

**Nutritional Supplement Habits and Perceptions of Disabled Athletes**

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## **Nutritional Supplement Habits and Perceptions of Disabled Athletes**

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## **Section 1: Acknowledgements**

The completion of this project is the result of contributions from many individuals, sporting organisations and governing bodies. We would like to extend our gratitude to all those that helped develop, translate and promote the questionnaire, to those that helped analyse the responses but most importantly to the athletes who gave their time to complete it.

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British Sledge Hockey  
British Wheelchair Basketball  
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Goalball UK  
Great Britain Disability Swimming  
Great Britain Wheelchair Rugby  
International Paralympic Committee  
International Tennis Federation  
The British Wheelchair Tennis Open  
The Lakeshore Foundation  
World Para Volley

## **Section 2: Abbreviations**

SCI = Spinal cord injury

CP = Cerebral palsy

NS = Nutritional supplements

AB = Able-bodied

IPC = International Paralympic Committee

BOS = Bristol Online Surveys

BPA = British Paralympic Association

PHC = The Peter Harrison Centre for Disability Sport

WADA = World Anti-Doping Agency

### **Section 3: Executive Summary**

#### *Introduction and Purpose*

Very few studies have investigated the nutritional knowledge and supplement use of athletes with a disability. To our knowledge no studies have looked beyond the descriptive use of nutritional supplements (NS) at the perceptions of disabled athletes and the sources of information they use when deciding whether to consume NS. With the popularity of disability sport from grassroots up to elite level on the rise, further understanding of the dietary practices and NS use of athletes at all levels is warranted. This is especially so as the specific nutritional needs of each disability can mean there is a greater prevalence of NS use in disability sport. Research is also urgently needed as the current recommendations (type, frequency and dosage) for the use of NS in disability sport are based upon data from able-bodied (AB) athletes and cannot be directly transferred to disabled athletes e.g. due to autonomic dysregulation in spinal cord injury (SCI), impaired renal function or other medical complications.

The International Olympic Committee (IOC) encourages AB athletes to meet their nutrient requirements from food. They do however recognise that a few ergogenic aids may be of benefit to some individuals. The practical implications of disabilities such as cerebral palsy (CP) or a visual impairment can make it difficult to prepare nutritious meals. Therefore, issues related to meeting nutrient needs solely from whole foods might lead to some individuals relying on NS. Given the lack of information regarding supplement habits and perceptions in elite disabled sportsmen and women it is hard to deliver education on NS and anti-doping to this population. It is thus essential that NS habits and perceptions of disabled athletes are considered when the International Paralympic Committee (IPC) or the World Anti-Doping Agency (WADA) delivers any message regarding the use of NS. The current study will help provide this information and answer a number of vital questions regarding NS and the disabled athlete.

The objectives of this study were to determine: (1) the prevalence and type of NS used by athletes; (2) the frequency and dosage of use, and the reasons for their use; (3) where athletes obtain their information regarding supplements; (4) if age, nationality, gender, sport category, training hours, performance level and disability influence an athlete's use of NS; (5) how athletes perceive NS use; and (6) the knowledge of disabled athletes on topics relating to doping/anti-doping in sport.

#### *Research Design*

The research was undertaken by the Peter Harrison Centre for Disability Sport (PHC) with support granted from the IPC to attend IPC sanctioned events. The research study involved three stages. In stage one, a comprehensive questionnaire was designed and developed by the PHC and external research team partners to evaluate the NS habits and perceptions of disabled athletes. In stage two, a pilot study was conducted to evaluate the content of the questionnaire and appropriateness for data collection in a field-based environment. In the third stage, data were collected in the following ways: (i) an on-line version of the anonymous questionnaire was posted on both the IPC London 2012 Paralympic Games Research webpage and PHC website (<http://www.lboro.ac.uk/phc>) so that development and elite athletes could complete this at their convenience; (ii) the questionnaire was sent to colleagues in the field of disability sport for distribution and (iii) the questionnaire was made

available on a number of laptops and ipads at domestic UK and overseas competitions for athletes to complete on site.

### *Participants*

A total of 399 participants completed the questionnaire (296 (74%) male and 103 (26%) female) all aged above 18 years. The majority (87%) of athletes' ethnic origin was reported as white. Athletes were represented from 21 different nationalities across 28 different sports with a large proportion from the wheelchair court sports (20% Wheelchair Rugby, 12% Wheelchair Basketball, 10% Wheelchair Tennis), Athletics (8%), Sitting Volleyball (7%) and Cycling (6%). The number of years the athletes' reported playing their main sport (experience) was  $8.1 \pm 7.1$  y, with 64% and 36% playing at an elite (National or International) and non-elite (club, regional or development) performance level, respectively.

### *Key findings from the Questionnaire*

- 58% of participants used at least one NS in the previous six month period.
- Frequency of NS is similar if not slightly lower than the AB athletic population.
- Use of some NS may be greater in a disabled population e.g. cranberry and omega fatty acids, due to their perceived health benefits to aid disability-specific needs.
- 40% of NS users follow the AB recommendations on the label/manufacturers website which may not be optimal for disabled individuals either due to the nature of their disability or the often lower energy requirements of disability sports compared to AB sports.
- 9% of participants experienced a negative effect from using NS.
- Elite level participants are more likely to use NS but this is unlikely due to the pressure to improve sporting performance and may reflect greater access to nutritionists/dietitians.
- The pressure to use NS and a 'more is better' culture appears to be minimal in this disabled athletic population.
- The majority of participants understand the (health and doping) risks associated with using NS.
- The most trusted and used source of information regarding NS was a nutritionist/dietitian.
- The coach is also a frequently used source of information and should therefore be educated regarding NS and the disabled athlete.
- The two most popular formats to receive information via were the internet and leaflets. These are the cheapest and least time consuming ways to provide information and should therefore be utilised for educational purposes.

We provide data on a total of 28 sports with participants competing across the exercise continuum. These data suggest the use of NS is common with over half of the 399 athletes reporting the use of at least one NS. Despite the majority of athletes understanding the risks of using NS, it is of great concern that 33% of elite level athletes report never having attended an anti-doping or NS workshop. It is clear that this should be mandatory for all elite athletes and that education needs to be improved.

Overall the findings in this report suggest that more information should be readily available to athletes and their coaches on the use of NS for disabled people. The participants in the current study specifically requested information on topics such as effective NS and their dosage recommendations, anti-doping issues, personalised information and how their needs compare to AB athletes. Athletes are currently guided by sport scientists and/or nutritionists/dietitians on the use of NS but unfortunately not all athletes have access to such practitioners, especially below the elite level. Disabled athletes who are undertaking a training and competition schedule that pushes their body to the limits of their ability may benefit from the use of NS. However, given the limited evidence base they must perform a personal cost-benefit analysis prior to using them to help prevent any negative effects or complications. Consequently, over time we should seek more evidence-based recommendations and practice in this specific population. The outcomes from such disability-specific NS research would help reduce the issue of a 'lack of understanding' and 'trial and error', which is currently reported.

To achieve these goals the following recommendations are made:

- WADA education workshops should be mandatory for all elite level disabled athletes and should include information that is aimed at this specific population.
- Information on topics such as NS and their effectiveness, how to adapt the dosage to suit an individual's disability and to help prevent the possible negative effects of some NS should be highlighted during education sessions. This type of information could initially be provided in an online and leaflet format.
- Education should be aimed at both athletes and their coaches. It should also be considered whether a factsheet could be produced for other medical professionals such as doctors, general practitioners and physiotherapists in the event that they are approached by athletes with questions on the topic of NS.
- Where possible, education should also be provided to those below the elite level of performance.
- Further research should be conducted into the use of specific NS and the dose, effectiveness and possible negative effects of NS for athletes who have a variety of disabilities including SCI, CP, amputations, multiple sclerosis and dwarfism.

#### **Section 4: Main Outcomes**

1. The prevalence and type of NS use is similar in the disabled and AB athletic population. The level and depth of education and information regarding anti-doping and NS should therefore be delivered to both populations similarly.
2. Participants need and more importantly, want more information regarding effective NS and their dosage recommendations, anti-doping issues, personalised information and how their needs compare to AB athletes. Disability-specific information should be sought through further research and should be included in WADA workshops, on the internet or in a leaflet format.
3. Beyond consulting a registered nutritionist/dietitian, who should be qualified to answer questions on NS, participants report using their coach and fellow athletes as sources of information. Education should therefore be targeted at coaches and should include disability-specific information.

## **Section 5: Introduction**

### **i) Nutrition for Disabled Athletes**

Numerous studies have documented the nutritional knowledge and practices of able-bodied (AB) athletes (Burke et al. 2003; Dunn et al. 2007; Economos et al. 1993; Zawila et al., 2003). However, few have focused on a disabled athletic population (Goosey-Tolfrey & Crosland 2010; Goosey-Tolfrey et al. in press; Rastmanesh et al. 2007). Despite the physiological consequences of a physical disability having an effect on individuals' nutritional needs there is a paucity of specialist nutritional knowledge that can be applied to this population.

It is widely accepted that nutrition can influence exercise performance (Jeukendrup & Gleeson 2010) and that it should therefore be considered as part of an athlete's programme to fully capitalise on their athletic potential. From an AB perspective, the nutritional needs of an athlete are largely determined by two factors; 1) training load (the intensity  $\times$  frequency  $\times$  duration of training sessions), and 2) body mass (Hawley et al. 1995). Calculating these needs can be problematic for disabled individuals for many reasons; i) the demands of many disability sports are unknown and therefore the calculation of a training load can be difficult, and ii) some athletes have a reduced active muscle mass due to their disability e.g. SCI, which makes it hard to determine daily energy requirements (Price 2010). Consequently, the two aforementioned factors are highly dependent on the nature, onset and severity of the disability, and so the AB nutritional guidelines cannot be used in the disabled athletic population and should be discussed in relation to functional capacity.

**Training load.** It has been reported that disabled athletes often undertake similar training schedules to their AB counterparts, especially at an elite level (Fulton et al. 2010) and should therefore also adopt specific nutritional strategies for their sport and their disability (Krempien & Barr 2011). It is often assumed that the energy expenditure (EE) of disability sports is lower than AB versions but research to determine the energy demands of such sports is scarce (Abel et al. 2008; Price 2010). That said this information is vital to help practitioners calculate disabled athletes' nutritional requirements. Anecdotally, many practitioners still use their understanding from AB sports to determine energy requirements and yet this data is almost certainly not directly transferable to disability sport even when sports may appear similar. For example, the energy requirements for wheelchair tennis are reported to be 5.0 kcal/min (Roy et al. 2006), which is 48.7% of the energy requirements for the AB version of tennis (10.6 kcal/min; Smekal et al. 2001) (Price 2010). Moreover, for less researched sports such as Goalball or CP 7-a-side football there are no AB equivalents for comparisons to be made.

**Body mass.** Disabled athletes may need to adapt their diet to suit either i) being overweight due to the influence of their disability on body composition or lifestyle changes or ii) being underweight if they display a reduced body mass due to the additional daily ambulatory tasks (wheelchair propulsion, transfers, spasms etc.) or feeding difficulties. Some individuals also have a reduced active muscle mass due to their disability. For example, an individual with a SCI who has full use of their trunk may use only 60-70% of their total muscle mass during wheelchair propulsion (Goosey-Tolfrey & Crosland 2010). This reduced active muscle mass will reduce the energy requirements for some athletes and hence individuals will often reduce the total volume of food they consume to help prevent a concomitant increase in body mass. In doing this an athlete may not meet nutritional recommendations for their sport, which in

turn, can limit sporting performance (Goosey-Tolfrey & Crosland 2010) and may result in a greater risk of decubitus ulcers (pressure sores). Reduced energy intake can also result in individuals not meeting their perceived macro- and micronutrient recommendations (Gomes et al. 2006; Krempien & Barr 2011; Perret & Stoffel-Kurt 2011) and hence the use of NS to help meet these needs. There are no specific guideline figures for disabled populations and hence these perceptions are based on AB data and recommendations, which are not necessarily appropriate for disabled athletes.

With the popularity of disability sport in recent years, as well as greater emphasis on the scientific support of disabled athletes, a greater understanding of the dietary practices of disabled athletes is needed (Vliet et al. 2010). The specific needs of different disabilities could result in a greater prevalence of supplement use in this population such as the use of meal replacement or protein drinks in those with severe CP to help prevent the malnutrition that can occur (Dahl et al. 1996), or the use of multivitamins by those with a SCI who reduce their energy intake to prevent weight gain and therefore do not meet AB micronutrient needs (Krempien & Barr 2011; Perret & Stoffel-Kurt 2011; Walters et al. 2009). Athletes' perceptions regarding their use of nutritional supplements (NS) may therefore differ from those of the AB athlete population, viewing these as 'essential' rather than 'optional'. Yet, without knowing the reasons individuals provide for the use of NS this cannot be presumed.

## **ii) Nutritional Supplements**

When considering the use of NS for athletic performance it is clear that AB athletes have been studied to a much greater extent than disabled athletes (Braun et al. 2009; Erdman et al. 2006; Sundgot-Borgen et al. 2003; Titsimpikou et al. 2009). The majority of evidence suggests that the consumption of NS is common among AB athletes (Braun et al. 2009; Erdman et al. 2006; Sundgot-Borgen et al. 2003) and yet we do not know whether this translates into the disabled athletic population. To our knowledge the study by Titsimpikou et al., (2009) is currently the only one to investigate the use of food supplements by disabled athletes. This sole research also occurred many years ago during the Athens 2004 Paralympic Games. The study reported the descriptive use of supplements and medication rather than investigating athletes' perceptions or the sources of information they use when considering their use. Titsimpikou and colleagues (2009) did however provide important evidence that supplement use is common among Paralympic athletes and revealed that vitamins, minerals/electrolytes and proteins/amino acids were used most commonly.

The number of NS on the market continues to increase and yet many are unsupported by scientific evidence (Abel et al. 2005; Jeukendrup & Randall 2011), especially in a disabled population. New NS are being used prior to a body of evidence existing regarding their effectiveness and long-term effects. This could be dangerous in disabled populations where NS could potentially interact with the use of medication or an athlete's response to exercise, especially when an appropriate dose for some disabilities is unclear. For example, individuals with a disability may be more likely to experience medical conditions such as impaired renal function, which could result in contraindications if using an incorrect dose of creatine or protein. The consumption of inappropriate doses of NS has been highlighted as an issue in an athletic population and it has been suggested that some athletes ignore the need for caution given the potential harmful effects (Maughan et al. 2004). A lack of nutrition knowledge regarding their habitual dietary intake can also lead to the overuse of NS by athletes and therefore, the consumption of micronutrients in excess of the recommended tolerable upper limit, which in some circumstances can cause toxic effects (Carlsohn et al. 2011).

Elite disabled athletes often experience the same pressures to perform as their AB counterparts. As such one might predict that the use of NS as an ergogenic aid would be similar in this population. Given this, it is important to understand 'who' or 'what' athletes use as a source of information when considering the use of NS to help ensure they are receiving evidence-based advice. Froiland et al., (2004) reported that family members and fellow athletes were the most common source of information regarding NS. Others have reported coaches and trainers to be influential when deciding whether to use NS but, despite working in the field of sport, there is no guarantee that their knowledge of NS or anti-doping procedures will be accurate (Jacobson et al. 2001; Juhn et al. 1999). To educate the disabled athletic population effectively, it is therefore important that we understand where athletes obtain information regarding NS.

The use of performance-enhancing NS is usually a personal choice made by the athlete and/or their dietitian/sport nutritionist, ideally following a full cost-benefit analysis. The International Olympic Committee (IOC) consensus statement on sports nutrition 2010, encourages AB athletes to meet their nutrient requirements from food. The authors do however recognise that NS such as vitamin D, calcium, iron and sports foods/drinks containing carbohydrate may be of benefit to some athletes. Given a lack of evidence-based knowledge regarding the nutritional needs of some disabled athletes and the minimal information regarding NS habits and perceptions in elite disabled sportsmen and women, it is currently hard to deliver the same message to this population. It is essential then that current NS habits and perceptions of disabled athletes are investigated.

Set against this background of limited knowledge and profound implications for athletic performance/individual health, the objectives of this study were therefore to determine: (1) the prevalence and type of NS used by athletes; (2) the reasons for their use; (3) where athletes obtain their information regarding NS; (4) if gender, age, sport, disability and nationality influence NS use; (5) how athletes perceive the use of NS; and (6) the knowledge of disabled athletes on topics relating to doping/anti-doping in sport.

## **Section 6: Design and Procedure**

The current study was a cross sectional analysis of male and female disabled athletes who regularly took part in disability sport (club, regional, development, national and international). Approval for the study procedures was obtained from the University Research Ethics Committee and written informed consent was obtained from all participants.

Participants were recruited via a dedicated webpage on the International Paralympic Committee (IPC) website, promotional flyers, on social media sites, through existing contacts in the Paralympic field i.e. National coaches, athletes and support teams, and in the Peter Harrison Centre for Disability Sport newsletter and website. Recruitment also took place at a number of IPC and Sports Federation approved National and domestic disability sport events. The majority of questionnaires were completed online via the Bristol Online Surveys (BOS) website; however a paper version was available for those that required/requested it, including a large print version for visually impaired athletes, or when internet access was not available at the study location. If an athlete required assistance, a member of the project team or an assistant facilitated the completion of a questionnaire. Participants had access to email and telephone contact details to talk to a member of the research team at any time should they have required assistance. Questionnaires were completed anonymously and athletes were asked to be as honest as possible.

The term ‘nutritional supplement’ was defined as ‘any product intended to supplement the diet, provide nutrients and/or improve performance.’ During completion of the questionnaire participants were provided with examples of sport-specific/performance-enhancing NS (sports drinks, gels, bars, drinks powders, creatine, beta-alanine, caffeine, beetroot juice etc) and health-related NS (vitamins, minerals, herbal remedies, probiotics, omega 3, cranberry extract etc).

## **Section 7: Research Questionnaire Overview**

The standardised questionnaire was developed by an expert team. This included several sport science professionals including a registered Dietitian and Sports Nutritionist, Professor of Sport and Exercise Nutrition, Reader in Disability Sport, Exercise Physiologist and Assistant Head of Sports Medicine. Collectively the team also assessed the face validity of the final questionnaire. A pilot version of the questionnaire was completed by several Paralympic Wheelchair Rugby and Goalball athletes to assess the usability of different formats, the length of time taken to complete the questionnaire and their ability to understand and complete the main descriptive NS table (Appendix B, questions 16 & 17).

Athletes were asked to recall and report their use of NS over the previous six month period. The questionnaire included four main sections: (1) demographic, anthropometric, disability and sporting experience; (2) nutritional habits and supplement use (if, when, how and why a participant used NS); (3) sources of information used when considering the use of NS; and (4) personal opinions on the necessity, safety and pressure to use NS.

The format of the questionnaire included closed and open-ended questions, multiple choice options, 5 Likert-type rating scales and ranking options. The questionnaire took approximately 15-20 minutes to complete. Participants could complete it either on an electronic device (iPad or portable computer) or by hand using a paper version. A copy of the questionnaire can be found in Appendix B. The questionnaire was translated into French, German, Portuguese and Spanish to widen the participant pool and to allow the potential comparison between Nationalities. Having piloted the questionnaire with a number of visually impaired athletes a brail/audio version was not deemed necessary. Athletes who experienced problems completing the questionnaire, or those with a B3 classification (registered blind) were assisted by a member of the project team or an assistant.

## **Section 8: Statistical Analysis**

The Statistical Package for the Social Sciences version 20 software (SPSS Inc., Chicago, IL) was used to analyse the data. All descriptive data including nationality, sport, gender, experience, training hours, NS used and sources of information are presented as frequencies (%) or mean  $\pm$  SD. Chi-squared statistical ( $\chi^2$ ) analyses were employed to evaluate the relationship between gender, age, sport category, training hours, disability and nationality and (1) NS habits and perceptions, and (2) sources of information. During chi-squared analyses, groups were eliminated where expected frequencies were less than 5. Significant results were interpreted using the odds ratios where appropriate. For subsequent analysis, sports were placed into four groups according to the nature of the sport (intermittent, speed and power, endurance, skill-based) (Table 1). Significance was determined at  $p < .05$ .

Performance-enhancing NS (sports drink, carbohydrate supplement, protein, recovery, caffeine, buffering agents, amino acids, creatine, combination, other, unknown) and health-related NS (essential fatty acids, joint care, multivitamin, probiotic, vitamin C, vitamin D/calcium, iron, cranberry, herbal, combination, other, unknown) were categorised prior to analysis.

Qualitative data analysis was also performed on the open-ended questions using a content analysis. This allowed the identification of themes within the participants' responses.

Table 1. Sport grouping according to the nature of the sport.

<b>Group</b>	<b>Sports</b>
Intermittent	Badminton, Football, Sitting Volleyball, Sledge Hockey, Wheelchair Basketball, Wheelchair Tennis, Wheelchair Rugby, Wheelchair Flag Football
Speed and power	Field Athletics, Goalball, Kickboxing, Paracanoeing, Paraclimbing, Rowing, Swimming, Powerlifting, Skiing
Endurance	Biathlon, Cycling, Paratriathlon, Track Athletics
Skill-based	Archery, Boccia, Equestrian, Shooting, Table Tennis, Wheelchair Curling, Wheelchair Dance, Wheelchair Fencing

## **Section 9: Sample Characteristics**

A total of 399 participants completed the questionnaire between August 2012 and November 2013. The gender distribution was found to be skewed in favour of males (296 (74%) male and 103 (26%) female). This partly reflects the larger percentage of males who take part in disability sport and compete at the Paralympic Games. This is demonstrated in the gender distribution at both the Beijing 2008 (65% male, 35% female) and London 2012 (64% male, 36% female) Paralympic Games. This may also represent the gender distribution within certain disabilities e.g. the male/female ratio was 4:1 for new SCIs in the USA over 3 decades (Jackson et al. 2004). The large male response may also reflect the targeted data collection at two Wheelchair Rugby competitions (Appendix D) which represented 20% of all sports surveyed (Figure 1).

All athletes were over 18 years of age, had a physical disability or visual impairment and regularly took part in disability sport. Participants were aged 18-24 (24%), 25-30 (24%), 31-35 (18%), 36-40 (12%), 41-45 (9%) and 46+ (13%) years. The majority (87%) of athletes' ethnic origin was reported as white. Athletes were represented from 21 different nationalities; however the majority were from Great Britain (44%), the United States of America (14%), Switzerland (14%), Germany (8%) and Brazil (6%).

Responses were collected from athletes taking part in 28 different sports with a large proportion from the wheelchair court sports (20% Wheelchair Rugby, 12% Wheelchair Basketball, 10% Wheelchair Tennis), Athletics (8%), Sitting Volleyball (7%) and Cycling (6%). The number of years the athletes' reported playing their main sport (experience) was  $8.1 \pm 7.1$  y with 64% and 36% playing at an elite (National or International) and non-elite (club, regional or development) performance level, respectively. The proportion of participants that reported weekly average training hours of 0-5, 6-10, 11-15, 16-20 and 21+ h were 17%, 30%, 23%, 20% and 10%, respectively (Figure 2).

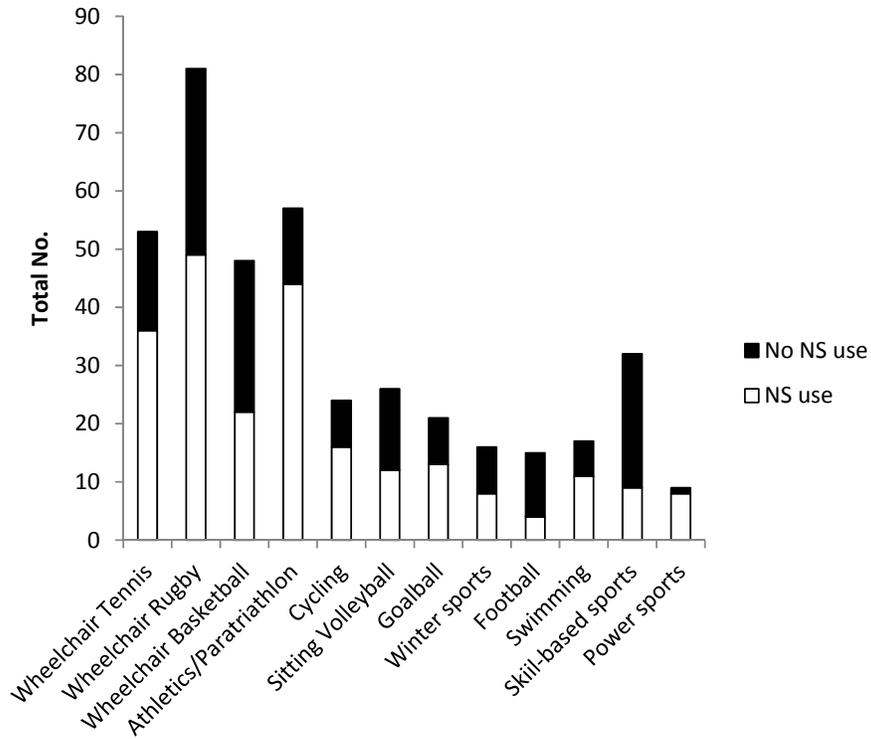


Figure 1. Frequency of nutritional supplement use within sports.

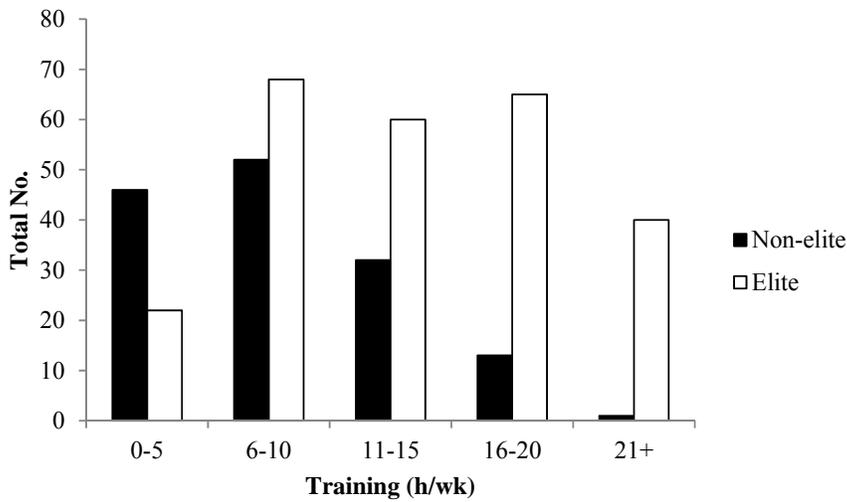


Figure 2. Distribution of training hours per week for elite and non-elite level participants.

## **Section 10: Results**

### **i) Nutritional Supplement Habits**

In total, 58% of participants used at least one NS in the previous six month period. The use of multiple NS was commonplace with 33%, 30%, 15%, 8%, 6% and 8% reporting the use of 1, 2, 3, 4, 5 or 6 different types of NS, respectively.

The most popular performance-enhancing NS were protein, sports drinks and carbohydrate supplements which were reportedly used by 26%, 20% and 13% of all participants surveyed, respectively (Figure 3). The most popular health-related NS were multivitamins, other health-related supplements and essential fatty acids which were reportedly used by 14%, 10% and 8%, respectively (Figure 3). The 'other health-related NS' category included NS such as aloe vera, coenzyme Q10, mushroom extract, evening primrose oil and chromium. Thirty-seven participants (9%) reported having experienced a negative effect from using NS. Common negative effects included gastrointestinal/digestive problems (protein, sports drinks and gels, creatine, cherry juice and beetroot juice), itchiness (beta-alanine), weight gain (protein), dizziness (spirulina), loss of appetite (calcium) and palpitations (caffeine). Of the 399 participants, only four reported having taken NS (iron, vitamin D, Nutriflex infusion) by injection. The three most common outlets where participants purchased or obtained NS were the supermarket, the internet and a health food/sports shop (Figure 4).

When asked 'How do you decide whether a supplement is safe to use?' the most common responses were 'I ask a sports nutritionist/dietitian/medical professional' (139), 'I check a dedicated website that indicates which products have been tested for banned substances e.g. Informed-Sport' (108), 'I ask a coach/teammate' (87) and 'I do my own research using the internet, books, journals etc' (72). Participants were able to select multiple responses if applicable.

When asked 'How do you decide how much of a supplement to take?' 41% of NS users followed the instructions on the label/manufacturers website (AB guidelines), 24% were told by a sports nutritionist/dietitian, 14% calculate it based on their body weight, 9% were unsure and 13% indicated 'other'. 'Other' responses included 'doctor's advice', 'based on how I feel', 'usually take the lowest dose', 'I use a third of the recommended as I have roughly a third of body function', 'half the instructions', 'read label and deduct a bit', 'based on how physically active I have been' and 'trial and error'.

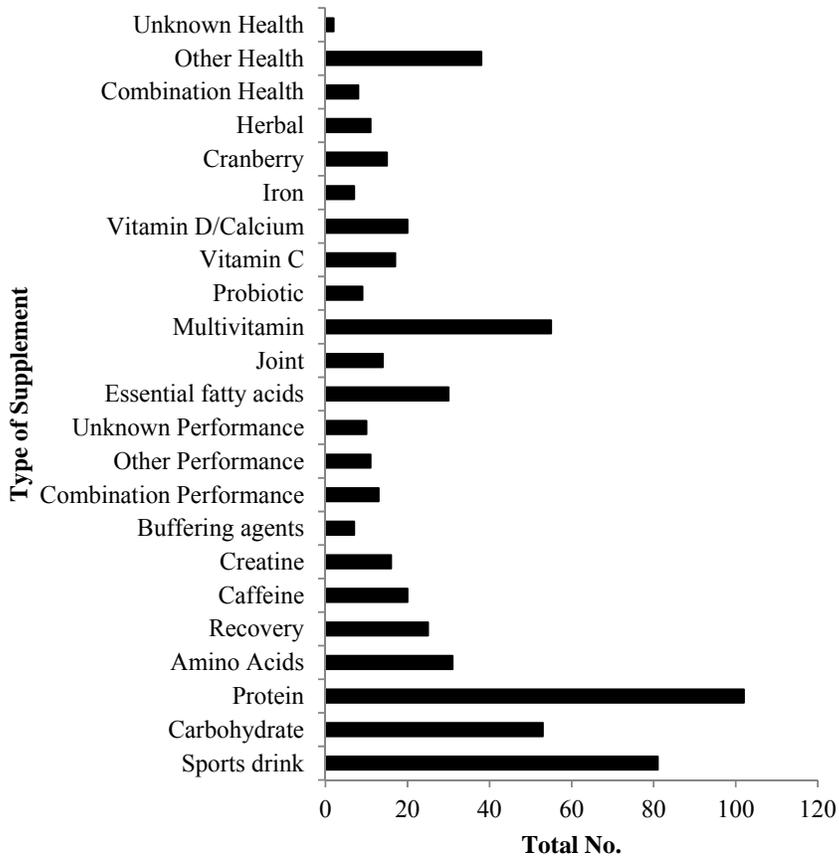


Figure 3. Frequency for the type of nutritional supplements used. ‘Unknown’ categories include supplements which could not be identified. ‘Other’ categories include a variety of supplements that did not fit into the remaining category descriptions.

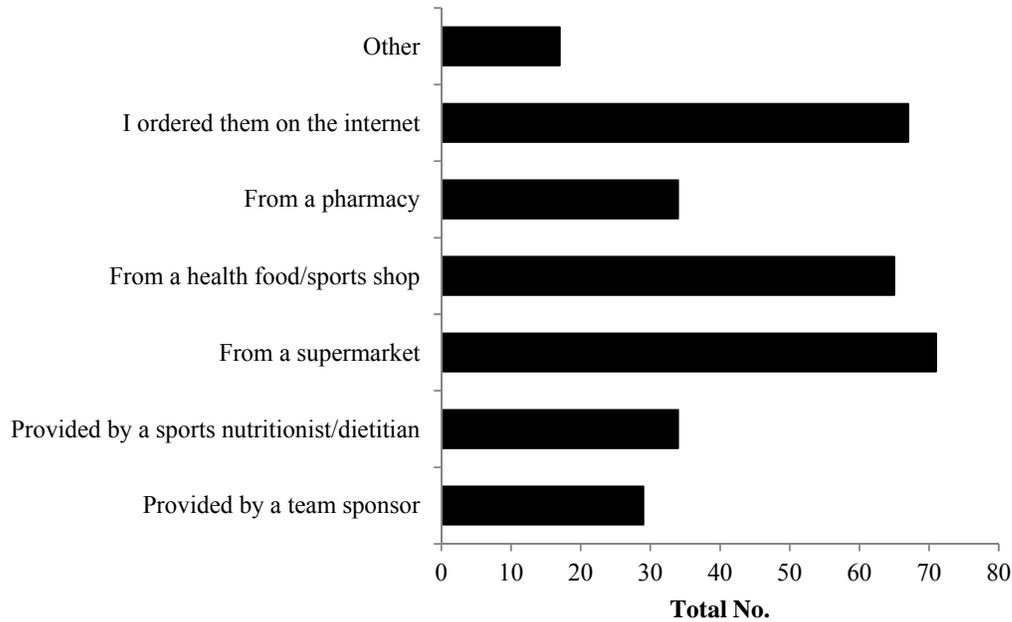


Figure 4. Frequency of where nutritional supplement users obtain or buy their supplements.  
*Note: Participants were able to select multiple responses if applicable.*

**ii) Comparisons by Age, Nationality, Gender, Sport Category, Training Hours, Performance Level and Disability**

There was no association between age and whether an athlete used NS ( $p > .05$ ). However, when the two oldest categories were combined there was a significant association ( $\chi^2(4) = 11.6, p < .05$ ) whereby the 41+ y age category were 4.0, 1.2, 2.8 and 1.3 times more likely to use a multivitamin than those in the age categories 18-25, 26-30, 31-35 and 36-40 years, respectively.

There was no association between nationality and whether an athlete used NS ( $p > .05$ ). However, there was a significant association between nationality and whether an athlete used protein ( $\chi^2(5) = 21.7, p < .05$ ) whereby the American participants were 21, 4.5, 1.9 and 1.5 times more likely to use protein than the German, Swiss, Brazilian and British athletes. Additionally, there was a significant association between nationality and whether a participant used sports drinks ( $\chi^2(4) = 19.80, p < .05$ ) whereby the British athletes were 7.4, 4.0 and 2.1 times more likely to use sports drinks than the American, German and Canadian athletes. There was no association between gender and whether a participant used NS.

There was a significant association ( $\chi^2(3) = 19.57, p < .05$ ) between sport category and whether a participant used NS. Based on the odds ratio this seems to represent that those who took part in a predominantly endurance sport were 6.3, 2.2 and 1.4 times more likely to use NS than those in a skill-based, intermittent or speed and power sport, respectively. There were also significant associations between the sport category and the type of NS used ( $p < .05$ ) whereby the participants who took part in endurance sports were most likely to use sports drinks, carbohydrate supplements, protein and multivitamins.

There was a significant association between training hours and whether a participant competed at a non-elite or elite level ( $\chi^2(4) = 65.04, p < .05$ ) whereby elite level participants trained more. There was a significant association between performance level and whether a participant used NS ( $\chi^2(1) = 5.14, p < .05$ ) whereby elite level participants were 1.6 times more likely to use NS. Elite level participants were also significantly more likely to use multivitamins (2 times more likely), amino acids (2.5 times more likely) and sports drinks (1.8 times more likely) ( $p < .05$ ) compared to non-elite. There was no significant influence of disability on whether a participant used NS or on the type of NS used ( $p > .05$ ). Of note however, 8% of SCI participants reported using cranberry supplements, with only one non-SCI individual choosing to use it.

### iii) Reasons for Nutritional Supplement Habits

The three or four most prevalent reasons reported for non-use and use of NS are reported in Table 2. Reasons in the health-related ‘other’ category included anti-inflammatory, joint care, I thought I’d give it a go, heart health, to help promote a lean body mass, and to support female reproduction.

Table 2. Reasons for use and non-use of nutritional supplements (NS).

Reasons for use of performance-enhancing NS	Frequency (n)	Reasons for use of health-related NS	Frequency (n)	Reasons for non-use of NS	Frequency (n)
Support exercise recovery	224	Support immune system	114	I don’t know enough about them	70
Provide energy	200	Medical need/deficiency	80	I don’t need them	67
Increase strength/power	142	Other	41	I am concerned about a positive drugs test	49
		Inadequate diet	40		

*Note: The questionnaire allowed participants to select as many reasons for NS use/non-use as were applicable.*

### iv) Participants’ Perceptions on Doping Use and Nutritional Supplements

Seventy-seven percent of participants believed that doping agents have the potential to improve sports performance. When asked ‘If you would definitely not be caught, would you risk your health for any performance gains that may come with taking doping agents?’ 2% participants responded ‘yes’, 5% responded ‘maybe’ and 93% responded ‘no’.

When asked ‘Do you think there is a health risk associated with taking supplements?’ 5% responded ‘no, no supplements carry a health risk’, 20% responded ‘yes, all supplements carry a health risk’ and 75% responded ‘some supplements carry a health risk’. Sixteen percent of participants believed that all NS that are commercially available on the market have been scientifically tested and are therefore safe to use, while 84% disagreed.

When asked ‘In your opinion, do you need the same supplements as an AB individual competing in a similar version of your sport?’ 44% responded ‘yes’, 29% responded ‘no’, 15% responded ‘yes, but different amounts’ and 12% responded ‘other’.

Participants were asked to strongly agree through to strongly disagree with six statements; the responses to these are shown in Table 3. Thirty-one percent of NS users ‘agreed’ or ‘strongly agreed’ that “exercise increases the need for NS” compared to only 13% of non-users. Similarly, 22% of NS users ‘agreed’ or ‘strongly agreed’ that NS give them the “competitive edge to win”, compared to only 7% of non-users.

Table 3. Participant’s personal opinions.

	<b>“The more NS I take, the better”</b>	<b>“Taking NS gives me the competitive edge I need to win”</b>	<b>“I feel under pressure to use NS”</b>	<b>“Exercise increases the need for NS”</b>	<b>“There is a risk of consuming a banned substance when taking NS”</b>	<b>‘I feel pressured to take NS because my competitors/opponents do’</b>
<b>“Strongly disagree”</b>	32%	21%	49%	17%	5%	40%
<b>“Disagree”</b>	38%	32%	34%	26%	9%	36%
<b>“Neither agree nor disagree”</b>	25%	32%	11%	23%	14%	16%
<b>“Agree”</b>	5%	15%	5%	32%	52%	7%
<b>“Strongly agree”</b>	1%	1%	0%	2%	20%	2%

*Note: Data includes all participants; nutritional supplement users and non-users. NS refer to nutritional supplements.*

**v) Sources of Information**

Eighty-two percent of all participants reported having access to information on anti-doping. Fifty-three percent of all participants reported attendance at a workshop/presentation on NS and/or anti-doping which included 67% of elite level participants and 29% of non-elite. Of those who have never attended a workshop/presentation, 58% indicated that they would like to attend one in the future. Elite level participants had greater access to a nutritionist/dietitian (60%) compared to non-elite participants (22%). Fifty-two percent of participants would like more information and education regarding NS and anti-doping. The preferred means to receive this information was via the internet, leaflets, an individual consultation, workshops or presentations (28%, 22%, 18%, 17%, 15%, respectively) and did not differ between performance levels. The type of information sought by participants is shown in Figure 5.

Participants were asked to rank their top five sources of information on NS. Participants chose the sports nutritionist/dietitian as their most used source of information, coach as their second and training partner/athlete as their third. When asked who provided the most trusted source of information, participants still chose the sports nutritionist/dietitian as the most trusted source however, doctor/medical professional was second and coach was third.

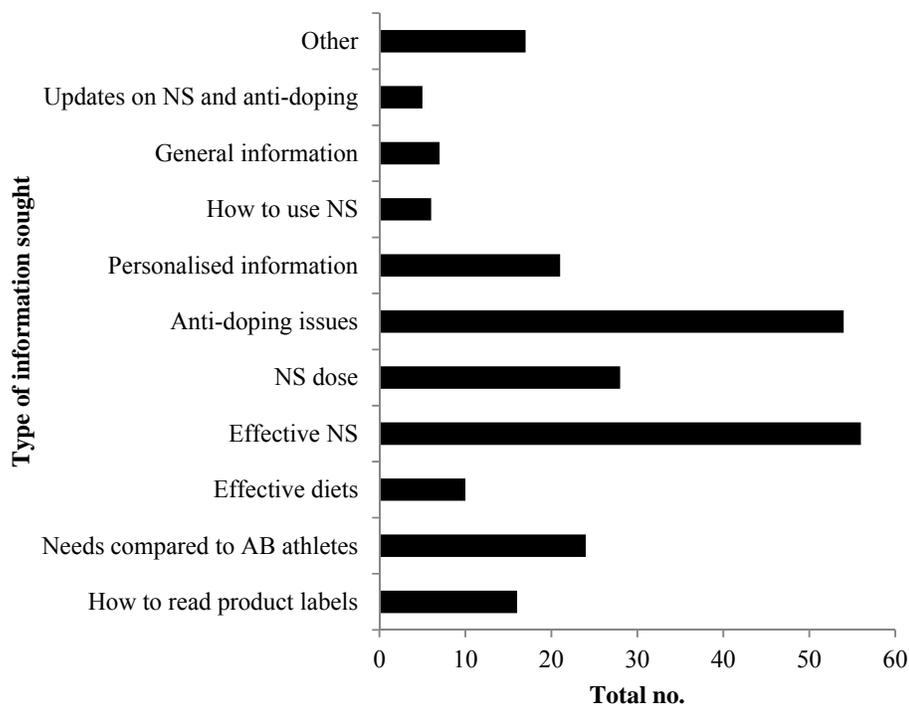


Figure 5. Frequency for the type of information sought by participants who indicated they would like more information/education regarding nutritional supplements and anti-doping.

*Note: Participants were able to indicate multiple responses where applicable.*

## **Section 11: Discussion**

### **i) Nutritional Supplement Habits**

The purpose of the current study was to report on the NS habits and perceptions of disabled athletes. The data collected demonstrates that a wide-variety of NS are currently being used across a range of disability sports and 58% of participants surveyed used at least one NS in the previous six month period. To our knowledge the only other study that has investigated the use of NS by disabled athletes, Tsitsimpikou et al., (2009) reported that 64.2% of athletes tested for doping control at the Athens Paralympic Games declared the use of medications and food supplements (57.9% and 42.1%, respectively). Interpretation of this data would suggest that 27% of all athletes tested used at least one food supplement, which is less than half that reported in the current study. The current results are also importantly higher than that reported by a meta-analysis of literature based on the vitamin/mineral supplement habits of 10,274 elite AB athletes (Sobal & Marquart 1994) however, it must be highlighted that this does not include all NS.

Use of NS in the current study was similar to that reported in elite AB male and female Norwegian and American collegiate athletes where  $\geq 51\%$  reported the use of at least one NS (Kruskall & Johnson 2001; Sundgot-Borgen et al. 2003). However, the current study results are lower than those reported by AB elite Canadian and state-based Australian sporting institute athletes where  $>87\%$  used NS (Dascombe et al. 2010; Erdman et al. 2006). This appears to agree with the observations of Tsitsimpikou and colleagues (2009) who reported that Paralympic athletes appeared to use a more rational intake pattern of supplements compared to their Olympic AB counterparts. The lower reported use of NS in the current study compared to AB athletes may reflect the lack of knowledge regarding their effectiveness, side-effects and the dosage recommendations for this specific population; disabled athletes. The lower reported use of NS may also reflect a non-homogenous sample that included non-elite participants, not solely elite athletes. This is supported by the finding that elite participants used more NS than non-elite. Other reasons may include the type of sport participants played and their nationality.

It was hypothesised that the use of NS may be increased in a disabled population given the large percentage of individuals that use medications, highlighted by Tsitsimpikou and colleagues (2009). However, it is evident from the current research that many believe they 'do not know enough about them', they are 'concerned about a positive drugs test' or they 'do not need them'. The athletes' use of medication may therefore have the opposite effect in that they do not want to take anything beyond what they need to in order to maintain their health. This was highlighted by one participant's response to 'why don't you use NS?', 'I take enough medication as it is'.

#### **Take home message:**

- 58% of participants used at least one NS in the previous six month period
- Frequency of use is similar if not slightly lower than the AB athletic population

**ii) Comparisons by Nationality, Gender, Sport Category, Training Hours, Performance Level and Disability**

The type of NS reported in the current study are similar to those reported in previous AB studies. This said, the use of some NS appears to be more prevalent due to the perceived benefits to those with a disability. For example, the use of cranberry to reduce the incidence of urinary tract infections in participants with a SCI (used by 8% of SCI participants) or essential fatty acids often used by those with chronic fatigue conditions to help maintain a specific intake of omega-3 or 6 essential fatty acids (used by 8% of participants). Whereas the prevalence of some more common NS such as sports drinks, protein and multivitamins appears to be lower than AB findings (Burns et al. 2004, Froiland et al. 2004). The most common NS were also similar to those reported by the Athens 2004 Paralympic athletes (vitamins, minerals/electrolytes and proteins/amino acids) (Tsitsimpikou et al. 2009) but also included sports drinks.

Participants use various methods by which to calculate how much of a NS to take but 40% follow the instructions on the label/manufacturers website. The NS dose for SCI, amputee and CP individuals may need to be reduced from the AB recommendation due to a reduced active muscle mass or the effects it could have on their disability and/or any secondary complications due to their disability. A number of participants did however indicate that they use half or a third of the recommended dose, or that they adapt the dose based on trial and error or personal experience. Given the nature of the questionnaire we cannot be sure whether these adaptations to dosage recommendations are the participant's decision or those of a nutritionist/dietitian. Although there are no specific recommendations for NS dosage, some individuals may be aware of emerging evidence regarding the segmental body composition (obtained via DEXA) of athletes with a SCI (Goosey-Tolfrey & Sutton 2012) and also the energy requirements of some disability sports (Abel et al. 2008). This type of evidence provides some basic information on which to base the dosage recommendations for NS however, further research is required.

Previous AB studies have suggested that the use of NS is greater by female compared to male athletes (Kruskall & Johnson 2001; Neiper 2005, Sobal & Marquart 1994, Zeigler et al. 2003). This is in contrast to the results from the current study which found a similar number of male (174/296; 59%) and female (58/103; 56%) disabled participants reported using NS in the previous six month period. There was a tendency for females to be more likely to use probiotics, iron and herbal NS. However, a larger sample size would be required to explore this further.

It is well-documented that AB athletes report the use of more NS than the general population (Erdman et al. 2006, Sobal & Marquart 1994). Level of performance is therefore considered to be a major indicator of the use of NS. The current study supports this statement since those that played at an elite level were 1.6 times more likely to use NS. The participant's responses to whether they "feel under pressure to use NS" did not differ between performance levels and therefore the increased frequency of use cannot be attributed to the pressure to use NS to achieve performance gains at an elite level. The significant association between training hours and performance level whereby those that trained more (h/wk) were more likely to take part in elite sport, may help to explain the greater use by elite participants. The perceived energy demand and therefore nutritional requirement of more training hours may influence a participant's perceived need for NS at an elite level. Elite participants also had greater access

to a nutritionist/dietitian and may therefore have more knowledge regarding NS and the required dose, and therefore the confidence to use them.

**Take home message:**

- Use of some NS may be greater in a disabled population e.g. cranberry and omega fatty acids, due to their perceived health benefits to aid disability-specific needs
- 40% of NS users follow the AB recommendations on the label/manufacturers website which may not be optimal for disabled individuals
- Elite level participants are more likely to use NS but this is unlikely due to the pressure to improve sporting performance and may reflect greater access to nutritionists/dietitians

**iii) Reasons for Nutrition Supplement Habits**

Generally, participants' reported common reasons for use and non-use. 'I don't know enough about them' suggests that NS-specific information may be either unavailable, inaccessible or has not been targeted at the correct audience. The participant who stated 'I thought I'd give it a go' may highlight a need for education and the need to recommend a personal cost-benefit analysis prior to using NS.

**iv) Participants' Perceptions.**

It is encouraging to see that the pressure to use NS, in general and from competitors/opponents is low (83% and 76% 'disagree' and 'strongly disagree', respectively) and that 70% of participants 'disagree' or 'strongly disagree' that "the more supplements I take, the better", with a further 25% responding 'neither agree nor disagree'. Seventy-two percent of participants 'agreed or strongly agreed' that "there is a risk of consuming a banned substance when taking NS". Only 16% of participants reported that they believed "all NS that are commercially available on the market have been scientifically tested and are therefore safe to use". These results suggest that a culture of 'more is better' or 'if s/he's taking it, I need to as well' does not exist in these participants. It also suggests that participants have an understanding about the risks associated with using NS.

**Take home message:**

- The pressure to use NS and a 'more is better' culture appears to be minimal
- The majority of participants understand the risks associated with using NS

**v) Sources of Information.**

Knowledge of where athletes seek advice regarding the use of NS is essential to devise and implement educational strategies for those involved in educating athletes themselves (Erdman et al. 2006). Erdman and colleagues (2006) reported that elite Canadian athletes consulted family or friends (52.7%), teammates (44.3%), coaches (40.7%), and athletic trainers (34.4%) as their most used sources of information. The college athletes surveyed by Froiland et al., (2004) chose to obtain information from family members (32.4%), fellow athletes (31.9%) and dietitians/nutritionists (28.5%), whereas the university athletes surveyed by Krumbach et al., (1999) chose self (40.6%), nutritionist/dietitian (32.1%) and friends/family members (31.1%) as their top three sources of information. The participants in the current study report the use of similar sources of information and the top three were sports nutritionist/dietitian, coach and training partner/athlete. The coach-athlete relationship puts the coach in a unique position to influence his/her athlete's diet. The coach can therefore help enhance their

performance by promoting good nutrition (Turner & Bass 2001) and NS choices. This emphasises the need to educate coaches regarding issues pertaining to a healthy diet and the use of NS. It also highlights the need to educate athletes themselves on who is a knowledgeable source of information on NS.

When the question was rephrased to ask ‘who the most trusted sources of information are’ their top three changed to sports nutritionist/dietitian, doctor/medical professional and coach. Doctors and medical professionals may have been selected by these participants due to an increased frequency of consultations/visits regarding their disability, medication or secondary complications, compared to AB athletes, and the on-going and trustworthy relationship that may develop between an athlete and their doctor. Despite being a trusted source of information, doctors and medical professionals do not necessarily possess the area-specific expertise to advice athletes on their use of NS and should therefore be educated on how to deal with these questions should they arise.

It is also concerning that 33% of elite level participants have never attended a workshop/presentation regarding anti-doping and/or NS. They have therefore not received any official education regarding anti-doping procedures, the code or the prohibited list. Despite the participant’s performance level being self-reported, this may indicate that some disabled athletes are slipping through the net. It was also highlighted by one non-elite level participant that information should ‘be given at a club level not just elite’. A frequently shorter talent pathway in Paralympic sport may indicate that education on topics such as anti-doping and the use of NS should occur at a lower performance level.

It is clear that disability-specific information and education regarding NS and anti-doping for this population is required, with 52% of all participants indicating they would like more. Participants’ responses indicate that the two most preferred means of receiving information was via the internet (28%) and leaflets (22%). These methods of communicating information are relatively cheap and would ensure any individual, no matter what their performance level, could access disability-specific information on NS and anti-doping.

**Take home message:**

- Participants report their trust and use of nutritionists/dietitians as a source of information regarding NS
- The coach is also a frequently use source of information and should therefore be educated regarding NS
- Educational information should be delivered via the internet or leaflets

## **Section 12: Conclusions**

In conclusion, the current study provides an insight into the use of NS in a disabled athletic population at both a non-elite and elite level. Disabled athletes appear to require and more importantly, want more information and advice regarding NS and anti-doping issues. Athletes specifically requested information on topics such as effective NS and their dosage recommendations, anti-doping issues, personalised information and how their needs compare to AB athletes.

Beyond registered nutritionists/dietitians, who should provide impartial, evidence-based and trustworthy information regarding NS, disabled athletes appear to consult coaches and fellow athletes as sources of information. Evidence-based disability-specific education should therefore be delivered to coaches in order to access the athletes themselves. Direct education to the athlete should also be provided and should include disability-specific information regarding effective and safe NS and dosages. Education should also highlight some of the possible adverse effects associated with some NS. Education should also help to dispel some of the myths surrounding NS and the perceptions of performance-enhancement associated with them despite an extremely small pool of evidence in a disabled athletic population. This information can be delivered via the internet and leaflets.

It is recommended that further research is conducted into the effectiveness and long-term effects of commonly used NS such as sports drinks, protein, caffeine and multivitamins in a disabled athletic population. This type of research is needed in order to provide more evidence-based recommendations and practice in this specific population, and reduce the issue of a 'lack of understanding' and 'trial and error'.

### **Section 13: Recommendations**

- WADA education workshops should be mandatory for all elite level disabled athletes and should include information that is specifically aimed at disabled athletes.
- Information on NS and their effectiveness, how to adapt the dosage to suit an individual's disability and to help prevent the possible negative effects of some NS, and any anti-doping disability-specific information should be highlighted during education sessions. This type of information could initially be provided in an online and leaflet format.
- Education should be aimed at both athletes and their coaches. It should also be considered whether a factsheet could be produced for other medical professionals such as doctors, general practitioners and physiotherapists in the event that they are approached by athletes with questions on the topic of NS.
- Where possible, education should also be provided to those below the elite level of performance.
- Further research should be conducted into the use of specific NS and the dose, effectiveness and possible negative effects of NS for athletes who have a variety of disabilities including SCI, CP, amputations, multiple sclerosis and dwarfism.

## **Section 14: References**

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## Section 15: Appendices

### **Appendix A: Ethics Approval**

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24 August 2011

Reference Number: SSEHS-1091

Dear Dr Tolfrey

I can confirm that your ethics checklist:

*Nutritional supplement habits and perceptions of elite Paralympic athletes*

has been approved. The reference number is SSEHS-1091.

Yours sincerely

A handwritten signature in black ink, appearing to read 'J A Green'.

J A Green  
Research Administrator



## Appendix B: Letter from the International Paralympic Committee



Dr. Vicky Goose-Tolfrey  
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Bonn, 23 February 2012

PV/IPC

**London 2012 Research Application Titled: "Nutritional supplement habits and perceptions of elite Paralympic athletes".**

Dear Dr. Goose-Tolfrey,

The IPC Sports Science Committee received the above mentioned research application for data collection at the occasion of the London 2012 Paralympic Games and after assessment is in view that your research can be ensured to contribute to the broad sports science agenda of the Paralympic Movement.

After careful review, the SSC has, however, also decided to not allow for in-person and on-site data collection of applications with a primary survey/questionnaire/interview approach. This decision is not based on any quality-assessment criterion but taken in order to allow athletes to focus 100% on their main purpose and presence at the Paralympic Games.

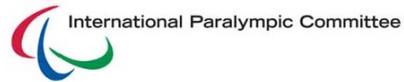
The IPC, however, has offered to create a 'London Paralympic Games online-research website' on which your research together with all research applications that meet the IPC Sports Science Committee review criteria, will be listed and explained to potential participants. From these abstracts, a link to the Principal Investigator or - if applicable - to an online questionnaire of your study can be provided.

The IPC was happy to receive your decision to take part in this "online-research website" and will engage to make your study project in its Games

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related communication to all delegations participating in London as well as on-site in chef de mission/team physician meetings.

With regard to your wish to seek for a research grant from WADA by extending the IPC study to: the 'Nutritional supplement habits and perceptions of athletes with a disability', IPC is willing to support this request on the condition that no changes to the IPC approved study proposal are guaranteed.

May I kindly ask you to send IPC a copy of the grant application for WADA including all supporting materials?

We wish you luck with the application and look forward to your feedback.

Kind regards,

(On behalf of the IPC Sports Science Committee)

A handwritten signature in blue ink, appearing to read "Peter Van de Vliet".

Dr. Peter Van de Vliet  
Medical & Scientific Director  
International Paralympic Committee

C.c. Yves Vanlandewijck, chairperson IPC Sports Science Committee

**Appendix C:  
Nutritional Supplement Habits and Perceptions of Athletes with a Disability.**

Thank you for choosing to complete this questionnaire, it should only take approximately 15-20 minutes. Please remember that your answers are confidential and we therefore ask you to be as honest as possible.

The following section refers to details about you and your sport.

**1. What is your age?**

18-24       25-30       31-35       36-40       41-45       46+

**2. What is your gender?**

Male   
Female

**3. What is your nationality?**

**4. What is your ethnic origin?**

White   
Black   
Asian   
Hispanic   
Other  Please state in the box below

**5. How much do you weigh?** (Please provide units of measurement such as kg, lbs)

Actual (measured in the last 3 months)  
 Estimated

**6. What is your height?** (Please provide units of measurement such as feet, metres)

Actual (measured in the last 3 months)  
 Estimated

**7. What is your current sport/discipline/event?** (Please give as much detail as possible)

**8. How many years have you been competing in your current sport?**

**9. What is the highest level you currently represent in your sport?**

- Club   
Regional   
National  If checked, please state which country in the box below.

**10. On average, how many hours per week do you train in total? (Please check 1 box)**

- 0-5     6-10     11-15     16-20     21-25     26+

**11. What is your disability? (Please give as much detail as possible)**

**12. What is your sport-specific classification?**

The following section refers to your nutritional supplement habits. The term ‘supplements’ refers to any product intended to supplement the diet, provide nutrients and/ or enhance performance such as vitamins, minerals, carbohydrate sports drinks/ bars, amino acids, herbal remedies, creatine and caffeine etc.

**13. How important do you think good nutrition is to sports performance?**

- Very important   
Important   
Moderately important   
Of little importance   
Unimportant

**14. Do you monitor your hydration status?**

- Yes  Please go to Question 14A  
No  Please go to Question 14B

**14A. Which of the following methods do you use? (Please check all that apply)**

- I use thirst as an indicator of hydration
- I check my urine colour/ compare it to a urine/ pee chart
- I weigh myself before and after exercise
- A sport scientist/nutritionist/coach measures my hydration status using a machine to measure urine specific gravity or serum osmolality
- Other (Please state in the box below)

**14B. Please indicate if there is a reason why you can't/ don't use any of these methods.**

The following section asks about your use of nutritional supplements **in the last 6 months**. The term 'supplements' refers to any product intended to supplement the diet, provide nutrients and/or enhance performance such as vitamins, minerals, carbohydrate sports drinks/ bars, amino acids, herbal remedies, creatine and caffeine etc.

**15. Have you used any nutritional supplements in the last 6 months?**

- Yes  Please go to Question 15A, B and C
- No  Please go to Question 15D

**15A. For each sport-specific/ performance-enhancing supplement that you have used in the last 6 months please complete a row in the table below.**

Examples of sport-specific/ performance-enhancing supplements include sports drinks, gels, bars, drinks powders, creatine, beta-alanine, caffeine, beetroot juice...

**\*Do not enter health supplements here; these will be entered in Question 15B**

If you have any doubt whether a product is classified as a nutritional supplement then please write it down.

Supplement type and brand	How do you take this supplement? We are looking for as much detail as possible For example, <ul style="list-style-type: none"> <li>• <b>How often?</b> <i>Daily, once a week...</i></li> <li>• <b>When?</b> <i>During a cold/ in the off-season... Or Only on training or rest days</i></li> <li>• <b>Only for some training?</b> <i>Strength, endurance or skills sessions</i></li> <li>• <b>Timing?</b> <i>Before, during or after a session</i></li> <li>• <b>How much?</b> <i>Do you know the dose/ how many grams or pills a day?</i></li> </ul>	Reason for taking the supplement? (Please check all that apply)
<i>Example: Powerade ION4 isotonic sports drink</i>	<i>Example: Sip during a cardio session lasting more than 60 min or if I have not eaten in the 3-4 hours before training.</i>	<i>Example:</i> Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input checked="" type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other <i>-Hydration/ tastes better than water</i>
Supplement 1		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)

<b>Supplement 2</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 3</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 4</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 5</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)

<b>Supplement 6</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 7</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)

**15B. For each health supplement that you have used in the last 6 months please complete a row in the table below.**

Examples of health supplements include vitamins, minerals, herbal remedies, probiotics, omega 3, cranberry extract...

If you have any doubt whether a product is classified as a nutritional supplement then please write it down.

<b>Supplement type and brand</b>	<b>How do you take this supplement?</b> We are looking for as much detail as possible <ul style="list-style-type: none"> <li>• <b>How often?</b> <i>Daily, once a week...</i></li> <li>• <b>When?</b> <i>During a cold/ in the off-season... Or Only on training or rest days</i></li> <li>• <b>Only for some training?</b> <i>Strength, endurance or skills sessions</i></li> <li>• <b>Timing?</b> <i>Before, during or after a session</i></li> <li>• <b>How much?</b> <i>Do you know the dose/ how many grams or pills a day?</i></li> </ul>	<b>Reason for taking the supplement?</b> (Please check all that apply)
<b>Supplement 1</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state) <input type="checkbox"/>
<b>Supplement 2</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state) <input type="checkbox"/>

<b>Supplement 3</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 4</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 5</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)
<b>Supplement 6</b>		Medical need/ deficiency <input type="checkbox"/> Due to an inadequate diet <input type="checkbox"/> Support immune system <input type="checkbox"/> To provide energy <input type="checkbox"/> Increase strength/power <input type="checkbox"/> To aid recovery <input type="checkbox"/> Because everyone else does <input type="checkbox"/> Because I am told to <input type="checkbox"/> Other (Please state)

<b>Supplement 7</b>	Medical need/ deficiency	<input type="checkbox"/>
	Due to an inadequate diet	<input type="checkbox"/>
	Support immune system	<input type="checkbox"/>
	To provide energy	<input type="checkbox"/>
	Increase strength/power	<input type="checkbox"/>
	To aid recovery	<input type="checkbox"/>
	Because everyone else does	<input type="checkbox"/>
	Because I am told to	<input type="checkbox"/>
Other (Please state)		

**15C. Where did you obtain/ buy your supplements?** (Please check all that apply)

- Provided by a team sponsor
- Provided by a sports nutritionist/ dietitian
- From a supermarket
- From a health food/ sports shop
- From a pharmacy
- I ordered them on the internet
- Other (Please state in the box below)

--

**15D. If you don't use supplements, why not?** (Please check all that apply)

- I do not need them
- They are unhealthy
- I don't know enough about them
- I am concerned about a positive drugs test
- They are too expensive
- My sport does not allow them
- Taking supplements is like cheating
- Other (Please state in the box below)

--

**16. Have you taken any supplements by injection in the last 6 months?**

- Yes  Please go to Question 16A
- No  Please continue to Question 17

**16A. Please indicate which supplements you have had injected and why you used them in the box below.**

Product	Why?

**17. Have you EVER experienced any negative/side-effects from using a supplement? E.g gastrointestinal distress, rapid bowel movements, spasticity, cramps etc**

- Yes  Please go to Question 17A  
No  Please continue to Question 18

**17A. Which product(s) did you use and what were the negative/side effects?**

Product (Please specify brand where possible)	Negative/side-effects

The following section relates to the sources of information YOU use when considering your nutritional supplement habits.

**18. Do you have access to information on anti-doping?**

- Yes   
No

**19. Have you ever attended a workshop/ presentation on nutritional supplements and/ or anti-doping?**

- Yes  Please go to Question 19A  
No  Please go to Question 19B

**19A. If yes, when did you attend it?**

--

**19B. If no, would you like to?**

- Yes   
No

**20. Would you like more information and education regarding nutritional supplements and anti-doping?**

- Yes  Please go to Question 20A and 20B  
No  Please continue to Question 21

**20A. If yes, how would you prefer to receive this information? (Please check all that apply)**

- Workshops   
Presentations   
Leaflets/ booklets   
Individual consultation   
Internet   
Other (please state in the box below)

--

**20B. What type of information would be most useful for you regarding nutritional supplements and/ or anti-doping?** For example effective supplements/ doses, doping concerns, the World Anti-Doping Code, how to read product labels, whether your needs are different to able-bodied athletes, other information.

**21. How do you decide whether a supplement is safe to use?** (Please check all that apply)

- It's says on the label
- I ask a sports nutritionist/ dietitian/ medical professional
- I ask my coach/ teammates
- I check the manufacturer's website
- I check a website that indicates which products have been tested for banned substances i.e., Informed-Sport
- I do my own research using the internet, books, journals etc
- No supplement is safe
- N/A (I don't use supplements)
- Other (Please state in the box below)

**22. Who/ What do you currently use to help you make a decision about your use of supplements? Please only rank up to 5 responses, 1=Your most used source, 2 = your second most used source, 5=Only used a little/ sometimes.** If you only use 2, 3 or 4 sources, only rank 1 down to 2, 3 or 4.

E.g. if you use a physiotherapist most often for information on supplements, write a number 1 in the box opposite and so on, up to a maximum of 5.

**Note** - The numbers 1, 2, 3, 4 and 5 should only occur once in your answers and therefore **some options will be left blank.**

**Please ask for help if you are at all unsure about this question!**

	<b>Rank</b>
Training partner/athlete	
Coach	
Friends/family	
Physiotherapist	
Sports nutritionist/ dietitian	
Doctor/medical professional	
Supplement/ health food store	
*Books/ magazines	
*Evidence-based/ scientific journals	
*Internet/ websites	
*Other	

**22A. If you checked a box with an \*, where possible please indicate which books, magazines, journals, websites or 'other' that you use.**

**23. Do you have access to a sports nutritionist/ dietitian through your sport/ team?**

- Yes   
No

**24. Have you ever seen a registered sports nutritionist/ dietitian in person for advice?**

- Yes  Please go to Question 24A  
No  Please go to Question 25

**24A. How often do you see them?**

- Very frequently   
Frequently   
Occasionally   
Rarely   
Very rarely

**25. In your opinion, do you need the same supplements as an able-bodied individual competing in a similar version of your sport?**

- Yes, I need the same type of supplements   
No, I have different nutritional requirements   
Yes, I need the same type of supplements but different amounts   
Other (Please state in the box below)

**26. How do you decide how much of a supplement to take? (Please only check 1 box)**

- I calculate it based on my body weight   
I am told/ given it by the sports nutritionist/ dietitian   
I follow the instructions on the label/ manufacturers website   
Unsure   
N/A – I don't use supplements   
Other (Please state in the box below)

The following section relates to YOUR personal opinions regarding nutritional supplements and anti-doping.

**27. Do you think all nutritional supplements that are commercially available on the market have been scientifically tested and are therefore safe to use?**

Yes

No

**28. Do you think there is a health risk associated with taking supplements?**

Yes, all supplements carry a health risk

Some supplements have health risks

No, no supplements carry a health risk

**29. Who provides the most trusted source of information on nutritional supplements?** You do not necessarily have to use these sources but you believe they are trustworthy. **Please only rank up to 5 responses, 1=Your most trusted source, 2 = your second most trusted source and so on.** If you only trust 2, 3 or 4 sources, only rank 1 down to 2, 3 or 4.

**Note -** The numbers 1, 2, 3, 4 and 5 should only occur once in your answers and therefore **some options will be left blank.**

**Please ask for help if you are at all unsure about this question!**

	Rank
Training partner/athlete	
Coach	
Friends/family	
Physiotherapist	
Sports nutritionist/ dietitian	
Doctor/medical professional	
Supplement/ health food store	
*Books/ magazines	
*Evidence-based/ scientific journals	
*Internet/ websites	
*Other	

**29A. If you checked a box with an \*, where possible please indicate which books, magazines, journals, websites or ‘other’ that you use.**

**30. Do you think doping agents have the potential to improve sports performance?**

Yes

No

**31. If you would definitely not be caught, would you risk your health for any performance gains that may come with taking doping agents?**

- Yes
- No
- Maybe

**32. Which (if any) of the prohibited substances/ methods do you believe has the greatest potential to improve performance in your sport?** (This is not saying you would use it, just that you believe it would aid performance in your sport).  
(Please only check 1 box).

- Stimulants *e.g. amphetamines*
- Anabolic-androgenic steroids *e.g. nandrolone*
- Diuretics and masking agents to prevent detection
- Blood doping *e.g. EPO, blood reinfusion*
- Peptide hormones, growth factors and related substance
- Beta-2 agonists *e.g. clenbuterol*
- Hormone and metabolic modulators
- Anorectics and weight loss agents *e.g. sibutramine*
- Boosting
- Other substances/methods (Please state in the box below)

**32A. How/ why do you believe this type of doping would improve your sports performance?**

Please indicate to what extent you agree or disagree with the following statements:

**33. 'The more supplements I take, the better I will perform'.**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

**34. 'Taking supplements gives me the competitive edge I need to win'.**

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

**35. 'I feel under pressure to use supplements'.**

- Strongly disagree
- Disagree
- Neither agree nor disagree

Agree

Strongly agree

**36. 'Exercise increases the need for supplements'.**

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

**37. 'There is a risk of consuming a banned substance when taking a supplement'.**

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

**38. 'I feel pressured to take nutritional supplements because my competitors/opponents do'**

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

Thank you for taking the time to complete this questionnaire, we greatly appreciate your assistance in helping us to further understand the nutritional supplement habits of disabled athletes.

Please don't hesitate to contact us if you have any questions regarding the questionnaire or the overall study.

**Appendix D:  
Timeline of sporting events, presentations and opportunities for project promotion,  
data collection and dissemination of results.**

<u>Date</u>	<u>Event</u>	<u>Comments</u>	<u>Approximate Response Numbers</u>
29.08.12- 09.09.12	2012 Paralympic Games (London)	Promotion via the IPC online research page and a small number of promotional flyers handed to athletes with the Nutrition for Paralympians booklets. Unfortunately, neither method resulted in athlete responses.	1
Sept 2012	GB Goalball athletes (Loughborough, UK)	Having recently had the squad in for laboratory testing, all players were contacted via phone or email and asked to complete (no obligation) the inline questionnaire.	6
Nov 2012	Swiss Paralympians	A PHC contact at the Swiss Paraplegic Centre, Nottwill, works with a large number of Swiss Paralympic athletes. Dr Claudio Perret kindly emailed a request for their help. This resulted in a large number of responses from this nation.	55
03.12.12	BPA Sports Fest (Guildford, UK)	Promotion of the project via A5 flyers handed out from a PHC stand along with other information and giveaways.	10
16.01.13- 19.01.13	Canadian Wheelchair basketball club visits (Toronto, Canada)	We visited 2 wheelchair basketball clubs to promote the questionnaire. Unfortunately we had low response numbers from these visits.	5
23.01.13 – 17.01.13	Demolition Derby Wheelchair Rugby tournament (Alabama, USA)	We had 7 iPads on which the majority of athletes in attendance completed the questionnaire during their downtime at the tournament. We also provided players with a ‘Nutrition for Paralympians’ booklet.	45
02.02.13– 03.02.13	GB Paratriathlon Talent Day (Loughborough, UK)	GB Paratriathlon allowed us to speak to all of the talent athletes to promote the questionnaire. The majority completed a paper version overnight. Some completed the online version following the camp.	12
02.03.13	GB Nutritionist meeting (Loughborough, UK) GB Sledge Hockey squad educational sessions (Loughborough, UK)	Following this meeting the GB swimming nutritionist agreed to email her athletes asking them to complete the questionnaire online. Following 2 educational sessions from PHC team members, willing players completed the questionnaire using iPads and paper copies.	12 10
26.04.13 – 27.04.13	BPA Sports Fest (Sheffield, UK)	Promotion of the project via A5 flyers handed out from a PHC stand along with other information and giveaways.	10
01.05.13– 04.05.13	IPC VISTA Conference (Bonn, Germany)	Terri Graham presented preliminary findings to a large audience of sport scientists and practitioners. The presentation prompted some interesting questions and a large number of individuals from various countries approached her to offer their help in promoting the questionnaire to boost numbers and the coverage of different sports.	N/A
11.05.13	IPC Athletics Permit	2 PHC team members attended the permit	16

21.05.13– 22.05.13	meeting (Manchester, UK) UK High Performance Conference for Paralympic Sport (Burton, UK)	meeting and collected paper responses from a variety of club and national level athletes. Promotional flyers were placed in delegate packs and Terri Graham presented a poster on the preliminary findings. Conversations prompted responses from a few previously unrepresented sports e.g. disability cricket.	N/A
23.05.13	European Powerlifting tournament (Russia)	We were invited to this event following the IPC VISTA presentation but were unfortunately unable to obtain a visa in time and therefore the questionnaire was promoted by an IPC team member at and following the event. This method unfortunately resulted in no responses.	0
23.05.13– 24.05.13	GB Disability Skiing Laboratory testing (Loughborough, UK)	Following the skiers laboratory fitness testing and health screening we asked them to complete the questionnaire. The visually impaired athletes were aided by a PHC team member.	6
27.05.13	Wheelchair Rugby tournament (Doncaster, UK)	2 PHC team members attended the final day of a Super-Series A & B tournament. Due to a lack of wifi, questionnaires were completed on paper.	25
June 2013	Brazilian translation and collection	Following the poster presentation at the above UK Paralympic conference, a leading sport scientist in Brazil put us in touch with their nutritionist. She was kind enough to collect data from all of her visually impaired athletes (a category in which we were lacking responses).	12
June 2013	Sitting Volleyball	Following the IPC VISTA presentation, Terri's sitting volleyball contact emailed all participating nations and asked them to send the online questionnaire links (appropriate languages) to their zones. This resulted in a moderate response from athletes.	15
June 2013	CP Sports (Germany)	A PHC contact from the University of Cologne promoted the questionnaire at a CP athletics meeting. This resulted in low response numbers.	6
16.07.13– 21.07.13	British Wheelchair Tennis Open (Nottingham, UK)	British tennis provided a stand to promote the questionnaire and emailed all players informing them of the purpose of the questionnaire. The majority of players who spoke the 5 languages we have the questionnaire in completed the survey.	27
June 2013	Steelers Wheelchair Basketball training session (Sheffield, UK)	Short introduction to the project and why we were collecting such information. Gave each player a flyer. Unfortunately the coach was slightly negative about the questionnaire and so this may have dampened our response numbers.	6
Aug 2013	GB Wheelchair Basketball	Following the interest of the new GB Wheelchair Basketball coach, the men's and women's teams were emailed the link and asked whether they would complete the questionnaire (no obligation). This resulted in a good response from players.	22
Sept 2013	Spanish Paratriathlon	A visiting sport scientist, working on the new	7

		classification system for Paratriathlon, contacted the Spanish athletes asking them to complete the Spanish online version.	
14.09.13– 15.09.13	GB Goalball Laboratory testing (Loughborough, UK)	PHC team members helped the visually impaired athletes complete the questionnaire when visiting the university for fitness testing.	5
Future-Feb 2014	England and Wales Disability Cricket	The PHC has recently started working with English Disability Cricket and these athletes will hopefully form the participant pool for a test-retest of the questionnaire.	N/A
Future– June 2015	20 <sup>th</sup> Annual Congress of the European College of Sport Science (Malmö, Sweden)	The European Research Group in Disability Sport (ERGiDs) has applied for a symposium entitled ‘Nutritional Supplements in Disability Sport’ in which the results from this study would be presented.	N/A

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