first trimester of 2010. All interviews were completed.

2.2 Measures

All measures were assessed using a survey, applied in interview form. The instrument of the survey was a questionnaire developed by a group of 8 people with various backgrounds (sport scientists, marketers, specialists in medical informatics, psychologists, and specialists in knowledge management) with proven expertise in questionnaire design. The questionnaire was piloted with 13 individuals to ensure the comprehensibility of the wording and internal validity.

Some demographic information were collected from all interviewed: age, gender, height and weight (self-reported) and level of education (basic education, low education being up to high school; high education being university or other tertiary degree).

Physical activity level was evaluated using the International Physical Activity Questionnaire (IPAQ, www.ipaq.ki.se), validated to Portugal by Craig *et al.* 2003. IPAQ questions included items on duration and frequency of walking, of moderate and vigorous-intensity physical activity in the previous week. Adequate PA level was defined as 1260 MET-minutes per week (Craig *et al.* 2009) (one metabolic equivalent (MET) is defined as the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O₂ per kg body weight x min) - so in our analyze we considered two groups: people with adequate level of PA, if MET-minutes per week ≥ 1260 and people with no adequate level - MET-minutes per week < 1260 .

Awareness of American College of Sport Medicine (ACSM) Physical Activity Recommendations was evaluated according to Bennett *et al.* 2009: interviewed were asked two questions: a frequency item: "How many days a week of physical activity or exercise are recommended for the average adult to stay healthy?" (An open ended response option was provided) and a duration item: "On those days, how long should the average adult be physically active to stay healthy?" Participants were provided an open-ended response option along with a choice of unit (min or h).

Physical activity Information sources were evaluated, using the question: "I obtain Information on PA from... (information source in investigation)". Items evaluated were consistent with typical information sources for PA (Pennbridge *et al.*, 1999; Cotten & Gupta, 2004; Dumitru *et al.*, 2007; Pinheiro *et al.*, 2011), such as Medical personnel (Leijon *et al.*, 2010); TV/newspapers (Beaudoin & Hong, 2011); Friends/family (Trost *et al.*, 2002, Trost *et al.*, 2003; Kimiecik & Horn, 2012); Teachers (Pate *et al.*, 2006; McDavid *et al.*, 2012); Advertising/governmental information/public health campaigns (Marcus *et al.*, 1998; Berry *et al.*, 2008; Healthy People 2010 - Educational and Community-Based Programs); Internet/social networks (Rice, 2006; Beaudoin & Hong, 2011) and Sport professionals (McKenzie *et al.*, 2000; Vilhjalmsdottir & Kristjansdottir, 2003, Seabra *et al.*, 2008).

5-point Likert scale (from 1, strongly disagree, to 5, strongly agree) were used to evaluate the use of each information source on the information regarding PA. Statistical analysis used the SPSS 19.0.

3 Results

3.1 PA Information Sources

Several PA information sources were evaluated (Medical personnel; TV; Friends/family; Teachers; Advertising/governmental information/public health campaigns; Internet/social networks and Sport professionals, Verheijden *et al.* 2007), using the question: “*I obtained information on PA from...*”. Likert scales were used (5=“strongly agree”, 4=“agree”, 3=“not sure”, 2=“disagree”, and 1=“strongly disagree”) to evaluate the importance of each information source on the information regarding PA. Results are shown in Table 1.

Table 1: Evaluation of main PA information sources

PA Information Source	Mean rating	s	% of frequent use
Medical personnel	2.49	1.215	21,5%
TV	2.49	1.130	19,0%
Friends/family	2.80	1.095	25,5%
Teachers	3.00	1.336	39,0%
Advertising/governmental information/public health campaigns	2.49	1.182	19,5%
Internet Sites	2.42	1.373	21,5%
Sport professionals	3.01	1.332	39,0%
Social networks	1.79	0.940	5,0%

All investigated items show a low mean rating, reporting little importance as PA information source. Sport Professionals and Teachers are the most used information sources, whereas Internet sites and social networks are the less used sources. This result contrasts with presented by Brouwer *et al.*, 2011 and Berry *et al.*, 2011 that consider the Internet as the most often cited source of physical activity information.

3.2.2. Relation of PA information sources with age range, gender and education

For data analysis, 5 age ranges were established: Younger than 20 = Young (Y); 20-30 = Young Adults (YA); 31-45 = Adults (A); older than 45= Old Adults (OA).

Results of statistic relations of age information sources were obtained by an ANOVA and a Tukey HSD, $p=0.05$ and are synthesised on Table 2.

Table 2: Relation of age and PA information source

	G 1				G 2				G 3			
	Y	YA	A	OA	Y	YA	A	OA	Y	YA	A	OA
Medical personnel	2.00	2.39		2.68		2.39	2.86	2.68				
TV	2.25	2.65	2.30	2.42								
Friends/family			2.19	2.68	3.04	3.01		2.68				
Teachers			2.35	2.08	3.25	3.55						
Public health campaigns	2.29	2.74	2.11	2.33								
Internet sites			1.92	1.63	2.42		1.92		2.42	2.84		
Sport professionals			2.25		3.17	3.26	3.03					
Social networks			1.59	1.40	2.00	1.96	1.59					

Results regarding of Internet sites and Social networks as PA information sources show statistical differences among age range, being less used by Adults and Old Adults.

The results present no statistical difference in using TV and Public health campaigns as PA information source, across all age range.

Medical personnel as a information source for PA is more used with the aging of individuals, being less used by Young.

The use of Friends/family, Teachers and Sports professionals as PA information source is more common among the early years, being the only PA sources with a positive mean (more often used) in any age group.

Regarding the relation of PA information sources with gender, results were obtained by a t-test, $p=0.05$ and are synthesised on Table 3.

Table 3: Relation of gender and PA information source

		t-test for equality of means (95% Confidence)			
		Mean rating	s	t	Significance (two-tailed) ↓
Medical personnel	Male	2.40	1.160	1.345	.248
	Female	2.60	1.273		
TV	Male	2.37	1.141	2.655	.105
	Female	2.63	1.107		
Friends/family	Male	2.78	1.042	.027	.870
	Female	2.81	1.157		
Teachers	Male	2.85	1.248	2.716	.101
	Female	3.16	1.417		
Public health campaigns	Male	2.30	1.080	5.538	.020 ↓
	Female	2.69	1.253		
Internet Sites	Male	2.37	1.229	.007	.932
	Female	2.38	1.245		
Sport professionals	Male	3.05	1.290	.225	.636
	Female	2.96	1.383		
Social networks	Male	1.82	.993	.325	.569
	Female	1.74	.879		

df=200

Results found that the gender almost don't influence the use of the different information sources. Only Public health campaigns show a statistical difference between males and females, being more used by women.

This work also investigated the relation between PA information sources and education (basic education (BE), low education being up to high school (LE); high education being university or other tertiary degree (HE)), results were obtained by an ANOVA and a Tukey HSD, $p=0.05$ and are synthesised on Table 4.

Table 4: Relation of education and PA information source

	G 1			G 2		
	BE	LE	HE	BE	LE	HE
Medical personnel		2.54	2.11	2.80	2.54	
TV	2.60	2.45	2.60			
Friends/family	2.65	2.83	2.74			
Teachers	2.25			2.99	3.46	
Public health campaigns	2.50	2.47	2.54			
Internet sites	1.65			2.37	2.80	
Sport professionals	2.30			3.06	3.17	
Social networks	1.35	1.81		1.81	1.91	

There's no relation between education and the use of TV, Friends/family and Public Health campaigns as a PA information source. The search of Medical personnel to gather information about PA is more common among people with less education. On the other hand the individuals with more education seek PA information more often in Teachers, Internet sites, Sports professionals and Social networks than the ones which has only Basic Education.

3.3 Relation of PA knowledge and information sources

The knowledge retention regarding the characteristics (intensity, duration and frequency) of adequate PA for the enhancement of health was evaluated according to Bennett, *et al.* 2009 as described in methods. According to the answers, two knowledge categories were established: inadequate knowledge and adequate knowledge. Results were obtained by t-test, $p=0.05$ and are synthesised on Table 5.

Table 5: Relation between Knowledge and PA information sources

		t-test for equality of means (95% Confidence)			
		Mean rating	s	t	Significance (two-tailed) ↓
Medical personnel	Inadequate Knowledge	2.51	1.226	.212	.646
	Adequate Knowledge	2.42	1.194		
TV	Inadequate Knowledge	2.41	1.093	3.227	.074
	Adequate Knowledge	2.73	1.206		
Friends/family	Inadequate Knowledge	2.86	1.104	2.333	.128
	Adequate Knowledge	2.60	1.053		
Teachers	Inadequate Knowledge	3.07	1.330	2.018	.157
	Adequate Knowledge	2.77	1.337		
Public health campaigns	Inadequate Knowledge	2.54	1.145	1.259	.263
	Adequate Knowledge	2.33	1.279		
Internet Sites	Inadequate Knowledge	2.41	1.183	.515	.474
	Adequate Knowledge	2.27	1.374		
Sport professionals	Inadequate Knowledge	3.08	1.358	1.866	.174
	Adequate Knowledge	2.79	1.242		
Social networks	Inadequate Knowledge	1.79	.949	.020	.889
	Adequate Knowledge	1.77	.921		

df=200

For all information sources there were no statistically significant differences between the mean scores of people with inadequate and adequate knowledge. The PA knowledge is statistically independent on PA information source.

3.5 4. Relation on PA level with different information sources

Assessment of PA level was made using the International Physical Activity Questionnaire (IPAQ), validated to Portugal by Craig *et al.* 2003.

Adequate PA level was defined as 1260 MET-minutes per week (Craig *et al.* 2009) so in our analyze we considered two groups: people with adequate level of PA, if MET-minutes per week ≥ 1260 and people with inadequate level - MET-minutes per week <1260 .

26.0% of interviewed presented an inadequate level of PA, with serious consequences to health status. This result is consistent with information that a large percentage of population is not active enough.

t-test was perform to find statistic relations between adequate PA level and information sources. Results can be found in Table 6.

Table 6: Relation of adequate PA level and information sources

		t-test for equality of means (95% Confidence)			
		Mean rating	s	t	Significance (two-tailed) ↓
Medical personnel	Inadequate PA level	2.46	1.196	.038	.845
	Adequate PA level	2.50	1.226		
TV	Inadequate PA level	2.48	1.146	.005	.946
	Adequate PA level	2.49	1.128		
Friends/family	Inadequate PA level	2.77	1.078	.039	.844
	Adequate PA level	2.80	1.104		
Teachers	Inadequate PA level	3.29	1.304	3.434	.065
	Adequate PA level	2.89	1.336		
Public health campaigns	Inadequate PA level	2.46	1.244	.028	.868
	Adequate PA level	2.49	1.163		
Internet Sites	Inadequate PA level	2.19	1.172	1.545	.215
	Adequate PA level	2.44	1.252		
Sport professionals	Inadequate Knowledge	2.90	1.376	.404	.526
	Adequate Knowledge	3.04	1.319		
Social networks	Inadequate PA level	1.50	.700	6.646	.011 ↓
	Adequate PA level	1.89	.993		

df=200

PA level is statistically independent on the use of Internet sites as PA information source.

Social networks is the only information source that presents statistically significant differences between the mean scores of people with adequate and inadequate (low) PA level, meaning that social networks influence (positively) the adoption of an active lifestyle.

4. Discussion

Internet interventions on PA level should comprehend information dissemination and appliance in real-world settings (Lewis 2007).

The PA information available on the Internet is raising (Mitchell *et al.* 2009) even though our findings don't report Internet as a major information source: only 21.5% of interviewed use Internet sites (2.42 ± 1.37) and only 5.0% use social networks (1.79 ± 0.94), concluding a low use of new technologies as PA information dissemination.

The importance of Internet and social networks was rated rather low in comparison with other sources of PA information, while teachers and sport professionals was deemed the most important source of PA information by all socio-demographic groups considered.

These results are very similar with those presented by Dumitru *et al.*, 2007, where internet use presented a mean of 2.86 ± 1.44 .

Pennbridge et al, 1999 reports an Internet use of 19%, in general population, regarding health information seeking (including Exercise and fitness). The higher result presented in this study may be related with a higher Internet use, in the last years.

According to Fox & Jones, 2009, Internet users report a surge of interest in information about exercise and fitness. The percentage of American adults getting exercise and fitness information online has jumped from 21% in 2002 to 38% in 2009 (88% growth). The 2009 data is significant higher than our findings.

Regarding social networks as health and PA information source, Kummervold et al, 2008, refers the preference for active communication channels, both for reaching health and sport professionals and for communicating with peers.

This investigation conclude that The Internet and social networks are more used by youngest groups. Literature also found a higher Internet use among young people (e.g. Borzekowski and Rickert, 2001, refer that half of the teenagers look for fitness and exercise information on the Internet). Hardiker & Grant (2011) found that increasing age was a contributing factor in decreased levels of Internet use for health and fitness related information.

Internet and social networks are equally used by male and female as PA information source. Public health campaigns are the only information source that is used differently between genders, being more used be women. This result is somehow opposite to Berry *et al.*, (2008) statement that most of institutional advertisements failed to highlight the benefits of PA, so, the positive effect of these advertisements may have been compromised.

Internet and social networks are used as PA information sources by more educated individuals. This result is similar to the work of Verheijden *et al.* (2007), that refer that PA information seeking in new technological tools is related with literacy level of each individual, in the sense that higher educated look for information related to PA in Internet.

Greenberg *et al.*, 2004 refer that a 2003 report from the Pew Internet & American Life (Pew) found that Internet users tend to be younger and more affluent, and are more likely to be employed, white, well-educated, and to be suburban or urban residents. Our results are consistent with this statement.

Evaluation of PA Knowledge found that no significant relation was found between adequate and inadequate knowledge and information sources. This result suggests that specific knowledge on PA present in Internet or Social Networks don't influence individual knowledge of those engaged with the online world. This result may be related with Greenberg *et al.*, 2004, explanation: Internet has opened a vast library of information to consumers of PA and health information and made that information more accessible than ever before, however, the volume of information and the variable quality of information has created new interpretive challenges, impairing consumers to find the information they want.

Morahan-Martin, 2004 found that the quality of online health and PA information is mixed, which raises serious concerns about the impact of this information and Weaver et al, 2009 refers an increasing concern that some health information disseminated via the internet is inaccurate, erroneous, misleading, or fraudulent and actually poses a threat to public health in general.

From our results, we conclude that PA information, easily available in Internet and Social Networks, has not capacity to improve individual PA knowledge.

Regarding influence of information sources on active lifestyle, results report that interviews with social networks as information sources have a more adequate PA level. This is an important finding, in the

sense that the use of this information source seems to have a positive impact on PA level. This is the first time this relation is reported, so, further research will be needed about this subject.

5 Conclusion

One major reason for IT/IS evaluation is to take actions based on the results of the evaluation that should form a base of knowledge to be used to plan and perform knowledgeable actions (Lagsten and Goldkuhl 2008).

Internet and social networks are the only sources with potential to reach large numbers of the population, with flexibility of use and easy access.

In spite of huge increment on Internet applications to promote healthy lifestyle, Internet and social networks presents the lowest usage as PA information source (21.5 and 5.0% respectively).

The Internet is used as PA information source equally by genders (21.7 males % vs female 21.3%), mainly by and young adults (31.3%), and educated people 31.4%.

Social networks are used mainly by males (6.6% vs female 3.2%), young and young adults (8.3 and 6 %), and equally (and less used) be low and educated people (5.5 and 5.7%).

The most used PA information sources depend on age and education. Gender has little influence on the information source used.

Looking for PA information in Internet sites no influence nor in PA knowledge nor in PA level, whereas looking for PA information in social networks show no influence on PA knowledge, but present a positive influence on PA level.

Promotion of internet use as PA information source should be considered, and actions to assure information quality and websites more appealing and useful to users must be taking.

These results should promote a reflection regarding what kind of information and technology should be considered, to increase active life style adherence.

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