CARDIFF METROPLPITAN UNIVERSITY

CARDIFF SCHOOL OF HEALTH SCIENCES

DEPARTMENT OF HEALTHCARE SCIENCE AND FOOD

Bsc (Hons) Human Nutrition and Dietetics

Dissertation Academic Paper

Title: To explore the intake, knowledge and perceived perceptions of caffeine consumption on performance within a population of elite hockey players.

[redacted]

Student number: S[redacted]

Submitted: May 2018

Supervisor: [redacted]

Student Declaration in Respect of individual Work

I declare that the whole of this work is the result of my individual effort and that all quotations from other authors have been acknowledged.

Dissertation submitted in partial fulfilment of the requirements of Cardiff Metropolitan University for the Degree of Bachelor of Science with Honours.

[redacted]

Dated:_____10.05.18_____

Abstract

Background: Previous literature has debated the effectiveness of caffeine as a stimulant on specific aspects of an athlete's performance. Although associations have been drawn between caffeine consumption and performance enhancement in team based sports, other research has noted the individualised nature of the perceptions of caffeine supplementation. The purpose of this study is to explore the intake, knowledge and perceived perceptions of caffeine consumption on performance within a population of elite hockey players.

Method: The research used opportunistic sampling of the male and female Welsh Hockey team members and Development squad, thus enabling a whole population approach. Data was collected through an online questionnaire, results were collated and statistically analysed.

Results: Thirty-one elite hockey players out of a possible forty-four completed the online questionnaire, providing a 70% response rate. The results indicated that the majority (94%) of participants were not aware of the daily caffeine recommendations. However, 71% of participants predominately consume caffeinated products to enhance energy and sporting/mental performance with only (21%) consuming caffeine for its social aspect. Nevertheless, the majority perceived pre-match caffeine to be more effective as a stimulant compared to post-match consumption.

Conclusion: Respondents demonstrated some positive perceptions relating to caffeine intake on performance but this was not uniform across all the performance components explored, with more positive perceptions associated with caffeine pre-match as opposed to post match recovery. The degree of performance improvement was noted to be variable and likely influenced by the timing of ingestion, amount ingested and frequency of caffeine consumption.

Keywords: Hockey, performance, caffeine, stimulant, elite, sport.

Introduction

Caffeine has the capability to stimulate the body's central nervous system, potentially reducing muscle fatigue, improving concentration levels and post-performance recovery with minimal side effects (Maughan and Gleeson, 2010). Consequently, this has sparked huge interest amongst the sporting community with field hockey players being no exception (Goldstein et al., 2010).

Caffeine Intake and performance

Associations have been drawn between caffeine consumption and performance enhancement in team based sports (Tarnopolsky and Cupido, 2000; Bell and McLellan, 2002). However, the individualised frequency of caffeine consumption, caffeine sensitivity and the varying concentrations of caffeine in foods and beverages create difficulty when attempting to accurately quantify an individual's intake (Goldstein et al., 2010).

Bell and McLellan (2002) conducted a randomised control study on twenty-one civilian participants classified as regularly active (based on their $V_{O_2\,max}$ values). Participants were classified into habitual caffeine users (≥ 300 mg/d) and non-users (≤ 50 mg/d) and asked to complete six randomised exercises to exhaustion at 80% of maximal oxygen after the consumption of either a placebo or a 5mg/kg caffeine tablet (Bell and McLellan, 2002).

Results concluded that irrespective of the frequency of caffeine consumption both sample groups had an overall enhanced performance (19% for habitual users and 28% for the nonusers) when compared to the placebo. However, the improvements in exercise time to exhaustion were greater and lasted approximately 3 hours longer for the nonusers of caffeine (Bell and McLellan, 2002).

Positively, the recruitment of regularly active participants in the above study reinforce the theory that caffeine supplementation and the specific physiologic adaptations present in

trained athletes, can enhance performance capabilities more effectively compared to their untrained counterparts (Goldstein et al., 2010; Collomp et al.,1991). This suggests that the ergogenic effects of caffeine could be masked in untrained individuals resulting in no enhanced performance for peak power or total work performance capabilities. Although different sports and athletes possess various physical and mental demands, basic similarities can be drawn from these studies due to the scientific standardisation of the participant inclusion criteria, enhancing the validity and applicability of the studies to elite hockey players.

Previous research suggests caffeine can provoke ergogenic effects in both endurance (Schniker et al., 2006) and high-intensity sports (Bottoms et al., 2013). Whereas, other research carried out on elite fencers undergoing high-intensity exercise discovered that caffeine had no effect on concentration levels with regards to improving the reaction time of participants (Bottoms et al., 2013). Contrary, research on sixty-seven American Navy seals during a 72-hour sleep deprivation study discovered that caffeine can prolong the stimulation of the basal forebrain neurons associated with maintaining an individual's wakefulness and concentration levels (Liebermann et al., 2002).

Knowledge of caffeine levels

Although professional sports personnel are experts within their chosen sport there is concern that they possess inadequate knowledge about the basic nutritional principles of effective caffeine supplementation (Llewelyn, 2013).

In a randomised cross over study conducted on 140 athletes competing in the Ironman Triathlon World championships, Desbrow and Leveritt (2007) discovered that the participant's knowledge level in relation to caffeine was adequate, however, it was not extensive. The study uncovered that although many participants could correctly identify

sources of caffeine, they were unable to quantify the level of caffeine in certain products listed on the self-administered questionnaire, especially with regards to the less customary items such as caffeinated sports tablets (Desbrow and Leveritt, 2007). A limitation of the research is that the respondents were from a range of countries from around the world which could have led to potential variations in interpretation concerning caffeinated food and drink items listed within the research. Interestingly Dascombe et al., (2010) discovered most participants were dissatisfied with the level of knowledge they held regarding caffeinated supplements and supplementation in general.

Caffeine and Fatigue in sport

Increasing levels of fatigue can be detrimental in influencing an athlete's physical, technical, psychological and decision-making skills at a competitive level therefore minor alterations including the consumption of caffeine, could be employed to assist, mask or improve an individual's fatigue levels (Knicker et al., 2011).

Schneiker et al., (2006) conducted a small study which investigated the responsiveness and variation of caffeine supplementation on fatigue development and performance in ten male amateur team-sport athletes. The study evaluated participants' perceived effect of caffeine ingestion on fatigue after two 36-min intermittent-sprint exercise tests (Schneiker et al., 2006).

Results indicate those individuals who consumed the caffeine supplement shown an average 8.1% increase in their sprint performance and a reduction in fatigue development (based on percent decrement scores) compared to individuals who received the placebo (Schneiker et al., 2006). Similarly, Polito et al. (2017) discovered a significant improvement in the endurance capabilities of the soccer players sampled post caffeine consumption. Although both studies were conducted in laboratory conditions which omitted potential variables that

are present within competitive hockey matches, it nevertheless provides scientific evidence of the biological effects of caffeine on fatigue and endurance.

Despite evidence to show caffeine's improvement in levels of fatigue and endurance amongst athletes, it must be remembered that fatigue is an individual measurement influenced by an extensive range of factors therefore, is difficult to accurately quantify and assess, and may be perceived differently by individuals (Lewis, 2014; Bloomfield et al., 2005).

Caffeine and hydration

It has been widely suggested that caffeine can induce an acute state of dehydration amongst individuals (Maughan and Griffin, 2003). A study carried out by Roti et al., (2006) investigated the sweat loss of fifty-nine participants after the consumption of either ingested 0, 3, or 6 mg/kg of caffeine; indicating no significant difference in individual sweat loss or urinary losses between the groups. This suggests that irrespective of the level of caffeine consumption, a conditioned athlete's hydration status should not be altered and therefore their performance is unlikely to be hindered by caffeine consumption at this level (Roti et al., 2006), which is confirmed by Del Coso et al., (2009).

Caffeine and recovery

Hockey is a strenuous team sport that can result in several physiological changes, including glycogen depletion that can persist for up to 24hours post-performance (Goldstein et al., 2010). Therefore, it is vital adequate recovery methods including potential caffeine consumption are employed to maximise individual recovery and replenish glycogen stores.

Battram et al., (2004) indicated that caffeine is not detrimental to glycogen repletion, and in combination with exogenous carbohydrate may act to enhance synthesis in the recovery phase of exercise. This is reinforced by a small study conducted by Pedersen et al., (2008) who revealed that glycogen re-synthesise was increased by 66% for the carbohydrate-caffeine

treatment, compared to the carbohydrate-only treatment after extensive exercise in fasted cyclists. Although this research does not focus on the isolated effects of caffeine it could be a vital aspect in why elite hockey players may perceive caffeine as an effective recovery model.

Various studies have investigated the effect of caffeine on different aspects of performance both within the general population and within the sporting community. Although the scientific literature associated with caffeine supplementation is extensive, it could be argued that there is limited research into the perceptions of caffeine consumption on the various aspects of an elite hockey player's performance.

This research does not aim to quantify a player's caffeine intake but rather explore whether the perceptions of the sampled elite hockey players undermines or supports results from previous studies and potentially highlighting suitable areas for future research.

Methodology

Study Design

The study used an opportunistic sample of the Welsh Hockey team and Development squad which included both male and female players. This enabled a whole population approach to the research within a defined population. A cross sectional approach was considered but not deemed appropriate for this study, as links are not already established across teams outside of the local Welsh demographic which could create significant differences in response rates and affect the value of the results. Additionally, a cross sectional approach often fails to produce high quality generalizable data compared to other research methods (Boynton, 2004 B).

The use of an anonymous online questionnaire (Appendix 1) was chosen in order to gather data from the population group regarding their intake, knowledge and perceptions of caffeine.

Specific biological tests of participants would have enabled the collection of more accurate data and enabled the comparison with other studies who used this approach (Bell and McLellan, 2002). However, this was not incorporated in this study due to the limited time, budget and ethical constraints.

The sample size has been restricted to elite hockey players as research conducted by Laurence et al., (2012), indicated that different activity levels affect caffeine distribution, thus, influencing an individual's perceptions of its effects.

Pilot questionnaire

A pilot study was conducted using the questionnaire (Appendix 1) on five participants to ensure ambiguous questions were removed and therefore enhance beneficence from the study. Players from the Welsh squad were excluded from the pilot to maximise population size for the main study. Therefore, the population of the pilot study comprised of hockey

players that compete at a high level within University hockey or play internationally in other UK regions; however, their results were not included in the final study.

Once individuals completed the pilot, participants were encouraged to provide constructive feedback on the layout, ease of understanding and overall process of completing the questionnaire. This provided the researcher with the opportunity to implement suitable changes before distribution.

Questionnaire

An online questionnaire was developed to assess the areas of general intake, knowledge and perception of caffeine in elite hockey players. This provided participants the opportunity to complete the questionnaire at a time that was convenient to them, with the aim of enhancing participant response rate.

The questionnaire was designed to take an estimated 5-10-minutes for its completion, to ensure beneficence, reduce participant burden, and encourage completion. The questionnaire consisted of a six-question structure incorporating multiple choice, Likert style and a qualitative style question created using Qualtrics.

Multiple choice questions were used to assess the general intake and knowledge of elite hockey players minimising participant burden whilst providing quantitative data for analysis (Little and Bjork, 2014). A single qualitative style question was incorporated, investigating participants knowledge of the daily adult caffeine recommendation and encouraging participants to expand their responses whilst avoiding prejudgements (Manchester Metropolitan University, 2008). Additional qualitative questions were considered but ruled out as results can be time consuming and difficult to quantify (Manchester Metropolitan University, 2008).

A separate section of the questionnaire focused on investigating hockey players' perceptions of caffeine on fatigue, concentration, performance and as an effective recovery model using Likert scale style questioning. Previous research has identified Likert style questioning as an effective method of investigating an individual's perceptions on a given subject, providing reliable, numerical data that can be statistically analysed, whilst avoiding potentially sensitive or personal questions (Boynton, 2004 B).

As this research did not to require the participants to provide extensive qualitative information, this method was sufficient for this purpose. However, despite the advantages of using a Likert scale, the closed response format forces respondents to make a choice from the given options that may not match their exact perception. This may result in potentially significant amounts of information being lost or distorted (Li, 2013). Therefore, this style of questioning would not be appropriate for gathering information relating to issues of a more sensitive and personal nature, as short questions can be perceived as abrupt and threatening (Boynton, 2004 B).

Participants

The researcher had access to the Welsh hockey federation through personal involvement, therefore, opportunistic sampling was utilised to gather participants for the study. Inclusion criteria for the study was extensive as participants had to be representing Wales currently in either the men and women's Welsh hockey or within the Developmental squad, all of whom were over the age of eighteen; thus, enabling a whole population approach.

Within larger research projects, sample size calculations are carried out to increase the validity and reliability of the given research. However, these power calculations have not been undertaken, as there is already a limited number of participants meeting the inclusion criteria through the opportunistic sampling. Therefore, an estimated sample size of forty-four

was predicted for the purpose of the study, which included the current male and female twenty-two member squad. Exclusion criteria applied to those elite players who were injured and not currently playing in the squad.

Ethics

The Cardiff Metropolitan University application of ethics form was submitted to the School of Health Science ethics committee at the University, for approval (Appendix 5). Once approval was granted, the study commenced.

Distribution of the questionnaire

The study commenced by sending an email to both the female and male Welsh hockey managers which outlined the study's background information, aims and objectives and it's relevance to hockey. To maximise completion rates, confidentiality of responses was assured and the managers were made aware of the researcher's personal interest in both the study and hockey. The pre-established relationship between the researcher and the Hockey team managers provided the researcher with access to a trusted communication channel to the sample population, thereby potentially enhancing questionnaire completion.

Although the use of a reminder email after two weeks was associated with a higher response rate in previous research, it was not carried out within this study as the researcher was not contacting the sample population directly.

Considering ethics, time constraints and required consent, an accessible link to the online questionnaire and the accompanied information sheet (Appendix 2) was forwarded to the current Welsh female and Male hockey players via appropriate members of the hockey managerial team.

Participants were informed through an accompanying information sheet that although the questionnaire would be sent out via the managerial staff, the results of the questionnaire did not go back to the manager, but was sent directly to the researcher in an anonymous format. This provided participants with the opportunity to openly express their perceptions of caffeine, thus, reducing the effect of social influences on the results obtained (Boynton, 2004 A). The information sheet informed participants of the aims and purpose of the study, reason why they were being asked for their involvement, assured confidentiality and anonymity whilst, highlighting that they are under no obligation to take part in the research and could withdraw at any time by simply exiting the questionnaire. Furthermore, informing participants that by completing the questionnaire is in itself, consent and will be within ethnical guidelines, as the information will only be used for the aims stated in the accompanying correspondence.

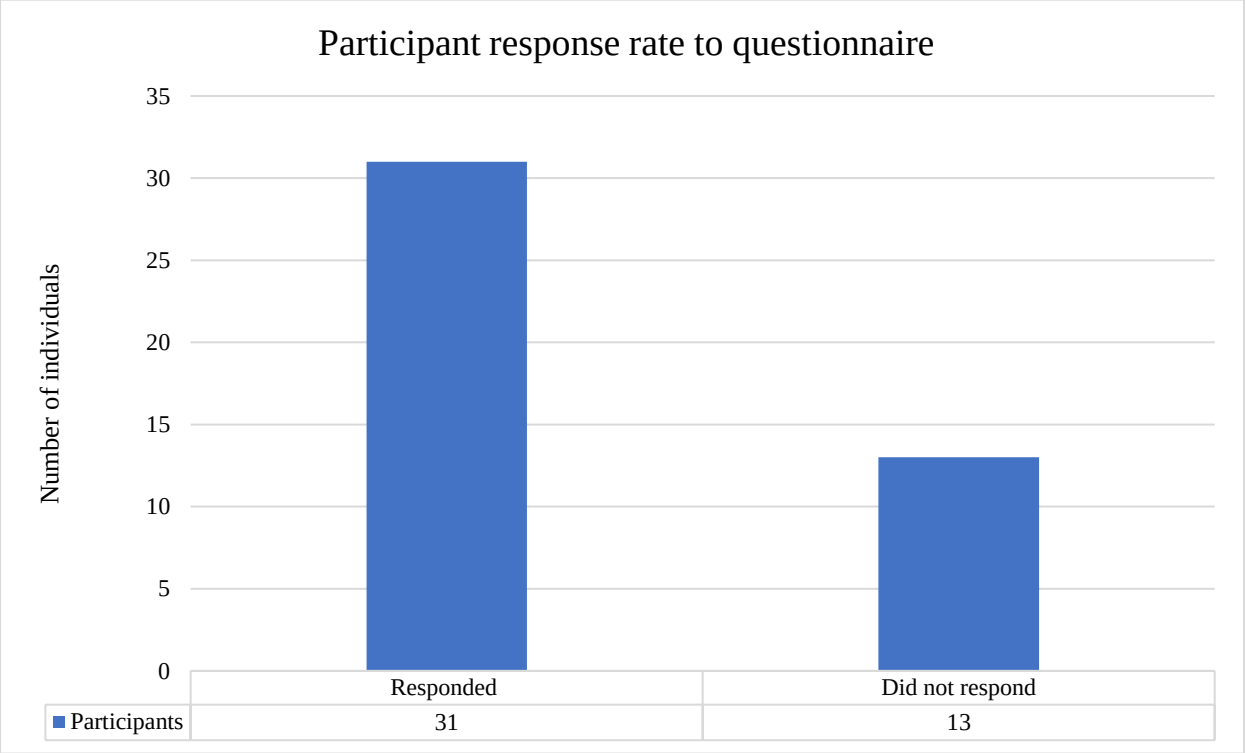
Data collection and analysis

Quantitative data was a combination of nominal and ordinal collected from the returned questionnaires and imported from Qualtrics into excel (Appendix 3). Within Excel, data was gathered and placed into a code book (Appendix 6), providing accurate documentation of the data collected and allowed the display of results through illustrated graphs and tables. Each variable was defined with numbers associated to each of the responses. To statistically analyse the data collected, SPSS (Statistical Package for Social Sciences version 17.0) (Appendix 4) was used to check for statistical significance.

All responses to the questionnaire have been recorded in the results section.

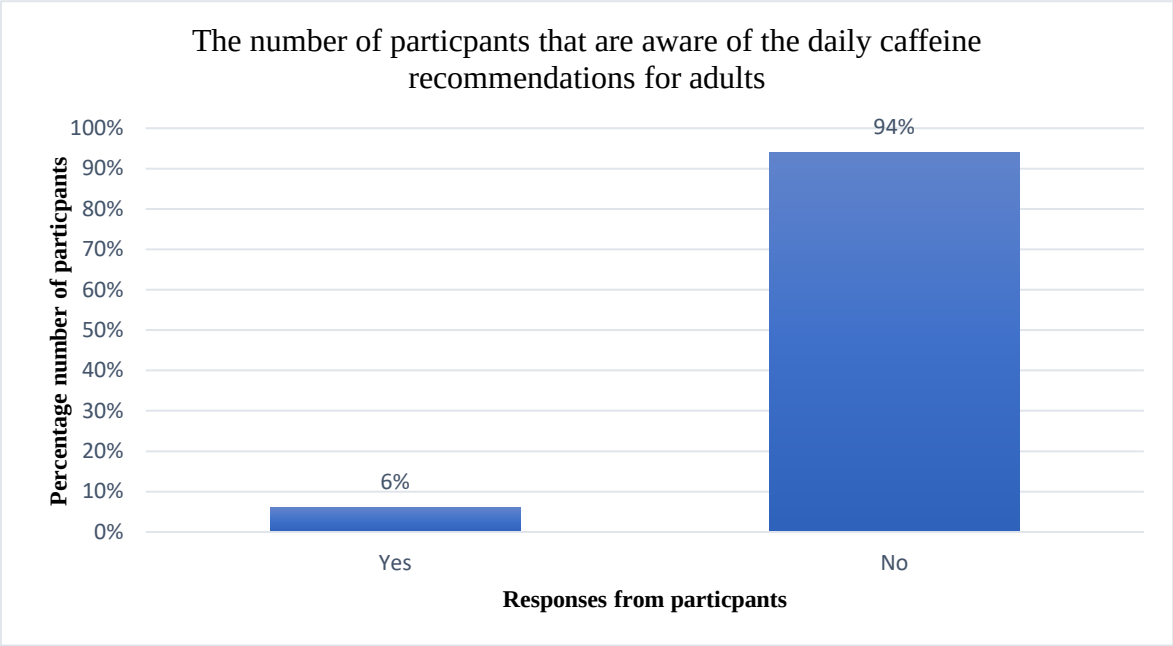
Results

Graph 1: Participant response rate to questionnaire.



Graph 1 illustrates a total response rate of 70% (n=31) out of an anticipated 44 participant sample size.

Graph 2: Awareness of the daily caffeine recommendations for adults



Graph 2 illustrates that 94% (n=29) participants out of the 31 participants sampled were not aware of the daily caffeine recommendations.

Figure 1: Daily caffeine recommendation.

Total responses provided
6 cups of coffee
300mg

Figure 1 is quantifiable data that indicates that only 6% (n=2) participants felt able to quantify their knowledge of the daily caffeine recommendation therefore the majority (94%) of participants were unable to answer the question.

Table 1: Responses to ‘reasons for the consumption of caffeine’.

	Number of responses	Percentage of responses (%)
Enhance sporting performance	11	17
Increase energy	24	36
Enhance mental performance	12	18
Social aspect	14	21
Never thought about it	5	8
	Total n=66	

Chi squared test illustrated there is no statistical significance between the awareness of caffeine in drinks and the reasons for caffeine consumption. P value ($p=0.822$), the test statistic ($t=0.393$) and the degrees of freedom ($df=2$).

Table 2: Grouped reasons for the consumption of caffeine.

	Number of responses	Percentage of responses (%)
Enhance energy/ sporting /mental performance	47	71
Social aspect	14	21
Never thought about it	5	8
	n=66	

Table 2 illustrates that 66 responses were given from the 31 participants due to the multiple-choice style of the question. Results indicate that 71% (n=47) of elite hockey players primarily consume caffeinated products to enhance energy and sporting/mental performance.

.

Table 3: The frequency with which elite hockey players consume different forms of caffeinated drinks/supplements.

	Never	1-3 months	1 per week	2-4 per week	5-6 per week	1 per day	2-3 per day	4-5 per day	6+ per day
Hot Drinks	n=3 10%	n=4 13%	n=2 6%	n=4 13%	n=1 3%	n=6 19%	n=7 23%	n=3 10%	n=1 3%
Sports gels	n=17 55%	n=8 26%	n=3 10%	n=1 3%	n=1 3%	n=0 0%	n=1 3%	n=0 0%	n=0 0%
Sports drinks	n=12 39%	n=10 32%	n=3 10%	n=6 19%	n=0 0%	n=0 0%	n=0 0%	n=0 0%	n=0 0%
Energy drinks	n=18 58%	n=5 16%	n=3 10%	n=3 10%	n=1 3%	n=1 3%	n=0 0%	n=0 0%	n=0 0%
Caffeine supplements/tablets	n=20 65%	n=4 13%	n=2 6%	n=5 16%	n=0 0%	n=0 0%	n=0 0%	n=0 0%	n=0 0%

Table 3 illustrates that hot drinks are the most frequently consumed caffeinated drink/supplement amongst elite hockey players with 77% (n=26) consuming at least one caffeinated hot drink per week. Results further indicate that 65% (n=20) never consume caffeine supplements/tablets, 58% (n=18) never consume energy drinks and 55% (n=17) of participants never consume sports gels.

Table 4: The ranking of caffeinated drinks/supplements based on their level of caffeine (1 being the highest ranking and 7 being the lowest ranking).

	1	2	3	4	5	6	7	Total of responses per question
Cup of coffee	n=2 15%	n=9 69%	n=0 0%	n=1 8%	n=1 8%	n=0 0%	n=0 0%	13
Cup of tea	n=0 0%	n=5 17%	n=10 35%	n=2 7%	n=5 17%	n=3 10%	n=4 14%	29
Standards sports drink	n=6 22%	n=1 4%	n=3 11%	n=6 22%	n=4 15%	n=4 15%	n=3 11%	27
Energy drink	n=2 8%	6 22%	n=2 8%	n=2 8%	n=9 35%	n=5 19%	n=0 0%	26
Soft drink	n=8 30%	n=5 19%	n=2 7%	n=3 11%	n=2 7%	n=3 11%	n=4 15%	27
Sports gels	n=2 7%	n=4 14%	n=1 4%	n=8 29%	n=1 4%	n=3 12%	n=9 32%	28
Caffeine tablets/supplements	n=2 7%	n=2 7%	n=5 18%	n=7 25%	n=4 14%	n=6 22%	n=2 7%	28

Table 4 demonstrates that the level of caffeine in caffeinated drinks/supplements is variable with participant responses varying for each caffeinated drinks/supplement. Nevertheless, a soft drink was ranked as the highest containing caffeinated product listed according to 30%

(n=8) of respondents. The second highest containing caffeinated product was a cup of coffee with 69% (n=9).

A cup of tea was ranked third with 35% (n=10), sports gels were ranked fourth 29% (n=8), energy drinks were fifth 35% (n=9), caffeine tablets/supplements sixth 22% (n=6) resulting in respondents ranking a standard sports drink with the lowest level of caffeine content according to 11% (n=3) of participants.

Table 5: Participants perceptions regarding caffeine

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Pre-match caffeine consumption enhances a players performance by increasing their concentration levels	n=2 6%	n=2 6%	n=5 16%	n=16 52%	n=6 19%
Pre-match caffeine consumption enhances a player's performance by reducing muscle fatigue	n=6 19%	n=8 26%	n=12 39%	n=2 6%	n=3 10%
Pre-match caffeine consumption can contribute to dehydration	n=1 3%	n=1 3%	n=7 23%	n=17 56%	n=5 16%
Post-match caffeine consumption helps aid performance recovery	n=8 26%	n=12 39%	n=7 23%	n=4 13%	n=0 0%

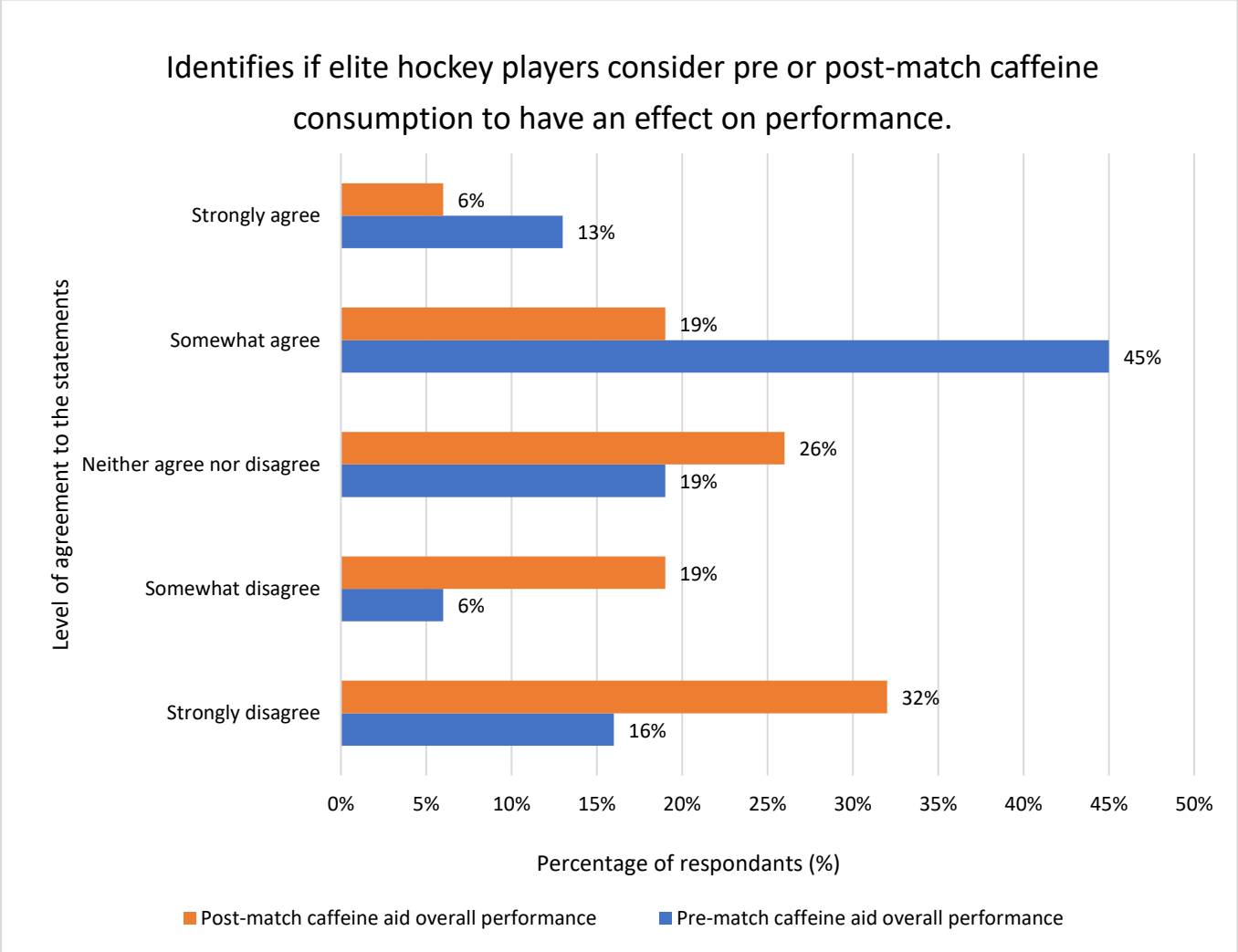
Table 5 illustrates that 71% (n= 24) of participants somewhat agree or strongly agreed that pre-match caffeine consumption enhances a player's performance by increasing their concentration levels.

Results also indicate that the majority of participants 84% (n= 26) disagree or remain neutral that pre-match caffeine consumption reduces muscle fatigue.

72% (n=22) of participants perceive that pre-match caffeine consumption can contribute to dehydration with only 6% (n=2) somewhat agree or strongly disagreeing with this statement.

65% (n=22) of participants strongly or somewhat disagree that post match caffeine consumption is an effective performance recovery method.

Graph 3: Identifies if elite hockey players consider pre or post-match caffeine consumption to have an effect on performance.



Results in graph 3 illustrate that a higher percentage of participants perceive pre-match caffeine consumption to be more effective than post-match on an elite hockey players overall performance.

Table 6: Identifies if elite hockey players consider pre or post-match caffeine consumption to have an effect on performance.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Pre-match caffeine consumption aid overall performance	16% n=5	6% n=2	19% n=6	45% n=14	13% n=4
Post-match caffeine consumption aid overall performance	32% n=10	19% n=6	26% n=8	19% n=6	6% n=2

Table 6 demonstrates that 58% (n=18) agree or strongly agree that pre-match caffeine can aid in the overall performance of an elite hockey player whereas, only 25% (n=8) somewhat agree or strongly agree that post-match caffeine can benefit the overall performance. 16% (n=5) of participants strongly disagree that pre-match caffeine consumption is not important in helping the overall performance of an elite hockey player. Whereas a higher majority of participants (32%, n=10) strongly disagree that post-match caffeine can positively impact on the overall performance of an elite hockey player.

Discussion

The study aimed to explore the intake, knowledge and perceptions of caffeine consumption on the performance of elite hockey players currently representing Wales or in the development squad through an online questionnaire.

The extensive participant exclusion criteria within the present study limited the sampled population to an anticipated 44 participant sample size, hindering the external validity of the research findings. From the anticipated 44 sample group, the study received 31 completed questionnaires resulting in a 70% response rate (Graph 1). To further enhance participant response rate, a financial incentive could have been employed however, this could influence the reliability of results obtained therefore should be implemented with caution (Cook et al., 2016).

Although the whole population approach and use of opportunistic sampling satisfied the studies overall aim, it nevertheless, produces selection bias and does not fully represent the whole elite hockey player population. Consequently, the results are limited to elite hockey players in Wales at this point in time, reducing the comparability of the results. To increase external validity, future studies could implement a cross sectional approach which may result in a larger sample size and therefore provide a greater representation of the hockey population.

The study indicated 29 out of the 31 participants sampled (94%) (Graph 2) were reportedly unaware of the daily adult caffeine recommendations yet the majority (77%) consume at least one form of caffeinated hot drink a week (Table 3). The results obtained, demonstrated no statistical significance between the knowledge of caffeine in drinks and the reasons for caffeine consumption within elite hockey players ($p=0.822$) (Table 1). This suggests knowledge of the current daily caffeine recommendations or level of caffeine in products

does not influence elite hockey players current reasons for caffeine consumption. This is similar to previous research by Llewelyn (2013) and Dascombe et al., (2010), which indicate that both individual and team based athletes may possess inadequate knowledge about the basic nutritional principles of effective caffeine supplementation.

Further, it has been argued that caffeine supplementation should be individually tailored by qualified personnel to meet the specific demands of the individual (Bridge and Jones, 2007). However, it is unknown if the Welsh Hockey Federation or squad have access or prioritises these specialised resources. Although the reasons for inadequate knowledge of caffeine supplementation was not investigated further in the present study, previous research conducted by Cockburn et al., (2014) suggests that the knowledge and perceptions held amongst the elite hockey players could be a result of the potential inaccurate or insufficient nutritional and supplementary knowledge provided by their coaches, media or peers. This potentially may have influenced the Welsh squad's perceptions of caffeine consumption and daily caffeine recommendation.

The majority (71%) of the sampled population primarily consume caffeinated products for enhanced energy, sporting and mental performance, with only a minority (21%) primarily consume caffeine for socialisation (Table 2). This supports research by Llewelyn (2013) which suggests that athletes have a greater consideration for their personal consumption of a supplement or stimulant compared to the general population. Although previous research has suggested an increase in caffeine consumption amongst the general population, limited research has investigated their individual reasons for consumption.

Alternatively, the results obtained reinforce the perceived performance enhancing properties demonstrated in previous research by Tarnopolsky and Cupido, (2000) and Bell and

McLellan, (2002), which highlighted associations between caffeine consumption, enhanced performance reaction times and improved cognitive functioning.

Similarly, the present results suggest that 71% (n= 24) of participants somewhat or strongly agreed that pre-match caffeine consumption enhances a player's performance by increasing their concentration levels (Table 5). This reinforces findings by Goldstein et al., (2010) and Liebermann at al., (2002), which discovered that caffeine consumption can influence both the skeletal muscle and central mechanisms, thereby, potentially improving an individual's short-term memory; potentially minimising the deterioration of an individual's performance. On the contrary, Bottoms et al., (2013) discovered that caffeine had no effect on concentration levels on elite fencers with regards to improving reaction time. These conflicting pieces of research could be a result of the individualised nature of caffeine supplementation and perceived effectiveness as a stimulant consequently, variation is expected between both individuals and studies.

The present study indicates that the majority of participants (84%) perceive pre-match caffeine to be ineffective at minimising muscle fatigue (Table 5). This supports the findings of Schneiker et al., (2006), who suggested that caffeine ingestion was negligible on the statistical mean sprint performance and fatigue, indicating that team-sport athletes should not expect caffeine to enhance repeated-sprint performance. By contrast, Bridge and Jones (2007) and Polito et al., (2017) present a positive link between caffeine consumption and fatigue, through enhanced endurance capacity in both individual and team based athletes. A potential contribution to the varied degree of observed improvements between the above studies could be attributable to the lack of control over subject habituation, which could have an effect on individual perceptions.

Although, specific aspects of fatigue were not investigated in the present study, research by Bloomfield et al., (2005) demonstrates that fatigue is influenced by an extensive range of factors including an individual's age, Body Mass Index (BMI) and the physical demands of an individual's sport, diet and lifestyle. This enforces the idea that caffeine consumption is subjective to individual interpretation and therefore, difficult to accurately quantify. Nevertheless, the results are suggestive that the majority of participants do not perceive caffeine to minimise fatigue.

Results demonstrate that 72% of elite hockey players sampled perceive pre-match caffeine consumption to be a contributory factor to an individual's dehydration status (Table 5). These findings mirror results from Maughan and Griffin, (2003) who suggest that the general population associated caffeine consumption with inducing an acute state of dehydration. By contrast, research by Del Coso et al., (2009) indicates that diuresis may only occur in a caffeine induced individual at rest rather than those participating in physical activity. Consequently, suggesting that an elite athlete hydration may not be compromised compared to the general population. Nevertheless, as this ideology is a perceived perception of the general population, it may also be an influencing factor amongst the sporting community affecting the consumption of caffeinated products amongst elite athletes.

Individuals predominately perceive pre-match caffeine to be more effective than post-match consumption to an athlete's overall performance (Graph 3); with the majority (65%) of respondents not recognising post-match caffeine consumption as an effective performance recovery method (Table 5). Although various studies have investigated caffeine consumption and performance enhancement in team based sports, limited research has been conducted comparing caffeine consumption post and pre-match on the performance of elite hockey players (Tarnopolsky and Cupido, 2000; Bell and McLellan, 2002).

Nevertheless, Battram et al., (2004) and Pedersen et al., (2008) have presented research, which suggest that caffeine is not detrimental to glycogen replenishment and in combination with carbohydrate may act as an important part of the recovery phase, conflicting with results from current study.

For a number of reasons this piece of research was limited to a whole population of 44 elite hockey players currently playing for Wales. In future studies, a cross-sectional approach could be implemented to provide a more effective method for exploring the intake, knowledge and perceptions of caffeine consumption on the performance of elite hockey players across the UK to enhance the evidence base of the study. This would allow further statistical analysis on larger number or participants and facilitate the exploration of trends and potentially highlight regional differences. This future larger study could potentially be used for identifying the comparisons between different sporting groups and to explore how the perceptions could be related to the specific skills required for each sport and how much information is available to the teams through their coaches and associated support systems. Further studies could also be carried out within the general population to create a comparison between perceptions of elite hockey players and those leading a more sedentary lifestyle.

In addition to the quantitative information obtained through the questionnaire, more qualitative information could be obtained through future investigations into the individual perceptions of caffeine through different research methods such as researcher lead focus groups or increase the usage of qualitative style of questioning within the questionnaire. Part of this quantitative research methodology could investigate if the associate ergogenic benefits of caffeine on sporting performance outweighs the perceived effect on hydration amongst the elite athletes.

There is no doubt that hockey players representing Wales are amongst the most elite hockey players within the UK. At this level of competition there are various skills and qualities required during both training and competitive matches to achieve maximum sporting success. For this reason, there is significant interest in various sport enhancing stimulants including the consumption of caffeine amongst elite hockey players and the wider sporting community.

In relation to caffeine intake, knowledge and consumption, respondents in the study had positive perceptions relating to pre-match caffeine intake on performance. However, this was not uniform across all the performance components explored; with more positive perceptions associated with pre-match caffeine intake as opposed to improved post-match recovery. These individual perceptions of caffeine in relation to performance are likely to be influenced by numerous factors including the volume and frequency of caffeine consumption and the availability of caffeine information provided to the players.

Future research could be carried out to provide more in-depth exploration into the perceptions of caffeine amongst elite hockey players in relation to performance or a similar study carried out within a larger population size to provide a broader statistical base for analysis.

References

- Battram D., Shearer J., Robinson D., Graham T. (2004). 'Caffeine ingestion does not impede the resynthesise of proglucagon and macro-glycogen after prolonged exercise and carbohydrate supplementation in humans.' *Journal of Applied Physiology.* 96:3 pp943-950. 10.1152/japplphysiol.00745.2003.
- Bell D. and McLellan T. (2002). 'Exercise endurance 1, 3, and 6 h after caffeine ingestion in caffeine users and nonusers.' *Journal of Applied Physiology.* 93:4 pp1227-34.
- Bloomfield J., Polman R., Butterly R. and O'Donoghue P. (2005). 'Analysis of age, stature, body mass, BMI and quality of elite soccer players from 4 European Leagues.' *Journal of Sports Medicine and Physical Fitness.* 45 pp58-67.
- Bottoms L., Greenhalgh A. and Gregory K. (2013). 'The effect of caffeine ingestion on skill maintenance and fatigue in epee fencers.' *Journal of Sports Sciences.* 31:10 pp1091-1099, DOI: 10.1080/02640414.2013.764466
- Boynton, P. (2004). (A) Reaching beyond the white middle classes. BMJ, 328(7453), pp.1433-1436.
- Boynton, P. (2004). (B) Selecting, designing, and developing your questionnaire. BMJ, [online] 328(7451), pp.1312-1315. Available at: http://www.bmj.com.ezproxy.cardiffmet.ac.uk/content/328/7451/1312 [Accessed 5 Apr. 2017].
- Bridge C. and Jones M. (2007). 'The effect of caffeine ingestion on 8 km run performance in a field setting.' [online] Taylor and Francis Online. Available at: http://www-tandfonline-com.ezproxy.cardiffmet.ac.uk/doi/citedby/10.1080/02640410500231496?scroll=top&needAccess=true [Accessed 7 Apr. 2017].
- Cockburn, E., Fortune, A., Briggs, M. and Rumbold, P. (2014). Nutritional Knowledge of UK Coaches. Nutrients, [online] 6(4), pp.1442-1453. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4011044/ [Accessed 9 May 2018].
- Collomp K., Ahmaidi S., Audran M., Chanal J. and Prefaut C. (1991). 'Effects of caffeine ingestion on performance and anaerobic metabolism during the wingate test.' *International Journal of Sports Medicine*.;12 pp439–43. doi: 10.1055/s-2007-1024710.
- Cook, D., Wittich, C., Daniels, W., West, C., Harris, A. and Beebe, T. (2016). Incentive and Reminder Strategies to Improve Response Rate for Internet-Based Physician Surveys: A Randomized Experiment. Journal of Medical Internet Research, [online] 18(9), p.e244. Available at: https://www-ncbi-nlm-nih-gov.ezproxy.cardiffmet.ac.uk/pmc/articles/PMC5045523/ [Accessed 3 May 2018].
- Dascombe B., Karunaratna M., Cartoon J., Fergie B. and Goodman C. (2010). 'Nutritional supplementation habits and perceptions of elite athletes within a state-based sporting institute.' *Journal of Science and Medicine in Sport*. [online] 13(2) pp.274-280. Available at: http://www.sciencedirect.com.ezproxy.cardiffmet.ac.uk/science/article/pii/S1440244009000863?via%3Dihub [Accessed 19 Jul. 2017].

- Del Coso J., Estevez E. and Mora-Rodriguez R. (2009). 'Caffeine during exercise in the heat: Thermoregulation and fluid-electrolyte balance.' *Medicine & Science in Sports & Exercise*, 41: pp164-73.
- Desbrow B. and Leveritt M. (2007). 'Well-Trained Endurance Athletes' Knowledge, Insight, and Experience of Caffeine Use.' *International Journal of Sport Nutrition and Exercise Metabolism.* [online] 17(4), pp.328-339. Available at: http://web.b.ebscohost.com.ezproxy.cardiffmet.ac.uk/ehost/pdfviewer/pdfviewer?vid=1&sid=cd59815c-c88d-4d71-a85e-27647b66511c%40sessionmgr101 [Accessed 20 Jul. 2017].
- Goldstein E., Ziegenfuss T., Kalman D., Kreider R., Campbel B., Wilborn C., Taylor L., Willoughby D., Stout J., Graves B., Wildman R., Ivy J., Spano M., Smith A. and Antonio J. (2010). 'International society of sports nutrition position stand: caffeine and performance.' *Journal of the International Society of Sports Nutrition*. [online] 7:1 p.5. Available at: https://jissn.biomedcentral.com/articles/10.1186/1550-2783-7-5 [Accessed 11 Apr. 2017].
- Knicker A. J., Renshaw I., Oldham R., and Cairns P. (2011). 'Interactive processes link the multiple symptoms of fatigue in sport competition.' *Sports Medicine.* 41:4 pp307-328
- Laurence G., Wallman K. and Guelfi K. (2012). 'Effects of caffeine on time trial performance in sedentary men.' [online] Taylor and Francis Online. Available at: http://www-tandfonline-com.ezproxy.cardiffmet.ac.uk/doi/full/10.1080/02640414.2012.693620?scroll=top&needAccess=true [Accessed 7 Apr. 2017].
- Lewis O. (2014). *The effects of fatigue on field hockey players*. Honours Bachelor of science. Cardiff Metropolitan University.
- Li, Q. ed., (2013). A novel Likert scale based on fuzzy sets theory. In: Expert systems and Aplications, 5th ed. [online] USA: Elevier, pp.1609-1618. Available at: http://www.sciencedirect.com.ezproxy.cardiffmet.ac.uk/science/article/pii/S095741741201069X [Accessed 6 Apr. 2017].
- Lieberman H., Tharion W., Shukitt-Hale B., Speckman K. and Tulley R. (2002). 'Effects of caffeine, sleep loss, and stress on cognitive performance and mood during U.S. Navy SEAL training.' *Psychopharmacology*. [online] 164:3 pp.250-261. Available at: http://jtoomim.org/brain-training/Effects%20of%20caffeine,%20sleep%20loss,%20and%20stress%20on%20cognitive%20performance%20and%20mood%20during%20US%20Navy%20SEAL%20training.pdf [Accessed 23 Aug. 2017]
- Little, J. and Bjork, E. (2014). The Persisting Benefits of Using Multiple-Choice Tests as Learning Events. Memory & Cognition, [online] 43(1), pp.14-26. Available at: https://mindmodeling.org/cogsci2012/papers/0128/paper0128.pdf [Accessed 2 May 2018].
- Llewelyn R. (2013). Does a relationship exist between level of nutritional knowledge and dietary intake application amongst football player's?. Bachelor of science (Honours). Cardiff Metropolitan University.
- Manchester Metropolitan University., (2008). Analyse This!!! - qualitative data - advantages and disadvantages. [online] Available at:

http://archive.learnhigher.ac.uk/analysethis/main/qualitative1.html [Accessed 25 Apr. 2018].

- Maughan R. and Gleeson M. (2010). *The biochemical basis of sports performance.* (2nd ed) Oxford: Oxford University Press. pp.168-169.
- Maughan R. and Griffin J. (2003). 'Caffeine ingestion and fluid balance: A review.' *Journal of Human Nutrition and Dietetics*. [online] 16:6 pp.411-420. Available at: http://onlinelibrary.wiley.com.ezproxy.cardiffmet.ac.uk/doi/10.1046/j.1365-277X.2003.00477.x/full [Accessed 10 Apr. 2017].
- Pedersen J., Lessard J., Coffey G., Churchley E., Wootton M., Ng T., Watt M. and Hawley A. (2008). 'High rate of muscle glycogen resynthesises after exhaustive exercise when carbohydrate is ingested with caffeine.' *Journal of Applied Physiology*.105 pp7-13. 10.1152/japplphysiol.01121.2007.
- Polito L., Figueria A., Miranda M., Chtourou H., Marinda J. and Brandan M. (2017). 'Psychophysiological indicators of fatigue in soccer players: A systematic review.' *Science and Sport*. [online] 32:1 pp.1-13. Available at: http://www.sciencedirect.com.ezproxy.cardiffmet.ac.uk/science/article/pii/S0765159716301484 [Accessed 7 Apr. 2017].
- Roti W., Casa D., Pumerantz C., Watson G., Judelson A., Dias C., Ruffin K. and Armstrong L. (2006). 'Thermoregulatory responses to exercise in the heat: chronic caffeine intake has no effect.' *Aviation Space Environment Medicine*. 77:2 pp124-9.Available at https://www-ncbi-nlm-nih gov.ezproxy.cardiffmet.ac.uk/pubmed/16491580?report=docsum&format=text [Accessed 4 Aug 2017]
- Schneiker K., Bishop D., Dawson B. and Hackett L. (2006). 'Effects of Caffeine on Prolonged Intermittent-Sprint Ability in Team-Sport Athletes.' *Medicine & Science in Sports & Exercise.* [online] 38:3 pp.578-585. Available at: https://www.researchgate.net/profile/David_John_Bishop/publication/7237558_Effects_of_Caffeine_on_Prolonged_Intermittent-Sprint_Ability_in_Team-Sport_Athletes/links/53e243e70cf24f90ff65d5b7.pdf [Accessed 11 Apr. 2017].
- Tarnopolsky M. and Cupido C. (2000). 'Caffeine potentiates low frequency skeletal muscle force in habitual and nonhabitual caffeine consumers.' *Journal of Applied Physiology*. [online] 89:5 pp.1719-1724. Available at: http://jap.physiology.org.ezproxy.cardiffmet.ac.uk/content/89/5/1719.article-info [Accessed 19 Jul. 2017].

Word count: 5446

Appendix 1: Research tool

The following questions are regarding your caffeine intake:

1. **From the following options please write how frequently you consume these different forms of caffeinated drinks/supplements. If you do not consume some or all of these caffeinated drinks/supplements, please write not applicable (N/A) in the appropriate box.**

Name of the caffeinated drink/supplement	How regularly do you consume this form of caffeine? (For example: n/a, once a month, 3 times a day, twice a week)
Hot drinks eg tea/coffee	
Sports drinks	
Energy dink eg red bull/monster	
Fizzy/soft drinks	
Sports gels	
Caffeine tablets/ supplementations	

If you consume other forms of caffeine please specify with the frequency of consumption:
_____

2. **Please circle the reasons why you choose to consume caffeine. (Circle as many as applicable).** ***If you do not consume caffeine, please proceed to question 3****.*

Enhance sporting performance Enhance mental performance

Increase energy Social aspect

Never thought about it

If you have other reasons, please specify: _____

The following questions are regarding your caffeine knowledge

3. **Please rank the following caffeinated drinks/supplements based on their level of caffeine (1 being the highest ranking and 6 being the lowest ranking).**

A cup of Coffee	
A cup of Tea	
Sports drinks	
Energy drink eg red bull/monster	
Soft drinks	
Sports gels	
Caffeine tablets/ supplements	

4. **Are you aware of the daily caffeine recommendations for adults?** ***(Please circle the appropriate answer, if the answer is no please continue to question 5).***

Yes No

b) If yes, please state the daily caffeine recommendation _____

The following questions are regarding your perceptions about caffeine

5. Please rate your agreement with the following statements by highlighting/selecting the most relevant score below.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Pre-match Caffeine consumption enhances a hockey player's performance by increasing their concentration levels.	1	2	3	4	5
Pre-match Caffeine consumption enhances a hockey player's performance by reducing muscle fatigue	1	2	3	4	5
Pre-match Caffeine consumption can contribute to dehydration	1	2	3	4	5
Pre-match Caffeine consumption is important to aid my performance.	1	2	3	4	5
Post-match caffeine consumption helps aid my performance recovery.	1	2	3	4	5
Post-match Caffeine consumption is important to aid my overall performance.	1	2	3	4	5

Thank-you for participating in this study ☺

Appendix 2: Information sheet

Dear Elite hockey player,

I am a final year BSc Human Nutrition and Dietetics student, studying at Cardiff Metropolitan University. As a keen hockey player myself, my chosen dissertation involves conducting a small-scale survey on elite hockey players' perceptions of the effects of caffeine on overall sporting performance.

The number of elite hockey players that are included in my survey is relatively small for this type of research. Therefore, I would appreciate it if you could assist me by filling in my short questionnaire. I have included a link which will lead you to an online questionnaire which should take you no longer than 5 minutes to complete. Should you decide to take part and then change your mind, just withdraw from the study at any point by exiting the questionnaire. It will be assumed that when completing this questionnaire, you imply your consent to take part. I would like to reassure you that no intrusive information is asked for and there are no correct or incorrect answers. My final report will be a composite one and all responses will be treated as anonymous.

I would like to thank you for reading my email and I really hope you decide to take part.

If you would like more information about this research, you are encouraged to contact the researcher' supervisor, Ms Victoria Gould who can be contacted on vjgould@cardiffmet.ac.uk

Yours sincerely,

Jane McClements

Appendix 3: Excel spreadsheet summary

Hot_freq	Gel_Freq	Sport_Dr	EnergyD	Caf_Sup	Reasons	Lev_COC	Lev_COT	Lev_SpDr	Lev_EnDr	Lev_Soft	Lev_Gel	Lev_Supp	Awarenes	Recommen	Pre_Conc	Pre_fat	Pre_Dehy	Pre_Per	Pos_Per	OVR_POS
7	1	2	1	1	1	2	1	3	7	4	5	6	1	6 cups of coffee	3	3	2	3	3	2
4	3	4	6	1	2,3,4	7	3	2	1	4	6	5	2		1	2	3	4	2	5
7	2	2	1	1	2	7	1	2	6	4	5	3	2		4	3	3	1	4	3
8	1	1	1	2	4					4	6	7	2		4	3	3	4	4	4
2	5	4	4	4	2	3	1	2	5	4	6	7	2		4	4	4	4	4	4
2	2	3	3	4	2	2	5	6	4	7	3	1	2		4	3	4	4	2	3
1	3	4	5	4	2	6			2	4	5	3	2		2	3	4	3	4	4
3	3	4	4	4	2	2	3	6	4	7	5	1	2		4	3	4	3	3	4
2	1	1	1	1	5	2	4	5	1	7	6	3	2		3	3	3	3	3	3
7	1	4	1	1	2,4	4	7	5	1	6	3	2	2		3	3	3	2	2	1
7	1	1	1	1	1,2,3,4	7	5	2	3	1	4	6	1	300 mg	5	5	1	5	1	5
7	1	2	2	2	1,3,4	3	7	5	1	6	4	2	2		4	3	3	4	2	4
6	2	1	1	1	2,4	3	6			7	4	2	2		4	2	4	1	3	1
6	7	1	1	1	2	6	3	4	1		2	7	2		4	2	4	4	1	3
6	2	1	1	1	1,2,3,4	3	7	5	2	6	4	1	2		5	5	5	5	1	1
1	1	1	3	4	1	5	4	2	6	1	3	7	2		5	4	4	5	2	2
7	1	3	1	1	1,2,4				1	2			2		4	1	4	4	3	2
6	1	2	1	1	1,2,3,4	3	5		1		7	2	2		5	2	4	4	2	4
6	1	3	3	1	2,3	3	5	6	2	4	7	1	2		4	1	4	1	1	1
4	1	4	4	1	2,3	5	4	1	7	2	3	6	2		4	5	4	3	2	3
9	1	2	2	2	1,2,3	6	4	5	2	3	1	7	2		5	2	4	4	2	4
6	1	1	1	1	2	2	6	3		7	4	1	2		3	2	4	4	2	1
2	2	2	2	3	1,2,3	4	6	5	2	7	3	1	1		2	2	5	4	1	1
4	1	2	2	2	1,2,4	5	1	4	7	2	6	3	2		4	1	4	3	2	1
8	1	1	1	1	3,4	5	4	6	3	7	1	2	2		1	1	5	1	1	1

8	2	1	1	1	2,4	3	1	2	4	5	6	7	2		5	1	5	1	1	1
1	4	1	1	1	2	3	4	5	6	7	2	1	2		4	3	3	4	2	2
3	2	2	1	1	1,2	5	1	6	7	2	4	3	2		3	2	4	5	2	2
7	1	2	1	1	3,4	3	6	5	1	7	4	2	2		4	1	5	2	1	2
5	2	2	2	3	1,2, 3,4	3	2	1	5			7	2		4	3	4	4	3	3
4	1	1	1	1	2	7		5		4		1	2		4	3	4	4	3	3

Appendix 4: Copy of SPS output

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.393[a]	2	.822
Likelihood Ratio	.566	2	.753
Linear-by-Linear Association	.004	1	.949
N of Valid Cases	31		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .19.

Appendix 5: Ethical approval letter

Cardiff Metropolitan University | Prifysgol Metropolitan Caerdydd

Thursday, 29 June 2017
cshs/ethics /approved

[redacted]
BSc (Hons) Human Nutrition & Dietetics
Cardiff School of Health Sciences

Dear Applicant

Re: Application for Ethical Approval: An exploration of the knowledge, intake and perceptions of caffeine in sport amongst Elite Hockey Players in Wales

Project Reference Number : 9242

Your ethics application, as shown above, was considered by the Health Care and Food Ethics Panel on 28/06/2017.

I am pleased to inform you that your application for ethical approval was **APPROVED**.

Minor issues may still need addressing before you commence any work – if so these will be listed below.

N/A

Where changes to the information sheet, consent form and/or procedures are deemed necessary you must submit revised versions to the relevant ethics inbox. If you are a student – your supervisor must do this on your behalf.

Note: Failure to comply with any issues listed abiove will nullify this approval.

Standard Conditions of Approval

1. Your Ethics Application has been given a Project Reference number as above. This **MUST** be quoted on all documentation relating to the project (E.g. consent forms, information sheets), together with the full project title.
2. All documents must also have the approved University Logo and the Version number in addition to the reference and project title as above
3. A full **Risk Assessment** must be undertaken for this proposal, as appropriate, and be made available to the Committee if requested.
4. Any changes in connection to the proposal as approved, must be referred to the Panel/Committee for consideration ***without delay quoting your Project Reference Number.*** Changes to the proposed project may have ethical implications so must be approved.
5. Any untoward incident which occurs in connection with this proposal must be reported back to the Panel ***without delay***.
6. If your project involves the use of **human samples**, your approval is given on the condition that you or your supervisor **notify the HTA Designated Individual** of your intention to work with such material by **completing** the form entitled *"Notification of Intention to Work with Human Samples"*. The form must be submitted to the PD (Sean Duggan), **BEFORE** any activity on this project is undertaken

Cardiff School of Health Sciences
Western Avenue,
Cardiff, CF5 2YB
Ysgol Gwyddorau Iechyd Caerdydd
Rhodfa'r Gorllewin,
Caerdydd, CF5 2YB
Telephone/Ffôn
+44(0)29 2041 6070
Fax/Ffacs
+44 (0)29 2041 6985
www.cardiffmet.ac.uk

This approval expires on 28/06/2018 . It is your responsibility to reapply / request extension if necessary.

Yours sincerely

Chair of Department of Healthcare and Food Ethics Panel
Cardiff School of Health Sciences
Llandaf Campus
Western Avenue, Cardiff CF5 2YB
2 5

Co

PLEASE RETAIN THIS LETTER FOR REFERENCE

Appendix 6: Coding tool

The aim of this research is to explore the intake, knowledge and perceived perceptions of caffeine consumption on performance within a population of elite hockey players currently within the development squad or representing Wales.

The objectives are:

- Investigate elite hockey player's intake and sources of caffeine.
- Investigate elite hockey player's knowledge of caffeine content of drinks/supplements and recommendations for safe limits.
- Explore elite hockey player's perceptions of caffeine on their performance in sport

Description of variable	SPSS Variable name	Type of data	Coding Instructions
1. Name forms of caffeinated drinks/supplements consume. a) Hot drink frequency	Hot_freq	ordinal	1= never 2= 1-3 per month 3= 1 per week 4= 2-4 per week 5= 5-6 per week 6= 1 per day 7= 2-3 per day 8= 4-5 per day 9= 6+ per day
b) Sports gels	Gel_Freq	ordinal	1= never 2= 1-3 per month 3= 1 per week 4= 2-4 per week 5= 5-6 per week 6= 1 per day 7= 2-3 per day 8= 4-5 per day 9= 6+ per day
c) Sports drinks	Sport_Dr	ordinal	1= never 2= 1-3 per month 3= 1 per week 4= 2-4 per week 5= 5-6 per week 6= 1 per day 7= 2-3 per day 8= 4-5 per day 9= 6+ per day
d) Energy drinks	EnergyD	ordinal	1= never 2= 1-3 per month 3= 1 per week 4= 2-4 per week 5= 5-6 per week 6= 1 per day 7= 2-3 per day 8= 4-5 per day 9= 6+ per day

e) Caffeine tablets/ supplements	Caf_sup	ordinal	1= never 2= 1-3 per month 3= 1 per week 4= 2-4 per week 5= 5-6 per week 6= 1 per day 7= 2-3 per day 8= 4-5 per day 9= 6+ per day
2. Reasons consuming caffeine.	Reasons	Nominal	1= Enhance sporting performance 2= increasing energy 3= enhance mental performance 4= Social aspect 5= never thought about it
3. Rank the following caffeinated drinks/supplements based on their level of caffeine. a) Cup coffee	Lev_COC	Ordinal	1-7 where 1=highest and 7=lowest
b) Cup of tea	Lev_COT	Ordinal	1-7 where 1=highest and 7=lowest
c) Standard sports drink	Lev_SpDr	Ordinal	1-7 where 1=highest and 7=lowest
d) Energy drink	Lev_EnDr	Ordinal	1-7 where 1=highest and 7=lowest
e) Soft drink	Lev_Soft	Ordinal	1-7 where 1=highest and 7=lowest
f) Sports gels	Lev_Gel	Ordinal	1-7 where 1=highest and 7=lowest
g) Caffeine tablets/supplements	Lev_Supp	Ordinal	1-7 where 1=highest and 7=lowest
4. Awareness of the daily caffeine recommendations for adults.	Awarenes	Nominal	1=yes 2=no
5. State the daily caffeine recommendation	Recommen	Scale	Refer to the actual Caffeine intake.
6. Rating of pre-match Caffeine consumption on performance by increasing their concentration levels.	Pre_Conc	Ordinal	1-5 where 5= strongly agree 4=agree 3=neither agree/disagree 2=disagree 1= strongly disagree
b) Rating of pre-match Caffeine consumption on reducing muscle fatigue.	Pre_fat	Ordinal	1-5 where: 5= strongly agree 4=agree 3=neither agree/disagree 2=disagree 1= strongly disagree
c) Rating pre-match Caffeine consumption on dehydration	Pre_Dehy	Ordinal	1-5 where 5= strongly agree

			4=agree 3=neither agree/disagree 2=disagree 1= strongly disagree
d)Rating pre-match Caffeine consumption on performance.	Pre_Per	Ordinal	1-5 where 5= strongly agree 4=agree 3=neither agree/disagree 2=disagree 1= strongly disagree
e) Rating post-match caffeine on performance recovery.	Pos_Per	Ordinal	1-5 where 5= strongly agree 4=agree 3=neither agree/disagree 2=disagree 1= strongly disagree
f) Rating post-match caffeine on overall performance.	OVR_POS	Ordinal	1-5 where 5= strongly agree 4=agree 3=neither agree/disagree 2=disagree 1= strongly disagree