We Can Work (it) Out Together: Boot Camp for Type 1 Diabetes Patients and Providers Improves Exercise Self-Efficacy

Running Title: Type 1 diabetes and exercise self-efficacy (max 75 characters)

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Key Messages: Education and group exercise improve exercise self-efficacy in diabetes care providers. CGM is a valuable tool for teaching T1D patients about exercise responses.

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Abstract

Objective: This project aimed to use educational sessions and exercise classes to improve exercise self-efficacy in individuals with type 1 diabetes (T1D) and diabetes care providers (DCP).

Methods: We recruited 12 T1D participants and 12 DCP who participated in 4 weekly group sessions to learn about exercise physiology and experience different exercise types. We provided participants with T1D with real-time continuous glucose monitors (CGM) and heart rate monitors to enhance experiential learning. Both groups completed questionnaires before and after the study to assess confidence around exercise. Following the study, focus groups assessed the impact of the study on knowledge and self-efficacy.

Results: There was an improvement in DCP attitudes toward exercise (p=0.004). DCP confidence in providing clients with advice regarding the time, type, and intensity of exercise (p=0.005), and strategies for overcoming barriers to exercise (p=0.016) improved significantly. We found no significant changes in results from T1D participant questionnaires. Focus group analysis suggested that the study improved awareness of the importance of exercise in T1D as well as knowledge about the effects of exercise in T1D in both DCP and T1D participants. CGM use alleviated fear of hypoglycemia among T1D participants.

Conclusion: These findings suggest that a 4-week education and exercise-focused program improves DCP self-efficacy in providing exercise advice to patients. T1D did not experience an improvement in exercise self-efficacy; however, the study supports the use of CGM and the grouping of DCP and individuals with T1D to facilitate experiential learning.

PAEC = Physical Activity and Exercise Counselling Survey
DDS17 = Diabetes Distress Screening Scale
BAPAD1 = Barriers to Physical Activity in Type 1 Diabetes Scale
DCP = diabetes care providers
T1D = type 1 diabetes

Introduction

Exercise is recommended for individuals with type 1 diabetes (T1D) as it enhances quality of life, improves cardiovascular health and lowers insulin requirements[1, 2]. It has been shown to reduce both all-cause and cardiovascular disease mortality in those with diabetes, improve longevity[3, 4], while also delaying the onset of neuropathy[5]. However, exercise can be complicated for individuals with T1D, as insulin dosage and carbohydrate intake must be adjusted depending on the timing, type, intensity, and duration of exercise in order to manage blood glucose levels and reduce the risk of exercise-related hypoglycemia[6]. Fear of hypoglycemia is a major barrier to exercise in this population[7].

Exercise can cause rapid declines in blood glucose in individuals with T1D[6], resulting in an increased risk of hypoglycemia. Studies have shown that using real-time continuous glucose monitors (CGM) may reduce rates of hypoglycemia[8] and that CGM may also help in blood glucose management[9, 10]. Additionally, CGM use has been shown to improve self-monitoring and exercise adherence in those with type 2 diabetes[11]. These qualities of CGM suggest that they may be useful for decreasing barriers to and improving confidence with exercise in T1D[12].

Self-efficacy is a term used to describe expectations of oneself to achieve success despite barriers and setbacks. It is said to improve through "experiences of mastery"[13]. In the context of exercise, the term self-efficacy describes one's belief in their ability to perform exercise safely and consistently and can be used to predict whether an individual will adhere to regular exercise[14]. In individuals with diabetes, a positive relationship has been demonstrated between self-efficacy and both physical activity and adherence to treatment recommendations[15].

The perception of barriers, as measured by the Barriers to Physical Activity in Type 1 Diabetes Scale (BAPAD-1)[16], is inversely related to step count in individuals with T1D[17]. In theory, reducing these perceived barriers should help promote regular physical activity uptake in this population. Diabetes care providers (DCP) are also aware of the challenges that those with T1D encounter with respect to exercise, and are often expected to provide advice on managing insulin dosage and carbohydrate intake.

However, many DCP have little physical activity and/or exercise training which can affect their confidence and accuracy in delivering such information[18].

We propose that a method of overcoming these obstacles involves both parties learning from each other. Co-learning has been defined as the practice of learning together, between professionals and students or patients[19] and has been suggested as a method to improve health education and care[19, 20]. It has been described as an element of participatory action research in primary care, which has been shown to positively impact doctor-patient relationships and patient well-being[21]. In a qualitative study on the inclusion of patients (with a variety of health issues) in health care education, benefits were seen in both the students and the patients, who were viewed as teachers, experts, and exemplars of their condition[22]. Thus, the joint learning of patients and professionals has been shown to positively impact both groups, which may be useful in the relationship between diabetes educators and their patients, especially in an exercise context.

As self-efficacy is said to be determined by one's experiences, accomplishments, persuasion, and arousal[23], we hypothesized that the use of co-learning in lectures and supervised group exercise sessions, as well as CGM technology, would provide the experiences and feedback that both DCP and individuals with T1D need to improve exercise self-efficacy. These experiences will, in turn, decrease the perception of barriers in individuals with T1D and improve exercise self-efficacy in both groups.

Methods

Participants

We recruited 12 adults with T1D and 12 DCP through flyers and word of mouth. None of the participants were currently using CGM. Individuals were excluded if they had comorbid health conditions (e.g. uncontrolled hypertension, angina, etc.) which could make exercise dangerous. We excluded individuals with T1D if they had A1C >10.0%, severe hypoglycemia in the last 6 months, or a T1D duration of less than 1 year. The University of Alberta Research Ethics Board approved the study.

Questionnaires

T1D participants completed 2 questionnaires, the Diabetes Distress Screening Scale (DDS17) and BAPAD-1, before and after the study. The DDS17[24] assesses whether dealing with diabetes causes distress for those with the condition. It consists of 17 items, rated on a scale of 1 (not a problem) to 6 (a very serious problem). The items focus on emotional (5 items), physician-related (4 items), regimen-related (5 items), and interpersonal (3 items) distress. The BAPAD-1[16] scale includes 12 statements about barriers, each of them rated on a scale from 1 (extremely unlikely) to 7 (extremely likely) for the probability that they would prevent an individual with T1D from exercising. Four of the items relate to diabetes and 8 of the items are non-diabetes related.

The DCP completed an investigator-adapted version of the Physical Activity and Exercise Counselling survey (PAEC)[25]. The adapted PAEC assesses DCP confidence in recommending exercise (12 items), confidence in their clients' ability to perform exercise (6 items), attitudes towards exercise (6 items), and perceived difficulty in relaying information about exercise (4 items). Confidence is measured with scales from 0% (not at all confident) to 100% (completely confident), attitudes with scales from 1 (not at all) to 5 (extremely), and perceived difficulties with scales from 1 (not at all difficult) to 5 (very difficult). An open-ended question related to other sources of difficulty when recommending exercise was also included.

CGM

One week before the first session, T1D participants were equipped with a real-time CGM sensor, transmitter, and receiver (Dexcom G4 Platinum, Dexcom Inc., San Diego, CA) to allow for a 1-week habituation period. They were instructed on insertion, calibration, and use of their devices and were provided with new sensors weekly, to be inserted 2 days before each session. Participants were also provided with a glucometer for CGM calibration. CGM data were uploaded each week and analyzed for hypoglycemic events. For the purposes of this study, mild hypoglycemia is defined as interstitial glucose <4.0 mmol/L and significant biochemical hypoglycemia is any interstitial glucose value <2.8

mmol/L[26]. Events, both mild and significant, lasting less than 15 minutes were not included in order to avoid overcalling transient dips or false positives[27].

Boot Camp Sessions

Both DCP and T1D participants took part in a total of 4 boot camp sessions (held once per week) at the Physical Activity and Diabetes Laboratory within the Alberta Diabetes Institute. Each week consisted of a 30-minute education session followed by a group exercise class. The 4 exercise modes, in order, were moderate intensity aerobic exercise [Borg Scale 6-20 scale[28] rate of perceived exertion (RPE) = 12-13], sustained (~10-15 minutes) high intensity [anaerobic, RPE = 16-18)] exercise, high intensity interval exercise, and resistance exercise. The education session included information about the physiology of the exercise being performed and about the current recommendations for insulin dosage adjustments and carbohydrate intake[6]. During the education session, all participants were provided with a snack bar to be eaten either before or after exercise, depending on the type of exercise being performed during the session.

Following the education sessions, participants tested their capillary glucose using a hand-held glucose meter before taking part in an exercise class designed and led by a certified group fitness instructor. The glucose measurements were used to ensure that those with T1D were in a safe glycemic range before beginning exercise, that CGM were displaying appropriate values, and to give the DCP a similar experience to the T1D participants. During exercise, T1D participants were encouraged to pair up with a DCP in order to facilitate co-learning between the 2 groups.

Classes began around 6 o'clock in the evening, with a 5-10 minute warm-up, and ended with a 5-10 minute cool-down and stretch. T1D participants were equipped with heart rate monitors and were asked about their Borg 6-20 scale RPE[28] to ensure appropriate exercise intensity. While trend arrows and CGM values were constantly monitored for safety, participants were asked to verify their capillary glucose when CGM glucose values dropped below 4.7 mmol/L. Following each exercise class, participants performed another capillary glucose test to ensure safe glucose ranges and CGM accuracy before leaving the session. Suggestions for post-exercise nutrition were provided. Time following exercise was used for discussion between study participants and staff.

Statistics

Two-tailed paired sample t-tests were performed to compare pre- and post-boot camp means for individual questions, sections within questionnaires, and questionnaire totals. Paired t-tests were also used for diabetes and non-diabetes related barriers to compare pre- and post-boot camp questionnaires. We used Pearson's correlations to assess relationships between hypoglycemic events and changes in questionnaire scores from pre- to post-boot camp. Significance was set at 0.05.

Qualitative Evaluations / Focus Groups

Upon study completion, participants were invited to join a focus group session. Separate focus group sessions were designed for T1D and DCP participants and were led by a trained facilitator. During the focus groups, participants provided feedback on the content and format of the sessions. They were also asked about benefits of the study and impacts on their understanding of blood glucose responses to exercise. Groups were audio-recorded and transcribed. Transcripts were reviewed for accuracy and to clarify unintelligible sections on the recording. Data were coded thematically using a framework approach that was both deductive, guided by the research questions, and inductive, through open coding of emergent themes. Coding was iterative, based on multiple readings of the data, coded by a single analyst, and reviewed by the primary research team.

Results

Participant Characteristics and Attendance

All recruited DCP were female. The mean age of DCP was 48.5 years. Educational backgrounds of DCP included completing community college or obtaining Bachelor's or Master's degrees. The DCP included nurse educators, dieticians, and physicians with between 2 and 10 years of experience working with patients with diabetes. Eight of the DCP attended all of the sessions, 3 missed 1 session, and 1 participant failed to attend sessions and did not complete any questionnaires. Of the 12 individuals recruited with T1D, 9 participants were female and 3 were male. Mean age of T1D participants was 44.1 years. Seven of the 12 T1D participants attended all 4 of the sessions, 4 attended 3 sessions and 1 participant attended 2 sessions.

Questionnaires

Of the DCP participants, 11 completed the pre-boot camp questionnaire and 10 completed the post-boot camp questionnaire. All 12 of the T1D participants completed both pre- and post- boot camp questionnaires (Table 1).

Physical Activity and Exercise Counselling Survey (PAEC)

During the study, overall confidence of the DCP in providing information about physical activity and exercise increased to a point that approached statistical significance [from 46.13% ± 11.22% to 56.34% ± 15.33% (p=0.06)]. Confidence in providing advice and instruction on high intensity exercise (p=0.015) improved significantly, while increased confidence in providing advice and instruction on aerobic exercise (p=0.07), and resistance training (p=0.06) approached statistical significance. "Confidence in providing advice and instruction regarding appropriate frequency, intensity, time, or type of exercise" improved significantly (p-0.005), as did "confidence in providing clients with strategies to overcome barriers to physical activity and exercise" (p=0.016). DCP "confidence in assisting clients in managing blood glucose and preventing hypoglycemia associated with exercise" showed an increase that approached statistical significance (p=0.07). However, there were no changes in the confidence of the DCP in "designing a physical activity or exercise program" or "evaluating and monitoring the progress of clients," which remained at ~20% and ~40% confident, respectively (p=0.59, p=0.87).

Amongst the DCP, positive attitudes towards physical activity and exercise importance were high to begin with and did not show a statistically significant change [from 4.81 ± 0.39 to 5.00 ± 0 (p=0.17)].

The DCP also increased their ratings of how knowledgeable they feel their clients are in the area of physical activity and exercise (p=0.02). The mean DCP attitude (a combination of 6 statements regarding attitude) towards physical activity and exercise increased from a 3.42 ± 0.41 to 3.77 ± 0.27 (p=0.004).

A statistically significant increase was found in “confidence in client to perform exercise using the correct mode, frequency, duration, and intensity” (p=0.024). Other questions regarding confidence in clients did not change significantly. Overall, the mean confidence in client (a combination of responses to 6 questions related to DCP confidence in client) did not change (p=0.52).

There were no changes in DCP responses to the perceived difficulty in incorporating more exercise information and counseling into their sessions with clients (p=0.604). Before the study, the most common challenges associated with incorporating exercise information into sessions with clients were time restrictions (mentioned by 6 of 11 DCP), lack of teaching resources (n=4), and DCP knowledge level (n=3). After the 4 sessions, time restrictions became a concern for more DCP (9 of 10 DCP), as did knowledge/confidence (n=6). Lack of teaching resources remained a concern (n=3).

Barriers to Physical Activity in Type 1 Diabetes (PADAD-1)

Pre-study, the most highly rated barrier on the BAPAD-1 scale was the “loss of control over your diabetes” (3.00 ± 2.04). Other diabetes-related barriers, including the “risk of hypoglycemia” and the “fact that you have diabetes”, were rated slightly lower (2.25 ± 1.69; 2.08 ± 1.89). Non-diabetes related barriers, such as “the fear of being tired” and “your work/school schedule” were rated somewhat higher than the aforementioned diabetes-related barriers (2.42 ± 1.85; 2.83 ± 1.77). There were no statistically significant changes in any of the ratings from the questionnaire post-study. In general, the mean of the diabetes-related barriers did not differ from the non-diabetes related barriers before (p=0.617), or after (p=0.953) the boot camp study. The overall mean score before boot camp (2.36 ± 1.69) did not differ from the overall mean score after boot camp (2.51 ± 1.40) (p=0.550).

Diabetes Distress Scale 17 (DDS17)

Among T1D participants, there were also no statistically significant changes in the responses to the DDS17 questionnaire between pre- and post-boot camp. The questions that received the highest ratings before the study were “feeling that I am often failing with my diabetes routine” (2.50 ± 1.24), “not feeling confident in my day-to-day ability to manage diabetes” (2.50 ± 1.38), and “feeling that I am not sticking closely enough to a good meal plan (2.83 ± 1.11). None of these ratings changed during the study (p=1.00, p=1.00, p=0.612).

CGM

All 12 T1D participants had at least 1 mild hypoglycemic event either during or following (within 24 hours) boot camp sessions. There were a total of 43 mild hypoglycemic events. The per person average number of mild hypoglycemic events within 24 hours of boot camp during the study period was 3.6 ± 2.1. Four individuals experienced significant biochemical hypoglycemic events in the 24-hour periods following exercise sessions during the study. There were a total of 10 significant biochemical hypoglycemic events following exercise during boot camp among these 4 individuals. One event occurred within 6 hours of boot camp, 7 within 12 hours of boot camp, and 2 within 24 hours of boot camp (Figure 1). Thus, most of the significant biochemical hypoglycemia occurred during the night. Mean duration of each significant biochemical hypoglycemic event was 19.5 ± 8.7 minutes. Three significant biochemical hypoglycemic events occurred following aerobic exercise, 1 following sustained high intensity exercise, 3 following high intensity intermittent exercise, and 3 following resistance exercise. Additionally, we observed a positive correlation between number of hypoglycemic events and change in BAPAD-1 scores from pre- to post-boot camp (r=0.82) (p=0.001). There were no other adverse events reported.

Focus Groups

Eight T1D participants and 6 DCP participated in separate focus group sessions. In the sessions, both DCP and T1D participants stated that the study improved their exercise-based knowledge. DCP indicated very little of their previous training focused on exercise and its benefits and participating in the study helped them improve their understanding of the benefits of exercise. One said, “what I’ve really learned is that exercise is vitally important for diabetes.” The study also helped inform T1D participants about the effects that different types of exercise had on the body. One T1D participant stated that they “never thought about exercise as forms with different effects.” New information that was well-received by both DCP and T1D participants was the potential of high intensity exercise to increase or stabilize blood glucose.

CGM use was considered by both DCP and T1D participants as valuable to the study. One DCP described the CGM use as a “really good learning opportunity.” CGM use was viewed as a “safety net” by some of the T1D participants as they tried the different types of exercise and one stated that it “helped correct low blood sugar without overcorrecting.” One of the T1D participants noted, “without the CGM, I’m scared,” when asked about fears related to exercise and management of glycemia.

When DCP were questioned about prescribing exercise, they mentioned that their new knowledge about different exercise types and effects on blood glucose would change the way that they talk about exercise with their patients. One mentioned that she would “[be] a little more specific” with her clients, while another mentioned that she would “maybe [explain] the benefits or the outcome … when before I didn’t really know for sure what was going to happen with the blood sugars.” Potential strategies for advising clients about exercise discussed by the DCP included using “detailed recording, testing, and then [trying] it.” Following discussions of their strategies for prescribing exercise, the DCP noted the need for more resources to use with patients, stating that currently available exercise materials were insufficient. They described the need for guidelines for different exercise modalities and sports and how these would be helpful, particularly in youths.

Discussion

Type 1 Diabetes

Consistent with other studies, we found that individuals with T1D report multiple barriers to exercise, including the fear of hypoglycemia; however, T1D participants in our study reported a lower rating for the risk of hypoglycemia, both before (2.25, out of a possible 7) and after (3.17) boot camp, than participants in another study (3.51)[7]. The low initial numbers may reflect a lack of experience with exercise and its associated risks among some of the participants, and could also explain the non-significant increase in perceived risks throughout the study. Results from the BAPAD-1 questionnaire suggest that a 4-week co-learning and activity-based program was insufficient to reduce the magnitude of perceived barriers and therefore, may not help in improving exercise self-efficacy.

The fact that the average rating for the barrier "the risk of hypoglycemia" did not decrease, suggests that following the study, the fear of hypoglycemia still affected exercise self-efficacy in T1D participants. Some study participants had little experience with exercise prior to participation and all participants experienced at least 1 study-related mild hypoglycemic event. Thus, participation in the study may have heightened awareness of the risk of exercise-induced hypoglycemia for some participants. This possibility is supported by the positive relationship between number of hypoglycemic events and change in perception of barriers. Thus, in order to improve exercise self-efficacy in T1D participants, a longer study may be more beneficial as it would provide participants with more experience with each exercise modality and managing glucose responses to exercise. Increasing experience with exercise and hypoglycemia prevention would lend a sense of mastery over perceived barriers, which is important to improving self-efficacy[13].

The lack of statistically significant results obtained in the questionnaires for perceived barriers and distress may be, in part, due to the lack of specificity to our study in the questions. Unlike the PAEC questionnaire[25] used for DCP, the BAPAD-1[16] and DDS17[24] questionnaires did not ask about confidence levels in performing different forms of exercise or about overall perceived competence in managing insulin dosing for different exercise types. The Confidence in Diabetes Self-Care Scale[29], asks individuals about confidence in diabetes self-management, including items like, “I believe I can . . . adjust my insulin for exercise.” Other surveys, like the Hypoglycemia Fear Survey-II[30] and the Self-Care Inventory Revised[31] have been used in other studies[17] to assess concerns related to managing hypoglycemia risk and may have provided useful information had they been used in the present study. However, all of these questionnaires would require modification in order to properly assess improvements in exercise self-efficacy in individuals with T1D.

T1D participants found real-time CGM use positively impacted their willingness to exercise in our study, which was evident in qualitative data obtained in the focus group. Other studies have shown that CGM use is effective in improving glycemic control[9, 10] and that real-time CGM can reduce rates of hypoglycemia[8]. There have been few studies examining real-time CGM use in the context of exercise in T1D; however, use of real-time CGM and a carbohydrate algorithm have resulted in appropriate glucose management during exercise in T1D[32]. Additionally, in a study on exercise in T1D adolescents, real-time CGM were more effective in identifying hyper- and hypoglycemia than regular capillary glucose tests throughout the day and night[33]. Thus, CGM is useful in recognizing glucose excursions and managing glycemia during and after exercise. These findings, paired with the qualitative data provided by T1D individuals in our study, suggest that CGM may be useful in improving exercise self-efficacy in T1D, and that continued use of CGM may have been an asset to T1D participants following study completion.

Diabetes Care Providers

Similar to findings in another study[18], DCP in our study report insufficient exercise-related resources and training opportunities for diabetes professionals counseling patients with T1D. Based on both questionnaires and focus group data, DCP in our study improved their knowledge on the effects of different exercise modalities on blood glucose as well as their confidence in delivering this information. These results support the use of a 4-week co-learning-based boot camp for improving exercise self-efficacy among diabetes care professionals. The specificity of the PAEC[25] questionnaire was an asset in obtaining positive results from DCP.

Following the study, DCP participating in our study unanimously agreed on the importance of exercise and physical activity in the lives of individuals with T1D. However, they did not change their perception of the challenges associated with providing information about exercise to their clients. The perceived difficulty in consulting with clients about exercise were likely affected by the reported lack of time and resources, which are described as barriers for diabetes educators in another study[18]. Some of the DCP in our study described specific resources that would be helpful to them when working with clients, such as exercise logs which could be provided to patients. In other studies, the provision of such exercise-related tools was beneficial to DCP confidence[25].

Study limitations include data collected from a small number of participants, all residing in Alberta, Canada, of whom a large percentage were female. A lack of participant characteristics collected for those with T1D, such as duration of diagnosis, make it difficult to generalize these results. Additionally, self-reporting methods of data collection carry the risk of inaccuracy. Study strengths include the novel approach of grouping DCP and T1D participants in sessions that include the use of CGM, co-learning, and exercise. The mixed methods approach to data collection can also be seen as a strength as the focus group data were beneficial in explaining some of the questionnaire outcomes.

Conclusion

This study served as a pragmatic co-learning experience for T1D and DCP participants. Questionnaire data suggest that this program was more beneficial for DCP than for T1D participants, but this may be due to increased participant awareness of exercise-induced hypoglycemia, lack of questionnaire specificity, or insufficient program length where T1D participants are concerned. Results from the focus groups suggest that the educational sessions, combined with the CGM use and exercise classes, were useful to both groups. This study supports findings from another study suggesting that DCP need more training and resources with respect to exercise in T1D[18] and that individuals with T1D are affected by diabetes-related barriers to exercise[7]. Finally, the results of the study encourage the use of co-learning educational sessions involving DCP and patients, exercise classes, and real-time CGM when implementing a program for addressing exercise self-efficacy and suggest that the provision of exercise-related tools would be beneficial to both T1D and DCP participants.

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Author Contributions

PS and JY conceited the original design. RD and NK drafted the manuscript. RD, DF, JY, PS, and RY were responsible for participant recruitment. JY and RD oversaw data collection; NK, RD and JY performed data analysis. JY, PS, RY, RD, and DF planned and implemented the study. JY, RY, DF, NK and PS reviewed and edited the manuscript.

Author Disclosures

RD and DF have no conflicts of interest to declare. JY has received speaker's fees from Animas Canada and in-kind research support from Animas Canada, Metronic Canada, Abbott Nutrition and Ascensia Diabetes Care Canada. RY has received speaker's fees from Sanofi, consultation fees from

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Tables

Table 1.
Change in questionnaire (BAPAD-1, DDS17, & PAEC) means from pre- to post-boot camp.

GROUP	QUESTIONNAIRE	SUBSECTION	PRE-BOOT CAMP AVERAGE	POST-BOOT CAMP AVERAGE	P-VALUE
T1D	BAPAD-1 (Scale of 1-7)	Diabetes-related barriers	2.26 ± 1.87	2.52 ± 2.04	0.2748
		General barriers	2.43 ± 1.98	2.50 ± 1.87	0.6917
	DDS17 (Scale of 1-6)	Emotional	2.20 ± 0.68	2.30 ± 0.95	0.4910
		Physician-related	1.42 ± 0.59	1.46 ± 0.57	0.7318
		Regimen-related	2.33 ± 0.94	2.17 ± 0.93	0.5259
		Interpersonal	1.83 ± 1.02	1.67 ± 0.96	0.1394
DCP	PAEC (Scale differs by subsection)	Confidence (0-100%)	46.14 ± 11.22	56.35 ± 15.33	0.0638
		Attitude (1-5)	3.42 ± 0.41	3.77 ± 0.27	0.004*
		Confidence in Client (0-100%)	37.42 ± 11.69	41.50 ± 13.85	0.521
		Perceived Difficulty (1-5)	3.05 ± 1.20	3.18 ± 0.81	0.604

*=Significant at 0.01 level
PAEC = Physical Activity and Exercise Counselling Survey
DDS17 = Diabetes Distress Screening Scale
BAPAD1 = Barriers to Physical Activity in Type 1 Diabetes Scale

Figures

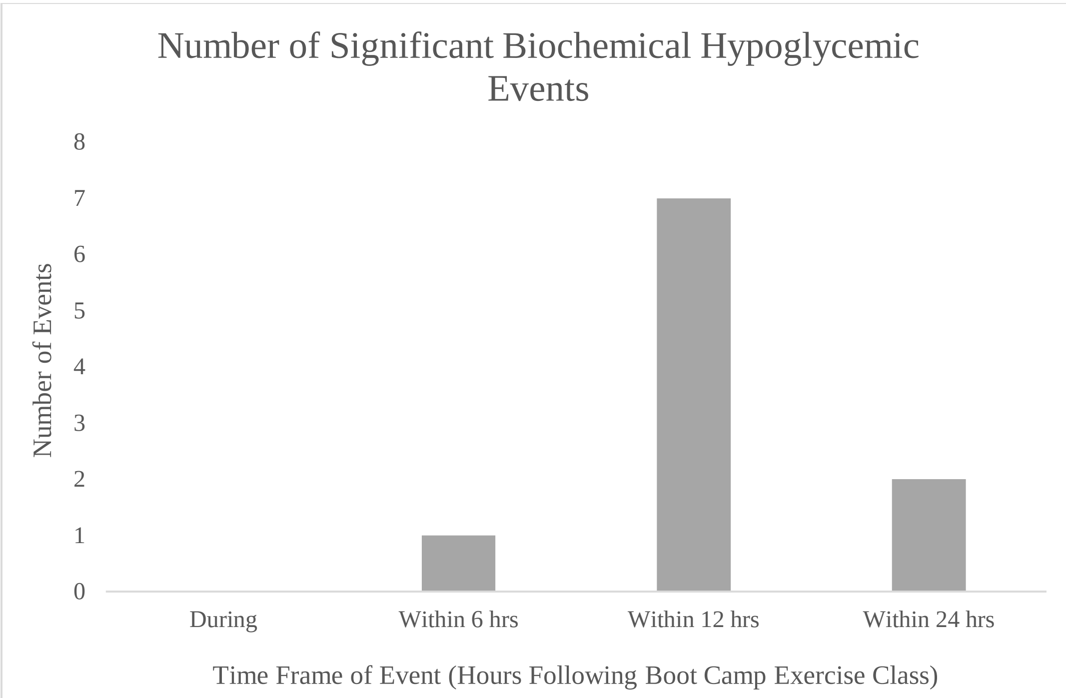

Figure 1. Frequency of significant biochemical hypoglycemic events in the study, displayed by time frames of events (in hours following boot camp).