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ANÁLISE GLICÊMICA DE 48 HORAS APÓS SESSÕES DE VÍDEO-GAME ATIVO E CORRIDA EM DIABÉTICO TIPO 1

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Resumo: Inserir resumo em português. O controle glicêmico e a redução da hipoglicemia em pacientes diabéticos tipo 1 (DM1) antes, durante e após várias horas de exercício continua sendo um desafio. Atualmente, novas formas de exercício têm sido utilizadas para ajudar a população em geral. Videogames ativos (AVG) podem ser uma alternativa no controle glicêmico para diabéticos tipo 1 (DM1)? Esta pesquisa teve como objetivo analisar a glicemia em corrida (esteira) e videogames ativos (AVG) em paciente com DM1. Foi realizado um estudo de caso com um paciente com DM1 do sexo masculino realizando AVG e preparo (30 minutos). A glicemia capilar foi analisada no início do estudo, imediatamente e 30 minutos após, e a cada 6 horas até 48 horas e o recordatório alimentar foi verificado durante 48h. As respostas cardiovasculares e de motivação foram verificadas durante e após as sessões. Foi realizada análise descritiva. Como resultado, as taxas aumentaram os parâmetros cardiovasculares e a corrida atingiu 12 pontos de esforço percebido a 72% da frequência cardíaca. AVG, 11 pontos e 62%. Ambos imediatamente após a sessão tomam a glicemia em relação ao repouso e mantêm valores abaixo da glicemia estimada. Ele destacou que a corrida promove a hipoglicemia noturna. Em uma sessão de AVG, os valores de motivação foram 99 vs 79 pontos para corrida. Através desta pesquisa, conclui-se que o AVG também foi glicemicamente interessante para o DM1 masculino.

Palavras-chave: glicemia; diabetes mellitus; exercício; jogos de vídeo; corrida

Afiliação

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48-H GLYCEMIC ANALYSIS AFTER AN ACTIVE VIDEO GAME AND RUNNING SESSIONS IN TYPE 1 DIABETIC

Abstract: Glycemic control and reducing hypoglycemia in type 1 diabetic (T1DM) patients before, during, and after several hours of exercise remains a challenge. Nowadays new exercise forms have been used to help the general population. Could active video games (AVG) be an alternative in glycemic control for type 1 diabetic (T1DM) patients? This research aimed to analyze blood glucose in running (treadmill) and active video games (AVG) in a T1DM patient. A case study was carried out with a male T1DM patient performing AVG and preparation (30 minutes). Capillary blood glucose was analyzed at the beginning of the study, immediately and 30 minutes later, and every 6 hours up to 48 hours, and food recall was verified during 48 hours. Cardiovascular and motivation responses were verified during and after t he sessions. A descriptive analysis was performed. As a result, rates increased cardiovascular parameters and running reached 12 points of perceived exertion at 72% of heart rate. AVG, 11 points, and 62%. Both immediately after the session take blood glucose compared to rest and maintain values below the estimated blood glucose. He highlighted that running promotes nocturnal hypoglycemia. In an AVG session, the motivation values were 99 vs 79 points for running. Through this research, it is concluded that AVG was also interesting for glycemic responses for a male T1DM patient

Key words: blood glucose; diabetes mellitus; exercise; vídeo games; running

Introduction

Type 1 diabetes (T1DM) is the most common endocrine condition because of multifactorial metabolic changes that cause hyperglycemia[1]. The clinical approaches to control glycemia are exogenous insulin, dietary control, and exercise[2]. However, excessive screen time with video games and poor eating habits may aggravate the metabolism[2]. Besides, achieving the recommended levels of exercise is important to glycemic control during and after exercise preventing nocturnal hypoglycemia[2,3].

Although exists several types of exercise (e.g. Aerobic)[4] active videogame (AVG) is a new exercise that physically actively changes the way to control the game with all body movements (e.g. jumps, squats, and lateral shifts with vertical and horizontal shoulder extension)[3]. They have been used because of increased heart rate (HR), blood pressure (BP), and energy expenditure[3,5].

However, studies with DM and AVG are scarce and it is known that people with DM use the same time of screen time as healthy[6]. A few studies have been performed specifically with T1DM and AVG. Faulkner et al personalized exercise for adolescents with diabetes or obesity. Otherwise, because of different exercises (dance, kickboxing, and running), it is not clear the responsibility for the benefits[7]. Also, a recent crossover trial verifies AVG vs. running in TD1M. Otherwise, the glycemia was reported only after pre-post and 30 minutes after the sessions[8].

Thus, considering the importance of monitoring blood glucose during recovery (immediate and up to 48 hours post-exercise)[9] and that there are many different traditional forms of exercise[4], not all have been used for individuals with diabetes because the motivation to practice traditional exercises seems to be reduced[8,10]. This study case aims to analyze the glucose responses after an active video game and running session in a T1DM patient.

Materials and methods

Ethical aspects and Study design

Case study approved by Pernambuco University ethics committee (nº 1.560.045). This study consisted of visits for 3 weeks with every two last weeks verifying for 48 hours. The sessions were at the Human Performance Assessment Laboratory (temperature 22C–26C; ambient relative humidity 40%–60%; atmospheric pressure &101.3 Pa). Figure 1 resumes the study design.

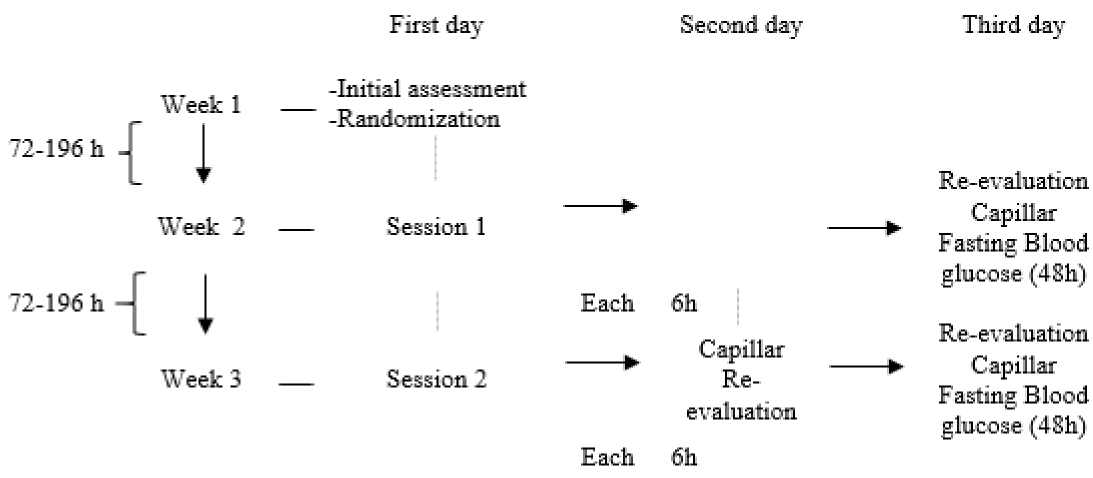


Figure 1 – Study design

Participant/Case description

The volunteer had 33 years of age, was male, had 17 years of diagnosis and family history of diabetes mellitus, had previous experience in treadmill running and practice of AVG, weighed 79kg, had a body mass index of 25.2 kg/m², a lean mass of 58.3 kg, 26.6% fat, used 30 units of basal insulin and about 24 units of ultrafast insulin, 7.7% glycated hemoglobin with estimated glucose of 170 mg/dL, HDL 66 mg/dL, LDL 122 mg/dL, total cholesterol 206 mg/dL, triglycerides 88 mg/dL and 290 fasting blood glucose.

Table 1 – Anthropometric and lipid baseline characteristics of the participant.

Anthropometric and lipid baseline characteristics	
Age (years)	33
Weight (kg)	79
BMI (kg/m²)	25.2
Lean mass(kg)	58.3
Fat mass(%)	26.6
Fasting glycaemia(mg/dL)	290
Glycated hemoglobin(%)	7.7

HDL(mg/dL)	66
LDL(mg/dL)	122
Total cholesterol(mg/dL)	206

BMI: Body Mass Index; HDL: High-Density Lipoproteins; LDL: Low-Density Lipoproteins.

Weeks descriptions

The first week: Initially, lab biochemical measurements. Then, body composition and anthropometric measures (weight, height). Next, a 10-minute passive rest (lying down position) was performed for baseline cardiovascular measures (HR and BP) and capillary glycemia (G) before the maximal test of running. Finally, a randomization of the session was performed by “door prize” (“AVG” or “Running”).

The second week: In the second week (after 72-196 hours), the first session (day 2) was performed. Initially, HR, BP, and G were performed. The session was then started with running on the treadmill or AVG (30-minute session). The subjective perception of effort and motivation to practice was verified immediately before, after 30 minutes, and each 6h until 48h the capillary glycemia was also measured.

A standard snack (Chart 1) was given according to Lima (2015) and food recall on the subsequent days of the sessions was made (Figure 2).

Chart 1 – A standard snack is given to the volunteer.

Food	Estimated weight (g)	Kcal (%)	Protein %VD	Carbohydrate %VD	Lipids %DV
Bread (2 slices)	100	12	6	8,5	2
Cheese (1 slice)	35	10	3	10	5
Ham (1 slice)	35	8	14	1	8,5
Juice 300ml (100ml pulp)	100	1	1	2	1

%DV: Daily values - The approximate and calculated values with average in a daily feed of 2000kcal.

The third week: All procedures were methodologically repeated with the session that was not performed in the previous week.

Anthropometry, cardiovascular and perceptual measures, and blood sample

The measurement of anthropometry was according to international recommendations[11]. Cardiovascular measures were made by an HR (RS800CX, Polar®, Finland) and an automatic BP monitor (OMROM 7113). Double product (DP) was calculated. The capillary glycemia was analyzed as recommended[12]. A trained and qualified professional collected blood in the antecubital artery on day 1. The motivation was measured by the Visual Analog Scale adapted for AVGs[3,12]. The Borg scale[13] analyzes physical exertion. A standard snack was given according to the previous study[5] and food recall was made.

Intervention

Active video game session

The console used was the Xbox 360 with a device (Kinect) able to capture the movements of players and dispense joysticks or accelerometers helping in greater mobility of the individual. The body of the player was mapped by cameras equipped with sensors capable of detecting the body movements and transmitting them to the games. The AVG session used Xbox 360 with the Kinect Adventures (30 minutes) because of the wide range of movements required during the match according to a previous study[14]. The volunteer played 10 minutes of the three most intense mini-games (River Rush, Rally Ball, and Reflex Ridge). Participants performed jumps, squats, and lateral shifts with vertical and horizontal shoulder extension in all mini-games to collect all possible pins.

Running session

The running session consisted of treadmill running (Super ATL, Inbrasport, Brazil) with moderate intensity (50-69% of the maximum intensity), with one minute at each intensity. The speed reached in the maximum test of day 1 was used to calculate de %.

Statistical analysis

A descriptive analysis of the general and laboratory variables was performed, the delta of variation (%) was added to better elucidate these changes. Microsoft Excel 2013 for Windows® was used.

Results

Initially, before the sessions, HR, SBP, DBP, and DP presented close values (76 bpm, 120 mmHg, 69 mmHg, and 9120 mmHg x bpm, for the running session and 74 bpm, 130 mmHg, 82 mmHg, and 9620 mmHg x bpm in the session AVG) (Table 2).

Table 2 – Cardiovascular characteristics pre exercise, during exercise, running e AVG.

Pre exercise	**AVG**	**Running**
HR (bpm)	74	76
SBP (mmHg)	130	120
DBP (mmHg)	82	69
DP (bpm.mmHg)	9620	9120
During exercise		
Heart rate (%)	62	72
Perceive Exertion (6-20 points)	11	12

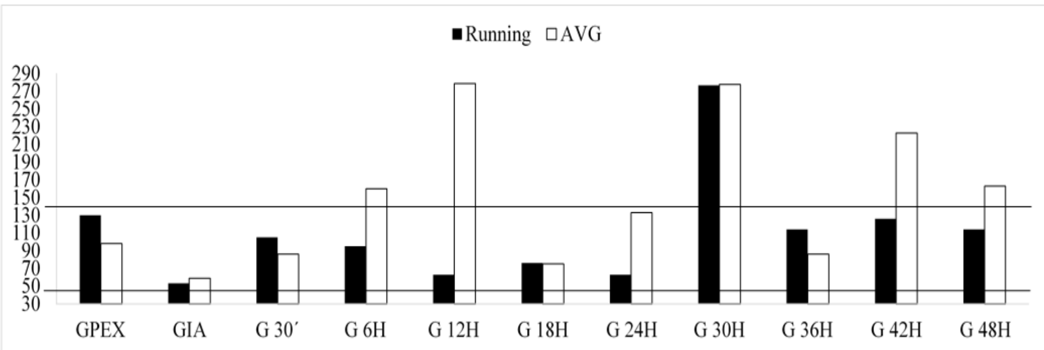
Note: HR= heart rate; SBP= systolic blood pressure; DBP= diastolic blood pressure; DP= Double product.

These sessions were responsible for changes in blood glucose. The volunteer was fed a standard snack before and 48h after the sessions. On the up and downside of figure 2, Running and AVG food recall.

Feeding on running days

GPEX: Standard snack + 6UI G IA: Cola refrigerant(250ml)(11:00AM) G30´: Spaghetti, bean and Beef G6H: Popsicle + diet Guarana + 6UI G12H– 1 salt wafer + diet jelly G18H: G24H: Cola refrigerant(250ml) G30H: Glass of yogurt + 1 cup of curd G36H: G42H: G48H: Standard snack

*Symptoms of nocturnal hypoglycemia (between 18-24h after running session)



Feeding on Active Videogame days

GPEX: Standard snack + 9UI G IP: Cola refrigerant (250ml) (11:00 AM) G30´: Spaghetti, bean and Beef G6H: Guarana G12H: three hot dogs G18H: G24H: G30H: 10ui + 4 slices whole wheat bread with tuna pate and 1 slice cheese G36H: G42H: 3UI G48H: Standard snack

GPEX: Pre exercise glycaemia; GIA: Immediately after glycaemia; G 30´: 30 minutes glycaemia. UI: Ultra rapid Insulin Units.

Figure 2 – Capillary glycemic profile and food recall and insulin correction before and after the sessions.

Discussion

The present study shows that an AVG session provides glycemic alterations similar to an interval running session normally recommended by guidelines. However, the running session provided nocturnal hypoglycemia (Figure 2). The novelty of the literature was the glycemic responses in type 1 diabetes were verified in two different forms of exercise, in an immediate and late form. A few studies with diabetics and exercise are performed and with type 1 diabetics about ~10% [15]. Also, related to AVG and T1DM[5].

People with T1DM face a substantial risk of hypoglycemia during and after exercising[5,16]. Trials have studied the hyperglycemic response to vigorous-intensity physical activity to prevent hypoglycemia during and after exercise[17,18]. These strategies are difficult to implement in the exercise-naive patient because they depend on the timing, duration, and intensity of an exercise [19]. In a systematic review was observed that several mechanisms have been studied to correct post-activity hypoglycemia. Aerobic or intermittent exercises, together with an adequate diet, proved to be effective in the management of several metabolic variables[16].

In this study case, the running session was moderate intensity by PSE (12 points on the Borg scale) and moderate-vigorous by % maximal HR (72% of the maximal HR exercise test). While the AVG presented moderate intensity by PSE and % HR (11 points, 62% of maximal HR exercise test). Exercise intensity is very important since it influences hormones and, consequently, glycaemia[2]. Anaerobic exercises generally do not cause significant changes in blood glucose because of the increase in catecholamine[15].

Regarding the capillary glycemic alterations, the running session and AVG session were efficient in controlling glycemia below 170mg/dL in most of the analyzed points. These data corroborate with others [20,21]. Our study was analyzed until 48h, different from the case study of analyzing pre-post session[4], which is dangerous due to several risks of hypoglycemia after hours of exercise. Both sessions were reduced after (-77mg/dL in the running and -39mg/dL VGA) the sessions but without severe hypoglycemia (53mg/dl and 59mg/dl, respectively) (Figure 2). Also, the running session caused symptoms of nocturnal hypoglycemia (sweating and irritability) between 12h-18h and remained in hypoglycemia in 24h (<70mg/dL). This highlights the importance of our study because some studies analyze immediate glycaemia[5,22] but, forget the late acute effects.

Notwithstanding AVG session didn't present hypoglycemia symptoms, there were points (G12h, G30h, and G42h) above 170 mg/dL). These values may be indicated by feeding off the "normal" diet in G12h and G30h (according to volunteers). While G42h the volunteer had not remembered whether he had applied basal insulin at night, causing hyperglycemia. No sign of nocturnal hypoglycemia was found and this concern with post-exercise and nighttime glycemic variation is a constant to T1DM[23,24].

Yardley's study found four nocturnal hypoglycemia after 45 minutes of moderate-intensity (60% VO_2) aerobic exercise in 12 T1DM patients[19] and systematic reviews with meta-analysis have pointed this concern[24,25]. Anyway, beneficial responses in AVG can be explained by the fact that counter-regulatory hormones[26]. Similar to Lima performing a 30-minute moderate aerobic session with 10-second bouts in high intensity in a cycle ergometer[20]. Also, a recent study verified AVG, running, and sitting in TD1M patients and found similar blood glucose reductions for AVG and running immediately after and 30 minutes compared to sitting ($P<0.05$) and lower descriptive glucose values than sitting at 6 hours, 12 hours, 18 hours, and 24 hours after the sessions [27].

Finally, the running session reached 79 points, and the AVG session 99 points. These results are similar to another study with AVG presenting a value of 60-100 motivation points[3] in healthy participants. In T1DM patients after treadmill running, Carvalho et al confirmed 73±20 points of motivation[28]. In another study performed with T1DM patients, our motivation result may be confirmed as similar when 77±16 and 94±7 points after AVG and running session were found[8].

A limitation of the study was that it was carried out with only a single male participant. Sex extrapolations could not be realized and the blood glucose responses may be different when intensity- and duration are matched [27,28]. It is intended to carry out future studies with a larger sample of volunteers, to analyze the effects of the studied interventions and to measure their size. Although small, the study can contribute to the practices of health and education professionals, adapting the prescribed exercises for male adults with T1DM. They can use HR and RPE for session intensity control [29].

Conclusion

AVG session was glycemic-safe for male T1DM over 48 hours. Both activities performed in the present study are interesting for an adult male with T1DM because the glycemic safety showed in post-exercise analysis, even though in several moments after both sessions the capillary blood glucose remained below the values of the average glycemia estimated by glycated hemoglobin. However, the running session caused nocturnal hypoglycemia. It is suggested that other studies also analyze at least the first 24 hours after exercise in a higher sample, since nocturnal hypoglycemia may occur and alter other endothelial, inflammatory, and cardiovascular variables.

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