

MSc Sport and Exercise Nutrition (MSC24-PTMSC-SENU)

Title: Exploring nutritional knowledge and practices among recreational tennis players:
a mixed-methods study

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DECLARATION FORM



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Abstract

Aim: To examine nutrition practices, knowledge and trusted sources of nutrition information amongst recreational tennis players in Cardiff, the Vale of Glamorgan and Greater London.

Methods: A cross-sectional mixed-methods study, consisting of an online questionnaire followed by semi-structured interviews, was used to explore the research aim. 48 participants completed the questionnaire, with three participants taking part in semi-structured interviews.

Results: The majority of participants (n=43) reported always or sometimes eating prior to a tennis match, with carbohydrate-based foods being the predominant choice (n=35). Variable nutrition habits were displayed both during and post-match. A statistically significant relationship was identified between the length of matches and taking on in-match nutrition. For those that consumed food in-play, bananas were the most commonly reported choice (n=16). Popular in-play nutrition choices included household snacks (bananas, cereal bars and sweets), highlighting accessibility and convenience as factors driving nutritional behaviours. No significant relationship was identified between perceived confidence in nutrition knowledge and nutrition knowledge scores, or nutrition knowledge and reported dietary behaviours. The majority of participants consumed only water during matches (n=34). Social media/ the internet was the most popular source of nutrition information (n=32).

Conclusion: Participants displayed knowledge of the importance of carbohydrate intake through responses to nutrition knowledge questions and reported pre-match nutrition habits. Nutrition habits amongst recreational tennis players are not solely driven by knowledge. Any tennis-specific nutrition education needs to offer practical and convenient solutions, and focus on the role of nutrition in recovery, alongside adjusting fluid intake dependent on the length of matches and temperature.

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Chapter 1: Introduction

1.1 Nutrition and hydration considerations specific to tennis

Existing research on nutrition knowledge and practices within the world of tennis and wider racquet sports has identified a mismatch between perceived and actual knowledge, different levels of support around nutrition, and carbohydrate and energy intake below recommendations (Kondric, et al., 2013). As nutrition behaviours have been found to differ from the belief that nutrition is a vital element of a robust sports performance strategy (Jenner, et al., 2019), it is worthwhile identifying if this is as a result of incomplete knowledge or inconsistent guidance.

Tennis players place value on the role of nutrition in optimising performance and optimising recovery, but may lack access to accurate nutrition knowledge and sufficient means to implement nutrition strategies (Ranchordas, et al., 2013). Access to qualified nutrition professionals and promotion of evidence-based resources advising on sound sports nutrition advice could help to bridge this gap. As could ensuring that structured nutrition education is embedded into youth tennis and racquet sports pathways.

Tennis is the most popular racquet sport globally, with an estimated 60 million players worldwide (Kondric, et al., 2013). The physical demands of tennis are characterised by explosive bouts of high physical exertion combined with short periods of rest, repeated over a prolonged period (Reid, et al., 2008). This physical combination during match play and training, alongside considerable travel and a near year-round competition calendar for professionals, can place unique nutritional demands on players to maintain physiological and neurological performance during matches (Vicente-Salar, et al., 2025).

Tournaments are typically played outdoors in the summer months, thereby affecting heat exposure and hydration needs (Ranchordas, et al., 2013). Furthermore, the demands of travel can affect access to training facilities and time taken to acclimatise to new surroundings. The necessity of travel within the annual tennis calendar is accompanied by an element of uncertainty around food availability and reliance on external providers of food. (Murphy, et al., 2015). When formulating tailored advice for a tennis players, a sports nutritionist needs to assess timing of play, frequency of

matches, length of the season alongside physique characteristics for particular players (Jenner, et al., 2019).

Standard tennis match durations range from two to four hours, with tournaments involving multiple matches in one day, and often less than 48 hours between matches for recovery. Furthermore, some players may partake in singles and doubles matches in a single day, thereby significantly affecting nutritional demands (Reid & Duffield, 2014). In such circumstances, players could be undertaking preparations for matches from “suboptimal nutritional status” (Vicente-Salar, et al., 2025). Ensuring a strategic hydration strategy and within-play carbohydrate intake, coupled with nutrition to optimise recovery, are therefore of even greater importance following periods of prolonged matches or intense, consecutive match play (Ojala & Häkkinen, 2013). At the elite level, even small benefits gained from optimal nutrition and hydration can be critically advantageous during competition (Sánchez-Oliver, et al., 2018).

The training load of recreational tennis players is typically lower in volume, with matches being less frequent and shorter in duration. With this in mind, typical energy requirements of recreational tennis players are lower than elite counterparts (Ranchordas, et al., 2013).

A tennis player’s nutritional practices and intake can affect a number of factors which directly impact performance, including optimisation of muscle glycogen (energy) stores and fatigue reduction (Kovacs, 2006). Furthermore, enhancing a tennis player’s nutrition can play a central role in supporting immune health and optimising recovery, potentially reducing the risk of an illness and/ or injury which could impact performance (Vicente-Salar, et al., 2025). Periods of increased training in sport have been linked with an increased risk of athletes developing gastrointestinal issues and respiratory infections, with travel, low energy availability and poor sleep also associated with impaired immune function (Colbey, et al., 2018). Alongside the physiological demands that the game of tennis places on players, Girard & Millet (2009) also note the perceptual toll of the game which can result in neuromuscular fatigue. Physical fitness during a tennis game is profoundly influenced by nutrition and hydration status (Sayuty, et al., 2026). A tennis player’s knowledge of, and adherence to, a sound nutritional strategy during can therefore have a significant impact on performance and recovery. Despite the well-established nutritional demands of tennis,

recreational tennis players have demonstrated inconsistent nutrition habits, failing to optimise carbohydrate consumption and timing of nutritional intake (Fleming, et al., 2018).

1.2 Aims and objectives of the study

Promoting knowledge of evidence-based nutrition and ensuring athletes have practical strategies to help them meet nutritional requirements is a key tenet in the prevention of adverse effects on health and performance associated with low energy intake.

The majority of research conducted thus far on the nutritional practices and knowledge within the tennis community has primarily centred around professional athletes and youth athletes. Burke (2008) comments that elite athletes may possess unique characteristics resulting from genetics or conditioning that have enabled them to perform at the highest level. In light of this, applying the results of existing studies on nutritional intake and knowledge to the more general cohort of recreational athletes may be inappropriate.

It is also noted that a lack of randomised controlled trials for tennis specific recommendations has been identified, and that male tennis players have tended to feature more heavily as participants in research than their female counterparts (Vicente-Salar, et al., 2025). Given the differences in nutritional requirements between male and female tennis players when it comes to sports performance, aiming to include equal measures of both genders in future research would be beneficial (Ranchordas, et al., 2013).

To better disseminate and inform nutritional strategies for recreational tennis players, a useful starting point would be to discover current nutrition knowledge and practices amongst this athlete group. The aim of this research is therefore to examine nutrition practices and knowledge amongst recreational tennis players. For this purpose, a questionnaire and semi-structured interview questions have been designed seeking to find out the nutrition knowledge of recreational tennis players, from where such knowledge is obtained, and what, if any, nutritional practices, they follow. The questionnaire and interviews will seek to explore the following objectives:

- Recording current nutritional practices of recreational tennis players;

- Identifying the primary source of nutrition information used by recreational tennis players;
- Exploring current levels of tennis-specific sports nutrition knowledge amongst recreational tennis players.

The structure of the research is organised into the following chapters. Chapter 2 (Literature Review) provides a review of existing research. Chapter 3 (Methodology) details the mixed-method research design, sample selection and data analysis techniques used. Chapter 4 (Results) presents the results, including quantitative data analysis and the thematic analysis of qualitative responses. Results are critically analysed alongside existing research in Chapter 5 (Discussion).

Chapter 2: Literature review

A review of existing literature was undertaken, following the search strategy below.

2.1: Research strategy

The literature review was conducted between September 2025 and February 2026 with searches carried out on the database of the University of Wales Trinity St David online library. The following search terms were used to identify relevant existing research: *nutrition knowledge in tennis players, sports nutrition knowledge, nutrition recommendations for tennis players, nutrition literacy amongst athletes, nutritional supplement usage in tennis, nutrition knowledge questionnaire, nutrition for tennis performance.*

Boolean operators were included in the search linking key words to widen the scope of articles identified. Articles were then screened by the researcher to ensure relevancy for inclusion in the literature review. Studies for inclusion in the literature review were those which covered current nutritional recommendations for adult and adolescent tennis and racquet sport players, alongside studies which reported on nutrition knowledge and practices amongst this cohort of participants. Studies covering the topic of sources of nutrition knowledge for athletes in general (not specific to tennis players) were also included. The reference lists of these articles were read to identify further relevant studies. Inclusion criteria for the literature review were English language studies published between 1991 and 2026 covering the aforementioned topics.

2.2: Current nutrition recommendations for tennis players

The International Tennis Federation (ITF), Women's Tennis Association (WTA), and Association of Tennis Professionals (ATP) Expert Group Statement on Nutrition in High-Performance Tennis acknowledges the central role that nutrition can play in optimising both physical and mental performance across training and match play, with factors including the type, timing and quantity of nutritional intake significantly impacting performance and recovery (Vicente-Salar, et al., 2025).

Annual tennis training schedules can be influenced by the competition calendar. The off season is not a defined period, but often includes two to three “blocks” of training, which can last between four to eight weeks in length. These blocks can typically feature both on and off court sessions, and include technical skills alongside fitness training (Reid, et al., 2010). The duration and intensity of training will have a bearing on nutritional requirements to optimise training and recovery. On court training often lasts 45 – 90 minutes, with aerobic drills lasting no more than 45 minutes in length (Vicente-Salar, et al., 2025). Recreational tennis is played year-round, with the majority of competitions taking place during spring and summer months. Match duration is often shorter, with fewer matches being played consecutively (Ranchordas, et al., 2013).

2.2.1: Energy requirements

Overall energy intake provides fuel for performance and supports a tennis player in meeting their macro and micronutrient requirements. Energy expenditure varies between tennis players, depending on duration and intensity of training or match play. It can also be dependent on physical goals individual to each player (Vicente-Salar, et al., 2025). During tournaments, the length of play is unknown at the start of a match, meaning that energy expenditure can often be difficult to predict. A delayed start could disrupt the timing of tennis player’s nutritional strategy, potentially leading to a player being hungry and under-fuelled at the start of a match, or conversely playing with a fuller stomach and risking gastrointestinal upset (Ranchordas, et al., 2013).

Ellis *et al.* (2021) utilised doubly labelled water protocols to estimate total daily energy expenditure amongst elite male and female tennis players; the average total daily energy expenditure (TDEE) for female players over five grand slam matches was 3,820 kcals. For male players, the average TDEE was 5,520kcals.

A consistent low energy intake, resulting either from an increase in training, decrease in energy intake (intentionally or unintentionally), or combination of the two, can lead to low energy availability (LEA). In LEA, energy intake is insufficient to meet the body’s physiological needs (Vicente-Salar, et al., 2025). High training volume combined with demands of travel and match competition can increase the likelihood of LEA and relative energy deficiency in sport (RED-S) for professional tennis players. Vincente-

Salar, *et al.* (2025) state that investigations into the prevalence of LEA and RED-S within tennis are lacking, and note the importance of raising awareness of, and early intervention in, LEA. A scoping review conducted by Flemming, *et al.* (2022) found that highly trained youth tennis players frequently did not meet energy requirements, increasing the risk of LEA and the likelihood of micronutrient deficiencies. LEA has been identified as prevalent within recreational, as well elite, athletes (Logue, *et al.*, 2020). A consistently low energy intake can increase the risk of disrupted immune function, loss of fat free fat mass, reduced bone density, all of which can impact performance, susceptibility to injury, and long-term future health (Jenner, *et al.*, 2019).

2.2.2: Carbohydrate requirements

The main source of energy for training and match play is from carbohydrate sources. Carbohydrate availability is essential to neurological function to maintain accurate ground strokes and to support high intensity performance. Carbohydrate intake is also critical in the prevention of fatigue during, and replenishment of liver and muscle glycogen stores after, matches (Sayuty, *et al.*, 2026).

Carbohydrate requirements can vary depending on the duration, frequency and intensity of training or play. Tennis is a high-intensity sport which combines explosive bursts of activity with short episodes of incomplete recovery, utilising both aerobic and anaerobic sources of energy (Vicente-Salar, *et al.*, 2020). Such interspersed periods of rest and recovery differentiate the physical demands of tennis from traditional endurance activities, such as running and cycling. As such, carbohydrate use and availability may differ (Kovacs, 2006). Individualised carbohydrate recommendations can match an athlete's carbohydrate intake to the "cost" of a particular day's training or match play output (Burke, *et al.*, 2018).

Periodising carbohydrate intake throughout the day can support a tennis player in meeting daily requirements, alongside adopting a targeted approach to timing of carbohydrate intake to fuel both pre and during high intensity performance, as well as refuelling post training/ match play. Players may be required to continually fuel during match play to meet their recommended carbohydrate intake when the duration of a match is unknown (Vicente-Salar, *et al.*, 2025).

Fernández-Elías (2015) found that temperature can also affect carbohydrate requirements; hyperthermia was found to be related to increased usage of glycogen during periods of intense exercise. Therefore, tennis players playing in hotter temperatures may need to increase carbohydrate intake to offset glycogen depletion.

The recommended suitable daily intake for professional adult tennis players ranges from 3 to 10g carbohydrate/ kg of body mass. Intakes towards the higher recommended intake are suited to intense training sessions and match play, with consideration given to the potential carryover of inadequate fuelling for or recovery from prior matches during a tournament (Vicente-Salar, et al., 2025). During tournaments, to maintain muscle glycogen stores, the consensus is that a daily recommended carbohydrate intake for tennis players should range from 6 – 10g/ kg body weight/ day (Ranchordas, et al., 2013).

Carbohydrate quality and timing of intake should be factored into any nutritional strategy. Consuming a meal which is 50 – 70% carbohydrate (aiming for 1 – 4g/ kg body weight) two to four hours before competition can support performance, though tennis players may not always be aware of the exact start time of a match when playing in a tournament. As well as considering meeting requirements, athletes should consider overall health and nutrient dense carbohydrate options. However, prior to match play it is recommended to consume familiar, low fibre carbohydrates to minimise potential gastrointestinal upset (Vicente-Salar, et al., 2025).

Carbohydrate supplementation during periods of extended aerobic activity during tennis matches improves performance and reduces fatigue; the changing of ends during a tennis match has been identified as an optimum time for regular, structured carbohydrate and fluid consumption (Kovacs, 2006). In matches exceeding one and a half to two hours in length, it is recommended to consume 30 – 60g of carbohydrate per hour (Ranchordas, et al., 2013), with this increasing to 60 – 90g of carbohydrate per hour for five set matches, or matches of three to five hours duration. Carbohydrate gels, drinks and chews contain a mix of glucose and fructose, and can optimise carbohydrate intake during matches (Vicente-Salar, et al., 2025). Matches played on clay courts have been associated with more intense physical strain (Martin, et al., 2011), which may mean that longer matches played on these surfaces may be accompanied by increased fuelling requirements.

Post-training or post-match carbohydrate intake strategies should prioritise the needs incurred by the physical activity undertaken; a key part of this is focusing on carbohydrate intake for refuelling, which is recommended as 1 – 1.5 g/kg within the four hours following training or match play as muscle glycogen synthesis is at its optimum in the period immediately following activity (Vicente-Salar, et al., 2025). To support recovery post-match and maximise, ensuring carbohydrate consumption during this time is recommended to maximise glycogen synthesis and support recovery, with carbohydrate containing fluids being an effective way to meet both carbohydrate and rehydration requirements (Kovacs, 2006).

2.2.3: Protein requirements

Protein is essential for myofibrillar protein synthesis, a process triggered by the amino acid leucine. Taking into account increased protein synthesis demands associated with training and performance, the protein intake of athletes is therefore above the general population guidelines of 0.8 – 1g/kg/ day (Vicente-Salar, et al., 2025). The recommended daily protein intake for professional tennis players to support recovery and optimise muscle protein ranges from 1.2 to 1.8g/kg body weight (Domínguez, et al., 2021). This is similar to recommended protein intakes for “athletes” in general which ranges from 1.4 to 2g/kg of body weight per day. During periods of heavier training and competition, protein intakes at the upper end of recommendations are required to meet recovery needs associated with increased intensity. Furthermore, in certain circumstances, such as maintenance of lean muscle mass during rehabilitation, or during periods of planned energy restriction, protein intake of up to 2.2 – 2.4 g/kg/ day may be required (Jäger, et al., 2017).

Recommendations for tennis players focus on periodising high-quality protein sources throughout the day with the goal of maximising amino acid bioavailability and reaching the leucine threshold required for myofibrillar protein synthesis (Antonio, et al., 2020). High-quality protein sources include meat, fish, dairy and eggs. Animal protein sources have shown superiority in comparison to vegetarian/ vegan protein in muscle protein synthesis, though for athletes following vegetarian or vegan diets, consuming protein intake towards the higher end of recommendations can help to overcome this (Hevia-Larraín, et al., 2021).

Consuming 20 to 40g of protein every three to four hours is recommended to optimise muscle protein synthesis (Kerksick, et al., 2017). In practice, this would translate into four to six meals or snacks, helping to meet requirements without necessitating large volume meals. Supplementation of protein using isolated protein rather than whole food sources can help to overcome challenges surrounding dietary intake, such as a reduced appetite or lack of access to suitable food sources when travelling for tournaments (Vicente-Salar, et al., 2025).

Ensuring timely intake of protein following training or competition is a consideration for tennis players as the anabolic effect of exercise will diminish as time following physical activity increases (Jäger, et al., 2017). Consuming 20 – 40g of a protein source containing essential amino acids in the period immediately after to within two hours of exercise is recommended to stimulate muscle protein synthesis (Trommelen, et al., 2023). Within this timeframe it is noted that liquid protein in the form of protein powder or milk-based drinks can provide an easy to consume and quick absorb option in time limited recovery periods (Vicente-Salar, et al., 2025).

2.2.4: Dietary fat recommendations

Carbohydrates provide the main source of energy for performance during tennis matches, with fat oxidation for energy provision being utilised in matches of longer duration (Sayuty, et al., 2026). There are no set recommendations for fat intake in tennis players, and general population guidelines are for fat to make-up 35% of dietary energy (COMA, 1991), with less than 10% of this being saturated fat (SACN, 2019). A study of adolescent male tennis players reported a fat intake of above 30% in 80% of those surveyed (Juzwiak, et al., 2008), which was above the recommendations at the time by the American Dietetic Association for 25 – 30% of daily energy intake to come from dietary fat. It is noted that tennis players may wish to maintain a lower body fat percentage, and, combined with prioritising carbohydrate and protein intake, may consume less dietary fat as a result (Ranchordas, et al., 2013). However, adequate intake of dietary fat is essential due to its role in hormone synthesis, cell membrane structure and the absorption of fat-soluble vitamins, A, D, E and K.

2.2.5: Micronutrient recommendations

There are currently no micronutrient recommendations in place specifically for the athlete population group. A balanced diet is likely sufficient to meet nutritional needs of tennis players without supplements, however amongst female and vegetarian players, iron supplementation may need to be considered (Vicente-Salar, et al., 2025). The authors also mention potential vitamin D supplementation for players who reside the majority of the year in regions north of the equator. Indeed, daily supplementation with 10 micrograms of vitamin D is recommended for all adults in the United Kingdom (SACN, 2016). Vitamin D plays a role in a range of physiological processes within the human body, of which maintaining bone and skeletal muscle health are of particular concerns to the athlete community, including tennis players. Wiciński *et al.* (2019) report that whilst supplementation with vitamin D “seemed” to have beneficial effects on exercise performance, definitive recommendations for all athletes could not endorsed.

Iron is required for the formation of haemoglobin and myoglobin to facilitate transportation the of oxygen to muscles (SACN, 2011), making it a significant micronutrient for optimal performance. Prolonged low iron levels can result in iron deficiency anaemia (IDA), the primary symptoms of which are fatigue, impaired immune function and reduced cognitive function, all of which can impact an athlete’s ability to train and perform (Vicente-Salar, et al., 2025). Athletes are at an increased risk of IDA linked to increased iron turnover and reduced absorption secondary to increased hepcidin levels associated with intense physical activity (Peeling, et al., 2021). Supplementation may be required when dietary strategies to optimise iron intake with bioavailable sources are inadequate.

2.2.6: Recommended intake and reported use of nutritional supplements

The popularity of nutritional supplements has increased during recent years, with supplements specifically targeting athlete groups being formulated (Sánchez-Oliver, et al., 2018). The use of nutritional supplements amongst tennis players is widespread, but Vicente-Salar, *et al.* (2025) comment that such use is not consistently well-informed. The term “nutritional supplements” can refer to vitamin and mineral supplements consumed by individuals to help meet nutritional requirements if dietary

intake alone is insufficient; it can also refer to the ingestion of ergogenic aids. Where tennis players are unable to meet their nutritional needs through diet alone, nutritional supplements can provide additional support towards meeting recommended intakes (Kondric, et al., 2013).

A survey of professional tennis players found that 81% of participants took at least one nutritional supplement, all of whom consumed sports drinks and 42% of those reporting caffeine supplement usage (López-Samanes, et al., 2017). A study conducted on supplementation use within padel players in Brazil found that 69% of participants used dietary supplements (Da Silva Mendes Huber, et al., 2018). Similar to tennis matches, padel has anaerobic and aerobic peaks, and padel players often possess similar body composition and physical characteristics to those of tennis players. Such findings demonstrate a high prevalence of nutritional supplement use in racquet sports across the two studies. However, while these findings suggest that supplementation is embedded within the sports, the studies relied on self-reported data, which may be susceptible to recall and social desirability bias.

Furthermore, Sánchez-Oliver et al. (2018) found that 88% of male amateur tennis players consumed nutritional supplements, primarily to enhance performance (87%) and address perceived nutritional deficiencies (41%). This highlights that supplement use is not solely a practice of elite tennis players. The reliance on the perceived benefit of a nutritional supplement rather than the presence of a clinically diagnosed nutritional deficiency raises issues regarding how appropriate and targeted nutritional supplement use is amongst recreational tennis players, and may be suggestive of performance expectations rather than evidence-based nutritional requirements.

Kondric, et al. (2013) found supplementation was to be more prevalent in female tennis players with all of the 43 females who partook in the study taking nutritional supplements (though not all 43 took supplements regularly), in comparison with 76% of the 21 male players surveyed. Protein was the most popular nutritional supplement amongst those surveyed; protein supplementation can aid in meeting protein requirements without overly increasing energy intake (Jäger, et al., 2017). Increased nutritional supplement usage in female tennis players has been linked to a high awareness of the role of nutritional supplements in sport, coupled with a genuine

increased need for supplementation amongst female tennis players (Kondric, et al., 2013).

Caffeine, creatine and sodium bicarbonate are amongst the most-popular ergogenic aids used by tennis players (Vicente-Salar, et al., 2025).

Caffeine

Caffeine is one of the most widely studied supplements within the sporting world; it acts as an adenosine receptor antagonist, blocking adenosine binding and delaying the onset of fatigue (Ferreira, et al., 2021). Caffeine is thereby associated with improved performance through reduced pain and fatigue perception (Guest, et al., 2021). Caffeine supplementation for sport is preferably found in tablets or gums, and caffeine containing gels. Coffee and energy drinks are considered less effective options due to variability and undeclared caffeine content (Vicente-Salar, et al., 2020).

Supplementation with caffeine has been found to have an ergogenic effect when consumed before or during tennis matches (Ranchordas, et al., 2013). The stimulant effect of caffeine on increasing alertness during “stop and go” events, such as racquet sports, have made it an effective aid in terms of improving reaction time and fatigue reduction (Burke, 2008). Vincente-Salar, *et al.* (2020) found that ingesting 3 – 6 mg of caffeine/ kg of body weight in the pre-match period improved sprint performance in racquet sports, though the effect on stroke accuracy was inconclusive. Within a simulated tennis match, pre- and/ or during match ingestion of caffeine was shown to aid in serve speed consistency (Hornery, et al., 2007). Caffeine has also been identified as a potential useful ergogenic aid for tennis players the day after a late-night match if play is taking place on consecutive days (Vicente-Salar, et al., 2025). However, caution in relation to potential side effects of caffeine ingestion towards higher dose is a consideration for tennis players, especially its impact on sleep, and therefore recovery, during tournaments. To minimise such adverse effects, periodising intake during training and match play has been identified as beneficial (Pickering, 2021).

Creatine

Creatine is a naturally occurring amino-acid derivative found within muscle cells. It is synthesised from arginine, glycine and methionine, and naturally occurs in food sources such as red meat and fish. Creatine supplementation, most commonly in the form of creatine monohydrate, is associated with improved performance and delayed onset of fatigue in anaerobic activity (Kreider, et al., 2017). Creatine supplementation can enhance capacity for training and performance by optimising phosphocreatine stores in muscle cells, thereby enabling rapid regeneration of ATP during bouts of maximal anaerobic effort. Within the sport of tennis, this could be useful for energy production to support short and explosive movement.

Amongst ATP-top 100 ranked tennis players, creatine was reported as the most commonly used nutritional supplement (López-Samanes, et al., 2017). Despite its popularity amongst tennis players, research on the topic of the effectiveness of creatine supplementation has not demonstrated consistent improvements in tennis specific performance. Creatine supplementation amongst a group of 36 competitive male tennis players resulted in 1 – 1.5kg gain in body mass, but did not show improvements in serve or forehand speed, neither in sprint or leg power (Pluim, et al., 2006). Ranchordas, *et al.* (2013) advocate for further research into the longer-term effects of creatine on muscle hypertrophy and potential enhancements related to repeated sprinting and ball stroke speed.

Sodium bicarbonate/ citrate

During high intensity activity, supplementation with the alkalising agent sodium bicarbonate or citrate can aid in the maintenance of blood and muscle pH levels, thereby buffering blood lactate levels, and delaying the onset of muscular fatigue and impairment to performance (Vicente-Salar, et al., 2025).

In a study of ten nationally ranked youth tennis players, supplementation with 0.5g/kg of sodium citrate two hours prior resulted in more games won in a simulated tennis match compared with placebo (Cunha, et al., 2022). Wu, et al. (2010) found that intake of 0.3g/kg of sodium bicarbonate prior to tennis skill testing resulted in lower blood lactate and improvements to ground stroke consistency.

Challenges associated with supplementation of sodium bicarbonate or citrate include balancing timing of ingestion to optimise blood concentration with the unknown start of tennis matches during a tournament, coupled with the increased risk of gastrointestinal upset (Vicente-Salar, et al., 2025).

2.2.7: Hydration recommendations

Fluid requirements can be influenced by the effect of environmental conditions on sweat rate and the length of play, the latter being an unknown factor when a match commences. To maintain adequate hydration levels in temperatures below 27 degrees Celsius, 200ml of electrolyte containing fluid is recommended at each changeover; in temperatures above 27 degrees Celsius, this increases to 400ml (Ranchordas, et al., 2013).

Fluid loss can be monitored by weighing pre- and post-match, with lost fluid being replaced through the adoption of a strategic and individualised hydration strategy. This should factor in timings of fluid intake, and fluid intake targets should be based on environmental conditions, individual sweat rate predictions, and the length of a tennis match (Périard, et al., 2014).

Matching fluid intake to sweat loss rates when playing or training in extreme heat presents a challenge for tennis players. Consuming large volumes of fluid when constantly moving and changing direction increases the risk of gastrointestinal upset, and it is recommended that building up a gradual practice of fluid intake during training can help improve tolerance to larger fluid volumes (Lambert, et al., 2008).

Replenishing electrolytes lost through sweat is an additional consideration. Changing ends provides an opportunity for tennis players to consume fluid as well as food (Vicente-Salar, et al., 2025). Fluid intake can also present an opportunity for athletes to meet other nutritional requirements. A carbohydrate and electrolyte drink can be preferable to plain water as it will aid in both energy provision and fluid retention by providing a source of glucose alongside sodium (Maughan, et al., 2016).

2.3: Further considerations impacting nutrition requirements, and variations between different groups of players

Physiological differences between male and female tennis players have a bearing on different nutritional requirements between these two groups of players (Ranchordas, et al., 2013). An increased risk of LEA, amenorrhea, and micronutrient deficiency has been identified amongst female athletes. The iron requirements of female tennis players are increased due to a combination of loss during menstruation and increased iron loss associated with the aforementioned reduced absorption and iron turnover during intense exercise. The lower energy intake of female tennis players in comparison to male players is associated with an increased risk of iron deficiency, and iron levels should be regularly monitored in female tennis players, with supplementation initiated if required (Vicente-Salar, et al., 2025).

Hormonal fluctuations experienced by female players during the menstrual cycle and menstruation itself can have an impact performance; Otaka, *et al.* (2018) found that serve accuracy was decreased during menstruation, but that serve velocity was not. Due to the subjective experience of each female within their menstrual cycle, an individualised approach is recommended when it comes to formulating nutrition plans to meet the needs of female tennis players. The low quality and quantity of research on this is however acknowledged; in light of this limitation, further studies are required prior to specific recommendations around nutrition and the menstrual cycle, and to balance out under representation of female participants in sports nutrition research in general (Vicente-Salar, et al., 2025).

Management of medical conditions, such as type 1 diabetes, can affect timing of nutritional intake to optimise performance alongside necessitating an increased level of planning for on court nutritional strategies. Tennis players living with type 1 diabetes are required to monitor blood glucose levels frequently, and ensure carbohydrate intake, activity levels and administration of insulin are finely balanced to provide sufficient energy for optimal performance and prevent activity induced hypoglycaemia (Riddell & Milliken, 2011).

As players progress through the ranks of tennis, the most successful and top ranked players will earn sufficient prize money to employ a team to support their performance and lifestyle, including a nutritionist. The majority of professional tennis players in the

lower rankings are unlikely to have access to such resources, which can impact nutritional strategy, thereby influencing performance and recovery (Vicente-Salar, et al., 2025).

Amongst youth tennis players, the nutritional requirements associated with growth alongside those of increased training present can present a challenge. At a time of development and increased nutritional demands, such challenges can lead to sub-optimal intake, affecting not only performance, but longer-term health (Vicente-Salar, et al., 2025). An analysis of the food diaries of youth tennis player over a seven-day period identified overall energy and carbohydrate intake below recommendations, demonstrating under fuelling within the surveyed cohort (Fleming, et al., 2021). For youth players, parents/ guardians strongly influence meal availability, timing and what foods and supplements are consumed. The aforementioned sub-optimal energy intake indicates that in some circumstances, parent/ guardian support alone may not be sufficient to meet the nutritional needs of elite youth athletes.

2.4: Nutrition knowledge amongst tennis players

Nutrition is fundamental to meeting the unique physical demands of a tennis match, and can help to optimise performance in long matches, support energy for repeated explosive effort, and optimise recovery during periods of extensive travel. Poor nutrition knowledge can be linked to suboptimal nutritional practices amongst athletes (Turner, et al., 2021). Despite this, there are limited studies researching the nutritional practices and levels of nutrition knowledge amongst tennis players (Ranchordas, et al., 2013).

A nutrition and recovery habit questionnaire was utilised by Flemming, *et al.* (2018) to investigate practices of 70 competitive adult tennis players during the pre, during and post match period. The importance of carbohydrate intake was recognised by the majority of participants, with over half consuming carbohydrate rich meals as part of their pre-match routine. Elite level players had a higher carbohydrate intake, potentially indicating an increased level of knowledge in relation to the role of carbohydrates for fuelling in comparison to lower-level players. Adaptations to nutrition strategy for the post-match period to facilitate recovery were less well known; 39% of participants reported consuming “nothing specific” during this period. Such a

revelation is worrying given the aforementioned importance of sufficient nutrition for muscle protein synthesis and glycogen replenishment.

A scoping review of nutrition practices amongst elite junior and young adult tennis players identified acknowledgement of the importance of nutrition, though this was accompanied by a lack of planning and sub-optimal intake amongst the participant group (Fleming, et al., 2022). Analysis of the nutritional intake of junior tennis players over a seven-day period of training and competition, showed that both carbohydrate and energy intake was below recommendations, potentially indicating a gap between perceived importance and practice within this athlete group (Fleming, et al., 2021).

Jenner, *et al.* (2019) also identified a difference amongst team sport athletes when comparing perceived importance of nutrition with nutrition behaviours. Kondric, *et al.* (2013) surveyed tennis players' knowledge of nutrition and doping, and found that increased nutrition knowledge was a protective factor against future doping activity. No significant difference in nutrition knowledge was identified between male and female tennis players. There are several factors related to nutrition knowledge which could influence a tennis player's nutrition strategy. Higher self-rated nutrition knowledge amongst athletes was found to be associated with an increased use of nutritional supplements (Knapik, et al., 2016).

For the duration of a tennis match, players are largely on court solo (aside from in doubles matches) and are exposed to intense mental challenge when compared to those who play team sports. With no physical on-court support with nutritional strategies available to players, a tennis player will need to be confident in following and applying their own nutritional and hydration plan during matches (Cowden, et al., 2014).

A robust, evidence based nutritional strategy can have a considerable impact and improvement performance, and it is therefore relevant to identify the source(s) of nutrition knowledge and advice that tennis players turn to.

2.4.1: Sources of sports nutrition knowledge and strategy

Coaches are frequently named as the primary source of nutrition advice for tennis players, though this may not be an area in which they have received formal training. Studies have reported a high level of trust placed in coaches by players in terms of nutritional strategies and supplementation (Torres-McGehee, et al., 2012). Indeed, the authors point out that coaches are the professional with which professional athletes, including tennis players, will have the most contact, so a sound and evidence-based nutrition knowledge within this staff base is essential. Within tennis Kondric, *et al.* (2013) comment that a players' trust in their coach is not surprising given the strong connection formed and time spent between players and coaches through travel, at training camps and during tournament play. However, it is noted that level of nutrition education can vary substantially between coaches. Outside of top 100 tennis players, coaches and/ or strength and conditioning trainers were found to provide the majority of supplement recommendations to players. Conversely, within the top 100 players, sports nutritionists were the principal advisors on nutritional supplement choices (López-Samanes, et al., 2017).

There are limited studies examining nutrition knowledge of coaches, both within sport generally, and tennis specifically. Juzwiak and Ancona-Lopez (2004) surveyed 55 coaches in Brazil who were involved in the sports of tennis, judo, gymnastics and swimming at adolescent level to ascertain their degree of nutrition knowledge and the dietary practices recommended to athletes; results showed that all coaches had provided dietary advice at some stage, with 43% of coaches recommending athletes work with a sports nutritionist, and 13% consulting a sports nutritionist themselves. Of the nutrition advice provided to athletes, there was a focus on the pre-competition period (93% provided advice on this period) when compared with recovery (46%). Recommendations to increase carbohydrate intake varied considerably based on whether the advice was for the pre-, during, or post-training and competition period. Protein was the macronutrient identified as highly valued by the coaches surveyed. Such results emphasise the need for standardised strategies to improve nutrition knowledge amongst sports coaches if they are going to be in the primary position to provide nutrition advice to athletes.

Due to their financial position, elite level tennis players are more likely to have access to a qualified sports nutritionist as part of a multi-disciplinary coaching team, who can provide nutritional training and a personalised nutrition strategy. The International Tennis Federation emphasises the need for an evidence-based nutrition and hydration strategy for performance and recovery tailored specifically to tennis (Vicente-Salar, *et al.*, 2025). Input from a sports nutritionist or registered dietitian can go beyond solely optimising performance. When reviewing the dietary practices of team athletes, in particular their animal protein intake, Jenner, *et al.* (2019) found that dietitians advised on longer-term nutritional strategies to ensure intakes of saturated and unsaturated fats were in line with recommendations, thereby ensuring an athletes' lipid profile could remain within target ranges alongside increasing lean muscle mass.

Turner, *et al.*, (2021) found that elite squash players who gained their main source of sports nutrition from a sports nutritionist had a greater level of nutrition knowledge than their counterparts who had consulted with a sports scientist. However, such sources might not always be accessible or be consulted in practice. Sanchez-Olivier, *et al.* (2018) comment that nutritional supplement usage in amateur tennis players was often influenced by family and friends, the internet and teammates, as opposed to sports nutritionists, doctors or scientists.

The internet, in particular social media, is emerging as one of the primary sources of nutrition information, with advice on social media platforms not being robustly fact-checked and often being linked with commercial gain (Knapik, *et al.*, 2016). Obtaining accurate information from such sources requires an ability to distinguish between evidence-based information and anecdotal advice due to large variations in reputability of sources.

In terms of where athletes themselves would like to receive nutrition education from, a performance nutritionist with sports specific experience has been identified as the preferred source (Solly, *et al.*, 2023), with a range of pre, during and post nutrition strategies covered and individual goal setting included. Such information is a useful insight into the different variables to be considered when formulating nutrition education initiatives for athlete groups.

Chapter 3: Methodology

To examine the nutrition knowledge and habits of tennis players, a mixed methods research design was adopted. The research design, participant selection, data analysis, and the timeline for research, are explored within this chapter.

3.1 Research Design

A cross-sectional mixed-methods research design by means of an online questionnaire alongside semi-structured interviews was used to answer the research aims and objectives. Cross-sectional studies are cost-effective and time-efficient, making them suitable for research projects where timeframes and resources are often limited (Bowling, 2009).

The primary aim of the study was to assess participants' nutrition knowledge in relation to tennis performance and recovery, while also exploring the nutritional practices, sources of nutrition information and access to sports nutrition information among recreational tennis players. The questionnaire therefore incorporated a combination of quantitative questions and open-ended qualitative questions. Further qualitative data was collected through a smaller number of follow-up semi-structured interviews with selected participants who consented to be contacted for additional participation. The increasing use of qualitative research in the area of health and wellness allows the researcher to gain an insight into individual “behaviours, motivations and expectations”, which can help inform client-centred research outcomes (Bazen, et al., 2021).

Data collection via an online questionnaire was similarly used by Sánchez-Oliver, *et al.*, (2018) and Torres-McGhee, *et al.* (2012) to investigate nutritional supplement usage in amateur tennis players and nutrition knowledge amongst collegiate athletes respectively. An online questionnaire was chosen as it has no geographical limitations, and allows the researcher to disseminate the questionnaire (Greetham, 2019). Online questionnaires have been identified as advantageous due to the convenience and automated data collection they offer (Wright, 2005).

Within the questionnaire, quantitative data collection was used to explore participant levels of nutrition knowledge and patterns in nutritional practices. Quantitative research

methodologies are well suited to questionnaire-based data collection, as responses can be coded into numerical formats and analysed using statistical techniques (Blaxter, 2010).

Further open questions with optional text boxes asked participants to describe dietary behaviours and options in greater detail to collect qualitative data. Through the collection of descriptive data, qualitative research enables researchers to conduct thematic analysis, providing deeper insight into participants' experiences, perceptions, and identifying potential shared viewpoints (Davies & Hughes, 2014).

Such a mixed-methods approach was chosen as the research objectives include the measurement of participant nutrition knowledge alongside the exploration of dietary behaviours amongst participants. Choosing to utilise a mixed-method approach in research can enhance depth and breadth of findings (Johnson, et al., 2007), allowing for a more comprehensive understanding of how reported knowledge can inform nutritional practices amongst participants. Analysing both quantitative and qualitative forms of data can allow the researcher to consider the context in which nutrition behaviours took place, rather than solely reporting the frequency of particular nutritional behaviours. Quantitative data was collected in the period December 2025 to May 2026, with semi-structured interviews taking place in July 2026.

3.2. Sample size and participant recruitment

The total number of participants who completed the online questionnaire was 48. For the semi-structured interviews, three participants took part.

Participants were recruited through opportunistic sampling of tennis clubs in the Cardiff and Vale of Glamorgan, and Greater London areas known to the researcher. Opportunistic sampling was chosen to overcome practical constraints on the time and resources available to the principal researcher, who was undertaking the research whilst working in a full-time role as a dietitian. It is acknowledged that the recruitment strategy employed could also increase the risk of potential sampling bias. Participants may have had similar geographical, social or sporting characteristics as the questionnaire was distributed amongst those known personally to the researcher. Therefore, a potential drawback of this sampling approach is that the sample may not

reflect nutrition knowledge and practices amongst the wider recreational tennis population. The relatively small sample size is a further limitation and restricts the extent to which the results can be generalised.

A link to the online questionnaire was distributed by the researcher to friends and acquaintances who played tennis using Whatsapp. An explanation of the purpose of the study and what participation would entail was provided to prospective participants to ensure confidence in the process with a view to maximising participant response rates (Bowling, 2009). This information was also detailed on the first page of the questionnaire (see Appendix 1). Participants were able to complete the questionnaire at a time that suited them and at their own pace, and could decide to opt out of the questionnaire at any time. Participants were also able to share the questionnaire with other eligible recreational racquet-sport players.

Participants were eligible for inclusion if they:

- were aged 18 years or older;
- participated recreationally in tennis, padel or a comparable racquet sport; and
- were not participating at a professional or semi-professional level.

The inclusion criteria were designed to ensure that the sample represented the recreational sporting population relevant to the research question while excluding professional/ semi-professional athletes whose access to sports nutrition support, training volume and nutritional requirements may differ substantially from those of recreational players.

3.3 Data collection

Data was collected through an online questionnaire designed by the researcher and administered through Microsoft Forms. Further data was collected through semi-structured 1:1 interviews between the researcher and a smaller number of participants.

3.3.1 Questionnaire design

The questionnaire was designed to answer the research aims and objectives of exploring levels of nutrition knowledge amongst participants and gathering information on their current nutritional habits in relation to tennis training and match play. The validated Nutrition for Sport Knowledge Questionnaire (NSKQ) developed by Trakman, *et.al* (2017) was used to inform the layout and wording of the questionnaire. Questions were selected and adapted to make them relevant to recreational tennis players and to address the specific research aim of gathering information on levels of nutrition knowledge and exploring nutritional practices. The validated NSKQ questionnaire was not reproduced for this study, therefore the validity of such an instrument is not assumed to apply to the current study and any nutrition knowledge scores calculated using the data collected. The joint International Tennis Federation, Women's Tennis Association and Association of Tennis Professionals nutritional recommendations (Vicente-Salar, *et al.*, 2025) served as the basis for the nutrition-based questions. A total of 22 questions sought to collect data on:

- Length and frequency of tennis participation, and typical match duration;
- pre, during and post-match nutrition and hydration strategies;
- nutrition knowledge and confidence in existing knowledge;
- preferred sources used to access to nutrition information and perceived personal need for such information;
- participant demographic information.

A final question invited participants who were willing to be contacted for a more in-depth interview to provide an email address. This question was optional and was separate from the main questionnaire responses. Any contact details collected for this purpose were separated from the research dataset to protect participant confidentiality.

The questionnaire was written in plain English and avoided technical jargon to maximise participant understanding and ease at completing the questionnaire. A sports specific and clearly worded questionnaire can simplify participant understanding (Kondric, *et al.*, 2013).

Participants were asked how long they had played tennis, how frequently they played each week and how long their typical matches lasted (questions 1 – 3). Such questions were included to gather information about participants' tennis experience, and to allow patterns in nutrition knowledge and nutritional practices to be considered in relation to playing experience and frequency.

Information on current nutrition and hydration practices was obtained through a combination of multiple-choice questions (questions 4 to 14), alongside optional questions using text boxes on specific food and fluid choices for the pre, during and post-match period.

Participants were asked whether they currently received sports nutrition advice from a professional, whether they ate before playing, how long before a match they would typically eat, and what food or drink they would consume.

Questions concerning hydration assessed the frequency with which participants drank during matches and the type of fluid consumed. Participants were also asked whether they consumed food during matches and, where applicable, what type of snack they selected.

Post-exercise practices were assessed by asking whether participants ate or drank soon after matches or training and what they typically consumed. Options participants could choose from included water, protein shakes, carbohydrate-based foods and protein-based foods. These questions were designed to provide an overview of reported nutritional behaviours surrounding tennis participation rather than a detailed assessment of dietary intake.

Question 15 asked participants to rate their level of confidence in their nutrition knowledge by selecting on a Likert scale of “extremely confident” to “not confident”. Questions 16 and 17 sought to gather from where participants would primarily obtain nutrition information and whether accessing sports nutrition information specific to their own needs was something they could obtain with ease. Information on sources of nutrition information (if any) was obtained via a question which asked participants to select relevant sources from a list including coaching staff, registered nutrition professionals and the internet. Participants had the option select multiple sources of information if applicable.

Nutrition knowledge was assessed by asking participants whether they believed five statements on nutrition and tennis performance were “true” or “false” (question 18), and participants were invited to share any comments about nutrition for recreational tennis players or if there was any area of nutrition that they would like to know more about in question 19, which was an optional text box.

Lastly, questions 20 and 21 gathered information on participant age and gender at the end of the questionnaire.

3.3.2 Semi-structured interview questions

Semi-structured interviews are the most frequently used data collection method within qualitative research, in part due to the flexibility and versatility they offer to the researcher, and allowing the researcher to improvise questions depending on participant responses (Kallio, et al., 2016). Questions are formulated ahead of the interview to provide a structure for the interview, but are not required to be followed rigidly, instead providing guidance and structure to the conversation (Gill, et al., 2008).

For the present study, 17 semi-structured interview questions were put together to expand on topics covered by the questionnaire, and give context to factors influencing nutritional behaviours, to include the following:

- lifestyle and work commitments outside of tennis which could impact on time spent on food shopping/ preparation and training schedules;
- perceived importance of nutrition for general health and tennis performance;
- potential barriers to adopting certain nutrition behaviours; and
- if nutrition and hydration habits in relation to tennis have changed over time.

The questions sought to be participant-centred and non-leading, and deliberately began with words such as “how” and “what” to encourage descriptive answers (R.J., 2011).

3.4 Data analysis

The quantitative data set was exported from Microsoft forms and statistical analysis carried out using IBM SPSS Statistics. Qualitative data gained from the questionnaire and semi-structured interviews was analysed using thematic analysis.

3.4.1 Quantitative data analysis

Variables within the dataset were coded and responses were assigned numerical values for statistical analysis. Descriptive statistics were used to summarise participant characteristics, tennis participation and nutritional practices. Variables, including gender, age group, frequency of tennis participation, pre-match eating behaviour, hydration practices and sources of nutrition information, were coded accordingly.

Responses to the nutrition knowledge questions were coded as correct or incorrect. Correct responses to each of the five nutrition knowledge questions were assigned a score of one and incorrect responses a score of zero. A study-specific total nutrition knowledge score was subsequently calculated, with a higher score indicating a greater level of nutrition knowledge specific to tennis. The highest score available was five. Each participant was then assigned their nutrition knowledge score, which was also converted into a percentage score. As noted above, this is not a validated nutrition knowledge score but is a score specific to the current study and used solely for the purpose of data analysis within the study.

A score of perceived confidence in nutrition knowledge was also calculated using the self-ranked levels of perceived confidence chosen by participants. The scoring system awarded is shown in table 1 below.

Table 1: Perceived confidence responses and corresponding scores

Perceived confidence response	Score awarded
Extremely confident	4
Somewhat confident	3
Neutral	2
Not confident	1

Perceived and demonstrated nutrition knowledge were compared using the total knowledge score alongside the self-reported confidence measure.

3.4.2 Qualitative data analysis

Participant responses to the open questions 7, 10, 12, 14 and 19 and the transcripts from semi-structured interviews were separately analysed qualitatively.

The first four of the questionnaire questions asked participants to provide specific examples of foods and fluids consumed pre, during or post-match. These responses were coded into categories, such as carbohydrate-based foods, protein-based foods, confectionery, sports drinks, water and other beverages. Question 19 was an open-ended question which provided broader qualitative data regarding participants' views on nutrition for recreational tennis players and areas in which they would like further information.

The majority of the qualitative data for the study was obtained from semi-structured interviews. The six stages of thematic analysis informed by Braun and Clarke (2006) were used to analyse the qualitative responses, grouping responses into themes and sub-themes. Illustrative quotes were used to provide examples within the themes. Thematic analysis provides a flexible approach for identifying and interpreting patterns within qualitative data (Byrne, 2021). The analysis involved:

1. *familiarisation with participants' responses;*
2. *generation of initial codes;*
3. *identification of themes within the responses;*
4. *reviewing and grouping potential themes;*
5. *defining and naming themes; and*
6. *using illustrative quotes to demonstrate themes and provide a narrative for findings.*

Themes were informed by participants' responses rather than using a predetermined thematic framework. However, the research objectives and questionnaire structure did provide context for interpretation of the data.

Due to the relatively small number of participants and the short-form nature of the open-ended responses, the qualitative analysis was intended to provide context and depth to the quantitative findings rather than act as a standalone in-depth qualitative investigation.

3.5 Ethical considerations

Ethical approval for the study to go ahead was sought from and provided by the University of Wales Trinity St David ethics committee. Participants were provided with an information sheet on the front page of the questionnaire which explained the purpose of the research and how data obtained would be used and a consent form accompanied semi-structured interviews. Completion of the questionnaire was voluntary and participants were required to provide informed consent before proceeding. Participants were informed that they could choose not to answer questions where this was permitted by the questionnaire design. No unnecessary personally identifiable information was collected.

Chapter 4: Results

Results and thematic analysis from the questionnaire and semi-structured interviews are presented in the following chapter.

4.1: Questionnaire results

Results from the questionnaire have been extrapolated and presented below and broken down by section to include both statistical and thematic analysis.

4.1.1: Participant characteristics

A breakdown of participant age and gender is shown in table 2 below.

Table 2: Age and gender of participants

		Participant age range				
	All ages	18 – 24	25 – 34	35 – 44	45 – 54	55+
All participants	100% (n=48)	10% (n=5)	19% (n=9)	21% (n=10)	33% (n=16)	17% (n=8)
Female	48% (n=23)	9% (n=2)	0% (n=0)	39% (n=9)	26% (n=6)	26% (n=6)
Male	52% (n=25)	12% (n=3)	36% (n=9)	4% (n=1)	40% (n=10)	8% (n=2)

4.1.2: Frequency and length of time playing tennis

The length of time and frequency of match play by participants is displayed in tables 3 and 4 below.

Table 3: Length of time participants have played tennis

How long participants have played tennis for	Number of participants
Less than 1 year	4% (n=2)
1 – 5 years	29% (n=14)
More than 5 years	15% (n=7)
More than 10 years	52% (n=25)

Over half of participants had played tennis for over 10 years, with nearly all participants having one year or more experience playing tennis (98%, n=46).

Table 4: How often participants play tennis

How often participants play tennis per week	Number of participants
Once per week	29% (n=14)
2 - 3 times per week	56% (n=27)
4 times or more per week	15% (n=7)

Figure 1 demonstrates the length of time that participants would typically spend on court during a match.

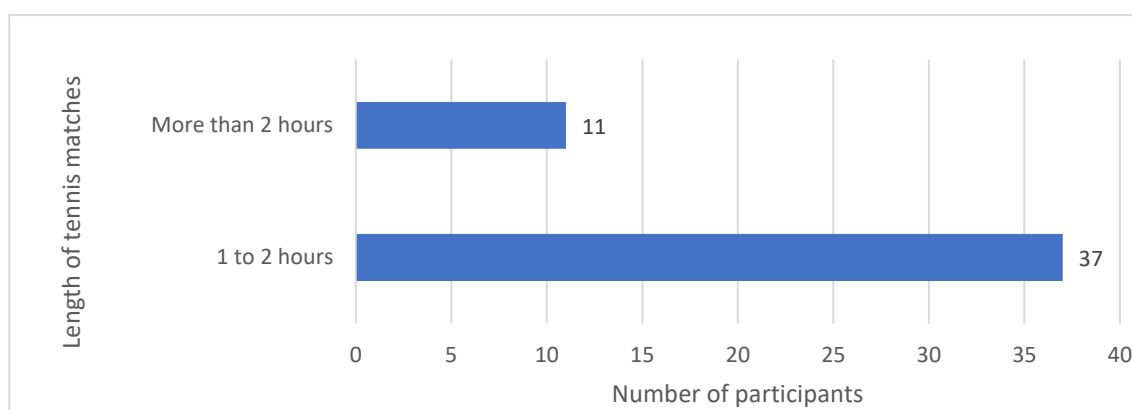


Figure 1: Typical reported length of tennis matches

The majority of participants reported typically partaking in tennis matches that last between one to two hours in length, with 77% (n=37) of those surveyed choosing this option.

4.1.3: Professional advice and pre, during and post-match nutrition and hydration practices

One participant (2%) reported currently receiving nutrition advice from a sports nutritionist. The tables and figures below provide a summary of reported participant nutrition and hydration habits pre, during and post-match. Participants were also asked to share what food and fluid options they would typically choose if they were to consume food and fluids pre, during or post-match play. Responses underwent thematic analysis and the results are presented below.

The frequency with which participants ate pre-match, if at all, is shown in figure 2 below.

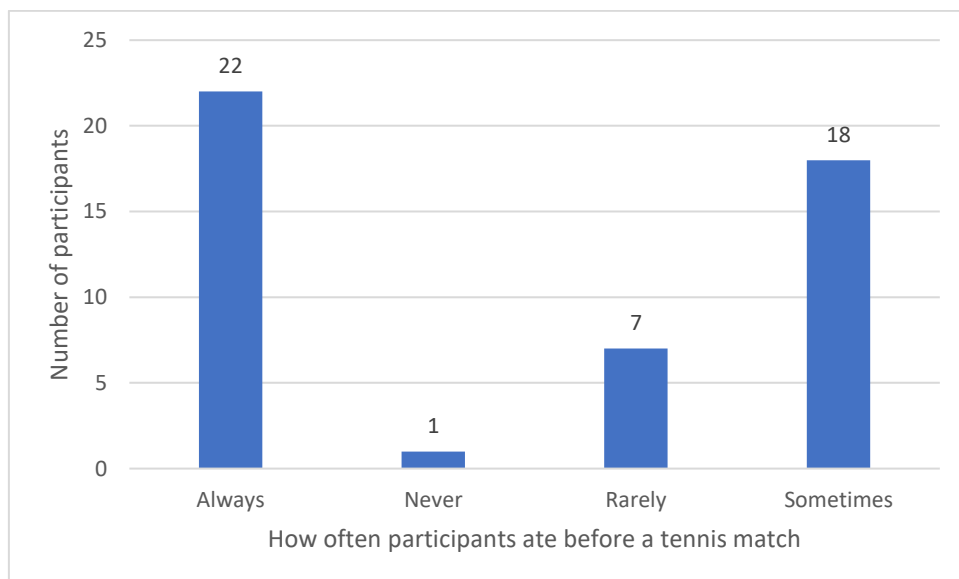


Figure 2: Frequency of food ingestion before a tennis match

46% (n=22) of participants reported always consuming food prior to a tennis match. One participant selected the option of never eating prior to a match in this question. However, when the subsequent question sought to establish typical timings of food consumption before play for those that did eat something, an additional four

participants chose the option “I don’t eat before a match”. Each of these participants had chosen “rarely” on the current question. With this in mind, it could therefore be put forward that 10% of participants (n=5) did not consume food prior to tennis matches.

Timings of ingestion of food pre-match varied between participants, as demonstrated in table 5.

Table 5: Timing ranges of food consumption pre-match

Timing of pre-match food intake	Number of participants
I don’t eat before a match	10% (n=5)
Less than 1 hour before play	17% (n=8)
1 – 2 hours before play	60% (n=29)
2 – 3 hours before play	13% (n=6)

The one participant who was receiving sports advice from a nutritionist reported always eating one to two hours before a match.

All responses from participants who did eat before a match were divided into different food and fluid themes. Of the 43 participants who reported always or sometimes eating prior to a tennis match, four participants left this text-box blank. Of the 39 responses received, 90% (n=35) of participants reported prioritising some form of carbohydrate-containing food in this period. Individual responses varied from naming the macronutrient category to stating specific carbohydrate options. 28% (n=11) of participants explicitly mentioned the word carbohydrate in their response, for example;

“carb-based foods”

The remainder of participants chose carbohydrate containing foods in their response, without explicitly naming the macronutrient carbohydrate. Complex carbohydrates were popular choices, being named by 46% (n=18) of participants, for example;

“Pasta dish or sandwich”

Participant responses also demonstrated an insight into nutrition strategy, with timing of intake and food choices varying depending on the time of the match. One participant stated they would consume:

“A carb rich meal a couple of hours prior, usually a pasta dish for a late lunch, but if I’m playing in the morning, I find oats and blueberries gives me sustained energy. I always have a banana too around 30 minutes before a match, and a double espresso”.

Protein containing meals were chosen by % 10(n=4) of participants for their pre-match nutrition choice. 8% (n=3) of participants explicitly mentioned protein in their response, which included a combination of protein and carbohydrate options for example;

“Salad, wrap or protein shake”

48% (n=23) of participants reported consuming food during a tennis match. An independent t-test was used to identify if there was a relationship between participants who reported eating during tennis matches and the length of matches played; this was found to be statistically significant (Independent t-test, $p=0.05$, $t=-2.701$, $df=46$).

All participants who ate during a match reported choosing at least one carbohydrate containing option. A banana, either on its own or accompanied by another food, was the most popular choice with 70% (n=16) of participants choosing this, for example;

“Banana and dates”

One participant described the reason behind their choice of food;

“Sometimes I will eat a banana if I’m struggling with energy esp if it’s a long match”

35% (n=8) of participants listed an everyday confectionary item (sweets or chocolate) as their in-match food choice, for example;

“Wine gums or similar”

Different types of “bars” or “flapjacks” were mentioned as in-game nutrition options by 26% (n=6) of participants. It was not specified if these were pre-made or homemade, nor what specific ingredients they contained other than;

“protein bar”

Nuts were chosen alongside a carbohydrate containing food as a during-play snack by 13% (n=3) of participants who consumed food at this time, for example:

“mix of nuts and raisins”

No participants consumed nuts alone as a snack during a tennis match.

Post match nutrition habits were explored by asking if participants took on any nutrition during this time, and if so, during what timescale. This data is displayed in Figure 3. Choices of pre-determined food and fluid selections during this time are recorded in table 6.

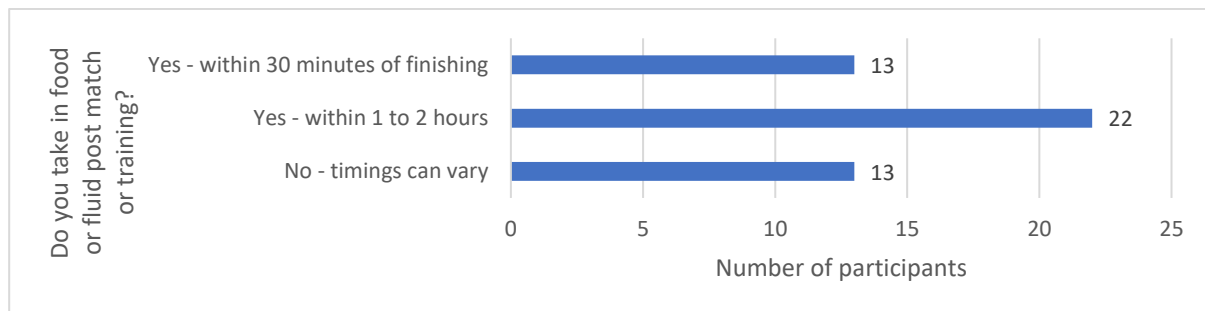


Figure 3: Reported post-match/ training nutrition and hydration behaviours

Table 6: Reported post-match nutrition and hydration food and fluid choices

Typical food/ fluid choices post-match	Number of participants
I don't consume anything after matches	15% (n=7)
Water	13% (n=6)
Protein Shake	2% (n=1)
Carbohydrate based meal (pasta, bread, potato, porridge, cereal)	31% (n=15)
Protein based meal (meat, fish, yoghurt, eggs)	31% (n=15)
Other	8% (n=4)

Meals containing carbohydrates or protein were the most popular choices for taking in nutrition during the post-match period. For participants who selected “other”, responses were vague, for example; “normal meal” or “whatever I fancy”.

Hydration habits were explored through a question which asked participants how often they took on fluid during a tennis match, and what their fluid of choice would be.

Frequency of fluid intake is detailed in table 7 and fluid choices are shown in table 8.

Table 7: Timing and frequency of in-match fluid intakes

Frequency of fluid intake	Number of participants
I rarely drink during matches	4% (n=2)
When I feel thirsty	15% (n=7)
Once or twice per set	8% (n=4)
At changeover times	73% (n=35)

Table 8: In-match fluid choices

Fluid options	Number of participants
Water	71% (n=34)
Electrolyte drinks/ dissolvable tablets	15% (n=7)
Commercial sports drinks	8% (n=4)
Other	6% (n=3)

A large proportion of participants selected water as their hydration choice during tennis matches, with 71% (n=34) choosing this. The household drink squash was reported as an in-match fluid choice by the participants who selected “other” hydration options.

Participants also reported combining different hydration choices using the optional text box;

“I take both a bottle of water and a bottle of high 5 electrolyte powder drink with me and drink the water for the first half hour-hour, and then the high 5”.

4.1.4: Sources of nutrition information and ease of access

Participant responses to the ease with which they were able to access nutrition information appropriate and specific to their needs as a tennis player is summarised in table 9 below. Participants were subsequently asked which sources they would turn to if they were to look for nutrition advice.

Table 9: Ease and relevance of obtaining nutrition information

Participant response	Number of participants
Yes	25% (n=12)
No	25% (n=12)
This is not something I look for	50% (n=24)

Half of participants stated that nutrition advice for tennis performance was not something they would actively seek out.

“Social media or the internet” was the most popular response to where one would look for nutrition information, with 67% (n = 32) of participants selecting this option (either alone or in combination with other sources).

“Friends or teammates” was the second most popular nutrition source chosen, with 29% (n=14) of participants selecting this option. Tennis coaches were selected by 13% (n=6) of participants as a trusted source of nutrition information, whilst 8% participants (n = 4) selected a sports nutritionist/ dietitian as their chosen information source. One participant mentioned “AI” as a source of nutrition information.

One participant stated on the questionnaire that they were a qualified sports nutritionist themselves. This was not known to the researcher ahead of completion of the questionnaire.

As participants were able to select more than one option, the above data includes responses from participants who chose single and multiple options.

4.1.5: Nutrition knowledge and confidence

The role of carbohydrates in energy provision during tennis and the role of protein in recovery post-match were the most well-known nutrition statements. Table 10 provides a summary how many participants correctly identified whether each nutrition statement was true or false.

Table 10: Number of participants who correctly answered nutrition knowledge questions

Nutrition statement	Number of participants
Consuming carbohydrates before tennis matches is important to maintain energy levels (true)	92% (n=44)
Protein intake immediately after a match helps to promote recovery (true)	90% (n=43)
It is sufficient to only consume water during matches longer than 2 hours, or matches played in the heat (false)	83% (n=40)
Caffeine can help with tennis performance (true)	58% (n=28)
Energy drinks can maintain performance levels during tennis matches (true)	65% (n=31)

Nutrition knowledge scores were calculated for each participant and are summarised in table 11. 35% (n=17) of participants correctly answered all five nutrition questions and obtained a nutrition knowledge score of 100%. The mean nutrition knowledge score was 3.9.

Table 11: Breakdown of nutrition knowledge scores

Nutrition knowledge score	Number of participants
100% (5/5)	35% (n=17)
80% (4/5)	27% (n=13)
60% (3/5)	31% (n=15)
40% (2/5)	4% (n=2)
20% (1/5)	2% (n=1)
0% (0/5)	0

An age breakdown of the participants who obtained a nutrition knowledge score of 100% is shown in figure 4.

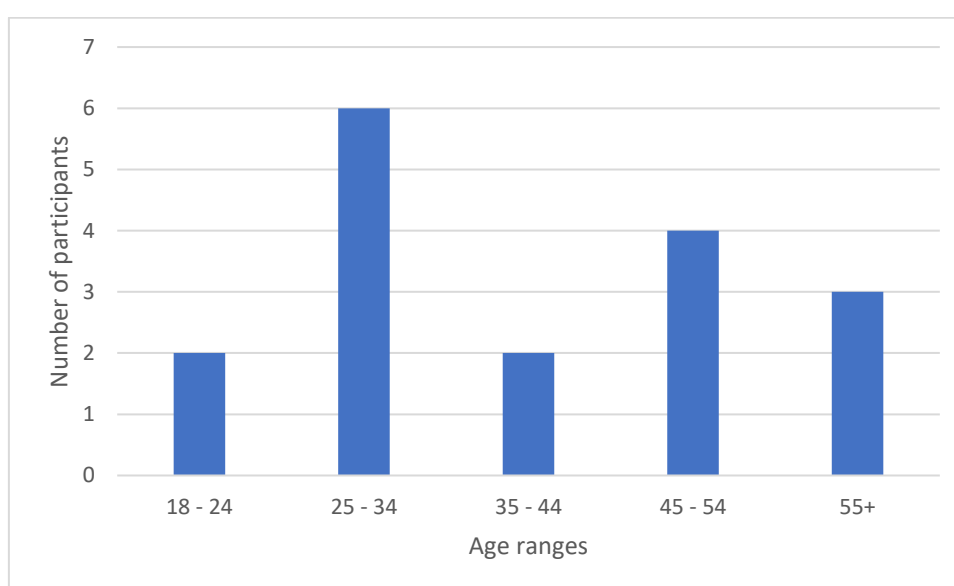


Figure 4: Participants who obtained a 100% nutrition knowledge score broken down by age.

Participants in the 25 – 34 age range made up 19% of total participants, with this percentage increased to 35% of participants who answered all nutrition knowledge questions correctly. This was not shown to be of statistical significance (Kruskal-Wallis H Test, $p=0.438$).

Mean nutrition knowledge scores were compared between different cohorts of players to assess potential statistical significance of data. Firstly, it was examined if the length of time playing had any impact on nutrition knowledge, as shown in table 12 below.

Table 12: A comparison of length of time playing tennis and nutrition knowledge scores

Length of time playing tennis	Mean nutrition knowledge score
Less than 1 year	80%
1 – 5 years	80%
More than 5 years	76%
More than 10 years	79%

No significant relationship was found between the length of time playing tennis and nutrition knowledge scores (Kruskal Wallace, $p=0.787$)

Reported eating behaviours were compared with nutrition knowledge scores to examine if there was a relationship between eating during tennis matches and levels of nutrition knowledge, as summarised in table 13.

Table 13: A comparison of nutrition knowledge scores and in-match nutrition intake

Participants who ate during tennis matches	Mean nutrition knowledge score
Yes	74%
No	75%

No significant relationship was found between nutrition knowledge scores and whether participants reported eating during tennis matches (Mann Whitney, $p=0.386$).

Nutrition knowledge scores were also compared between male and female participants and are presented in table 14.

Table 14: A breakdown of nutrition knowledge scores by gender

Gender	Mean nutrition knowledge score
Male	83%
Female	72%

Male participants demonstrated higher mean nutrition knowledge scores than that of females. This was shown to be statistically significant (Independent t-test, $p = 0.030$, $t = -1.933$, $df = 46$).

A perceived confidence score was calculated for each participant based on whether they felt extremely, somewhat, or not confident, or neutral in terms of their existing sports nutrition knowledge for tennis. The mean perceived confidence score was 2.1. The participant who obtained sports nutrition advice from a professional obtained a nutrition knowledge score of 80% and a perceived confidence score of 3.

A Spearman's Rank Correlation test was carried out to examine the relationship between nutrition knowledge scores and perceived confidence in nutrition knowledge. No statistically significant relationship was found (Spearman's rho, $p=0.070$).

4.1.6: Additional Information

Participants were asked an optional question to find out if there was a specific area of nutrition advice for tennis performance that they would like to know more about, or if they had any comments to share on nutrition advice for tennis performance. 6% of participants ($n=3$) opted to fill out this question.

Responses expressed uncertainty around timing of "nutrition during a match" and another that they found nutrition a "minefield" with a "lack of guidance online" as a barrier to information. One participant used this question as an opportunity to share their existing knowledge on nutrition for tennis performance.

4.2: Semi-structured interview results and analysis

Participants (n=3) reported viewing nutrition as a means to support general health, not from a sport or tennis specific standpoint, and that their interpretation of eating well was centred around a balanced diet for health, not a dietary approach to fuel and support athletic performance;

“It means, having a balanced diet with lots of good proteins, some complex carbs, lots of veggies, lots of different colours...And eating three meals a day with a couple of snacks.”

Participants described their nutrition practices pre-match as a tool to avoid feeling “low in energy” or “hungry”, rather than utilising nutrition behaviours as a way to enhance performance. All participants reported eating prior to matches, with timings varying depending on work or home-life schedules. The role of carbohydrate foods in energy provision was acknowledged by one participant who stated they would consume;

“a sandwich an hour or so beforehand to keep me going”

No participants used sports specific supplements as ergogenic aids. All participants did consume nutritional supplements, stating that these were informed by specific health concerns, and in some cases recommended by a healthcare professional, for example;

“probiotics....from a nutritionist”

and

“I take plant sterols as I was told my cholesterol was on the high side. I also take a meno-something supplement – it’s for menopause.”

Time constraints and the demands of daily life were identified by two participants as influencing nutrition behaviour. Convenience was identified as being a key consideration when it came to during-match food choices, for example;

“What is in the house, easy to grab and will keep for a while”

During-match food choices were informed by what was available, as well as their impact on sports performance;

“banana or chocolate, or if my partner...has brought something along that she’s made we might share that. Like a flapjack or something to give an energy boost.”

Changes to nutrition habits and thoughts around tennis-specific nutrition were influenced by family members, teammates, and the media;

“I’m more likely to drink electrolytes now than I was previously...My sons drink them, so they are in the house, and the heatwave too. I was conscious of playing in the heat and sweating more.”

and

“...watching tennis on TV you see their different bottles and what they have to eat at the change of ends”

Qualified nutrition professionals were reported as trusted sources of advice by two participants, with another participant stating that family members and the internet would be their go to source for nutrition;

“My sons are into sport and nutrition, and I have always been interested in my health. I suppose I would go online if I wanted to know something specific.”

None of the participants had received sports nutrition advice from a professional, nor was tennis specific nutrition advice something they had proactively looked into, but one participant mentioned that the interview had made him consider putting more thought into nutrition to see if he “might see some improvements in my game”.

Chapter 5: Discussion

Results and thematic analysis are analysed and critically discussed within this chapter.

5.1: Nutrition and hydration pre, during and post tennis matches

90% of participants who did eat prior to matches (n=43) reported consuming carbohydrates during this time. Qualitative responses highlighted complex carbohydrates, such as oats, pasta, rice and bread as popular food choices before tennis matches. Such selections are in line with established sports nutrition recommendations to consume carbohydrate rich meals prior to competition to maintain liver and muscle glycogen stores (Burke, et al., 2011) and reported nutrition practices of recreational tennis players (Fleming, et al., 2018). This behaviour could be shown to demonstrate participant understanding of the importance of adequate carbohydrate intake to support performance and recovery from tennis matches. 92% of participants correctly identified the role that pre-match consumption of carbohydrate food and drinks have in the provision of energy during play, potentially indicating that knowledge is informing nutrition behaviours. Sports specific nutritional strategies were not adopted by the semi-structured interview participants, who broadly viewed nutrition practices as a means to support general health, though they all identified the need to eat prior to match-play to sustain energy levels.

During match play, 48% of participants reported taking on nutrition. Thematic analysis of nutrition practices identified bananas as the single most prevalent food choice within participant responses for in-play nutrition. Such findings are similar to those of *Fleming et al., (2018)*, where 86% of tennis players surveyed cited bananas as the food they would consume during match-play. Bananas are a carbohydrate rich, cheap and easily transportable snack. Furthermore, bananas provide tennis players with potassium which can aid in prevention of cramps (Ranchordas, et al., 2013). Bananas were also identified as a food associated with tennis by all participants who took part in semi-structured interviews, even though one of these participants did not consume bananas themselves before or during matches. The reported frequency of the use of convenient household foods indicates that any practical education on sports nutrition for recreational tennis players should include strategies which are flexible and involve little preparation time.

Sweets were the second most popular choice for in-play consumption. As a high-glycaemic index carbohydrate, sweets can provide players with a supply of glucose which can be rapidly absorbed during tennis matches. Utilising sweets can therefore be an affordable and palatable alternative to commercial sports gels to maintain energy levels during competition (Burke, et al., 2011).

Nuts were mentioned as part of snack that participants would consume during a tennis match, though in all responses they were accompanied by a carbohydrate source rather than eaten in isolation. Nuts are a popular “healthy” snack, though they offer little in terms of tennis performance due to their low carbohydrate content. It may therefore be worthwhile educating recreational tennis players and athletes in general that though a food or fluid may have health benefits or form part of a balanced diet, this does not automatically make it a sound choice for sports performance.

Statistical analysis demonstrated that in-game nutrition intake was related to the length of tennis matches, indicating that match duration could itself be a factor influencing nutrition behaviours; prolonged exertion will increase the need for carbohydrate intake to support longer playing times (Kovacs, 2006).

Over half of participants (n=25) do not take on nutrition during tennis matches. In matches lasting over 60 minutes in length, a lack of carbohydrate ingestion could result in a higher likelihood of impaired performance and increased fatigue (Ranchordas, et al., 2013).

The majority of participants reported consuming food or fluid post-match (n=35), with 27% (n=13) consuming this within 30 minutes, and 46% (n=22) taking on food or fluid within one to two hours. Consuming appropriate foods and fluids during the post-match time window is essential as intermittent, high-intensity activity during match-play depletes glycogen stores and causes damage to muscle cells (Ranchordas, et al., 2013). Targeted consumption of carbohydrate (0.8 – 1.2g/kg/hour) and protein (0.25 – 0.4g/kg/hour) containing foods or fluids during this time can replenish muscle glycogen stores and stimulate muscle protein synthesis (Thomas, et al., 2016). Indeed, this is especially important if players are participating in a multi-day competition where a delay in nutritional intake could impair future performance (Fleming, et al., 2018). Carbohydrate and protein containing meals were equally the most frequently selected post-match meal choices (n=15), with protein shakes were

consumed by one participant. Whilst the majority of participants reported eating within two hours of play, just 27% (n=13) adhered to the recommendations to do so within 30 minutes of stopping play (Vicente-Salar, et al., 2025). The same number of participants (n=13) reported inconsistent timing of post-match nutrition, which highlights a potential area for nutrition education amongst recreational tennis players. Time, planning, and a lack of thought around nutrition strategies for tennis were reported by semi-structured interview participants as factors which affected their nutritional intake post-match. Amongst recreational athletes, inconsistent nutritional intake and timing of intake has been associated with overestimating the adequacy of current dietary intake, and a lack of awareness of the impact of nutrition on performance and recovery (Farran, et al., 2022). Ghrelin levels can temporarily decrease in response to periods of high to moderate intensity exercise, which could explain reduced dietary intake in the immediate post-match period (Anderson, et al., 2024).

During semi-structured interviews (n=3), none of the participants reported the use of supplements to aid in tennis performance or recovery. Supplementation for general health was something all three participants reported, with a focus on gut health and post-menopausal health. This supports existing research which has shown that recreational athletes reported health and wellness as drivers of nutrition and supplement choices, as opposed to athletic performance (Knapik, et al., 2016). Whilst the small qualitative sample size limits external validity of findings and cannot be broadly generalised, the absence of tennis-specific supplementation aligns with quantitative findings from the nutrition knowledge questionnaire (n=48), with just 58% of participants correctly identifying the benefits of caffeine for energy provision during tennis matches. This was the lowest scored correct answer, potentially indicating a gap in recreational athlete knowledge in relation to how ergogenic aids can aid in tennis performance and recovery.

Consumption of water alone was the most popular hydration option during tennis matches. 83% of participants correctly identified that consuming water alone during matches lasting longer than two hours, or matches played in the heat, was an insufficient hydration strategy. The Expert Group Statement on Nutrition in High-Performance Tennis recommends the use of electrolytes to replace losses through sweat and to aid in fluid retention (Vicente-Salar, et al., 2025). Participants who

adopted a dual fuelling strategy, combining water with an electrolyte containing drink, followed this approach. As ingesting electrolytes can enhance fluid absorption without overloading the stomach with fluid, a dual hydration approach can offset fluid and electrolytes lost during sweat without the need to consume high quantities of water or food mid-match (Shirreffs & Sawka, 2011).

5.2: Sources of nutrition information

The most popular nutrition information options were in line with previous research which identified that athletes tended to opt for passive sources of sports nutrition knowledge, including social media, coaches and teammates (Janiczak, et al., 2022).

Pre-existing research on trusted sources of nutrition information amongst athletes in general has demonstrated a high level of trust in sports coaches (Shifflett, et al., 2002). Coaches are not registered nutrition professionals, and nutrition knowledge could vary amongst this cohort. Amongst college sports level coaches, 36% were found to have nutrition knowledge classed as “adequate” (Torres-McGehee, et al., 2012). 13% of participants (n=6) selected a tennis coach as a source of nutrition information. It is acknowledged that the relationship between recreational athletes and their tennis coach may differ somewhat from their professional counterparts due to them not having as much time or involvement on a 1:1 basis with their coach.

Semi-structured interview participants reported not actively engaging with tennis-specific sports nutrition advice, with a reported change in nutritional habit being influenced by a participant’s son using electrolytes and the participant choosing to adopt this hydration strategy as a result.

Half of participants reported that nutrition information was not something they would actively seek out. Such behaviours could be attributed to feeling comfortable with levels of existing knowledge and current nutrition practices, or possibly a lack of interest/ understanding in the specific role that nutrition can have on athletic performance (Janiczak, et al., 2022).

5.3: Nutrition knowledge and perceived confidence

Examination of nutrition knowledge questions showed that participant responses demonstrated the lowest accuracy in relation to the ergogenic effect of caffeine and energy drinks on tennis performance, in comparison to the impact of macronutrient and hydration on tennis performance and recovery. Through its action as an adenosine receptor antagonist, caffeine has been found to improve sprint times on the tennis court (Poire, et al., 2019) and have some improvement in shot accuracy (Klein, et al., 2013). Energy drinks often contain caffeine alongside carbohydrates and the amino acid taurine, containing a formulation to improve metabolic and cognitive function during physical activity (Fye, et al., 2021). It may therefore be advisable for nutrition professionals to include the potential benefits of caffeine and energy drinks when advising recreational tennis players on all aspects of nutrition specific to tennis, whilst acknowledging the potential impact of these ergogenic aids on elevated heart rate and impaired sleep quality, dependant on dosage and timing of ingestion. Ensuring optimal and appropriate dosing practices could help to overcome potential side effects.

No relationship was identified between nutrition knowledge scores and reported nutrition behaviours. Previous research has identified that factual understanding of nutrition does not automatically translate into the adoption of evidence-based nutritional recommendations for sport (Janiczak, et al., 2022). Within recreational tennis, a number of factors could influence nutrition behaviours other than nutrition knowledge, such as time, or lack thereof, dietary preference and long-term dietary habits.

Similarly, no significant relationship was identified between nutrition knowledge scores and perceived participant confidence in their own nutrition knowledge. This differs from previous research where self-perceived competence in nutrition practices has previously been linked with lower levels of nutrition knowledge (Farran, et al., 2022).

Of interest, the participant who obtained nutrition advice from a sports nutritionist had a nutrition knowledge score of 80% and ranked their perceived confidence in their nutrition knowledge as “somewhat confident”, despite access to a qualified professional.

Statistical analysis showed a significant difference in nutrition knowledge scores between males and female. This differs to previous systematic review research

amongst broader athlete populations, the findings of which suggested that gender did not affect nutrition knowledge (Trakman, et al., 2016). Gender-specific variations in nutrition knowledge have been identified as variable and sports-specific, influenced by factors including resource accessibility and females receiving nutrition advice more focused on energy restriction (Trakman, et al., 2016).

5.4: Limitations of the study

Despite the practical advantages of an online questionnaire, potential limitations of this approach require acknowledgement. Self-selection bias amongst participants is an important consideration (Jones & Attia, 2017). Individuals chose whether to participate after receiving the questionnaire, meaning that those with a particular interest in nutrition, health or sport may have been more likely to respond.

The study also relied on self-reported nutritional practices. Participants were asked to report what foods and fluids they consumed pre, during and post tennis matches rather than having their dietary intake objectively assessed by means of a food diary. Recall error and social desirability bias may therefore have influenced responses (Hébert, et al., 1995).

Semi-structured interview participant numbers were extremely low (n=3), which limits external validity of findings. It is acknowledged however that qualitative research is not broadly generalisable (Glaser & Straus, 1967).

The questionnaire was adapted from the validated Trakman questionnaire and is not a validated nutrition knowledge questionnaire itself.

The research was undertaken alongside full-time employment, creating constraints on the time and resources available to the principal researcher. Utilising an online questionnaire reduced the resources required for recruitment and data collection, but the limited timeframe available restricted opportunities for larger-scale recruitment and more extensive qualitative investigation.

One participant reported being a qualified sports nutritionist themselves which would be expected to influence nutritional practices when playing tennis. For future research on this topic, it could be worthwhile excluding qualified nutrition professionals from

studies as they will possess a higher level of knowledge as a result of studies and employment undertaken.

Chapter 6: Conclusion

The aim of this study was to explore nutrition knowledge, habits, and trusted sources of nutrition information amongst recreational tennis players. Additionally, the study sought to examine how knowledge translated into nutrition behaviours in practice.

Participants involved in the study had experience of playing tennis of less than one year to over ten years. Despite this variable tennis experience, 90% of participants followed evidence-based tennis specific nutrition guidelines for the pre-match period and reported taking in nutrition prior to play. This fell to 48% for in-play nutrition, revealing potential gaps in nutrition knowledge. This could, however, be attributed to the shorter match length of recreational players when compared with elite counterparts, at whom the majority of tennis-specific nutrition recommendations are aimed.

In line with existing research, sound awareness of the importance of carbohydrate intake to fuel athletic performance was displayed throughout questionnaire responses, with 92% of participants correctly identifying carbohydrate intake as essential for energy provision, and carbohydrate foods being by far the most popular pre-match food choice (90% of participants who reported eating before a tennis match reported carbohydrate-heavy choices).

Reported in-play and post-match nutrition habits revealed potential gaps in nutrition knowledge and showed a prevalence of household snack choices as chosen options, rather than sports specific gels, drinks or recovery shakes. Under half of participants reported taking on nutrition during a tennis match (47%). Bananas were the most popular in-play refuelling option, followed by sweets.

73% of participants consumed food in the post-match period, though just 27% of these participants took on nutrition in the 30 minutes post-play. As above, this could be attributed to shorter match play, or alternatively dulled hunger signals in the post-exercise period.

Responses mentioned household foods as fuelling options, and highlighted time constraints and the ease of availability of foodstuffs and information as factors influencing nutrition behaviours. This indicates that any nutrition intervention to support recreational tennis players needs to have practicality and convenience at its core and

focus on accessible food and fluid options. It would also be worthwhile to highlight the importance of taking on carbohydrate and protein sources in the 30 minutes post-match to optimise recovery. Including coaching staff and ensuring that information is available on social media channels is likely to support the dissemination and retention of any nutrition recommendations shared, as these were identified as the primary sources of nutrition information amongst participants.

No significant relationship was identified between perceived confidence in nutrition knowledge and nutrition knowledge scores, or dietary behaviours. This could indicate that understanding alone cannot be used as a predictor of dietary practices. `

The small semi-structured interview sample size limits the external validity of these qualitative findings, and any future research should aim to include a higher number of participants.

Future research on the nutrition habits and understanding of recreational tennis players would be useful to seek to validate any relationship between gender and nutrition knowledge across a larger cohort of participants. Doing so would enable targeted nutrition education to be formulated if such a disparity is identified. This study looked at general eating habits, rather than a specific dietary recall. The latter would provide information on the amount of carbohydrate consumed, which could aid in further analysis of dietary habits of recreational tennis players, and enable comparisons with recommended carbohydrate ingestion.

To conclude, recreational tennis players possess knowledge of the basic tenets of sports nutrition, namely the importance of carbohydrate ingestion to fuel activity. In- and post-match practices were more variable and displayed a limited knowledge of nutrition timing and ergogenic aids. Focusing on actionable strategies could enable sports nutritionist to better support the performance and recovery of recreational tennis players.

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Appendix 1: Copy of MS forms questionnaire

Nutrition literacy and practices of competitive recreational tennis players

This is an invitation to you to join the study, and to let you know what this would involve. The study is being organised by Heidi Cleaver, a Sports and Exercise MSc student at University of Wales, Trinity St David. The data is being collected between December 2025 to February 2026.

What is the purpose of the study?

To gain an understanding of sports nutrition knowledge and nutrition practices of recreational tennis players/ racquet sports players who play at a competitive level.

Why have I been invited to participate?

We are asking adults aged 18 and over to take part who play tennis at a competitive level recreationally.

Do I have to take part?

Taking part in the project is entirely voluntary. If you decide to join the study you can change your mind and stop part way through the completing the questionnaire. If you choose to complete the questionnaire in full, you are consenting to take part in the research.

What will participation involve?

If you agree to join the study, then we will ask you to complete a questionnaire about your sports nutrition knowledge and nutritional choices you make whilst training, competing and recovering. We think this would take you about 5 minutes to complete.

Are there any risks associated with taking part?

We do not think there are any significant risks if you take part in the study. The project has received ethical approval from Ethics Committee of University of Wales, Trinity St David.

Are there any benefits from taking part?

There are no direct benefits to you for taking part.

What happens to the results of the research project?

All the information from the study will be put into a computer programme and analysed. The research will be used to complete a dissertation.

How will my data and my privacy be protected?

All the information we get from you is anonymous, and everyone working on the study will respect your privacy. At the end of the study, we will destroy the information we have gathered.

If you have any queries, please contact the researcher, Heidi Cleaver, via email on 2215987@student.uwtsd

Thank you for taking the time to read this.

When you submit this form, it will not automatically collect your details like name and email address unless you provide it yourself.

1.How long have you played tennis for?

Less than 1 year

1 to 5 years

More than 5 years

More than 10 years

2.How many times per week do you play tennis (including training and matches)

Once per week

2 - 3 times per week

4 or more times per week

3.How long do your tennis matches typically last?

Less than 1 hour

1 to 2 hours

More than 2 hours

4.Do you currently receive sports nutrition advice from a professional?

Yes - sports nutritionist/ dietitian

Yes - coach

No

5.Do you eat before playing a tennis match?

Always

Sometimes

Rarely

Never

6.How long before playing would you eat?

Less than 1 hour

1 - 2 hours

2 - 3 hours

I don't eat before a match

7.If you do eat or drink before a match, what type of food would you typically choose?

8.How often do you drink during matches?

When I feel thirsty

At changeover times

Once or twice per set

I rarely drink during matches

9.If you hydrate during tennis matches, what type of drink would you choose?

Water

Sports drink (e.g. Lucozade or Gatorade)

Electrolyte drink/ tablet dissolved into water

Other

10.If you selected other above, please specify your drink choice

11.Do you eat anything during tennis matches?

Yes

No

12.If you answered yes above, what type of snack would you eat during a match?

13.Do you typically eat or drink anything soon after a match or training session?

Yes - within 30 minutes of finishing

Yes - within 1 to 2 hours

No - timings can vary

14.If you do eat or drink soon after a match, what type of things would you have?

Water

Protein shake

I don't eat after matches

Carbohydrate based meal/ snack (pasta, bread, potatoes, porridge, cereal)

Protein based meal/ snack (meat, fish, yoghurt, eggs)

15.How confident do you feel about your nutrition knowledge for tennis performance and recovery from matches?

Extremely confident

Somewhat confident

Neutral

Not confident

16.Where would you typically look for sports nutrition advice or information? Please select all that apply

Sports nutritionist/ dietitian

Tennis coach

Friends or teammates

Professional bodies/ organisations (e.g. Lawn Tennis Association)

Social media or internet

17.Do you find it easy to access sports nutrition information specific to your needs as a tennis player?

Yes

No

This is not something I look for

18.Please state if you think the statements below are true or false

Consuming carbohydrates before tennis matches is important to maintain energy levels

Protein intake immediately after a match helps to promote recovery

It is sufficient to only consume water during matches longer than 2 hours, or matches played in the heat

Caffeine can help with tennis performance

Energy drinks can maintain performance levels during tennis matches

19. Please let us know if you have any comments about nutrition for recreational tennis players, or if there is any area that you would find it useful to know more information about.

20. What is your gender?

Woman

Man

Non-binary

Prefer not to say

21. Which age range applies to you?

18 - 24

25 - 34

35 - 44

45 - 54

55+

22. If you are willing to be contacted by the researcher for a more in depth interview, or have any questions you would like addressed, please leave your email address below.

Appendix 2: Semi-structured interview questions and consent form

- Tell me a bit about tennis - how often you play, train, and compete.
- What does a typical week look like for you outside of tennis?
- When you think about 'eating well', what does that mean to you personally?
- How important do you feel nutrition is for your tennis performance and recovery?
- Has your thinking changed over time?
- Can you talk me through how you usually manage hydration before, during, and after tennis?
- What do you typically eat or drink before training or matches?
- How far in advance do you usually eat?
- What does recovery look like for you after tennis?
- Do you think about protein or timing after sessions?
- Do you take any supplements or sports products? If so, which ones and why?
- Where do you get most of your nutrition information?
- What makes it difficult to follow the nutrition habits you think you 'should' for tennis?
- What helps you stay on track?
- If you imagine an 'ideal' way of eating and drinking for tennis, how close do you feel your current habits are to that?
- Is there anything about nutrition and tennis that we haven't talked about but feels important to you?
- Has anyone ever given you professional nutrition advice for tennis?

INFORMED CONSENT

Recreational tennis player interviews on the topic of nutrition behaviours knowledge

1) I confirm that the full details about the interview process have been explained to me. I am clear about what is involved and I am aware of the purpose. I can also confirm that I had the opportunity to ask questions.

2) I understand that the information I provide will be anonymised.

3) I agree to take part in the interview.

Name of Participant

Signature

Date

.....

.....

.....

Declaration by the student

I can confirm that I have provided information about the interview process which the above participant has consented to.

Student Name

Signature

Date

.....

.....

.....

Appendix 3: Research ethics board approval

APPLICATION FOR ETHICAL APPROVAL

RESEARCH STUDENTS

This form is to be completed by the student within **SIX** months for full-time students and **TWELVE** months for part time students, after the commencement of the research degree or following progression to Part Two of your course.

Once complete, submit this form via the **MyTSD Doctoral College Portal** at (<https://mytsd.uwtsd.ac.uk>).

This document is also available in Welsh.

RESEARCH STAFF ONLY

All communications relating to this application during its processing must be in writing and emailed to pgresearch@uwtsd.ac.uk, with the title 'Ethical Approval' followed by your name.

STUDENTS ON UNDERGRADUATE OR TAUGHT MASTERS PROGRAMMES should submit this form (and receive the outcome) via systems explained to you by the supervisor/module leader.

In order for research to result in benefit and minimise risk of harm, it must be conducted ethically. A researcher may not be covered by the University's insurance if ethical approval has not been obtained prior to commencement.

The University follows the OECD Frascati manual definition of **research activity**: "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". As such this covers activities undertaken by members of staff, postgraduate research students, and both taught postgraduate and undergraduate students working on dissertations/projects.

The individual undertaking the research activity is known as the "principal researcher".

Ethical approval is not required for routine audits, performance reviews, quality assurance studies, testing within normal educational requirements, and literary or artistic criticism.

Please read the notes for guidance before completing ALL sections of the form.

This form must be completed and approved prior to undertaking any research activity.

Please see Checklist for details of process for different categories of application.

SECTION A: About You (Principal Researcher)

1	Full Name:	Heidi Cleaver			
2	Tick all boxes that apply:	Member of staff:	☐	Honorary research fellow:	☐
	Undergraduate Student	☐	Taught Postgraduate Student	☒	Postgraduate Research Student
3	Institute/Academic Discipline/Centre:	University of Wales Trinity St David			

4	Campus:	Carmarthen
5	E-mail address:	2215987@student.uwtsd.ac.uk
6	Contact Telephone Number:	07733790368
For students:		
7	Student Number:	2215987
8	Programme of Study:	Master of Science, Sport and Exercise Nutrition (MSC24-PTMSC-SENU)
9	Director of Studies/Supervisor:	Chris Cashin

SECTION B: Approval for Research Activity

1	Has the research activity received approval in principle? (please check the Guidance Notes as to the appropriate approval process for different levels of research by different categories of individual)	YES	☐	NO	☒
					Date
2	If Yes, please indicate source of approval (and date where known): Approval in principle must be obtained from the relevant source prior to seeking ethical approval	Research Degrees Committee	☐		
Institute Research Committee		☐			
Other (write in)		☐			

SECTION C: Internal and External Ethical Guidance Materials

	Please list the core ethical guidance documents that have been referred to during the completion of this form (including any discipline-specific codes of research ethics, location-specific codes of research ethics, and also any specific ethical guidance relating to the proposed methodology). Please tick to confirm that your research proposal adheres to these codes and guidelines. You may add rows to this table if needed.	
1	UWTSD Research Ethics & Integrity Code of Practice	☐
2	UWTSD Research Data Management Policy	☐
3	<i>[List any other relevant documents here]</i>	☐

SECTION D: External Collaborative Research Activity

If there are external collaborators then you should gain consent from the contact persons to share their personal data with the university. If there are no external collaborators then leave this section blank and continue to section E.

1	Institution	
2	Contact person name	
3	Contact person e-mail address	

4	Is your research externally funded?		YES	☐	NO	☐
5	Are you in receipt of a KESS scholarship?		YES	☐	NO	☐
6	Are you specifically employed to undertake this research in either a paid or voluntary capacity?	Voluntary	YES	☐	NO	☐
7		Employed	YES	☐	NO	☐
8	Is the research being undertaken within an existing UWTSD Athrofa Professional Learning Partnership (APLP)?	If YES then the permission question below does not need to be answered.	YES	☐	NO	☐
9	Has permission to undertake the research has been provided by the partner organisation?	(If YES attach copy) If NO the application cannot continue	YES	☐	NO	☐

Where research activity is carried out in collaboration with an external organisation

10	Does this organisation have its own ethics approval system?	YES	☐	NO	☐
	If Yes, please attach a copy of any final approval (or interim approval) from the organisation (this may be a copy of an email if appropriate).				

SECTION E: Details of Research Activity

1	Indicative title:	Understanding nutrition literacy levels and nutrition practices of recreational tennis players who play at a competitive level.		
2	Proposed start date:	March 2025	Proposed end date:	December 2025
	Introduction to the Research (maximum 300 words per section) Ensure that you write for a <u>Non-Specialist Audience</u> when outlining your response to the points below: <i>Purpose of Research Activity</i> <i>Proposed Research Question</i> <i>Aims of Research Activity</i> <i>Objectives of Research Activity</i> Demonstrate, briefly, how <u>Existing Research</u> has informed the proposed activity and explain <i>What the research activity will add to the body of knowledge</i> <i>How it addresses an area of importance.</i>			
3	Purpose of Research Activity Tennis matches are played year-round in a variety of weather conditions for lengths of time unknown at the commencement of the match, thus placing demands on players in terms of nutrition and fluid intake, both when training and on match days. Research has identified a high range of variability in pre, during and post nutrition habits of tennis players, indicating that further research to enable a more targeted approach would be beneficial. Acquiring an insight into the current sports nutrition knowledge levels and practices of recreational tennis players could enable appropriate nutrition education to be developed with this cohort of athletes in mind to help maximise performance and recovery.			

	(this box should expand as you type)
4	Research Question What is the level of nutrition literacy of recreational tennis players, do they follow specific nutritional practices pre, during and post-game, and if so, are these practices in line with nutrition recommendations? (this box should expand as you type)
5	Aims of Research Activity The aim of this research is to gain an understanding of nutrition literacy levels and nutrition practices of recreational tennis players who play at a competitive level, but are not professional athletes. (this box should expand as you type)
6	Objectives of Research Activity • Understanding participants' nutrition literacy. • Finding out if participants follow a nutrition strategy for training, competition and recovery. • If so, determining if these nutrition strategies are in line with evidence-based guidelines. • Understanding what participants feel would be the best way for nutrition education to be delivered. (this box should expand as you type)
	Proposed methods (maximum 600 words) Provide a brief summary of all the methods that may be used in the research activity, making it clear what specific techniques may be used. If methods other than those listed in this section are deemed appropriate later, additional ethical approval for those methods will be needed. You do not need to justify the methods here, but should instead describe how you intend to collect the data necessary for you to complete your project.
7	A self-administered online questionnaire will be used to investigate the research question. The questionnaire will contain both quantitative and qualitative questions, the majority of which are quantitative. At the end of the questionnaire, an option for participants to be contacted by the researcher for a short interview will be offered for those willing to partake in this. The results of the questionnaire will be coded into numerical form and analysed using SPSS software. Qualitative data will be grouped into themes and thematic analysis carried out using NVIVO software. The questionnaire will be formulated using the validated and updated nutrition for sport knowledge questionnaire (A-NSKQ). Potential participants have been identified within Cardiff Lawn Tennis Club (CLTC) and Beach Tennis UK (BTUK). Participants will be identified and contacted via the head coach of CLTC and a team member of BTUK to ascertain if they would like to participate in the research project. The target sample size is fifty participants. (this box should expand as you type)
	Location of research activity Identify all locations where research activity will take place.

8	Cardiff and online. (this box should expand as you type)
	Research activity outside of the UK If research activity will take place overseas, you are responsible for ensuring that local ethical considerations are complied with and that the relevant permissions are sought. Specify any local guidelines (e.g. from local professional associations/learned societies/universities) that exist and whether these involve any ethical stipulations beyond those usual in the UK (provide details of any licenses or permissions required). Also specify whether there are any specific ethical issues raised by the local context in which the research activity is taking place, for example, particular cultural and/or legal sensitivities or vulnerabilities of participants. If you live in the country where you will do the research then please state this.
9	N/a (this box should expand as you type)

10	Use of documentation not in the public domain: Are any documents NOT publicly available?	NO	☒
		YES	☐
11	If Yes, please provide details here of how you will gain access to specific documentation that is not in the public domain and that this is in accordance with the current data protection law of the country in question and that of England and Wales. (this box should expand as you type)		

	Does your research relate to one or more of the seven aims of the Well-being of Future Generations (Wales) Act 2015?	YES	NO
12	A prosperous Wales	☐	☒
13	A resilient Wales	☐	☒
14	A healthier Wales	☐	☒
15	A more equal Wales	☐	☒
16	A Wales of cohesive communities	☐	☒
17	A Wales of vibrant culture and thriving Welsh language	☐	☒
18	A globally responsible Wales	☐	☒
19	If YES to any of the above, please give details:		
	(this box should expand as you type)		

SECTION F: Scope of Research Activity

	Will the research activity include:	YES	NO
1	Use of a questionnaire or similar research instrument?	☒	☐
2	Use of interviews?	☒	☐
3	Use of focus groups?	☐	☒
4	Use of participant diaries?	☐	☒
5	Use of video or audio recording?	☒	☐
6	Use of computer-generated log files?	☐	☒
7	Participant observation with their knowledge?	☐	☒
8	Participant observation without their knowledge?	☐	☒
9	Access to personal or confidential information without the participants' specific consent?	☐	☒
10	Administration of any questions, test stimuli, presentation that may be experienced as physically, mentally or emotionally harmful / offensive?	☐	☒
11	Performance of any acts which may cause embarrassment or affect self-esteem?	☐	☒
12	Investigation of participants involved in illegal activities?	☐	☒
13	Use of procedures that involve deception?	☐	☒
14	Administration of any substance, agent or placebo?	☐	☒
15	Working with live vertebrate animals?	☐	☒
16	Procedures that may have a negative impact on the environment?	☐	☒
17	Other primary data collection methods. Please indicate the type of data collection method(s) below.	☐	☒
	Details of any other primary data collection method: (this box should expand as you type)		

If NO to every question, then the research activity is (ethically) low risk and **may** be exempt from **some** of the following sections (please refer to Guidance Notes).

If YES to any question, then no research activity should be undertaken until full ethical approval has been obtained.

SECTION G: Intended Participants

If there are no participants then do not complete this section, but go directly to section H.

	Who are the intended participants:	YES	NO
1	Students or staff at the University?	☐	☒
2	Adults (over the age of 18 and competent to give consent)?	☒	☐

3	Vulnerable adults?	☐	☒
4	Children and Young People under the age of 18? (Consent from Parent, Carer or Guardian will be required)	☐	☒
5	Prisoners?	☐	☒
6	Young offenders?	☐	☒
7	Those who could be considered to have a particularly dependent relationship with the investigator or a gatekeeper?	☐	☒
8	People engaged in illegal activities?	☐	☒
9	Others. Please indicate the participants below, and specifically any group who may be unable to give consent.	☐	☒
	Details of any other participant groups: (this box should expand as you type)		

	Participant numbers and source Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?	
10	How many participants are expected?	50 (this box should expand as you type)
11	Who will the participants be?	Members of Cardiff Lawn Tennis Club, Members of Beach Tennis UK, friends of the principal researcher. (this box should expand as you type)
12	How will you identify the participants?	Speaking with the head coach at Cardiff Lawn Tennis Club and a friend who is part of Beach Tennis UK to see if they would be happy to circulate an email briefly describing the research project. For those who are interested in partaking in the questionnaire, they will be sent further information, a consent form, and a link to the online questionnaire. (this box should expand as you type)

	Information for participants:	YES	NO	N/A
13	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
14	Will you tell participants that their participation is voluntary?	☒	☐	☐
15	Will you obtain written consent for participation?	☒	☐	☐
16	Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☐	☐	☒
17	If the research is observational, will you ask participants for their consent to being observed?	☐	☐	☒

18	Will you tell participants that they may withdraw from the research at any time and for any reason?	☒	☐	☐
19	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☒	☐	☐
20	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐	☐
21	Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☒	☐	☐
22	If NO to any of above questions, please give an explanation			
	(this box should expand as you type)			

	Information for participants:	YES	NO	N/A
24	Will participants be paid?	☐	☒	☐
25	Is specialist electrical or other equipment to be used with participants?	☒	☐	☐
26	Are there any financial or other interests to the investigator or University arising from this study?	☐	☒	☐
27	Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☐	☒	☐
28	If YES to any question, please provide full details			
	For those participants that are happy to be contacted for a short semi-structured interview once they have completed the questionnaire, the interviews will be recorded and transcribed by the principal researcher using use of password protected UWSTD teams software to record via phone and laptop. (this box should expand as you type)			

SECTION H: Anticipated Risks

	Outline any anticipated risks that may adversely affect any of the participants, the researchers and/or the University, and the steps that will be taken to address them. If you have completed a full risk assessment (for example as required by a laboratory, or external research collaborator) you may append that to this form.		
1	Full risk assessment completed and appended?	Yes	☐
		No	☒
2	Risks to participants For example: sector-specific health & safety, emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information		
	Risk to participants: 1. Maintaining confidentiality.	How you will mitigate the risk to participants: Anonymise data using code names/ numbers to protect participant identify. Storing data in secure folder on OneDrive. Deleting contact details once interview has been arranged and conducted.	

	2. Concerns in relation to their nutritional knowledge base. <i>(this box should expand as you type)</i>	Using plain language, offering to meet with participant(s) following interviews to debrief or to provide a short presentation to the two tennis clubs on the topic of sports nutrition. <i>(this box should expand as you type)</i>
3	If research activity may include sensitive, embarrassing or upsetting topics (e.g. sexual activity, drug use) or issues likely to disclose information requiring further action (e.g. criminal activity), give details of the procedures to deal with these issues, including any support/advice (e.g. helpline numbers) to be offered to participants. Note that where applicable, consent procedures should make it clear that if something potentially or actually illegal is discovered in the course of a project, it may need to be disclosed to the proper authorities	
	N/a <i>(this box should expand as you type)</i>	
4	Risks to the investigator For example: personal health & safety, physical harm, emotional distress, risk of accusation of harm/impropriety, conflict of interest	
	Risk to the investigator: Low - emotional harm through discussion in interviews. <i>(this box should expand as you type)</i>	How you will mitigate the risk to the investigator: Use of interview guide. <i>(this box should expand as you type)</i>
5	University/institutional risks For example: adverse publicity, financial loss, data protection	
	Risk to the University: Low reputational risk. <i>(this box should expand as you type)</i>	How you will mitigate the risk to the University: Ensure all guidelines from UWSTD ethics guidance are followed. <i>(this box should expand as you type)</i>
6	Environmental risks For example: accidental spillage of pollutants, damage to local ecosystems	
	Risk to the environment: N/a <i>(this box should expand as you type)</i>	How you will mitigate the risk to environment: <i>(this box should expand as you type)</i>

Disclosure and Barring Service				
	If the research activity involves children or vulnerable adults, a Disclosure and Barring Service (DBS) certificate must be obtained before any contact with such participants.	YES	NO	N/A
7	Does your research require you to hold a current DBS Certificate?	☐	☐	☒
8	If YES, please give the certificate number. If the certificate number is not available please write "Pending"; in this case any ethical approval will be subject to providing the appropriate certificate number.			

SECTION I: Feedback, Consent and Confidentiality

1	Feedback What de-briefing and feedback will be provided to participants, how will this be done and when?
	Each team will be offered the opportunity to have a short presentation on sports nutrition in tennis following completion of the research collection. Should participants wish to meet following the interview to debrief and ask questions, the opportunity to do so will be offered. The results of the research can be shared with participants if requested. <i>(this box should expand as you type)</i>
2	Informed consent Describe the arrangements to inform potential participants, before providing consent, of what is involved in participating. Describe the arrangements for participants to provide full consent before data collection begins. If gaining consent in this way is inappropriate, explain how consent will be obtained and recorded in accordance with prevailing data protection legislation.
	A consent form will be included on the first page of the online questionnaire. <i>(this box should expand as you type)</i>
3	Confidentiality / Anonymity Set out how anonymity of participants and confidentiality will be ensured in any outputs. If anonymity is not being offered, explain why this is the case.
	Contact details of participants deleted once interviews have been arranged and conducted. Transcriptions of interviews will be anonymised so no identifiable participant data remains. <i>(this box should expand as you type)</i>

SECTION J: Data Protection and Storage

	Does the research activity involve personal data (as defined by the General Data Protection Regulation 2016 “GDPR” and the Data Protection Act 2018 “DPA”)?	YES	NO
1	“Personal data” means any information relating to an identified or identifiable natural person (‘data subject’). An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person. Any video or audio recordings of participants is considered to be personal data.	x	☐
	If YES, provide a description of the data and explain why this data needs to be collected:		
2	Audio recording of participant to enable transcription of interview. <i>(this box should expand as you type)</i>		
	Does it involve special category data (as defined by the GDPR)?	YES	NO
3	“Special category data” means sensitive personal data consisting of information as to the data subjects’ – (a) racial or ethnic origin, (b) political opinions, (c) religious beliefs or other beliefs of a similar nature,	☐	x

21	If YES to any question, please provide full details, explaining how this will be conducted in accordance with the GDPR and Data Protection Act (2018) (and any international equivalents, where appropriate):		
	Recordings transcribed then saved to secure one drive folder. All contact details (email addresses/ telephone numbers) will be deleted once the questionnaire has been sent out and interviews arranged. <i>(this box should expand as you type)</i>		
22	List all who will have access to the data generated by the research activity:		
	Myself only. <i>(this box should expand as you type)</i>		
23	List who will have control of, and act as custodian(s) for, data generated by the research activity:		
	Myself only. <i>(this box should expand as you type)</i>		
24	Give details of data storage arrangements, including security measures in place to protect the data, where data will be stored, how long for, and in what form. Will data be archived – if so how and if not why not.		
	All audio recording and transcribed interviews will be stored on the university one drive in a password protected folder. All data will be deleted once the research project has been concluded and written up. <i>(this box should expand as you type)</i>		
25	Please indicate if your data will be stored in the UWTSD Research Data Repository (see https://researchdata.uwt.ac.uk/). If so please explain. <i>(Most relevant to academic staff)</i>		
	N/a <i>(this box should expand as you type)</i>		
26	Confirm that you have read the UWTSD guidance on data management (see https://www.uwt.ac.uk/library/research-data-management/)	YES	☒
27	Confirm that you are aware that you need to keep all data until after your research has completed or the end of your funding	YES	☒

SECTION K: Declaration

	The information which I have provided is correct and complete to the best of my knowledge. I have attempted to identify any risks and issues related to the research activity and acknowledge my obligations and the rights of the participants. In submitting this application I hereby confirm that I undertake to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice which is published on the website: https://www.uwt.ac.uk/research/research-ethics/		
1	Signature of applicant:	H I Cleaver	Date: 11/02/2025

For STUDENT Submissions:

2	Director of Studies/Supervisor:	Dr Chris Cashin	Date: 13/02/2025
3	Signature:	C.Cashin	

For STAFF Submissions:

4	Academic Director/ Assistant Dean:		Date:
5	Signature:		

Checklist: Please complete the checklist below to ensure that you have completed the form according to the guidelines and attached any required documentation:

☒	I have read the guidance notes supplied before completing the form.
☒	I have completed ALL RELEVANT sections of the form in full.
☒	I confirm that the research activity has received approval in principle
☐	I have attached a copy of final/interim approval from external organisation (where appropriate)
☐	I have attached a full risk assessment (where appropriate) ONLY TICK IF YOU HAVE ATTACHED A FULL RISK ASSESSMENT
☒	I understand that it is my responsibility to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice.
☒	I understand that before commencing data collection all documents aimed at respondents (including information sheets, consent forms, questionnaires, interview schedules etc.) must be confirmed by the DoS/Supervisor, module tutor or Academic Director.

RESEARCH STUDENTS ONLY

Once complete, submit this form via the **MyTSD Doctoral College Portal** at (<https://mytsd.uwtsd.ac.uk>).

RESEARCH STAFF ONLY

All communications relating to this application during its processing must be in writing and emailed to pgresearch@uwtsd.ac.uk , with the title 'Ethical Approval' followed by your name.

STUDENTS ON UNDERGRADUATE OR TAUGHT MASTERS PROGRAMMES should submit this form (and receive the outcome) via systems explained to you by the supervisor/module leader.

Appendix 4: Codes from thematic analysis of questionnaire

Pre-match intake	THEME	Sub-theme	Quote
	Prioritise carbohydrate intake	Starchy carbohydrate	<i>"Carb based foods" (P14)</i>
			<i>"Pasta, something Carby" (P38)</i>
			<i>"High carbs" (P20)</i>
		Balanced meal containing carbohydrates	<i>"Chicken with rice or pasta" (P13)</i>
			<i>"Pasta, vegetables meat" (P48)</i>
			<i>"Balanced whole food meal" (P6)</i>
	Protein source	N/a	<i>"Salad wrap or protein shake" (P37)</i>
	Optimising nutrition timing	N/a	<i>"A carb rich meal a couple of hours prior, usually a pasta dish for a late lunch, but if im playing in the morning, I find oats and blueberries gives me sustained energy. I always have a banana too around 30 minutes before a match, and a double espresso" (P23)</i>
			<i>"Usually porridge because it keeps me going for a long time or pasta if it's in the evening" (P30)</i>

During match intake	THEME	Sub-theme	Quote
	Carbohydrate source	Banana-centric choice	<i>"Banana" (P9, P11)</i>
			<i>"Banana or cereal bar" (P32)</i>
			<i>"Bananas, chocolate bar" (P27)</i>
		Fast-release sugar	<i>"Wine gums or similar" (P40)</i>
		Combination	<i>"Banana/ jellybabies" (P45)</i>
			<i>"Banana or candy kittens" (P44)</i>
	Protein source	N/a	<i>"Protein bar" (P37)</i>
	Nuts	N/a	<i>"Mix of nuts and raisins" (P12)</i>
	Optimising nutrition timing	N/a	<i>"Sometimes I will eat a banana if I'm struggling with energy esp if it's a long match" (P30)</i>

Appendix 5: SPSS codebook

Variable name in full	Variable name, shortened for SPSS	Coding instructions
Q1 Tennis experience	Exp	1 = less than 1 year 2 = 1-5 years 3= more than 5 years 4 = more than 10 years
Q2 Tennis frequency	Freq	1 = Once per week 2= 2-3 times per week 3= 4 or more times per week
Q3 Length of games	Time	1= 1 – 2 hours 2= More than 2 hours
Q4 Receiving nutrition advice from a professional	Prof	0=No 1=Yes
Q5 Eating before a tennis match	Prematch	1=Never 2=Rarely 3=Sometimes 4=Always
Q6 How long before playing and eating	Length	0=I don't eat before a match 1=Less than 1 hour 2=1 – 2 hours 3=2 – 3 hours
Q8 Drinking during a match	Hydrafreq	1=Rarely 2=When I feel thirsty 3=Once or twice per set 4=At changeovers
Q11 Eating during a match	During	0=No 1=Yes
Q13 Eating after a match	Postmatch	1=No 2=Within 1-2 hours 3=Within 30 minutes
Q15 Perceived confidence in nutrition knowledge	Confidence	1= Not confident 2= Neutral 3= Somewhat confident 4= Extremely confident
Q17 Ease of access of nutrition knowledge	Ease	1=Yes 2=No 3=This is not something I look for
Q18 Consuming carbohydrates before tennis matches is important to maintain energy levels	CHO	0=False 1=True
Q18 Protein intake immediately after a match helps to promote recovery	PRO	0=False 1=True
Q18 It is sufficient to only consume water during matches longer than 2 hours, or matches played in the heat	WATER	0=False 1=True

Variable name in full	Variable name, shortened for SPSS	Coding instructions
Q18 Caffeine can help with tennis performance	CAFF	0=False 1=True
Q18 Energy drinks can maintain performance levels during tennis matches	ENERGY	0=False 1=True
Nutrition knowledge score	Score	5=100% 4=80% 3=60% 2=40% 1=20%
Q20 Gender	Gender	0=female 1=male
Q21 Age range	Agegroup	1=18-24 2=25-34 3=35-44 4=45-54 5=55+

Appendix 6: SPSS outputs

Hypothesis Test Summary

	Null Hypothesis	Test	Sig. ^{a,b}	Decision
1	The distribution of Knowledge is the same across categories of Exp.	Independent-Samples Kruskal-Wallis Test	.787	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig. ^{a,b}	Decision
1	The distribution of Knowledge is the same across categories of During.	Independent-Samples Mann-Whitney U Test	.386	Retain the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Independent Samples Test									
t-test for Equality of Means									
		t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				One-Sided p	Two-Sided p			Lower	Upper
Time	Equal variances assumed	-2.701	46	.005	.010	-.311	.115	-.543	-.079
	Equal variances not assumed	-2.641	33.746	.006	.012	-.311	.118	-.551	-.072

Independent-Samples Kruskal-Wallis Test

Knowledge across Agegroup

Independent-Samples Kruskal-Wallis Test Summary

Total N	48
Test Statistic	3.771 ^a
Degree Of Freedom	4
Asymptotic Sig.(2-sided test)	.438

a. The test statistic is adjusted for ties.

Independent Samples Test

		t-test for Equality of Means							
		t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				One-Sided p	Two-Sided p			Lower	Upper
Knowledge	Equal variances assumed	-1.933	46	.030	.059	-.551	.285	-1.125	.023
	Equal variances not assumed	-1.940	46.000	.029	.059	-.551	.284	-1.123	.021

Correlations

		Confidence		Knowledge
Spearman's rho	Confidence	Correlation Coefficient	1.000	.264
		Sig. (2-tailed)	.	.070
		N	48	48
	Knowledge	Correlation Coefficient	.264	1.000
		Sig. (2-tailed)	.070	.
		N	48	48

Appendix 7: Semi-structured interview transcripts

Participant 1:

Researcher: Tell me a bit about tennis, how often do you train or play.

Participant: About once a week.

What does a typical week look like outside of tennis for you?

Typically, I go to the gym two times, and I'll probably go for two runs.

What about work, how does that feature?

I'm a chef and I work about 12 hours a day, on my feet, six days a week.

Now I'm going to ask you about nutrition and understanding your attitude towards it.

When you think about eating well, what does that mean to you personally?

It means, having a balanced diet with lots of good proteins, some complex carbs, lots of veggies, lots of different colours. Avoiding sugar, avoiding alcohol, avoiding too many simple carbohydrates, and personally I don't have very cow's dairy. And eating three meals a day with a couple of snacks.

Thank you. How important do you feel that nutrition is for your own tennis performance and recovery?

Yeah, pretty important.

Has your thinking about nutrition and tennis changed over time?

I think it's important when you eat, so eating a good three hours before you are going to do the exercise, so you've digested it and you've got the energy releasing at the right time.

Can you talk me through how you manage hydration before, during and after tennis matches?

Yeah I make sure I'm hydrated before I play with a bit of water, and then probably at the change of ends, like every 3 games or something like that, I'll take on some water. And then depending how hot it is, drink some afterwards.

Are there times when staying hydrated is difficult for you?

No, it's always fine.

Where you play, do they have facilities to fill up your water bottle or do you have to take it with you?

I play in Battersea Park and they have water fountains.

Thank you. We've talked about how far in advance you might eat already, which was one of the next questions. What would you have to eat 2 or 3 hours before you were playing, and can this vary?

I wouldn't eat anything specific. It would obviously be nothing heavy.

Do you have any routines or rituals around tennis, and food, drink and tennis?

No I don't think so, no.

Would you ever use electrolyte drinks during matches?

I do not, but I would do. I think sometimes I've had coconut water which is quite good.

Do you every experience any cramping or fatigue during tennis matches?

No, not during a match.

In terms of recovery after tennis, do you do anything food or drink wise?

No, nothing specific.

Do you use any supplements?

I do take some supplements, but nothing specific to sport though – probiotics and stuff.

Are they more for gut health and general health as opposed to sports performance or muscle building?

Yeah, correct, yeah.

Where did you learn about those supplements, who recommended them to you?

From a nutritionist.

Where do you tend to, if you do look for nutrition information, where do you think is most trustworthy?

From a qualified nutritionist or dietitian.

Is there anything that makes it difficult for you to follow the nutrition habits that you think you should around tennis and performance, and is there anything that helps you stay on track?

I think only when travelling, it's sometimes harder to control the diet.

Has anyone ever given you any structured nutrition advice for tennis, and if so how did you feel about it?

No I haven't.

Is there anything that we haven't talked about that feels important to you in terms of nutrition and tennis/ sport.

Can't think of anything. Though it's not really something I've put much thought into before if I'm honest. Maybe I should. Might see some improvements in my game. Something to think about.

Are there any particular foods and drinks that you associate with tennis?

Bananas!

Participant 2

Tell me a bit about your tennis: how often you play, train, and compete

I play for a local tennis club in Cardiff, socially on a Friday night and then if we have matches, these are on Saturdays.

What does a typical week look like for you outside of tennis?

I'm a nurse, so pretty busy, and spend time with my husband and two sons, who are on the go. We might go for a long walk on the weekend or do something together as a family.

When you think about 'eating well', what does that mean to you personally?

Eating to fuel my body, being sensible most of the time but still enjoying myself. I cook balanced meals for my family, something quick and easy in the evening, but still nutritious as we are all active.

How important do you feel nutrition is for your tennis performance and recovery?

If I haven't eaten properly before playing on a Friday, I suppose I can feel a bit low in energy and will have a snack like a cereal bar in my bag.

What might cause you to not eat beforehand?

Going straight from work or being busy at home beforehand, so time probably, yeah.

What influences your views on tennis and nutrition – has this changed over time?

I know I need to eat before playing to give me the energy to get me through. With changes, not really sure. I haven't thought that much about it. I am more likely to drink electrolytes now.

What has brought about this change?

My sons drink them, so they are in the house, and the heatwave too. I was conscious of playing in the heat and sweating more.

Can you talk me through how you usually manage hydration before, during, and after tennis?

I take a bottle of water with me, and try to remember to take a bottle with an electrolyte sachet in on hotter days. I always have a water bottle in the car.

What do you typically eat or drink before training or matches?

Depends what time I'm playing. Usually if it's Friday night I try to have an early tea, or if it's on Saturday then I will have a brunch sort of meal where I know it's going to see me through for a few hours.

How far in advance do you usually eat?

A couple of hours usually. Depends on what's going on with the boys, but I'll try to fit something in. If not a meal, then a banana or cereal bar beforehand will have to do.

What do you usually consume during longer sessions or matches?

A banana or cereal bar, something with some natural sugar in to keep me going. I don't like anything too sweet.

How do you decide what to bring or buy?

What is in the house, easy to grab and will keep for a while.

What does recovery look like for you after tennis?

Sometimes a bath, and I'll usually have something to eat once I'm home. But it varies depending on what else is going on and what we have planned for the day. I wouldn't eat anything big if we had plans on Saturday evening to go out for food.

Do you think about protein or timing after sessions?

Not specifically for myself, but I know it is something that helps with muscles. I've just never thought about it specifically after tennis, and think I get protein in most of my meals.

Do you use any supplements or sports products? If so, which ones and why?

Not sports products. I take vitamin D and omega-3 capsules. They were recommended for perimenopause.

Where do you get most of your nutrition information?

My sons are into sport and nutrition, and I have always been interested in my health. I suppose I would go online if I wanted to know something specific.

What makes it difficult to follow the nutrition habits you think you 'should' for tennis?

Time! But I think I'm doing OK in terms of nutrition and tennis. I try and plan as much as possible, and feel well fuelled.

What helps you stay on track?

Planning. Having snacks in the car.

If you imagine an 'ideal' way of eating and drinking for tennis, how close do you feel your current habits are to that?

Not too far off. Maybe I could be a bit better with eating after playing, but then that's not real life, so I just do what I can.

Is there anything about nutrition and tennis that we haven't talked about but feels important to you?

I don't think so.

Has anyone ever given you structured nutrition advice for tennis?

No. It's not something I've ever looked into to be honest. Most people in the club do something similar to me.

Participant 3

Tell me a bit about your tennis: how often you play, train, and compete.

Well I play for the tennis club in the village, and we can have matches up to twice a week, mostly once on the weekend, but sometimes a weeknight if we're playing a rescheduled match. On top of matches I usually play with friends once a week or so, but it can vary.

What does a typical week look like for you outside of tennis?

I'm retired, but help my husband out with his business a couple of days a week. I go to pilates once a week, catch up with friends.

When you think about 'eating well', what does that mean to you personally?

Healthy eating, not too much fat. Trying to get a bit of everything on the plate. Plenty of fruit and veg.

How important do you feel nutrition is for your tennis performance and recovery?

I know I need to eat before I play. And watching tennis on TV you see their different bottles and what they have to eat at the change of ends.

What influences your views?

I'm not sure really. TV, friends and teammates, what they're doing, and if they suggest or try something.

Can you talk me through how you usually manage hydration before, during, and after tennis?

I always have a bottle of water with me, sometimes I take squash too.

Are there times when staying hydrated is difficult?

Not really. Though the heatwave over the summer meant I was drinking more.

What do you typically eat or drink before training or matches?

Usually something like a sandwich an hour or so beforehand to keep my going throughout the game. I take a banana with me, or some chocolate, in case I fancy something when I'm playing.

What do you usually consume during longer sessions or matches?

The banana or chocolate, or if my partner – I play doubles – has brought something along that she's made we might share that. Like a flapjack or something to give an energy boost.

What does recovery look like for you after tennis?

Going home and putting my feet up, having a cup of tea and a glass of water. I always try and have something to eat after tennis – it's usually time to eat something anyway. It'll be something quick like eggs or beans on toast if it's late. Otherwise my usual meal – I try to batch cook and have something to heat up if I know I'm playing in the evening.

Do you use any supplements or sports products? If so, which ones and why.

I take plant sterols as I was told my cholesterol was on the high side. I also take a meno-something supplement – it's for menopause.

Where do you get most of your nutrition information?

Social media – eek – I suppose. My niece is a dietitian so I have spoken to her about things too.

Which sources do you trust?

The NHS website and nutritionist/ dietitians.

What makes it difficult to follow the nutrition habits you think you 'should' for tennis?

I don't find it difficult, but probably because I have time to shop and cook food, and read about things too. There's lot out there, and I think some of it is a bit overcomplicated – like the gels and things. I don't need those at my level.

Has anyone ever given you structured nutrition advice for tennis? How did you feel about it if so?

They haven't, but I wouldn't be opposed to it.

Appendix 8: Thematic analysis of semi-structured interviews

THEME	Sub-theme	Quote
Nutrition for general health and wellbeing	Energy provision	<i>"Usually something like a sandwich an hour or so beforehand to keep my going throughout the game." (P3)</i>
		<i>"Eating a good three hours before... so you've digested it and you've got the energy releasing at the right time." (P1)</i>
Time/ resources	Convenience	<i>"Going straight from work or being busy at home... What is in the house, easy to grab and will keep for a while." (P2)</i>
	Household choices	<i>"A banana or cereal bar" (P2)</i>
Non-sport specific supplementation	Gut related/ age appropriate supplements	<i>"Probiotics and stuff... more for gut health and general health as opposed to sports performance." (P1)</i>
		<i>"I take vitamin D and omega-3 capsules. They were recommended for perimenopause." (P2)</i>
Passive information sources	Teammates/ family	<i>"My sons are into sport and nutrition..." (P2)</i>
		<i>"TV, friends and teammates, what they're doing, and if they suggest or try something." (P3)</i>
Qualified nutrition professional as trusted source	N/a	<i>"From a qualified nutritionist or dietitian." (p1)</i>