

Fasted-State Exercise in Diabetes Management: A Case Report

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Abstract

Several studies comparing fasted-state exercise with post-meal exercise showed the latter better for postprandial glucose. Comparing the immediate effects of these exercises on glycaemia did not help the case for fasted-state exercise. Looking closely at the delayed effects of fasted-state exercise gives a different picture. This report shows how valuable fasted-state exercise can be in diabetes management.

Abbreviations

1 carb -- 15 g carbohydrates

PPG -- postprandial glucose

CGM -- continuous glucose monitoring

MG -- 24-hour mean glucose

HOMA-IR -- Homeostatic Model Assessment for Insulin Resistance

Keywords: Prevalence, Risk Factors, Hypertension, Police officers and GOMA

1. Introduction

Fasted-state exercises are not included in the ADA guidelines yet. This is because not enough randomized control studies are available to establish its utility in diabetes lifestyle. All randomized studies that compared fasted-state exercise with post-meal exercise showed the latter better for glucose control. Studies looking into the immediate effects on glycaemia did not help the case for fasted-state exercise. One has to look closely at the delayed effects on glycemia of fasted-state exercise to see its benefits. A physician-patient managing her own type 2 diabetes for 24 + years, I had to keep away from morning walks for 16 years because of its immediate negative effects on glucose levels. Lately, however, I have been walking in the mornings, every other day for the last four + years because continuous glucose monitoring (CGM) showed me how to minimize the negative effects of fasted-state exercise. On the other hand, I have 8 relatives in South India, US and UK benefiting from morning walks every day. They have prevented diabetes or have been managing diabetes well. This case report is to share what I learned from my CGM data, so that patients can test it while waiting for new recommendations from ADA and other organizations.

Fasted-state exercise happens under counterregulatory hormones and this fact has several immediate consequences that are negative. Exercise on an empty stomach gives rise to post-exertion glucose elevation, higher postprandial glucose (PPG) values and glucose

dysregulation for 1-3 hours following the activity [2]. The risk of delayed hypoglycemia is high after high-intensity fasted-state exercise [3]. Moreover, when I tried the two lifestyles, with fasted state exercise (2002) versus post-breakfast exercise (2012), A1C and HDL were better in the latter case [4]. Many authors including myself found it necessary to caution against fasted state exercise [1,5].

The benefits of fasted state exercise have been well documented [1]. Since fasted-state exercise is under counter-regulation, hepatic glucose output does not stop, it continues and there is little hypoglycemia risk during the activity [6]. Liver glycogen depletion during fasted-state exercise is a powerful insulin sensitizer that lasts for well over 24 hours [1,2]. Fasted state exercise directly improves fasting glucose [7]. A training study by Verboven et al., with exercises performed three times a week, showed mixed results: although A1C was better in the case of post-meal training, insulin resistance (HOMA-IR) improved for the fasted state training (4.5 to 4.0). For post-meal training HOMA-IR increased from 7.7 to 7.9 [8]. Other training under fasting conditions also showed increased glycogen content, glut-4 protein level, and AMPK activity (a protein that promotes mitochondrial biogenesis [9,10]). Also, exercising during fasting increases lipolysis in adipose tissue while also stimulating peripheral fat oxidation, resulting in increased fat utilization and weight loss [11].

• CGM

My endocrinologist ordered CGM for me in 2017 because of severely impaired awareness of hypoglycemia. Two ER visits with seizures found blood glucose levels 25 and 15 mg/dL. After purposefully keeping away from pre-meal exercise for 16 years, CGM helped me to see fasted state exercise in a +ve light: moderate intensity would minimize delayed hypoglycemia risk and a light meal following the activity would minimize the immediate glucose dysregulation.

My CGM data also helped with the following results.

2. The Day After

CGM showed that glucose profile and 24-hour mean glucose (MG) on the day after were better when exercise was done in the fasted state [12]. They were worse on the day after the post-meal exercise. So, I started doing morning walks every other day to minimize the negative effects.

• A1C

I continued to improve my meal composition using the diabetes plate method (13) and meal timing [1,12,13]. The circadian-friendly meal plan involves a morning snack offering second-meal

phenomenon in order to moderate glucose levels in the morning and an early light supper which is critical in mitigating the poor glucose tolerance in the evening [1]. This makes breakfast and lunch the main meals of the day. It was not clear how much glucose dysregulation there would be with a light meal (morning snack) following the morning activity. Before my blood test on January 18, 2022, I tried morning walks every day for two months and A1C came out to be 6.4% (46 mmol/mol). From May, 2018 to April, 2022, when the morning walks were done every other day, A1C values were lower, 5.8-6.1% (40-43 mmol/mol) [1].

• MG

When the focus was on MG under free-living conditions, I used to get mixed results.

Since glucose levels are sensitive to numerous variables, I decided to observe the effects of pre-meal exercise every day versus every other day, using the same sensor that was synchronizing well with a regular glucometer while keeping medications and meals identical (Figure 1). My current medications are Metformin 500 mg twice a day, Jardiance 10 mg once a day and Semaglutide 1mg once a week, Simvastatin 20 mg once a day and Telmisartan 40 mg once a day.

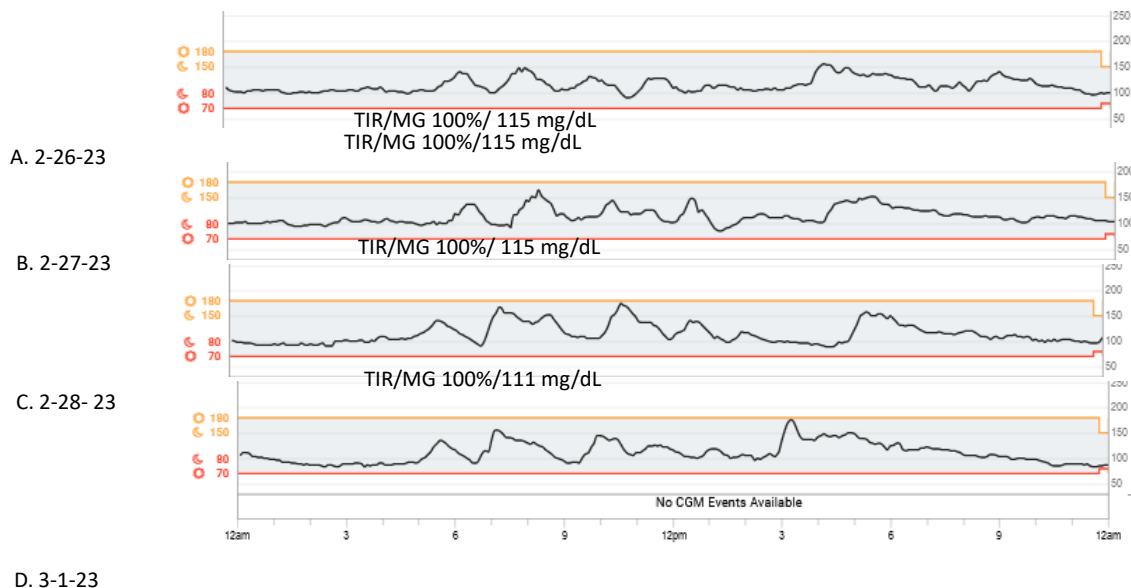


Figure 1: Morning-walk (30') followed by morning snack everyday vs every other day when medications and meals are identical.

Morning walk is done first 3 days (A, B and C). A post-breakfast exercise 10 minutes of RE + 15 minutes of walk is done on all days A-D. Upper body RE and core exercise + a short walk is the exercise used in A and C; lower body RE + walk is used in B and D. Other post-meal walks are done as needed per high alert which is set at 140 mg/dL. A -C; Morning walk every day produces similar time-in-range (TIR) and mean glucose (MG); 100%/115 mg/dL C-D; Morning walk every other day, MG improves from 115 to 111 mg/dL.

3. Discussion

Figure 1 C and D (with ½ carb morning snack) is showing that glucose profile and MG are better when morning walks are done on alternating days. Since glucose profile, MG and A1C are better when morning walks are done on alternating days, the net benefit of a morning walk may be greater when done every other day rather than every day.

Although post-meal exercise with proper timing, intensity and duration blunts postprandial glucose (PPG), it does not offer other benefits: aerobic exercise post-meal is not an insulin sensitizer nor does it improve fasting glucose [7]. Hypoglycemia may occur if energy expenditure is high and hyperglycemia may be the result if timing is delayed [1]. This is why morning walk followed by a morning snack every other day offers a lot more than post-meal exercise does.

4. Conclusions

On the basis of decades of data and my experience with CGM for 4+ years, the best exercise for beating diabetes is a 30 to 60-minute morning walk followed by a morning snack, every other day. Post-meal exercise (preferably resistance plus aerobic) still does help after bigger meals with moderating the glucose peak.

Randomized controlled studies in this area would be helpful toward promoting morning walks. In the meantime, patients with glucometers or CGM are free to test morning walks and monitor their progress, with the help of providers as needed.

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