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Physiological and nutrition-related challenges as perceived by spinal cord-injured endurance hand cyclists

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Abstract

This study explored the perceptions of spinal cord-injured (SCI) endurance hand cyclists regarding their physiological and nutrition-related challenges and the perceived impact of these challenges on nutritional intake and exercise capacity. This was an interpretive qualitative descriptive study in which semi-structured interviews were conducted with 12 adult South African national-level SCI endurance hand cyclists. Thematic analysis was used to explore perceptions regarding physiological and nutrition-related challenges and the impact thereof on nutritional practices and exercise capacity. Four themes emerged from the interviews: (i) physiological challenges experienced, (ii) nutrition-related challenges experienced, (iii) changes in nutritional practices, and (iv) compromised exercise capacity. The SCI endurance hand cyclists reported a number of physiological and nutrition-related challenges. Bowel and bladder challenges, limited hand function, muscle spasms, thermoregulatory challenges, pressure sores, menstrual periods, and low iron levels/anaemia were perceived to predominantly impact food and fluid intake (restrict intake) and compromise exercise capacity. This information can assist to devise tailored guidelines aimed to optimise fluid intake, overcome bladder challenges and ensure adequate nutritional intake in light of limited hand function.

Key words: spinal cord injury, endurance hand cyclists, physiological challenges, nutrition-related challenges

Introduction

Spinal cord injury is a traumatic and life-changing injury that significantly compromises an individual's physical ability (Shepherd Centre et al. 2018). It results in motor and sensory deficits as well as autonomic dysfunctions such as compromised cardiovascular, urinary, thermoregulatory, respiratory, gastrointestinal, and sexual activities (Hou and Rabchevsky 2014). These challenges may limit the exercise capacity of spinal cord-injured (SCI) athletes (Cowley 2018). However, despite numerous physiological challenges, SCI individuals can still be physically active and engage in a number of several activities. In fact, SCI athletes participate in a number of Paralympic sporting disciplines, including among others wheelchair rugby, wheelchair basketball, and para cycling (International Paralympic Committee 2015). Hand cycling is a sporting discipline within para cycling, where SCI hand cyclists participate in endurance events such as time trials and road races (International Paralympic Committee 2015).

Impairments in motor function and sympathetic neural input due to spinal cord injury can result in a number of physiological challenges that can affect the nutritional status and exercise capacity of SCI hand cyclists (Scaramella et al. 2018). For instance, muscle atrophy below the lesion level following spinal cord injury results in compromised muscle glycogen storage capacity and reduced power output that can negatively impact exercise capacity (Theisen 2012; Gorgey et al. 2014). Furthermore, a lower muscle mass reduces resting metabolic rate and energy expenditure, and can further impact body composition (Gorgey et al. 2014). SCI hand cyclists may also experience pain and pressure sores from sitting in one position for prolonged periods (Coleman et al. 2013). Compromised sympathetic neural input to target organs can result in prolonged gastrointestinal tract transit time (Fynne et al. 2012), as well as a lack of bladder and bowel control (Bernardi et al. 2020). It also affects the ability to sweat and impairs thermoregulation (Price and Campbell 1999), which can have dire consequences especially for endurance hand cyclists exercising in the heat.

The physiological challenges mentioned above have a number of practical implications on the nutrition practices of SCI athletes, in particular on pre- and during exercise intake (Flueck 2021). For example, a prolonged gastrointestinal tract transit time may have an impact on the timing of carbohydrate intake before and during prolonged exercise (Fynne et al. 2012). Therefore, endurance SCI athletes may need to ingest carbohydrates earlier to sustain blood glucose levels during exercise than able-bodied athletes (Ruettimann et al. 2021). Bladder dysfunction is another example of a physiological dysfunction that can have implications for the amount and timing of fluid intake of SCI endurance hand cyclists (Flueck 2021). Urinary tract infections (UTIs) can also be a challenge arising from bladder dysfunction (Salameh et al. 2015). To prevent UTIs, frequent fluid intake throughout the day may be needed to produce an adequate amount of urine for regular emptying of the bladder (Scott et al. 2020). The regular emptying of the bladder may be a practical challenge, especially during prolonged exercise for SCI endurance athletes.

Although able-bodied athletes' dietary guidelines have predominantly been considered for SCI athletes, these may not fully account for the unique physiological dysfunctions and challenges posed to SCI athletes, including SCI endurance hand cyclists (Flueck 2021; Ruettimann et al. 2021). To our knowledge, there is a paucity of research on the experiences of SCI athletes regarding these challenges and the perceived impact of these challenges on their nutritional practices and exercise capacity. This is concerning, considering the growth, professional development, commercial investment, and global appeal of parasport as evident by the most recent Summer Paralympic Games in Tokyo, 2020, which had seen the highest number of Paralympic athletes (4403) competing to date (Tokyo 2020 Paralympic Games 2021).

As with able-bodied athletes, an optimal nutritional intake tailored to their specific needs and challenges is important to optimise the health and exercise capacity of SCI endurance hand cyclists. Therefore, the aim of this study was to explore the perceptions of SCI endurance hand cyclists regarding their physiological and nutrition-related challenges as well as the perceived impact of these challenges on exercise capacity and nutritional intake. The findings of this study can assist with the development of exercise-specific guidelines for SCI endurance hand cyclists, based on their unique challenges.

Materials and methods

Study design

A qualitative descriptive study was conducted for which ethical approval was granted by the Health Research Ethics Committee of the North-West University (NWU-00127-17-S1). The study also complied with the Helsinki Declaration (World Medical Association 2013). The hand cyclists were informed of the purpose and procedures of the study and informed consent was obtained prior to the start of the study.

Participants

Twelve adult SCI endurance hand cyclists competing at a national level and representing the total number of registered active SCI endurance hand cyclists in South Africa at that time participated in this study. Table 1 summarises the participant characteristics, including the alias chosen by the participants for use during the interview, gender, and level of spinal cord injury. Of the 12 hand cyclists, 10 were male and two were female, while three were tetraplegic and nine were paraplegic. The mean time since injury was 20.3 ± 10.2 (range: 5–36) years. Participants trained on average five times per week (4.6 ± 1.4, range: 2–6) with an average duration of 96 min (95.7 ± 34.1, range: 60–179) per training session.

Table 1. Demographic characteristics of the participants.

Alias	Gender	Level of spinal cord injury
No Name	Male	C6–C7
Superman	Male	C6
Villa	Male	T10
Noodles	Female	C6 incomplete
007	Male	T10
Tsunami	Male	T7–T8
Christopher Reeves	Male	T7
Iron man	Male	T8 incomplete
Grey Hose	Male	T12
Hulk	Female	T9–T10
Bull	Male	T5
Spinagy	Male	T4

Data collection

Face-to-face semi-structured individual interviews lasting between 30 and 60 min were conducted in English by the first author (REG), a nutritionist and trained in qualitative research methodology. The interviews were voice recorded and conducted in a quiet, private, and comfortable room. Verbal permission to record the interview and written informed consent were obtained before the interview. The researcher described the context and aim of the interview to the participant, who was also informed that he/she could withdraw at any stage without any negative consequences.

The interview schedule consisted of six evaluated open-ended questions (see Box 1 below), and a copy of the interview schedule was given to each participant. The questions were developed by the researchers based on a review of relevant scientific literature and expertise in sport nutrition. The interview schedule was tested for trustworthiness during an initial interview (a pilot). Since no adjustments were needed, the pilot was included in the main data set. For the interviews, each participant chose a unique alias, which was used during the interview to ensure anonymity.

After the interview, the voice-recorded data were downloaded onto a password-protected computer. Each interview was then transcribed within 72 h and the data were deleted from the voice recorder only once they had been saved on the computer. The researcher wrote field notes within 72 h documenting the interview process.

Trustworthiness and thematic analysis

Trustworthiness refers to the degree of confidence in the data, analysis, and methods employed to ensure the quality of the study (Polit and Beck 2014). The researchers followed Creswell's six steps of thematic analysis (Creswell and Creswell 2018). This was done manually without the use of any computer-assisted qualitative data analysis software. Creswell's six steps involve organising the data, becoming familiar with the data, coding the data according to Tesch's eight steps, describing the themes, representation, and interpreting the meaning of the data. Trustworthiness was ensured by the researchers employing various strategies during each of the six steps of thematic analysis as recommended by

Box 1. Interview schedule.

Scenario: You are a national-level SCI hand cyclist and as a result of your injury you face unique physiological and nutrition-related challenges that may impact your nutritional requirements, your practices (i.e., that means what, how much, and how often you eat), and your ability to train and compete in hand cycling events. The purpose of this interview is to gain a better understanding of your physiological challenges and your nutrition-related challenges that you face as an SCI hand cyclist. Now there are six questions that we will cover. The first three questions will deal with any physiological or bodily function challenges and the last three will cover any nutrition- or food-related challenges.

1. Tell me your understanding of the term physiological challenges that may affect or impact the way you eat (*) and your ability to train and compete in hand cycling events (performance).
2. Tell me about any physiological challenges that you have experienced since the injury that has an impact on the way you eat (*) and your ability to train or compete in hand cycling events.
   Or should the cyclist not have any physiological challenges, the question was rephrased as follows: Tell me about any physiological challenges that SCI hand cyclists may experience that may have an impact on the way they eat and their ability to train or compete in hand cycling events.
3. In your opinion, tell me how/in what way these physiological challenges can impact the way you (they) eat (*) and your (their) ability to train or compete in hand cycling events.
4. Tell me your understanding of the term nutrition-related challenges that may affect or impact the way you eat (*) and your ability to train and compete in hand cycling events (performance).
5. Tell me about any nutrition-related challenges that you have experienced since the injury that has an impact on the way you eat (*) and your ability to train or compete in hand cycling events.
   Or should the cyclist not have any nutrition-related challenges, the question will be rephrased as follows: Tell me about any nutrition-related challenges that SCI hand cyclists may experience and that have an impact on the way they eat (*) and their ability to train or compete in hand cycling events.
6. In your opinion, tell me how/in what way these nutrition-related challenges can impact the way you (they) eat (*) and your (their) ability to compete in hand cycling events.

*(i.e., how much you need, what you eat, how much you eat, and how often you eat/drink before/during/after exercise)

Nowell et al. (2017). For example, during the fourth step when describing the themes, the researchers keep detailed notes on the development of the themes. Additionally, in the last step interpreting the meaning of the data member checks were conducted. The researcher (first author, REG) and an independent experienced co-coder (second author, BS) conducted coding independently. On three occasions where there were disagreements between the two coders, the third author (LHN) served as a mediator to ensure that consensus was reached. All 12 transcripts were coded and data saturation (i.e., no new themes emerged) was reached by the eighth transcript.

Trustworthiness was further ensured by investigator triangulation. Firstly, the interview transcripts were coded independently by two of the researchers (REG and BS), and differences were mediated by a third researcher (Carter et al. 2014). Secondly, member checks were conducted to ensure that the interview transcripts were an accurate reflection of what the participants had said. Lastly, the study was conducted among an all-inclusive sample of registered active national-level SCI endurance hand cyclists in South Africa. Therefore, the results may be generalised to the wider population of SCI hand cyclists in South Africa.

Results

Table 2 summarises the four themes that are in accordance with the interview schedule (Box 1), along with the associated sub-themes and categories. The themes indicate that the participants experienced physiological and nutrition-related challenges, which affected their nutritional practices and their exercise capacity.

Theme 1: physiological challenges experienced

The first theme was physiological challenges experienced (Table 2). The participants experienced challenges such as thermoregulatory, cardiovascular, musculoskeletal, and other physiological challenges (Table 2). The thermoregulation challenges included the inability to sweat (*"…obviously my level of injury is a C6-C7, and we don't have any perspiration or sweat". No Name, male, C6–C7*) and an inability to heat up the body (*"I mean it's ice cold and because I'm sitting still from the blood circulation that cold comes up to my body, I start shivering because I can't get my legs to heat up". Superman, male, C6*).

The cardiovascular challenges included low blood pressure (*"Blood pressure is very challenging because my blood pressure can be like anything from 80/40 to 90/50. I never have what you consider a normal blood pressure". Noodles, female, C6 incomplete*). In terms of musculoskeletal challenges, the participants experienced shoulder and rotator cuff injuries (*"I have struggled with a lot of shoulder injury, not like anything severe enough to go have surgery, but it's just always painful. And then I struggled with rotator cuff injuries especially with the hand cycling". No Name, male, C6–C7*), limited hand function (*"…I have adapted my bike to be able to*

Table 2. Themes, sub-themes, and categories.

Themes	Sub-themes	Categories
1. Physiological challenges experienced	1.1 Thermoregulatory challenges	Inability to sweat
		Inability to heat the body up
	1.2 Cardiovascular challenges	Low blood pressure
		Fatigue and poor recovery
	1.3 Excretory and musculoskeletal challenges	Bowel challenges
		Bladder challenges
		Shoulder and rotator cuff injuries
		Limited hand function
		Muscle spasms
	1.4 Other physiological challenges	Neuropathic pain and headaches
		Pressure sores
		Menstruation
		Respiratory challenges
2. Nutrition-related challenges experienced	No sub-themes	Lack of appetite
		Anaemia
		Constipation and bloating (diet-related bowel challenges)
3. Changes in nutritional practices	No sub-themes	Restriction of fluid and food intake before and during exercise
		Change in general dietary intake
		Increase in fluid intake
		Difficulty eating while on the hand cycle
4. Compromised exercise capacity	No sub-themes	Inability to exercise/compete
		Compromised exercise duration

manage it 100% with my limited hand function". Noodles, female, C6 incomplete), and muscle spasms ("*I have got spasms being a T4 paraplegic. I have bad spasms". Spinagy, male, T4*). The participants also experienced excretory challenges such as bowel and bladder challenges functions (*"So, I mean obviously spinal cord injuries you have got problems, bowel and bladder are functions that cause issues". Tsunami, male, T7–T8*).

The participants also experienced pressure sores ("*I had a bad experience as I said with pressure sores and I don't want to have one if I can prevent that because that is a killer." Christopher Reeves, male, T7*), neuropathic pain ("*…I have a lot of neuropathic pain, I have had it since my accident". Bull, male, T5*), and respiratory problems (*"The last three years I started doing hand cyclists but last year I was diagnosed with training-induced asthma which was never a problem before". Villa, male, T10*). The two female participants reported menstruation challenges ("*I do have running tummy when I am on my period… I did not have that before my spinal cord injury though". Hulk, female, T9–T10 complete*). The participants also experienced fatigue and poor recovery, which can negatively affect exercise capacity (*"I think you also feel more tired than the other athletes, as sometimes I'll be competing in a time trial, and the road race would be two days after. I will still be exhausted from the time trial". Hulk, female, T9–T10*).

Theme 2: nutrition-related challenges experienced

The second theme was nutrition-related challenges experienced by the participants (Table 2). These challenges included a lack of appetite ("*I do not really have much of an appetite when I train. That's my biggest problem. But I have to eat, because I know I have to eat". Hulk, female, T9–T10*), anaemia ("*I am very low in iron, I suffer from anaemia". Noodles, female, C6 incomplete*), and constipation (dietary-related bowel challenges) (*"As I say I struggle more with constipation … that could be due to lack of fluid but it could also be due to not enough fruit not enough fibre". No Name, male, C6–C7*). Bloating was another nutrition-related challenge reported by the participants ("*I stay clear of certain foods, I wont eat certain foods. The carbohydrate I try and keep to a minimum because it bloats me". Bull, male, T5*).

Theme 3: changes in nutritional practices

The third theme encompasses the changes in the nutritional practices of the participants. One of the categories was restricting fluid and food intake before and during training to manage bowel and bladder challenges ("*So I know I am guilty of not drinking enough water, and I know you must at least drink water, but I do not as I am always worried that I will be wet". 007, male, T10*).

The participants also reported having difficulty in eating while on the hand cycle, which was due to the limited hand function experienced by hand cyclists with high-level spinal cord injury ("*…so I do take bananas with me, but opening a banana I use my mouth because I can't use my fingers". Superman, male, C6*). The participants also had difficulty in eating and drinking while on the hand cycle as they have to use their hands to propel the cycle ("*The last point on that is drinking. You can't grab a bottle with your hand, and you have to stop peddling, and those kind of things". Superman, male, C6*).

The other categories related to adjustments in the general dietary intake included experimenting with food due to a lack of appetite and increasing fluid intake during the day to prevent bladder problems ("*I have not had any bladder problems this year …This year I have not been to the hospital. I drink a lot of water. I have a big cup at work which I drink lots of water and tea". Hulk, female, T9–T10*). The participants also adjusted their general dietary intake to reduce constipation ("*The oats makes me constipated, which makes my ride uncomfortable … the white bread also leads to constipation. That's why I avoid it". No Name, male, C6–C7*).

Theme 4: compromised exercise capacity

The fourth and final theme was compromised exercise capacity (Table 2). The first category that emerged under this theme was the inability to exercise/compete as a result of spasms ("*Because you get a spasms and then when you get on the bike your foot would just pull out. It has even happened when I was riding. Ja, that's very dangerous. No, it's very dangerous. I think that is a huge challenge. That was probably the biggest challenge". Iron man, male, T8 incomplete*) and the menstrual period ("*I guess because we differ. I know that time of the month I cannot compete as my system is messed up due to my spinal injury. I do not know when it is, it comes when it comes, it doesn't, it doesn't". Hulk, female, T9–T10*).

The participants also reported compromised exercise duration (second category) as a result of low iron levels ("*…the iron has affected me. When my iron levels are down, I just don't recover. In fact, one of the reasons I pulled out of competing internationally was my iron level, and also because I ended up having a lot of bowel problems". Noodles, female, C6 incomplete*) and bladder challenges ("*…I don't take that chance. If I know my bladder is not 100% then I will just call the ride off". No Name, male, C6–C7*; and "*I will go literally before I get onto the bike. I will catheterise and I will keep my ride to just under four hours to be safe and I normally take a catheter with". No Name, male, C6–C7*).

Discussion

To our knowledge, this is the first study to document the perceived physiological and nutrition-related challenges of SCI endurance hand cyclists. It also provides novel insights into the impact of these challenges on the nutritional practices, training, and exercise capacity of national-level SCI endurance hand cyclists.

Participants related the concept of physiological challenges to their bodily functions and their inability to perform certain activities because of their spinal cord injury, and therefore understood the term. Participants also understood the concept of nutrition-related challenges and related it to the effect of sub-optimal nutritional intake on the body, barriers to eating an optimal diet, and challenges impacting the ability to eat.

Perceived physiological and nutrition-related challenges impacted the participants' nutritional practices and exercise capacity in the following ways: They first reported a restriction of food and fluid intake before and during exercise. This was due to bowel and bladder challenges, limited hand function, and practical considerations while exercising. The restriction of food intake was to prevent abdominal discomfort such as bloating (a bowel challenge) during exercise, which may be a consequence of the prolonged gastrointestinal tract transit time experienced by SCI individuals (Ng et al. 2005; Fynne et al. 2012). Fluid intake was restricted due to a lack of bladder control resulting from compromised descending control of spinal neural circuitry following spinal cord injury (Shepherd Centre et al. 2018), and limited opportunities for the cyclists to empty their bladders during their endurance events. The restriction of food and fluid intake could also be due to the reported lack of appetite and having difficulty eating and drinking while on the hand cycles. Since they use their hands to propel the hand cycles, eating or drinking during exercise would result in their loss of momentum. Indeed, limited hand function is also a common challenge for cyclists with high-level spinal cord injury (C1–C6) (Shepherd Centre et al. 2018) and affects their nutritional intake while on the hand cycle.

Food and fluid restriction can have consequences for the health and exercise capacity of hand cyclists. Sub-optimal fluid intake can cause dehydration, which leads to increased cardiovascular strain and compromised thermoregulation during exercise (McDermott et al. 2017), particularly among low-level thoracic SCI athletes who have greater sweat losses than high-level thoracic SCI athletes who experience an inability to sweat (Price 2006). An inability to sweat was reported by participants in the current study and may increase the risk of overheating, especially when fluid intake is also restricted (Akerman et al. 2016). Without specifically inquiring about the management of physiological and nutrition-related challenges, some of the participants did mention how they manage these challenges. For example, participants reported thermoregulation as a challenge, but also reported the use of cooling strategies such as having water poured over themselves and using ice packs to manage their thermoregulatory challenges. Alternative cooling strategies also include the use of a lightweight evaporative cooling vest that was shown to effectively reduce the skin temperature of paraplegic males during exercise (Bongers et al. 2016).

The restriction of food intake, particularly carbohydrate intake, during endurance exercise puts the cyclists at risk of developing hypoglycemia (Cermak and van Loon 2013) and could compromise exercise capacity (Thomas et al. 2016). The recommended carbohydrate intake during endurance exercise exceeding 60 min for para-cyclists is 30–60 g per hour (Ruettimann et al. 2021). The reported median carbohydrate intake during exercise of the participants in the current study (45.6 (35.3–50.3) g/h) (Gordon et al. 2022) was actually not below the recommendations. The participants met the carbohydrate recommendation as they mainly relied on carbodydrates in a liquid form rather than a solid form as the participants had difficulty in eating solid foods while exercising. This is evident by 80% of the hand cyclists consuming sports drinks during exercise (Gordon et al. 2022).

In addition to restricting food and fluid intake before and during exercise, the second perceived impact of the spinal cord injury-induced challenges on the participants' nutritional practices was adjustments to their general dietary intake. This included among others avoiding white bread as this practice was perceived to reduce bowel challenges such as constipation. Avoiding refined carbohydrates such as white bread and consuming fibre-rich foods can indeed prevent constipation (Dahl and Stewart 2015). Bowel challenges can be managed by means of a colostomy (Johns et al. 2021), and the participants in the current study indeed reported colostomy as a method of managing their bowel challenges. Fluid intake is also needed for the management of bowel challenges as it can help maintain euhydration and reduce the risk of constipation (Bernardi et al. 2020; Johns et al. 2021).

Although the participants in the current study reported a restriction of fluid intake before and during exercise to deal with their bladder challenges during exercise, an increase in fluid intake during the day was also reported to prevent bladder challenges such as UTIs. There is evidence from a recent systematic review that increasing fluid intake can reduce recurrent UTIs (Scott et al. 2020). At a rate of 2.5 events per SCI individual per year, UTIs are the most frequent infection among SCI individuals. This is due to bladder dysfunction, which promotes bacterial proliferation and impairs the phagocytic ability of epithelial cells of the bladder (Salameh et al. 2015). To reduce bladder challenges, catheterization is often used by SCI individuals to empty their bladders (Woodbury et al. 2008), and was also used by the participants in the current study to manage their bladder challenges.

The perceived impact of spinal cord injury on the training and exercise capacity in the current study included the inability to exercise or compete and compromised exercise duration. This was due to discomfort, pain, and fatigue resulting from a number of challenges, including pressure sores, bowel and bladder challenges, menstruation, spasms, and low iron levels. Pressure sores can result in a significant loss of training time, as the athletes spend more time out of the wheelchair to reduce pressure on the wound site and promote healing (Lala et al. 2014). Risk factors for pressure sores include a lack of sensation, limited mobility, malnutrition, and anaemia (Breslow and Bergstrom 1994). To prevent pressure sores, it is important to keep the skin dry and clean, but unfortunately the moisture from bowel or bladder dysfunction can increase the risk of pressure sore development (Coleman et al. 2013). The first step in pressure sore management is relieving pressure on the wound site (Boyko et al. 2018), and this was indeed practiced by the participants in the current study by the use of padding to relieve the pressure. The pressure sores experienced by the participants in the current study would result in their protein requirements increasing to support the healing of the wound (Flueck and Parnell 2021).

Shoulder injury was also a reason for participants in the current study not being able to exercise. This is indeed a common problem among wheelchair athletes (Heyward et al. 2017) and may be because wheelchair sports participation results in an increase in musculoskeletal load (Ferrara and Davis 1990). Therefore, wheelchair athletes would need appropriate guidance on training load and where applicable to reduce the training load, as well as strategies to manage shoulder injuries.

Another reason for SCI athletes being unable to compete may be due to low iron levels/anaemia, which can also have serious consequences for their health and athletic performance (Scaramella et al. 2018). However, the challenge of low iron levels/anaemia was only reported by one participant in the current study and therefore cannot be generalised to the entire study population. Spinal cord injury above T4 can result in anaemia due to a reduction in total blood volume and haemoglobin mass (Dietz and Colombo 2004). In athletes, this reduction in haemoglobin content can affect oxygen delivery to the muscles, leading to decreased aerobic capacity and an increased rate of perceived exertion (Scaramella et al. 2018). One of the recommendations for hand cyclists would be to consume foods that are high in iron to help meet their iron requirements. However, red meat was a challenge for the participants as it resulted in them having cramps. Therefore, iron supplements and foods high in iron, besides red meat, could be needed.

Low blood pressure was a cardiovascular challenge reported by *Noodles (female, C6 incomplete)* and therefore cannot be generalised to all SCI hand cyclists. However, it is important to note that an impairment in blood pressure control was documented among wheelchair athletes with cervical injuries, namely a lower seated systolic blood pressure and greater delta systolic blood pressure (West et al. 2014). Therefore, wheelchair athletes with cervical injuries may need dietary guidance to optimise their blood pressure.

Conclusion

This study is the first to our knowledge to document not only the perceptions of SCI endurance hand cyclists regarding their physiological and nutrition-related challenges but also the perceived impact of these challenges on nutritional practices and exercise capacity. The hand cyclists reported a number of physiological and nutrition-related challenges that impact their nutritional practices and exercise capacity. Bowel and bladder challenges, limited hand function, muscle spasms, thermoregulatory challenges, pressure sores, menstrual periods, and low iron levels/anaemia were perceived to predominantly impact food and fluid intake (restrict intake) and compromise exercise capacity.

Future research should consider the findings of this study for the development of exercise-specific guidelines to better aid the SCI hand cyclists manage these challenges. The findings of this study have practical implications for health professionals working with SCI athletes, informing them of the unique physiological and nutrition-related challenges experienced by these athletes. Therefore, the health professionals would need to tailor their exercise guidelines for these SCI athletes considering their challenges.

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Data generated during this study are available from the corresponding author upon reasonable request.

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