

## Impact of Physical Activity on the Glycemic Control of Diabetics Using the GPAQ

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### Abstract

**Introduction:** Physical activity (PA) has become a key factor in preventing many chronic diseases, and also preventing the appearance of diabetes long term complications.

**Objectives:** The aim of this study is to evaluate the impact of PA using the GPAQ on the glycemic control of diabetics, in the province of kenitra, Morocco.

**Materiel and Methods:** The research sample consisted of 329 diabetics, aged 18-86 (28,6% of men and 70,5% of women), The study was carried out in the only provincial referral center of diabetes (RCD) in Kenitra, Morocco. Data was collected by the Global physical activity questionnaire (GPAQ)

**Results:** In general the glycemic control of this population is not meeting the standards for the glyated hemoglobin, fasting blood glucose and for the postprandial blood glucose. Also all this population suffer from overweight ( $26,37 \pm 4,7$  for Women and  $29,59 \pm 6,07$  for Men). There is a remarkable difference in the value of the glyated hemoglobin between people who does practice a PA and who don't. the value of the glycemic control and the BMI in men and women are proportional with the type of PA, otherwise, there is an effect of the physical activity on those variables; persons with a high level of physical activity show a low value of BMI and glycemic control which is represented in this study by the three common blood analysis, used by doctors to follow the health state of their patients.

**Conclusion:** These results confirm the effect of the practice of physical activity on the health status of diabetics, which explain the non-compliance of the glycemic control and BMI with the standards, therefore, the health organizations must design a new remediation plan capable of inciting patients to practice physical activity.

**Keywords:** Physical activity; Glycated hemoglobin; diabetes; BMI

**List of abbreviations:** GPAQ: General Physical Activity Questionnaire; MET: Metabolic Equivalents; PA: Physical Activity; RCD: Referral Center of Diabetes; WHO: World Health Organization

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### Introduction

Diabetes is defined as a group of metabolic diseases characterized by the presence of chronic hyperglycemia [1], according to the etiology, Three types of diabetes can be distinguished, type 2, 1 and gestational diabetes [2-4].

Diabetes is a world major health problem by its increasing prevalence [5]. In Morocco, more than 2 million and half of adults over 30 have diabetes and most of them are non-insulin dependent, the most common type of diabetes in Morocco, according to the latest statistics from the Ministry of Health [6].

The real threat of diabetes is its long term complications [5], all these complications can be managed by a healthy eating habits and a regular physical activity [7]. Physical inactivity called also sedentary behavior has a lot of health inconveniences. It is now identified as the fourth-leading risk factor for global mortality [8], thus, the promotion of physical activity (PA) has become a key factor in preventing many chronic diseases in public health strategies [9]. This can be a primordial act to help diabetics to reach an adequate glycemic control [10]. However, it is not known how physical activity and sedentary behavior are affecting the glycemic control of a Moroccan diabetic population. Therefore, the aim of this study is to evaluate the impact of PA using the GPAQ on the glycemic control of diabetics, in the province of kenitra.

### Methods

#### 1.1 Population and study design

This study was carried out from January 2015 to April 2016, the population was formed by diabetics presenting different types of diabetes (type 1, type 2 and gestational diabetes). The research sample consisted of 329 diabetics aged 18–86 (28,6% of men and 70,5% of women) living in Kenitra, Morocco. 12,7% were aged 18-39, 65,5% were aged 40-64 and 20,8% were aged 65-86. The response rate was 75%. The most frequent reason for non-response was the lack of time (35% of respondents). Participation in the study was voluntary. The study was carried out in the only provincial reference center of diabetes (CRD) located in the Urban Health Center -Moulay El Hassan in the city of Kenitra Morocco. Data was collected by the Global physical activity questionnaire (GPAQ).

All participants reported having already attended a nutritional education and education sessions to physical activity, organized by the health center dietician.

#### 1.2. Assessment of PA and sedentary behavior

The assessment of the physical activity was performed according to GPAQ, and the Analysis of the results was done by the analysis Guide proposed by the World Health Organization [11]. -METs (Metabolic Equivalents) are commonly used to express the intensity of physical activities, MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate. One MET is defined as the energy cost of sitting quietly, and is equivalent to a caloric consumption of 1 kcal/kg/hour, therefore for the analysis of GPAQ data, existing guidelines have been adopted: It is estimated that, compared to sitting quietly, a person's caloric consumption is four times as high when being moderately active, and eight times as high when being vigorously active [12-11].

#### 1.3 Statistical analysis

- The data was analyzed using SPSS v.18.

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## Results

The population size is 233 diabetics (70,5% women, and 28,6% men), with an age range of  $53,3 \pm 14,9$  for women and  $54,9 \pm 13,2$  for men. 12,7 of the population represent the age range of 18-39 years, 65,5% for 40-64 years and 20,8% for 65 years and above. 15,19% of men and 55,62% of women are illiterate, and 13,67% of men and 15,5% of women are literate.

As shown in the table 1, the glycemic control of this population is not meeting the standards for the HBA1C, fasting blood glucose and for the postprandial blood glucose. Also all this population are overweight ( $29,59 \pm 6,07$  for Women and  $26,37 \pm 4,7$  for Men)

Items	M ± S	
	Men	Women
Population size	(70,5%)	(28,6%)
Age (years)	$53,3 \pm 14,9$	$54,9 \pm 13,2$
Weight (kg)	$78,09 \pm 13,60$	$75,15 \pm 14,78$
Height (cm)	$172 \pm 7$	$159 \pm 8$
waist size (cm)	$95 \pm 12$	$102 \pm 11$
Hip size (cm)	$96 \pm 12$	$107 \pm 12$
Waist/Hip circumference	$0,96 \pm 0,15$	$0,98 \pm 0,53$
BMI	$26,37 \pm 4,7$	$29,59 \pm 6,07$
duration of disease (years)	$8 \pm 7$	$8 \pm 6$
Smoking habits	0%	4,5%
HBA1C (%)	$9,41 \pm 2,14$	$9,44 \pm 2,43$
Fasting blood glucose (g/l)	$1,99 \pm 0,87$	$2,10 \pm 0,85$
Postprandial blood glucose (g/l)	$2,54 \pm 0,92$	$2,66 \pm 0,93$
Duration in minutes of PA/day	$19,57 \pm 30,09$	$19,31 \pm 6,47$

**Table 1:** General characteristics of the study population.

(BMI: Body mass index, HBA1C: glycated hemoglobin, M ± S: Mean ± Standard deviation, PA: physical activity)

According to the table 2, there is a remarkable difference in the value of the HBA1C between people who does practice a PA and who don't, in the three age ranges.

ITEMS		Practice a PA		Do not practice PA	
		Men	Women	Men	Women
		M ± S		M ± S	
HBA1C (%)	18 - 39 Years	$10,10 \pm 2,31$	$9,74 \pm 3,87$	$10,76 \pm 1,23$	$11,75 \pm 3,01$
	40 - 64 Years	$9,24 \pm 2,25$	$9,05 \pm 2,40$	$10,13 \pm 2,02$	$11,22 \pm 1,70$
	65 or Above	$7,75 \pm 1,09$	$7,93 \pm 1,45$	$8,99 \pm 1,26$	$10,40 \pm 1,82$

\*HBA1C: glycated hemoglobin.

**Table2:** Impact of the practice of PA on the HBA1C value by age range.

From figure 1 and 2, the value of the glycemic control and the BMI in men and women are proportional with the type of PA, otherwise, there is an effect of the physical activity on those variables, persons with a high level of physical activity show a low value of BMI and in the glycemic control which is represented in this study by the three blood analysis, used by doctors to follow the health state of their patients.

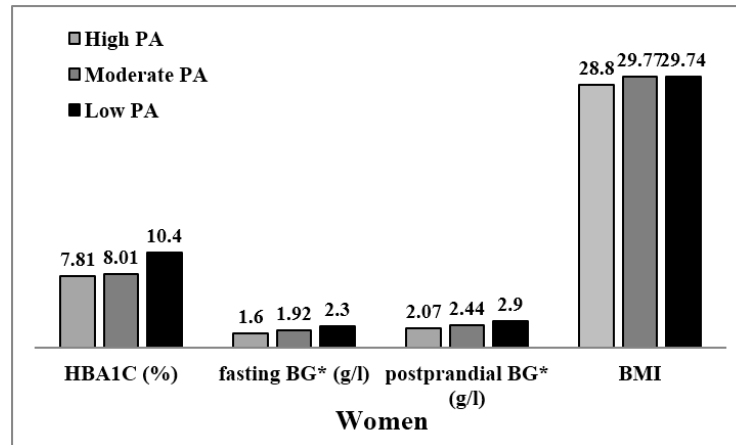


Figure 1: Impact of type of PA on the glycemic control and BMI in women.

(BG: Glycemic control, PA: physical activity, HBA1C: Glycated hemoglobin).

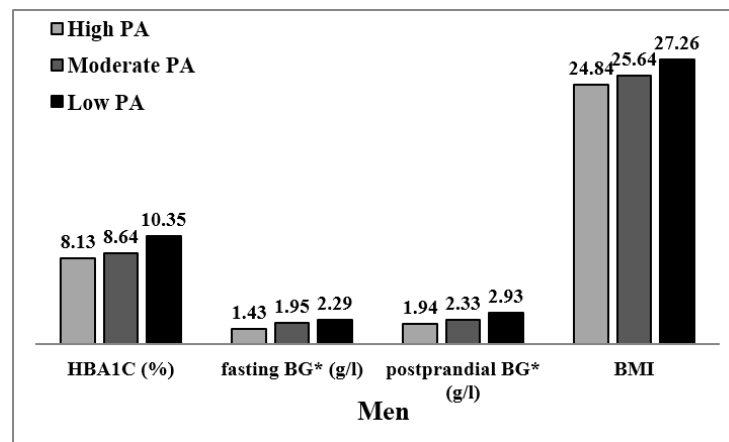


Figure 2: Impact of type of PA on the glycemic control and BMI in men.

(BG: Glycemic control, PA: physical activity, HBA1C: Glycated hemoglobin).

### Discussion

According to Table 1, glycemic control in this population is higher than the standard for HBA1C, GAJ and GPP. [11-13]; Similar results were approved by the study of A. coulibaly et al in 2007 [14], who worked on type 2 diabetics and found a glycosylated hemoglobin value of  $8.4 \pm 2.3$  And  $1.44 \pm 0.9$  for fasting blood glucose. (BMI > 25 Kg/m<sup>2</sup>), it is more pronounced in women (BMI >  $29.59 \pm 6.07$  > 25 Kg/m<sup>2</sup>) than men (BMI >  $26.37 \pm 4.7$ Kg/m<sup>2</sup>) this difference is the same reported by the national anthropometry survey in 2011 in Morocco where overweight is more common among women (61.1%) than men (38.9%) [15]. The average BMI of women tends towards obesity (BMI  $\approx$  30): ( $29.59 \text{ Kg/m}^2 \pm 6.07$ );This result is similar to that reported by Nthangeni., et al. In 2002 [16] and Alebiosu and Odusan in 2004 [17].

The average duration of daily physical activity in minutes is much lower than the values recommended by the WHO [8]. According to Figures 1 and 2, there is a direct link between the practice of physical activity, whether high, moderate or low, with the glycemic control that is elucidated in our case by the three types of blood tests (HBA1C, GPP, GAJ), this same link was approved on the BMI of these patients, because as long as physical activity decreases the BMI increases. And this is a classic result hence the role that plays physical activity either for a diabetic and a healthy subject [18-20].

### Conclusion

These results confirm the effect of the practice of physical activity on the health status of diabetics, which explain the non-compliance of the glycemic control and BMI with the standards, therefore, the health organizations must design a new remediation plan capable of inciting patients to practice physical activity.

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### Conflict of interest

There is no financial interest or conflict of interest.

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