

ORIGINAL ARTICLE



Supervised Exercise Patterns among Diabetic and Non-diabetic Portuguese Adults

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ABSTRACT

Background. Physical activity (PA) is a keystone of diabetes management, but although self-exercise is beneficial, supervised exercise (SE), adapted to individual characteristics, and is more effective. **Objectives.** The main research goal is to compare SE patterns among diabetic and non-diabetic Portuguese adults. **Methods.** A total of 484 participants (85 diabetics, 399 non-diabetics), aged 41-90 years old (mean=58.9; SD=11.9) were interviewed. PA level was assessed using short form of the International Physical Activity Questionnaire. Attendance in different SE programs was evaluated across three kinds of PA programs providers: gym/health-clubs; swimming pools and other club/ sports facilities. Items like Barriers to Exercise; Intention to participate; Importance of the structure and PA information sources were also evaluated. Independent t-tests were used to examine the difference between the group means, and Levene's test was used to check the homokedasticity of the groups' variances. **Results.** PA level of diabetics (32% low; 25% moderate; 44% high) and non-diabetics (29% low; 33% moderate; 39% high) display no differences. 90% of diabetics do not attend SE. The main barrier for diabetics' non-participation is the perception that the exercise is not adequate to their health. Doctors are the preferred information source for diabetics and they rely less on information provided by the Internet, with may impair on-line campaigns. **Conclusion.** Promoting exercise in diabetics should shift the focus from "promoting physical activity" to "promoting SE".

KEY WORDS: Health Promotion, Exercise, Diabetes

INTRODUCTION

The 2016 Position Statement of the American Diabetes Association reinforces that Physical Activity (PA) is critical for individuals with diabetes, since exercise improves blood glucose control in type 2 diabetes, reduces cardiovascular risk factors, contributes to weight loss and improves well-being (1). Nevertheless, the sedentary lifestyle continues to increase among the diabetic population,

despite extensive PA promotion campaigns (2, 3).

A keystone of diabetes prevention and management is the person's motivation to embrace a change in lifestyle, with primary emphasis in PA and diet (4, 5). PA alone improves glucose tolerance and whole-body insulin sensitivity (6). Despite the salutary

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effects of exercise on glycaemic control, people with diabetes do not exercise as much as nondiabetic individuals, possibly due to both behavioural (fear of injury as well as other diabetes-related concerns) and functional (impairments in both maximal and submaximal exercise performance) factors (3, 4).

Exercise presents significant benefits but also some risks in diabetes management (7). For example hypoglycemia, complications in the musculoskeletal system, cardiovascular risk, and feet neuropathy. Therefore, most diabetics can engage in PA without following any particular instructions or rules, but it is, however, essential to receive guidance (7). Diabetics should, therefore, participate in supervised exercise (SE) programs where they can exercise with minimum risks. Some authors emphasize that SE programs are preferable to patients with Diabetes, although the promotion of autonomous exercise is more feasible and should also be offered to diabetics (8). In fact, a meta-analysis of small-sized studies showed that SE is effective in improving cardio-respiratory fitness, glycaemic control and other cardiovascular risk factors (9).

The adequate “dose” of exercise as a preventive treatment to diabetics needs more research, since exercise should provide enough stimulus to improve critical clinical endpoints (e.g. insulin sensitivity and beta-cell dysfunction) but not necessarily avoid the risk of future complications (e.g. nephropathy, neuropathy, and retinopathy and macrovascular disease) (10). This fact means that current exercise recommendation for diabetics- 150 minutes of moderate to vigorous intensity aerobic exercise, spread out over at least three days during the week is a starting point, but the intensity, duration, and type of exercise should be customized to each person, better achieved under SE (1).

Grace et al. (11) performed a meta-analysis and concluded that higher intensities promote better responses regarding diabetes management. These higher intensities should be performed under professional supervision.

Based on these findings it seems clear, that exercise is an adjuvant therapy for diabetics, but its effectiveness depends on how it is performed, what causes SE to be more effective. Despite this evidence, literature refers that people with diabetes are often unwilling to participate in exercise programs due to specific barriers and the

absence of adequate information to persuade patients and providers to take concrete actions and modify the sedentary behaviour (2). These findings stress the need for better education and more information regarding the benefits of SE programs specially tailored for people with diabetes.

From the above reasoning, it can be established that PA is an essential aspect in the management of diabetes, being much more effective if performed with adequate mode, intensity, duration and frequency, requiring personalized monitoring and supervision. In order to promote the participation of diabetics in structured and supervised activities, the motivations and causes of non-participation that are specific to the diabetic population must be understood. Therefore, it is necessary to compare diabetics with non-diabetics regarding participation in SE programs to evaluate if there are differences that allow the elaboration/revision of PA programs that accomplish a higher attendance from diabetics.

The main objective of this research is to compare SE patterns among diabetic and non-diabetic Portuguese adults. The specific objectives are the comparison between diabetics and non-diabetics regarding: (i) PA level; (ii) attendance in different SE programs; (iii) PA information sources; (iv) intention to participate in different types of pre-defined programs and (v) the perceived importance of the characteristics of the structure that hosts the exercise program.

The findings are valuable to support the development of a strategy that will lead diabetics to become more active but mainly to engage in supervised intense PA activities. This strategy is vital for diabetics since by adhering to a personalized exercise and supervised by accredited professionals can simultaneously increase the benefits of PA in diabetes management and also in improving physical fitness.

MATERIAL AND METHODS

Participants. Following the approval of the Scientific Committee of the Ph.D. in Sports Science approval, from the University of Beira Interior, and according to the Declaration of Helsinki, 484 participants aged between 41 to 90 years old (mean=58.9; SD=11.9) were included in this study. Participants were recruited in public places, in different across all regions of Portugal,

in cities and rural villages. Participants were completely free to participate in the study, after the presentation of researchers' affiliation, investigation goals, and confidentiality assurance. Participants were considered to have diabetes (n=85) if they were undergoing medical treatment with hypoglycemic agents or insulin injections (self-reported) (12).

Study Design. This investigation is based on a cross-sectional population-based study in Portugal. All participants were asked to answer several questions regarding their physical activity and health. PA was assessed using the Portuguese validated version International Physical Activity Questionnaire short form (IPAQ) (13), which estimates PA across a comprehensive set of factors to yield a score in metabolic equivalents (METs)-minutes. Attendance in different SE programs was evaluated using a 3-point Likert scale (rarely – sometimes – often), across three kinds of PA programs providers: gym/health-clubs; swimming pools and another club/sports facilities. Measures for PA barriers were adapted from Thomas et al. (14). Items like the intention to participate in PA programs and the importance of the structure were evaluated by a 5-point Likert scale. PA information sources were evaluated using the scales by Pinheiro et al. (15). An expert panel of professors and researchers not involved in the study reviewed all items to ensure content and face validity. The board consisted of two sports scientists (with research experience), one expert researcher on market studies and survey development and one expert researcher on

knowledge management. Fieldwork supervisors conducted a pre-test of the questionnaire with a sample of 25 individuals to ensure clarity and completion time.

Data Collection. Final data were collected by nine researchers (post-graduate students) after attending a 10 hours training course.

Statistical Analysis. We used independent t-tests to examine the difference between the group means, and Levene's test to check the homokedasticity of the groups' variances.

RESULTS

Supervised vs. Self-selected PA among Diabetic and Non-diabetic. Regarding PA level assessed through IPAQ, diabetics (32% low; 25% moderate and 44% high) and non-diabetics (29% low; 33% moderate and 39% high) display no statistically significant differences. Diabetics show a higher prevalence of lower and higher PA level. This result may suggest the existence of two behaviours among diabetics: a more active one, already engaged in PA routines and a more sedentary one (32%) which does not meet PA recommendations.

Although 69% of diabetics report moderate or high physical activity, it is mostly unsupervised exercise since they do not attend sports facilities as shown in Table 1. Results show that both diabetics and non-diabetics opt by self-selected physical activity over SE. No significant differences were found between groups.

Table 1. Attendance of Sport Facilities

	Rarely	Sometimes	Often	χ^2
Do you attend a Swimming pool?				1.488
Diabetic	88%	2%	10%	
Non-diabetic	86%	5%	8%	
Do you attend any Gym/Health-club?				1.894
Diabetic	94%	1%	5%	
Non-diabetic	91%	4%	5%	
Do you attend any other club/sports facilities to do some physical activity?				1.173
Diabetic	90%	2%	8%	
Non-diabetic	86%	5%	9%	

P<95%, DF=2, Significant if >5.991

When asked about the reasons for non-participation in SE programs the diabetic place more importance on the feeling that the exercise is not adequate to their health (Table 2). This is an exciting result as it suggests that when considering existing exercise programs, diabetics have a perception that they are not suitable for their health

condition. From Table 2 it is important to point out that diabetics report a lower preference for autonomous exercise, which may mean that they would be more open for SE. Lack of time and activity schedules are factors more valued by non-diabetics than by diabetics, showing that diabetics are in some way available for exercise.

Table 2. Causes of Non-participation in Supervised Exercise Programs

	Levene's F	Levene's p-value	Mean Diabetic	Mean No-diabetic	t	df	t-test's p-value
The activities are not interesting	.437	.509	2.933	2.798	.784	424.0	.433
Price	3.905	.049	2.853	3.076	-1.084	102.3	.253
The exercise is not adequate to my health	1.356	.245	2.853	2.437	2.308	423.0	.021*
Distance	.828	.363	2.773	2.581	.982	424.0	.327
Lack of time	.611	.435	2.684	3.220	-2.721	108.5	.007*
Other things to do	.016	.899	2.680	2.955	-1.495	11.8	.136
Type of participants	.751	.387	2.568	2.602	-.194	103.2	.846
Participation could be dangerous to my health	.056	.814	2.533	2.278	1.412	422.0	.159
Schedule	.000	.989	2.520	2.946	-2.294	113.3	.022*
Laziness/ Lethargy	.000	.995	2.500	2.529	-.155	109.6	.877
Participation brings few benefits	.719	.397	2.453	2.314	.822	42.0	.412
Lack of transportation	2.992	.084	2.405	2.137	1.524	423.0	.128
Teacher training methodology	.311	.577	2.267	2.632	-2.045	112.6	.041*
I prefer doing self-select exercise	3.495	.062	2.147	2.689	-3.161	12.3	.002*

Significance level = 0.05

PA Information Sources used. Considering that both diabetics and non-diabetics embrace self-selected physical activity over SE, it is crucial to evaluate what are PA information sources used by diabetics and non-diabetics (Table 3).

Results show that doctors are the preferred source of information with diabetics giving more importance to doctors than the no-diabetic. Diabetics rely less on information provided by the Internet and sports professionals. These results emphasize the fact that diabetics recognize neither the importance nor the advantages of exercise supervised by specialized professionals.

It is also verified that the higher means for information source preference were reported by both groups for doctors followed by friends and family (Table 3).

Intention to Participate in Different Types of Pre-defined Programs. Aware of the general low attendance of participation in existing SE programs, the researchers created seven hypothetical scenarios where different conditions (indoor/outdoor, alone/with friends, paid/free, family participation, organized by social media online) were provided to assess the willingness to participate in SE programs. The results are reported in Table 4.

Table 3. Information Sources about PA

	Levene's F	Levene's p-value	Mean Diabetic	Mean No-diabetic	t	df	t-test's p-value
My doctor	11.814	.001	3.965	3.148	5.611	481.000	.000*
Friends/family	1.392	.239	2.940	3.114	-1.236	114.925	.217
Government awareness campaigns	1.078	.300	1.833	2.061	-1.606	126.352	.109
The Internet sites	9.294	.002	1.607	1.977	-2.969	141.652	.010*
Teacher – school	9.455	.002	1.583	1.842	-2.106	139.747	.063
The Internet social media	7.847	.005	1.464	1.694	-2.039	133.946	.063
The TV	1.570	.211	2.298	2.562	-1.790	125.067	.074
A sports professional	1.310	.253	2.286	2.680	-2.332	127.977	.020*
Newspaper/magazines	.006	.936	2.235	2.472	-1.559	122.889	.120

Diabetics value exercising with the family, as well as activities organized by primary health care (health centres).

Outdoor programs are not attractive to diabetics, and the presence of friends is more important for non-diabetics. The cost does not seem to be a crucial factor for participation in SE programs.

Importance of the Characteristics of the Structure that Hosts the Exercise Program. In order to call diabetics for the structures that host

the SE programs, it is foremost to evaluate the characteristics perceived as more important for diabetics, and if these differ from those chosen by non-diabetics (Table 5).

Facilities seem to be very important for the practice of exercise. Diabetics value the presence of specialists that can deal with the disease, whereas they care less about the equipment, the innovative activities and meet other participants. It also should be noticed that there is no difference between diabetic and no-diabetic on the

importance given to the presence of a doctor or a nurse, nor the degree of the fitness instructor.

These two items are valued by two groups, but diabetics present a lower mean.

Table 4. Intention to Participate in Supervised Exercise Programs

I would participate in an exercise program if	Levene's F	Levene's p-value	Mean Diabetic	Mean No-diabetic	t	df	p-value
that allowed the whole family to participate and had free entry	0,008	0,930	3,229	3,385	-0,979	116,689	0,328
that is organized by the Health Centre at no cost to the user	0,594	0,441	3,120	3,213	-0,573	121,947	0,567
that was organized in the gardens / parks of my locality and had free entrance	1,428	0,233	2,976	3,205	-1,405	122,694	0,161
that it was outdoors	0,949	0,330	2,831	3,256	-2,682	123,712	0,008*
that it was with my friends	0,097	0,756	2,831	3,165	-2,140	122,716	0,033*
I had a personal trainer coming to my house	1,111	0,292	2,373	2,636	-1,560	124,631	0,119
that is organized through online social media, at no cost to the user	2,651	0,104	1,807	2,036	-1,556	131,688	0,120

Table 5. Importance of the Structure that Hosts the Exercise Program

	Levene's F	Levene's p-value	Mean Diabetic	Mean No-diabetic	t	df	t-test's p-value
Have specialists who know how to deal with my needs (pathologies)	1,073	0,301	3,929	4,005	-0,569	115,884	0,569
Structure conditions (hygiene, furniture, equipment type ...)	1,347	0,246	3,893	4,070	-1,451	113,170	0,147
Localization	0,566	0,452	3,741	3,681	0,416	481,000	0,678
Price	5,798	0,016	3,718	3,819	-0,613	111,914	0,499
Have good equipment	9,997	0,002	3,690	3,960	-1,877	107,150	0,032*
Have evaluation parameters (measure heart rate and blood pressure)	0,464	0,496	3,607	3,602	0,035	116,869	0,972
Have doctor / nurse	0,895	0,345	3,459	3,529	-0,475	117,583	0,635
The fitness instructor has a degree in Sports Science	0,219	0,640	3,369	3,605	-1,575	119,642	0,116
Type of innovative activities	0,322	0,571	3,143	3,451	-2,211	117,320	0,027*
Have another type of services (restaurant / bar, hairdresser, dance classes, nutritional advice, ...)	1,344	0,247	2,893	2,861	0,204	477,000	0,839
Meet other participants	2,715	0,100	2,786	3,111	-2,266	115,885	0,024*

DISCUSSION

Physical activity is a crucial element in the prevention and management of diabetes (16, 17), but its effectiveness and risk management require professional supervision (8, 10, 11, 18). Previous research (2, 3, 12), also suggests that diabetics are reluctant to embrace SE programs. This evidence calls for actions to communicate the benefits of PA among diabetics better to stimulate their adherence to PA structured programs. For effectively achieve this goal it is essential to understand what diabetics think and feel, and what are the specific barriers preventing searching for information and engaging in physical activities when compared to the non-diabetic population.

Regarding physical activity level, the IPAQ score was not significantly different between patients with and without diabetes. Iwasa et al. (12) reported the same result. Results draw attention to 32% of diabetics are physically inactive, with all the health consequences that this situation carries out (17). Similar results were reported by Duarte et al. (19) where 31% of patients with type II Diabetes scored “low” in IPAQ. Our results on IPAQ scores, aligned with literature, reinforce the need to promote PA among Portuguese diabetic population.

Almost two-thirds of our diabetic sample presented a moderate or high level of PA. Nolan et al. (20) found a lower result (49%),

nevertheless, despite many respondents' being physically active, their activities did not have enough intensity to promote benefits in glycemic control. Despite diabetics' PA level, the attendance to SE programs is minimal what may indicate that exercise performed is not adequate to promote the benefits on diabetic control.

This lack of adherence is disadvantageous to diabetics themselves, as they do not take advantage of the benefits that PA could provide, not only in Diabetes management but also to improve their general physical condition (21, 22). Self-Selected PA tends to be performed at lower intensities and not so often, which impairs the physiological stimulus that the exercise produces (23). On the other hand, autonomous exercise does not consider a strategy to minimize the existing risks, which may generate dangerous situations for diabetics (7).

Both supervised and autonomous exercise show benefits to the health status in diabetics (18, 24), but SE is more effective (8, 10, 11, 25). The low adherence of diabetics to SE is also a missed business opportunity by the facilities hosting these programs.

Providing stable and trusty evidence of the benefits and the low risk associated with the SE for diabetics is crucial to surpass the significant barrier stated by them, which was the perception that exercise is not adequate to their health condition (Table 2). This finding may justify diabetics low-level of participation in these programs, and also reveals deficiencies in the communication between the structures that host the programs and diabetics, to show that they have professionals and methods for adapting PA exercises to the unique characteristics of each participant. The literature states that people with diabetes do not have enough information to take concrete actions to modify sedentary behavior and need better education and more information regarding the benefits of SE (2).

Since most diabetics perform self-selected PA, it is essential to evaluate where they obtain information about exercise (Table 3). Results show that diabetics undoubtedly prefer doctors as an information source. Similar results are presented in the literature (3, 26, 27). This result underpins that any PA promotional campaign target to diabetics must involve first care providers and medical personnel, reinforcing previous indications that health professionals are the first to recommend the adoption of new

dietary and exercise behaviors among diabetics (26). It is important to highlight that online campaigns (including the ones using social media) seem to be very limited, regarding the low audience reported. The present investigation is based on "real world" people, meaning they were not engaged in any intervention program, whereas literature often evaluates the effect of online interventions considering a particular (target) group (28). This distinctiveness may explain why those studies report higher use of social media as a PA information source, in contrast with our results.

The non-diabetics consistently reported receiving more information about physical activities programs. Noticeably, in line with previous research (27), current results show that doctors and family and friends are the best channels to convey PA information to diabetics. Results from non-diabetics are similar. Therefore, focusing the communication efforts primarily upon these two channels will be a winning bet. Additionally, it can be concluded that activities promoted by primary care centres, supported by the family and close friends could provide additional motivation and make the difference in increasing the attendance to physical activities events and programs by diabetics. These are precisely the major findings reported in Table 4, alongside in the importance of having "free entry," stressing the importance of the price factor. For that, it is recommended that these two aspects should always be included in any communication strategy and that the price must be set at a level that will not demotivate potential participants. Overall, both groups desire to have right conditions and equipment, and adequate counselling and monitoring while exercising. The two groups differ on the importance given to meeting other participants, innovative activities and having good equipment, which seems to be more critical to non-diabetics.

The instrument resulting from the adaptation of several questionnaires not extensively used is the main limitation and makes it difficult to compare results with previous studies. Also, the age range included a large variation of the characteristics of the diabetics interviewed, especially in the mental and physical characteristics, what may result in a limitations, when analysing all sample. These factors may condition the results obtained.

CONCLUSIONS

Based on the findings, and addressing the objectives, both diabetics and non-diabetics reported a regular PA level (about two thirds with moderate or high level) but meagre participation in SE programs. Diabetics perceive that structured exercise is not adequate for their health, which is a significant barrier to participate in SE programs. This perception implies a lack of information on the benefits of SE and its advantages versus autonomous physical activities. Data results also reveal a gap between service providers (gym/health club/sport facilities managers) and potential clients (diabetics). The risk associated with PA seems to be an essential issue mainly among diabetics, and that is the reason why they rely mostly on the information provided by doctors, and people they trust. In conclusion, physical activity is a critical factor in

controlling diabetes, so its promotion in this group has been of particular importance. However, PA may not provide enough stimuli to provide physiological changes that improve glycaemic balance, if not performed with adequate individualized goals (intensity, type, volume).

APPLICATIONS REMARKS

- The Fitness trainers and instructors must improve the exercise programs for diabetics not only to design specific exercises but also to minimize exercise risks.
- The promoters of PA programs such as gyms or health clubs should implement supervised exercises programs for diabetics as it can help to attract diabetics for their services.

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