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CASE REPORT

"Fighting spirit": specific personality traits as one of the key factors for sport championship in type 1 diabetes mellitus

Katarzyna Cyranka[1,3] · Dominika Dudek[1,3] · Maciej T. Małecki[2,3] · Tomasz Klupa[2,3]

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Abstract

There is ample evidence that sport is a protective factor against a number of health risks, across all ages, in the general population. An in-depth understanding of energy metabolism has reasonably entailed exercise as a cornerstone in the lifestyle of almost all subjects with type 1 diabetes mellitus (T1DM). Nevertheless, individuals with T1DM often fail in accomplishing exercise guidelines and they are often less active than their peer without diabetes. Two major obstacles are feared: management of blood glucose control and hypoglycemia. Nowadays, strategies, including glucose monitoring technology and insulin pump therapy, have significantly contributed to the participation in regular physical activity, and even in competitive sports, for T1DM people. The case report presents an analysis of specific personality traits and psychological parameters of 20 years old female Polish multiple champion in weightlifting with excellent T1DM control.

Keywords T1DM · Sport · Weightlifting · Personality · Psychological resources

Introduction

Physical activity should be embodied in the management of type 1 diabetes (T1DM) as it increases insulin sensitivity, lowers blood glucose levels, reduces body fat and ameliorates body mass composition, improves cardiovascular function. However, subjects with T1DM may face a number of challenges in preparation for, during, and after each session of exercise. Appropriate approaches, combining adjusted insulin therapy and diet, utilizing new technologies are crucial while planning regular exercises in T1DM [1].

Practicing sports, especially on a professional level, is much more difficult for a patient with T1DM than for a person without diabetes. It can be assumed that sustaining adequate T1DM control and high achievements, especially in master level strength athletics, requires special psychological resources, such as strong inner motivation, excellent stress management, specific personality traits providing, the ability to deal with everyday challenges, expectations or failures, as well as the feeling of responsibility for own health, and the ability to build and properly use the support of social network (trainer, diabetologist, dietician, psychologist, as well as family and friends) [2, 3]. Physical activity should be embodied in the management of T1DM as it increases insulin sensitivity, lowers blood glucose levels, reduces body fat and ameliorates body mass composition, improves cardiovascular function. However, due to the loss of the β-cell pancreatic mass and/or -function, subjects with T1DM may face a number of challenges in preparation for, during, and after each session of exercise [4]. If insulin levels are excessive, hypoglycemia may arise during and after exercise. On the contrary, if insulin levels are deficient, exercise may lead to hyperglycemia or ketosis. Exercise can also lead to an imbalance between hepatic glucose production and glucose disposal into muscle, increased insulin sensitivity related to glucose transporter type 4 translocation upregulation, and impaired counterregulatory hormonal response [5]. Appropriate approaches, combining adjusted insulin therapy and diet, are crucial while planning regular exercises in T1DM. Integrated monitoring systems, comprising continuous subcutaneous insulin infusion (CSII) and continuous glucose monitoring (CGM), have been proved to be efficient in exploiting the beneficial effects of exercise

✉ Tomasz Klupa
tomasz.klupa@uj.edu.pl

1 Department of Psychiatry, Jagiellonian University Medical College, Krakow, Poland

2 Department of Metabolic Diseases, Jagiellonian University Medical College, Krakow, Poland

3 University Hospital in Krakow, Krakow, Poland

in patients with T1DM, especially in case of performance and extreme sports [6–11].

As we approach the 100-year mark of the discovery of insulin, T1DM patients may have extraordinary achievements, also in competitive sports on an Olympic level. However, maintaining normal glucose levels during training, travel and competition can be a major challenge for T1DM athletes. The day-to-day management of the condition remains onerous, however, given the monotonous tasks of monitoring glucose, carbohydrate/macronutrient counting, insulin dosing, and managing stress/sick days, particularly while training and preparing for competition. Ongoing research is increasingly focusing on the unique physiology of T1DM high-level athletes, while also investigating how new insulin analogues and other therapeutic agents/technologies might improve their glycaemic management [12]. While some athletes perform well using multiple daily injections (MDI) of insulin, others prefer the flexibility afforded by continuous subcutaneous insulin infusion (CSII). For athletes who prefer pump removal during exercise, a hybrid approach that combines basal insulin delivery split between an ultra-long-acting insulin and 50% reduced basal insulin delivery by CSII can be used [13]. Combining proper insulin management with adequate for a given type of training diet is crucial [14, 15].

From the psychological perspective, sustaining adequate T1DM control and high achievements, especially in master level strength athletics, requires special resources, such as strong inner motivation, excellent stress management, specific personality traits providing the ability to deal with everyday challenges, expectations or failures, as well as the feeling of responsibility for own health, and the ability to build and properly use the support of social network (trainer, diabetologist, dietician, psychologist, as well as family and friends) [16, 17].

Aim of the study

In Poland, one of the most prominent athletes with T1DM is 20 years old female. She is famous for her extraordinary results in weightlifting, winning multiple championship on a national and international levels, also after being diagnosed. The aim of the case report was an in-depth psychological analysis of specific personality traits and stress coping mechanisms, allowing for expellant sport development and perfect glycemic control.

Method

To examine the psychological parameters two basic methods were applied: a psychological interview including life history of the patient, carried out by a qualified specialist in clinical psychology and a set of questionnaires filled in by the patient in her family house under the supervision of the psychologist. The examination of glucose management was performed by consultant in diabetology with long clinical experience.

The set of questionnaires included:

- MMPI (2 Minnesota Multiphasic Personality Inventory-2 MMPI-2)
- CISS (Coping Inventory for Stressful Situations)
- STAI (State-Trait Anxiety Inventory)
- PSS-10 (Perceived Stress Scale)
- KNS (Hope for Success Questionnaire)
- SWLS (Satisfaction with Life Scale)
- LOT-R (Life Orientation Test Revised)
- AIS (Acceptance of Illness Scale)

Results

T1DM medical record

The 20 years old Caucasian female patient was diagnosed with (T1DM) in 2017. At diagnosis her glucose level was 477 mg/dL, there were signs of ketosis with pH equal to 7.1, there was no coma. Since HbA1c was not determined at the onset of the disease or soon after, we cannot say if the diabetes was fulminant or not. From the very beginning her diabetes was managed with continuous subcutaneous insulin infusion (CSII). She is the user of MiniMed® Paradigm Veo™ insulin pump (Medtronic, USA), utilizes short acting insulin analog (LisPro). Since the diagnosis she has been very compliant and achieved excellent glycemic control. Her HbA1c ranged from 5.8 (39.89 mmol/mol) to 6.2% (44.27 mmol/mol). Her fasting *c*-peptide level determined approx. one year after diagnosis of T1DM was 0.13 ng/ml (*N*: 0.9–7.1). The last available 2 week insulin pump download recorded in May 2020 showed average total insulin dose of 29.1 U (approx. 0.5 U/kg), with 31% delivered as basal infusion. For each bolus delivered the patient used Bolus Calculator (BC) option, the average daily carbohydrate intake based on BC inputs was 332 g. Some time ago the patient used few CGM sensors, but as she claimed "it did not work for her", so he did not utilize the "suspend on low" feature of Veo insulin pump and herself glucose monitoring was based on hand blood glucose meter. The last pump download showed average blood glucose concentration of 116 mg/dL (± 31 mg/dL), with the average number of blood glucose measurements of 8.6/day and 5% of measurements below the target of 70 mg/dL. Her current weight is 59 kg, height 171 cm (BMI 20.18 kg/m^2).

Live history interview

The patient was born on 8th of September 2000 in a small town in eastern Poland, as a second child of her parents (she has a 7 years older brother). She is the only person in her family with T1DM. From her early childhood she was extraordinarily active, full of energy, mobile (at first cycling, running). She does not recollect any painful or traumatic events. The main figure was her father—he was also an athlete (as well as his brother, the patient's uncle)—and he motivated her to keep being active on a regular basis. The patients recollects her childhood as happy, joyful, with a significant presence of her grandparents.

She studied fairly well in school, was outspoken and resourceful. She had a large group of friends and was able to get along with everyone, actively participated in various additional activities, not only physical. She describes herself as an optimistic, positively oriented, joyful child. The relation with parents describes as satisfactory—her father being calm, stable, reasonable, while mother being a bit overprotective, sensitive, sometimes anxious.

The choice of the field of study (physiotherapy at the Academy of Physical Education in Biała Podlaska, first year at present) is motivated by the fact that she would like to make people aware of the importance of physical effort in human development, indicating high awareness of the meaning of physical activity.

In her sport development history she had been searching for the most suitable area—after trying many options she decided to choose weightlifting as a discipline that requires a lot of self-motivation, crossing ones' own barriers and limitations, high body awareness, individual approach. Her professional achievements are extraordinary (Fig. 1).

She has been training weightlifting since 7 years on a regular basis (5 days per week, 2 h per day) under the supervision of her personal female trainer, her uncle, with an active presence of the patient's father. In total, she was Polish champion in weightlifting five times, including twice after being diagnosed with diabetes.

The patient remembers the moment of diagnosing T1DM in 2017 as difficult, because it was an unexpected and rapid interruption in her regular training routine. So far she had no health problems. The first symptoms noticed by the patient were extreme thirst, lack of strength for exercise, pollakiuria, and visual impairment. After the diagnosis, the patient was admitted to the Pediatric Ward at the Hospital in Lublin (she was 17 years old at the time of diagnosis). The patient spent 2 weeks in the hospital. She quickly learned the principles of insulin therapy, her main thought was to return to normality, to trainings, as soon as possible, which she achieved.

The patient's mother reacted anxiously, while the father remained composed and calm.

The patient claims that she had positive thinking all the time and she was immediately looking for information on the possibility of treating diabetes and examples of people who have diabetes and are successful. She says she had not experienced any emotional crisis—breakdown, anxiety or depression. She was offered psychological support but refused to take advantage of it. After leaving the hospital, she immediately returned to her activities.

The second crisis situation occurred during the pandemic lockdown in March and April 2020. The global stressful situation resulted in another unexpected interruption in the patient's trainings, constituting additional stress connected with the possibility of being infected with coronavirus, which was said to be especially dangerous for patients with chronic diseases. After short period of apprehension the patient decided to organize her own small gym (Fig. 2) and continued with her trainings, diet and glucose control, maintaining excellent results.

Test results

MMPI (2 Minnesota Multiphasic Personality Inventory-2 MMPI-2)

Control scales: VRIN (47 T), TRIN (47 T), Cannot Say scale (0), L Lie (54 T), Self-Presentation S (65 T), F, Fb, Fp and FBS indicate that the profile is subject to interpretation, the respondent accurately described the state of mental health, the experiences are adequately reported. Defensiveness K (69 T) indicate certain level of tendency to use defense mechanisms, with no significant impact on the overall interpretation of the profile, which can be considered fully relevant and valid.

Clinical scales: all results are below 65 T, i.e. indicating lack of personality psychopathology. The result in Hypochondria (63 T) and the Hysteria (61 T) may suggest experiencing a certain level of somatic complaints, which can probably be associated with the fact of suffering from T1DM or a tendency to react to stress by psychosomatic symptoms.

Restructured Clinical (RC) Scales: results confirm functioning in the area typical for the population of people without personality disorders, with no traits of psychopathology.

Content Scales: confirm lack of psychopathology.

PSY-5 (Personality Psychopathology Five) Scales: all results within norms typical for healthy population.

Supplemental Scales: very high results, essential from the point of view of sports achievements indicating enormous psychological resources were obtained in: Ego Strength (66 T), Domination (65 T), Social Responsibility (66 T). This shows high self-confidence in face-to-face contacts, faith in one's own abilities, focus on achievements and a sense of freedom in social situations, strong sense of responsibility for one's actions, the ability to set

European Championship U 17	2017	Prisztina, KOS	M Nsf
National Youth Olympics	2017	Siedlce	Gold
National Championship	2020	Biała Podlaska	Gold
National Championship	2019	Puławy	Gold
National Championship U 20	2018	Mroczna	Gold
National Championship U 20/Open	2018	Mroczna	Bronze
National Championship U 17	2017	Siedlce	Gold
National Championship U 17/Open	2017	Nowa Ruda	Bronze
National Championship AZS	2017	Biała Podlaska	Silver
National Championship U 17	2016	Nowa Ruda	Gold
National Championship U/Open	2016	Siedlce	Bronze
National Championship Elite	2016	Mroczna	Bronze
National Championship AZS	2016	Czestochowa	Bronze
National Championship U 15	2015	Burzenin	Gold
National Championship U 15/Open	2015	Burzenin	Gold
National Championship AZS	2015	Biała Podlaska	Bronze
Tournament Memorial of Andrzej Matusiak	2017	Ciechanów	Bronze
Tournament Memorial of Andrzej Matusiak	2016	Ciechanów	Silver
Olympic Hopes Tournament	2018	Biłgoraj	Gold
Olympic Hopes Tournament	2017	Biłgoraj	Silver
Olympic Hopes Tournament	2016	Biłgoraj	Gold
Olympic Hopes Tournament	2015	Biłgoraj	Gold
Tournament of the Terespol Mayor Cup	2017	Małaszewicze	Silver
Tournament of the Terespol Mayor Cup	2016	Małaszewicze	Silver
Classification Open U 20	2018		M 10
Classification Open U 17	2017		M 7
Classification Open U 17	2016		M 5
Classification Open U 20	2016		M 10
Classification Open U 15	2015		M 2
Classification Open U 17	2015		M 9
National Ranking U 20	2018		M 5
National Ranking Elite	2018		M 9
National Ranking U 17	2017		M 2
National Ranking U 17	2017		M 6
National Ranking U 20	2017		M 3
National Ranking U 23	2017		M 5
National Ranking Elite	2017		M 7
National Ranking U 17	2016		M 1
National Rankin U 17g	2016		M 5
National Ranking U 20	2016		M 3
National Ranking U 23	2016		M 5
National Ranking Elite	2016		M 8
National Ranking U 15	2015		M 1
National Ranking U 15	2015		M 3
National Ranking U 17	2015		M 2
National Ranking U 17	2015		M 6
National Ranking U 20	2015		M 3
National Ranking Elite	2015		M 7

Fig. 1 Weightlifting achievements

ambitious goals and consistently achieve them, determination and faith in one's own abilities. All the other Supplemental Scales, confirm lack of psychopathology.

Interestingly, the analysis of the scales related to experiencing one's own gender identity: Masculinity/Femininity (42 T) and Gender Role Supplemental Scales (50 T) shows that the patient does not in any way reject the traditional female role, just on the contrary.

CISS (Coping Inventory for Stressful Situations)

Task-oriented style—6 stens, emotion-oriented style—5 stens, avoidance-oriented style 5 stens, (avoidance-distracted and avoidance-social coping both 5 stens); this shows broad spectrum of coping strategies.

Fig. 2 Self organized gym for trainings during pandemic lockdown

STAI (State-Trait Anxiety Inventory)

State anxiety—X1 and trait anxiety—X2 both on the level of 5 stens, i.e. in the area of moderate scores (range characteristic for the population of people without anxiety disorders, indicating lack of psychopathology in terms of neuroticism).

PSS-10 (Perceived Stress Scale)

8 T, i.e. in the area of high scores. This may suggest that achieving professional success is related to experiencing an increased level of tension and stress. It may have both a motivating effect (eustress), as well as negative one, expressed in, for instance, psychosomatic (distress).

KNS (hope for success questionnaire)

Very high result in the global score (79p) as well as in both subscales: ability to find solutions (29p), willpower (27p). The results show a stable system of beliefs about her own abilities, which allow for implementation of her own decisions in a very effective way and find solutions to problems standing on the way to the goal achievement. The patient has a very high sense of self-efficacy, self-esteem and life satisfaction. She is flexible in her actions and can adapt to emerging difficulties.

SWLS (Satisfaction with Life Scale)

8 T clearly indicates a very high sense of satisfaction with life, satisfaction with one's own achievements and a great sense of life control.

LOT-R (Life Orientation Test Revised)

10 points suggest that the she is extremely optimistic about her life and her future, in her actions focuses on solving problems in a constructive manner, has a great ability to accept life difficulties and reacts in a helpful way with a sense of humor. She has a very high self-efficacy, self-esteem and high level of control.

AIS (Acceptance of Illness Scale)

36 points—high score proves that she accepts her chronic disease and has no negative emotions related to the disease.

Discussion

The examined female has a very characteristic set of personality traits: exceptionally high level of mental resources and ego strength, with no features of psychopathology, neither in terms of personality functioning, nor in affective or anxiety disorders. She has great faith in her own abilities, an above-average need for achievements and success, consistency

in task implementation, high optimism and flexibility in adaptation to new, crisis situations, high self-esteem. The obtained results also indicate a wide repertoire of possibilities of coping with stress, which is crucial in sport achievements [18]. While confronted with the stressful situation (like T1DM diagnosis or lockdown during pandemic) she found the most optimal solutions to perform her tasks in spite of the obstacles.

Essential factor in her T1DM is high acceptance of her own illness and a very positive attitude towards suffering from diabetes. We can assume that due to the fact that she had been training for many years, since early childhood, she has learnt how to control her body, which in turn translated into her high ability and discipline in glycemic control. Research indicate that lite athletes experience a unique range of stressors that may potentially increase their vulnerability to mental ill-health. Key factors include the psychological impacts of injury, overtraining and burnout; intense public and media scrutiny; and managing ongoing competitive pressures to perform [19]. Involvement in rigorous trainings from early childhood could be for the patient a specific type of burden, but as she managed to deal with it throughout the years, it presumably also had a positive impact on her personality development—for instance she could master the ability to obtain peace of mind in stressful situations or develop mindfulness.

She has a great ability to use social support. By using social contacts, she was able to organize visits in the University Hospital Outpatient Clinic in Krakow, being about 400 km from her town of residence, but providing best specialist medical care for T1DM. Without having any special financial support, she keeps on training and fulfilling all her sport goals, the text being the Olympic competition [20].

However, few observations are worth reflection. MMPI-2 scales indicate her strong identification with female role, but in her everyday functioning she is strongly father-oriented and inspired by him, while her mother is perceived as emotionally weak, sometimes needing protection and care. This may suggest that one of the inner motivators to be strong and highly functioning is not to become similar to her mother.

On the onset of diabetes her mother expressed a lot of anxiety, uncertainty, strong emotions while the patient seemed to be emotionally untouched. Apart from her great psychological resources, the patient could apply strong defense mechanisms, like denial or repression, that did not allow her to contact with grief, sadness, fear and other emotional states usually observed while confronted with serious health condition.

Similarly, she may use the defense mechanisms in moments of stress during competitions, in situations of failures, pain, austerities connected with everyday trainings. Although her MMPI2 profile was fully valid, there were slight traces of tendency to positive autopresentation, and in clinical scales some level of tendency to express stress by psychosomatic symptoms.

She denies being competitive, while unconsciously the patient can to some extent rival not only with other athletes during competitions, but also with her partner, also being a sportsman and with her brother, with whom she definitely won the position in the family and in the relation with their father.

It is also worth remembering that apart from the patient's mental health status, psychological, medical and social resources, an important factor in her achievements constitute also her body composition and possibly hereditary factors. Research indicate, that there is an great need for increased public education and better-informed conversation about what causes diabetes and the daily experience of living with the disease. The widely held misconception that people with diabetes are responsible for developing their disease or that they have a character flaw is the predominant form of stigma directed against people with diabetes [21]. Thus, the case of our patient may serve also as an educational example debunking myths and stigmas concerning T1DM.

The patients was already well developed in her sport career while being diagnosed with T1DM. It opens a research question how would she develop if the onset of disease was in her early childhood. She had very favorable environment that supported her success after being diagnosed. However, the fact that the she was able to accept her innless while having her career already started and the sense of identity almost fully developed, may also give a kind of universal hope. This indicates that not only small children may adjust to the chronic disease as a part of their live and identity, while they are still in development, but also people who have already strong vision of their future. It may be an inspiration that young adults do not have to restructure their lives after the T1DM onset and resign from what they have already achieved, but with a proper support, adequate medical care and education may find a way to continue their already started live direction.

Another question concerns the future—whether she will keep on continuing on this level of functioning through the next decades, with perfect glucose management and extraordinary life achievements. Luckily enough, all the analyzed parameters indicate high probability of such continuation.

Conclusions

Presented in this paper case of a 20 years old patient with T1DM, with multiple extraordinary achievements in weightlifting, indicates that a combination of specific personality traits, social skills, family support and sport traditions as well as hereditary factors and access to the new technologies in T1DM treatment under the supervision of highly qualified

specialist in diabetology, resulted in a unique and inspiring success of the patient is life, sport and diabetes management, which can be an inspiration for patients with T1DM, their families and their dialectologists. One has to underline, however, that this case report cannot be simply generalized into broader population of T1DM, in each patient aiming for very high or professional sport activity the management should be individualized.

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Compliance with ethical standards

Conflict of interest Katarzyna Cyranka, Maciej T. Małecki declare no conflict of interest.

Ethical approval All procedures followed were in accordance with the ethical standards with the Helsinki Declaration of 1964 and later versions.

Informed consent The patient gave a written consent for this publication containing details of her medical record and private matters.

References

1. Toni S, Reali MF, Barni F, Lenzi L, Festini F. Managing insulin therapy during exercise in type 1 diabetes mellitus. Acta Biomed. 2006;77(1):34–40.
2. Prager C, Streli C, Prager R. Diabetes and sports. Wien Med Wochenschr. 1993;143(1):9–12.
3. Gallen IW. Exercise for people with type 1 diabetes. Med Sport Sci. 2014;60:141–53.
4. Codella R, Terruzzi I, Luzi L. Why should people with type 1 diabetes exercise regularly? Review Acta Diabetol. 2017;54(7):615–30.
5. Younk LM, Mikeladze M, Tate D, Davis SN. Exercise-related hypoglycemia in diabetes mellitus. Expert Rev EndocrinolMetab. 2011;6(1):93–108.
6. Rabasa-Lhoret R, Bourque J, Ducros F, Chiasson JL. Guidelines for premeal insulin dose reduction for postprandial exercise of different intensities and durations in type 1 diabetic subjects treated intensively with a basal-bolus insulin regimen (ultralente-lispro). Diabetes Care. 2001;24:625–30.
7. Dubé MC, Weisnagel SJ, Prud'homme D, Lavoie C. Exercise and newer insulins: how much glucose supplement to avoid hypoglycemia? Med Sci Sports Exerc. 2005;37:1276–82.
8. Yardley JE, Iscoe KE, Sigal RJ, et al. Insulin pump therapy is associated with less post-exercise hyperglycemia than multiple daily injections: an observational study of physically active type 1 diabetes patients. Diabetes TechnolTher. 2013. https://doi.org/10.1089/dia.2012.0168.
9. Peters AL, Ahmann AJ, Battelino T, Evert A, Hirsch IB, Murad MH, Winter WE, Wolpert H. Diabetes technology-continuous subcutaneous insulin infusion therapy and continuous glucose monitoring in adults: an endocrine society clinical practice guideline. J ClinEndocrinolMetab. 2016;101(11):3922–37.
10. Garcia-Tirado J, Corbett JP, Boiroux D, Jørgensen JB, Bretona MD. Closed-loop control with unannounced exercise for adults with type 1 diabetes using the ensemble model predictive control. J Process Control. 2019;80:202–10.
11. Klupa T, Hohendorff J, Benbenek-Klupa T, Matejko B, Malecki MT. Insulin pump settings and glucose patterns during a 1008-km non-stop bicycle race in a patient with type 1 diabetes mellitus. Acta Diabetol. 2019;56(5):593–5.
12. Mc R, Scott SN, Fournier PS, Colberg SR, Gallen WI, Moser O, Stettler Ch, Yardley JE, Zaharieva DP, Adolfsson P, Bracken RM. The competitive athlete with type 1 diabetes. Diabetologia. 2020;63(8):1475–90.
13. Aronson R, Brown RE, Li A, Riddell MC. Optimal insulin correction factor in post-high-intensity exercise hyperglycemia in adults with type 1 diabetes: the FIT study. Diabetes Care. 2019;42(1):10–6.
14. Burke LM, Castell LM, Casa DJ, et al. International association of athletics federations consensus statement 2019: nutrition for athletics. Int J Sport NutrExercMetab. 2019;29(2):73–84.
15. Gallen IW, Hume C, Lumb A. Fuelling the athlete with type 1 diabetes. DiabetesObesMetab. 2011;13(2):130–6.
16. Dizon S, Malcolm J, Rowan M, Keely EJ. Patient perspectives on managing type 1 diabetes during high-performance exercise: what resources do they want? Diabetes Spectr. 2019;32(1):36–45.
17. Hanton S, Wadey R, Mellalieu SD. Advanced psychological strategies and anxiety responses in sport. Sport Psychol. 2008;22(4):472–90.
18. Kopp A, Jekauc D. The influence of emotional intelligence on performance in competitive sports: a meta-analytical investigation. Sports (Basel). 2018;6(4):175.
19. Rice SM, Purcell R, De Silva S, Mawren D, McGorry PD, Parker AG. The mental health of elite athletes: a narrative systematic review. Sports Med. 2016;46(9):1333–53.
20. Baek RN, Tanenbaum ML, Gonzalez JS. Diabetes burden and diabetes distress: the buffering effect of social support. Ann Behav Med. 2014;48(2):145–215.
21. Liu NF, Brown AS, Younge MF, Guzman SJ, Close KL, Wood R. Stigma in people with type 1 or type 2 diabetes. Clin Diabetes. 2017;35(1):27–34.