The Body Composition, Nutritional Knowledge, Attitudes, Behaviors, and Future Education Needs of Senior Schoolboy Rugby Players in Ireland

Michelle Walsh, Laura Cartwright, Clare Corish, Sheila Sugrue, and Ruth Wood-Martin

Purpose: This study examined the body composition, nutritional knowledge, behaviors, attitudes, and educational needs of senior schoolboy rugby players in Ireland. Methods: Participants included 203 male rugby players age 15–18 yr competing at Senior School’s Cup level in Leinster, Ireland. Estimation of body composition included measurement of height, weight, and percentage body fat (PBF; using bioelectrical impedance analysis, Tanita BC-418). Nutritional knowledge, behaviors, attitudes, and education needs were assessed by questionnaire. Results: The range of PBF was 5.1–25.3%. Sixty-eight percent of the players in this study had a healthy PBF (10–20%), 32 (22%) were classified as underweight (<10% body fat), and 9.7% (n = 14) were overweight. Assessment of nutritional knowledge demonstrated poor knowledge of the foods required for refueling, appropriate use of sports drinks, and the role of protein in muscle formation. Alcohol consumption and dietary supplement use were reported by 87.7% and 64.5%, respectively. A perception that greater body size enhances sport performance did not predict dietary supplement use. Nutritional advice had been previously sought by 121 players from coaches (66.9%), magazines (42.1%), Web sites (38.8%), peers (35.5%), family (28.1%), sport organizations (16.5%), and health professionals (8.2%). Nutritional knowledge was no better in these players, nor did better nutritional knowledge correlate with positive dietary behaviors or attitudes. Conclusions: Most players had a healthy PBF. Despite a positive attitude toward nutrition, poor nutritional knowledge and dietary practices were observed in many players. Young athletes’ nutritional knowledge and dietary practices may benefit from appropriate nutritional education.

Keywords: adolescents, nutrition, percent body fat, dietary practices

Rugby union is a field sport that is increasing in popularity worldwide. Similar to rugby league in its physical demands, about which there has been more scientific study (Gabbett, Johns, & Riemann, 2008; Lundy, O’Connor, Pelly, & Caterson, 2006), a rugby union match lasts approximately 80 min and is characterized by frequent episodes of high-intensity running and tackling, interspersed with short recovery periods, demanding a high level of aerobic fitness, speed, agility, and muscle power. Rugby union is played by all age groups in Ireland, from underage level through to the senior national squad. Senior schoolboy rugby players are usually 15–18 years old and compete in the Irish Senior School’s Cup competition throughout the academic year. The level of competition is high, with some school players also playing for the under-18 and under-19-year-old national rugby union teams.

Young rugby players have unique nutritional requirements that include consuming sufficient energy, maintaining adequate hydration, and ensuring appropriate timing and composition of meals for optimal sport performance (Petrie, Stover, & Horswill, 2004). Although information on the nutritional practices of schoolboy rugby players is unavailable, young athletes generally are reported to have poor understanding of the principles of sports nutrition (Massad, Shier, Koceja, & Ellis, 1995; Nichols, Jonnalagadda, Rosenbloom, & Trinkaus, 2005; Reading, McCargar, & Marriage, 1999; Rosenbloom, Jonnalagadda, & Skinner, 2002; Shifflett, Timm, & Kahanov, 2002), do not adhere to dietary recommendations appropriate for sport (Cole et al., 2005), and often practice unhealthy dietary behaviors (Juzwiak, Paschoal, & Lopez, 2000).

In Ireland, although some basic nutrition education is incorporated into the secondary-school curriculum, there is no provision of nutritional advice specific to sport. There is also a lack of nutritional advice specifically for adolescent rugby players. To help the Irish Rugby Football Union (IRFU) develop their nutrition services in the school setting, this study investigated the body composition of schoolboy rugby players playing at a senior level and compared the findings with published reference values for healthy U.K. adolescents (McCarthy, Cole, Fry, & Jebb, 2006). Dietary behaviors, nutritional knowledge,
attitudes, previous nutrition education, and participants’ wishes for nutrition services were established.

Methods

Participant Selection

Participants were selected from the senior rugby panels in six secondary schools in Leinster, Ireland. Each school included had participated in rugby for at least 50 years, fielding a minimum of 15 rugby teams annually, regularly competing in provincial competitive matches, and providing players for national squads (under 18 and under 19 years). Ethical approval for the study was granted by the Dublin Institute of Technology Research ethics committee.

Body Composition

Height was measured using a freestanding, portable stadiometer (Leicester Height Measure, Seca Ltd., Birmingham, UK). Subjects stood upright in bare feet with heels together, looking straight ahead, using the Frankfort plane as a point of reference. Each subject was asked to inhale deeply and maintain a fully erect position while maintaining the head in the Frankfort position. Body-composition data were gathered for each participant using a Tanita body-composition analyzer (BC-418MA; Tanita Corp., Tokyo) that used an eight-electrode (two on each hand and foot) bioelectrical impedance analysis (BIA) technique (50 kHz, 200 μA). Body-composition measurements were performed with subjects barefoot, in light clothing, after a 4-hr fast from food and fluid, and having avoided alcohol consumption in the previous 24 hr and participation in intensive exercise in the previous 12 hr (Heyward, 1998). Hydration status was calculated from data obtained from body-composition analysis using the following equation: percentage hydration = \[ \frac{\text{[total body water/weight (kg)]}}{\times 100} \]. Participants with a percentage hydration of <50% were considered dehydrated (Van Loan & Boileau, 1996) and were excluded from body-composition data analysis because percentage body fat (PBF) would be overestimated (Kerr & Ackland, 2006). Athlete mode was selected, defined by Tanita as a person involved in intense activity at least 10 hr/week. This is based on differing hydration levels observed in athletic individuals compared with their nonathletic peers, making standard mode inappropriate for use with this group (Battistini, Virgili, & Bedogni, 1994). Body-composition data obtained from participants younger than 17 years were excluded from analysis because there are no valid equations for athletic mode for this age group, so PBF would be inaccurate (Battistini et al., 1994).

Questionnaire

Participants completed a questionnaire designed specifically for this study. It consisted of 40 questions categorized into five sections: position of play and training schedules, dietary and hydration practices, attitudes toward nutrition and hydration, nutrition knowledge, and sources of nutritional information and perceived future nutrition education needs. Closed single-answer questions were predominantly used in all five sections. A 4-point Likert scale was used in the evaluation of nutritional attitudes in two questions, and one open question was used to evaluate educational needs. Answers were later pooled by common themes for data analysis. Specific questions investigating dietary practices were taken from a previously validated questionnaire used with Irish adolescents (“SLAN,” 2006). Questions investigating sports nutrition knowledge and attitudes were adapted from previously published studies (Gracey, Stanley, Burke, Corti, & Beilin, 1996; Massad et al., 1995; Nichols et al., 2005; Rosenbloom et al., 2002; Zawila, Schofield, & Wall, 2003). A knowledge score was calculated for each athlete by adding the total number of correctly answered questions in the knowledge section. The minimum score that could be obtained was 0 (0%), and the maximum score was 16 (100%). Twenty-three additional questions were specifically designed to capture current practices, knowledge, and attitudes relevant to Irish schoolboy rugby players.

The initial draft of the questionnaire was piloted for comprehension by 4 male secondary-school pupils of age similar to those of the study participants (16–18 years) who participated in rugby at school level but were not attending a school participating in the research study. Based on the findings of the pilot study, minor changes were made to the wording and order of questions to facilitate comprehension of the questionnaire.

To minimize consultation between participants, the questionnaires were completed in the presence of two student BSc Human Nutrition and Dietetics researchers and the IRFU sports dietitian.

Statistical Analysis

A database for data entry was prepared using the statistical software package SPSS version 16.0 (SPSS Inc., Chicago, IL) for Windows. Descriptive statistics (mean, standard deviation, and range) together with frequency statistics were used to summarize the main observations (e.g., age, PBF, mean knowledge scores). Independent t tests or Mann–Whitney U tests (depending on the normality of distribution of the data variables) were used to explore whether there were differences between the dietary behaviors, attitudes, and information sources of those playing in forward and back positions. Cross-tabulation and chi-square analysis were used to examine relationships between categorical variables (e.g., the responses to individual nutritional knowledge questions and specific dietary behaviors, e.g., questions about hydration and hydration practices before, during, and after training and matches). Pearson product–moment correlation was used to explore the strength of correlation between continuous variables: knowledge scores, age, and PBF. We set a p value of <.05 as statistically significant.
Results

Body Composition

A total of 203 senior schoolboy rugby players participated in this study. Height, weight, and questionnaire data were obtained for all 203 players. PBF data were used only from those age 17 years or older who were normally hydrated ($n = 144$) for the reasons already outlined. The body-composition characteristics of the study participants are presented in Table 1. Backs were shorter ($p = .00$) and lighter ($p = .03$) than forwards, whereas forwards had significantly higher PBF than backs ($p < .01$).

Using the classification of PBF for adolescents published by McCarthy et al. (2006), 32 (22%) of the 144 participants were classified as underweight (<10% body fat), 68.1% ($n = 98$) as healthy weight (10–20% body fat), and 9.7% ($n = 14$) as overweight (>20% body fat). Of the 14 rugby players who were classified as overweight or obese, 13 (92.3%) were forwards.

Nutritional Knowledge

The average number of nutritional knowledge questions answered correctly was 9.5 ($SD = 2.0$), giving a mean nutritional knowledge score of 59.6%. No difference in nutrition knowledge among players of different ages (16, 17, or 18 years), PBF, or position of play was observed. The responses to the questions assessing nutritional knowledge are summarized in Tables 2 and 3. Questions on hydration were answered most accurately (mean score 76.4%), with those on protein being answered most poorly (mean score 39.2%). Most players (97%) were aware that dehydration can reduce performance, but only 39.4% were aware that excess protein consumed may be stored as fat, and 38.4% believed that the more protein you eat the more muscle you build. Examination of the nutritional practices of the group highlighted the disparity between knowledge and practices. Of the 168 athletes who knew they should eat immediately after exercise, 113 (67.7%) actually did so within half an hour of stopping exercise. Of the 163 young players who knew that it was unnecessary for everyone to take vitamin and mineral supplements, 21.6% ($n = 35$) took such supplements, and of the 171 players who knew that the claims made on dietary supplements may not always be trusted, 63.7% ($n = 109$) were taking these supplements.

Table 1 Body Composition of Senior-Cup Schoolboy Rugby Players

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total group ($n = 203$)</td>
<td>181.4</td>
<td>6.2</td>
<td>166–197</td>
</tr>
<tr>
<td>forward ($n = 115$)</td>
<td>182.5**</td>
<td>6.5</td>
<td>169–197</td>
</tr>
<tr>
<td>backs ($n = 85$)</td>
<td>179.8**</td>
<td>5.6</td>
<td>166–195</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total group ($n = 203$)</td>
<td>81.4</td>
<td>10.8</td>
<td>53–124</td>
</tr>
<tr>
<td>forward ($n = 115$)</td>
<td>85.5*</td>
<td>10.8</td>
<td>64.5–124</td>
</tr>
<tr>
<td>backs ($n = 85$)</td>
<td>75.9*</td>
<td>8</td>
<td>53–99.8</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total group ($n = 144$)</td>
<td>13.3</td>
<td>4.3</td>
<td>5.1–25.3</td>
</tr>
<tr>
<td>forward ($n = 84$)</td>
<td>14.7**</td>
<td>4.6</td>
<td>6.9–25.3</td>
</tr>
<tr>
<td>backs ($n = 57$)</td>
<td>11.3**</td>
<td>2.8</td>
<td>5.1–20.3</td>
</tr>
</tbody>
</table>

*Statistically significant difference ($p < .05$) between forwards and backs. **Statistically significant difference ($p < .01$) between forwards and backs.

Dietary Behaviors Relevant to Sport Performance

Food- and fluid-consumption patterns, before, during, and after training sessions and matches were obtained from all 203 senior schoolboy rugby players (Table 4). Subjects were asked how soon they ate before a match or training. Just over one quarter of those surveyed (26.6%) ate within the hour before a match or training session. After a match or training session, 61.6% ate within half an hour of finishing. Before exercise, 96.1% consumed high-carbohydrate foods including bread, bagels, rolls, wraps, potatoes (other than chips), pasta, rice, breakfast cereals, and scones. High-protein foods (meat, fish, chicken, beans, cheese, eggs, yogurt, and milk) were consumed by 80.8% of players before exercise. After exercise, 85.7% consumed high-carbohydrate foods and 92.1% consumed high-protein foods. Consumption of high-carbohydrate or high-protein foods occurred at a similar level among subjects who ate within a half hour of exercise and those who did not.

Two hundred two subjects reported consuming fluids before, during, and after exercise. Sports drinks were consumed by 38.4% before exercise, 13.8% during exercise, and 46.3% after exercise.

Some form of dietary supplement was reportedly used by 64.5% of the players. Protein and creatine supplements were used by 43.8% and 28.6%, respectively, and vitamin and mineral supplements were taken by 28.6%. Herbal products and preparations were consumed by 7.4% ($n = 15$). Although more forwards (68.7%) reported taking dietary supplements than backs (51%), the difference was not statistically significant. Of note, creatine was used by 16.8% of the 149 players younger than 18 years, and protein supplement use among this group occurred in 42.3%. The use of creatine and protein supplements was similar among those who played in forward and back positions. Those who used dietary supplements had levels of nutritional knowledge comparable to those who did not.

Senior Schoolboy Rugby Players in Ireland
Table 2  Responses to Nutritional-Knowledge Questions of 203 Senior-Cup Schoolboy Rugby Players, n (%)  

<table>
<thead>
<tr>
<th>Energy and Refueling</th>
<th>True</th>
<th>False</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>After training or a match you should eat immediately to start refueling.</td>
<td>168 (82.8)</td>
<td>4 (2.0)</td>
<td>31 (15.3)</td>
</tr>
<tr>
<td>Good for before and after exercise:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sausage and chips</td>
<td>1 (0.5)</td>
<td>171 (84.2)</td>
<td>31 (15.3)</td>
</tr>
<tr>
<td>chicken with pasta and tomato sauce</td>
<td>197 (97.0)</td>
<td>2 (1.0)</td>
<td>4 (2.0)</td>
</tr>
<tr>
<td>steak and salad</td>
<td>126 (62.1)</td>
<td>24 (11.8)</td>
<td>53 (26.1)</td>
</tr>
<tr>
<td>ham sandwiches and fruit</td>
<td>160 (78.8)</td>
<td>7 (3.4)</td>
<td>36 (17.7)</td>
</tr>
<tr>
<td>You shouldn’t eat carbohydrate after 5 p.m. or you will get fat.</td>
<td>15 (7.4)</td>
<td>133 (65.5)</td>
<td>55 (27.1)</td>
</tr>
<tr>
<td>From what you eat and drink, you should get most of your energy from carbohydrate.</td>
<td>155 (76.4)</td>
<td>18 (8.9)</td>
<td>30 (14.8)</td>
</tr>
</tbody>
</table>

| Hydration                                                                           |            |            |            |
| During exercise of >1 hr, sports drinks are better than water.                      | 80 (39.4)  | 46 (22.7)  | 77 (37.9)  |
| You only need to drink when you’re thirsty.                                         | 9 (4.4)    | 188 (92.6) | 6 (3.0)    |
| Dehydration can reduce performance.                                                 | 197 (97.0) | 4 (2.0)    | 2 (1.0)    |

| Supplements                                                                         |            |            |            |
| It is better to get vitamins and minerals from supplements than from foods.         | 13 (6.4)   | 163 (80.3) | 27 (13.3)  |
| You can trust all the claims made about supplements, e.g., “rapidly builds muscle.” | 12 (5.9)   | 171 (84.2) | 20 (9.9)   |
| Most people can’t get all the vitamins and minerals they need from food, so they should take a supplement. | 72 (35.5) | 88 (43.3)  | 43 (21.2)  |

| Protein                                                                             |            |            |            |
| Muscles get most of their energy for exercise from protein.                         | 96 (47.3)  | 73 (36.0)  | 34 (16.7)  |
| If you eat more protein than you need, it is likely to be stored as fat.            | 80 (39.4)  | 77 (37.9)  | 46 (22.7)  |
| The more protein you eat, the more muscle you build.                                | 78 (38.4)  | 86 (42.4)  | 39 (19.2)  |

<Correct response.>

Table 3  Mean Knowledge Scores of Senior-Cup Schoolboy Rugby Players  

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall nutritional knowledge</td>
<td>59.6</td>
<td>12.8</td>
<td>25–87.5</td>
</tr>
<tr>
<td>Knowledge about hydration</td>
<td>76.4</td>
<td>20.7</td>
<td>0–100</td>
</tr>
<tr>
<td>Knowledge about dietary supplements</td>
<td>69.3</td>
<td>28.6</td>
<td>0–100</td>
</tr>
<tr>
<td>Knowledge about energy and refueling</td>
<td>57.1</td>
<td>15.4</td>
<td>14.3–85.7</td>
</tr>
<tr>
<td>Knowledge about protein</td>
<td>39.2</td>
<td>31.4</td>
<td>0–100</td>
</tr>
</tbody>
</table>

Attitudes About Nutrition  
Almost 40% of these senior schoolboy rugby players believed they were following a diet that would improve their sport performance, although 37.4% described difficulty knowing what to eat. Only a small number (6.4%) reported pressure from teammates, coaches, and others to follow a particular diet or to use dietary supplements (6.9%).

Although 84.7% of players in this study believed that increasing muscle mass is essential to improving rugby performance, with 25.6% of subjects strongly agreeing with this statement, only 38.9% believed that heavier players (i.e., those with greater muscle mass) play rugby more successfully than lighter players. Almost half (46.8%) either agreed or strongly agreed that supplements are necessary to support their training program. Of those who reported taking dietary supplements, 63.8% believed that their use is necessary to support training performance (p < .001). No differences were observed between backs and forwards in their responses to these questions.

Educational-Needs Assessment  
Of the 203 young rugby players who participated in this study, 59.6% had previously sought sports-specific dietary advice. Over two thirds (66.9%) of those 121 players looked to coaches for advice, and over one third...
To their teammates or peers. Health care professionals were cited by only 10 participants (8.2%) as a source of nutritional information and included dietitians (n = 3), nutritionists (n = 2), physiotherapists (n = 2), and dermatologists (n = 3). Those who had previously sought dietary advice had nutritional knowledge scores similar to those who had not. Of the 115 athletes who had previously been given dietary advice, the advice given most frequently was about protein, with 47 players (40.7%) reporting this. Of the 115 players who had been given nutritional advice, 93% reported finding the advice useful. Most (n = 197, 97%) of the young rugby players who participated in this study perceived that they could benefit from nutritional education. Match-day nutritional advice was requested most frequently (by 68%). Other topics included advice on muscle gain (6.4%, n = 13), fat loss (2%, n = 4), and dietary supplements (1.5%, n = 3). Despite coaches being cited as the primary source of nutritional information by 66.9% (n = 81) of players, the most popular method for future nutrition education was information leaflets, asked for by 70.7% (n = 139) of players.

Table 4 Responses to Questions Related to Dietary and Hydration Practices Relevant to Sporting Performance, N = 203, n (%)

<table>
<thead>
<tr>
<th>Food</th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foods eaten before and after exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>high-protein foods</td>
<td>164 (80.8)</td>
<td>187 (92.1)</td>
<td></td>
</tr>
<tr>
<td>high-carbohydrate foods</td>
<td>195 (96.1)</td>
<td>174 (85.7)</td>
<td></td>
</tr>
<tr>
<td>Fluids drunk just before, during, and after exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water</td>
<td>178 (87.7)</td>
<td>197 (97)</td>
<td>163 (80.3)</td>
</tr>
<tr>
<td>sports drinks</td>
<td>78 (38.4)</td>
<td>28 (13.8)</td>
<td>94 (46.3)</td>
</tr>
<tr>
<td>pure fruit juice</td>
<td>28 (13.8)</td>
<td>2 (1)</td>
<td>32 (15.8)</td>
</tr>
<tr>
<td>diluted squash</td>
<td>27 (13.3)</td>
<td>8 (3.9)</td>
<td>43 (21.2)</td>
</tr>
<tr>
<td>soft drinks</td>
<td>7 (3.4)</td>
<td>2 (1)</td>
<td>28 (13.8)</td>
</tr>
<tr>
<td>diet drinks</td>
<td>2 (1)</td>
<td>1 (0.5)</td>
<td>18 (8.9)</td>
</tr>
<tr>
<td>none</td>
<td>0 (0)</td>
<td>1 (0.5)</td>
<td>2 (1)</td>
</tr>
</tbody>
</table>

Consistent with previous studies of professional rugby league players (Gabbett, 2005; Lundy et al., 2006), who could be compared with rugby union players in physicality, most adolescent players in this study have a healthy PBF, using reference data from healthy U.K. adolescents (McCarthy et al., 2006). Those playing in back positions at senior school level are shorter, lighter, and leaner than those playing in forward positions. This is explained by the differing roles of forwards and backs in the game of rugby. The role of the forward is to gain and retain possession of the ball by dominating opponents in the set pieces of the scrum and the lineout (McKenna, 2007). The role of the back consists of using the ball won by forwards to score points, by either running or kicking the ball (McKenna, 2007).

Over one fifth (22%) of players were classified as underweight using the criterion of PBF. The normal variability in growth rates that is a feature of the age group surveyed (Freeman et al., 1995) may account for this observation. Of the 14 players who were identified as having excessive body fat, 92.3% (n = 13) were forwards. When lifestyle and dietary habits overemphasize increasing body size through excess energy intake, without concomitant strength training, the long-term health effects associated with increased adiposity may outweigh the short-lived athletic benefits of having a large body mass (Miller, White, Kinley, Congleton, & Clark, 2002).

The players in this study demonstrated poor nutritional knowledge on how to maximize their sport performance (mean score 59.7%, SD 12.8) through dietary intervention, a finding supported by the results of several previous studies examining nutritional knowledge in other groups of young athletes (Reading et al., 1999; Rosenbloom et al., 2002; Shifflett et al., 2002). Knowledge of correct hydration practices (mean score 76.3%) was best, and this good level of knowledge coincided with players’ favorable hydration practices. Nearly all subjects (99%) followed recommendations to ingest fluids during exercise (Bass & Inge 2006; Juzwiak et al., 2000); however, a limitation to this finding is that data on specific quantities of fluids consumed were not obtained and the volumes consumed may not have met those recommended. During exercise of longer than 1 hr, such as a single game of rugby (80 min), the provision of additional carbohydrate is beneficial to reduce hypoglycemia and the utilization of endogenous protein for energy because of depleted glycogen stores (Bean, 2006). Therefore, a readily digestible form of carbohydrate, such as a sports drink (4–8% carbohydrate), should be consumed during this time (Bean, 2006; Nichols et al., 2005). Over two thirds (n = 123) of players were unaware that they should
consume sports drinks during activities with duration equal to that of a rugby match, a higher proportion than that reported (47.5%) by Nichols et al. in 2005.

The young rugby players in this study also demonstrated inadequate knowledge about energy substrates and refueling practices for sport (mean knowledge score 57.1%). Because glycogen stores are replenished more efficiently during the first hour after exercise, carbohydrate feeding immediately after exercise is recommended (Burke, Kiens, & Ivy, 2004), and the provision of carbohydrate during this period presents a window of opportunity to optimize glycogen for subsequent activity. In the current study, 61.6% of subjects followed recommendations to refuel immediately after exercise, with the remainder of subjects commencing refueling more than 30 min after exercise, although the precise time this occurred was not documented, thus limiting the interpretation of this finding. High-carbohydrate foods were consumed by 88% of players who began refueling within 30 min after exercise, and high-protein foods were consumed by 94.4%.

Although participants in the current study appeared aware of the importance of carbohydrate consumption immediately after exercise, they demonstrated poor applied knowledge, with 62.1% (incorrectly) believing that steak and salad, which provides a negligible amount of carbohydrate, is a good refueling meal. The reasons underlying players’ choice of the actual foods eaten before and after exercise were not investigated in this study; it could be postulated that their food choices reflect availability of the foods rather than knowledge of their nutrient content.

It is recommended that refueling snacks also contain a small amount of protein (0.15–0.25 g/kg body weight; Borsheim, Tipton, Wolf, & Wolfe, 2002; Kerksick et al., 2008; Tipton et al., 2001) to facilitate muscle glycogen storage (Burke et al., 2004). Moore et al. (2009) showed that 20 g intact high-quality protein is sufficient to maximize the anabolic response after resistance exercise and that this protein can be obtained from whole foods. However, the young rugby players in this study demonstrated a poor understanding of the role of protein in sport (mean score of 39.2%).

The widespread use of dietary supplements among young athletes was confirmed in this study; almost 65% of players took some form of dietary supplement. The prevalence of supplement use in child and adolescent athletes was found to range from 22.3% to 71% in a review by McDowall (2007). Although vitamin and mineral supplements are cited as the most frequently used dietary supplements among adolescent athletes (Kim & Keen, 1999; McDowall, 2007; O’Dea, 2003), the most common dietary supplement used in the current study was protein, possibly because of the perceived requirement for increased muscle mass among those playing rugby. Another misconception that emerged from this study was the belief among 72 young rugby players (35.5%) that adequate micronutrients are unobtainable from food and that this necessitates consuming a dietary supplement. This was reflected in the fact that 28.6% of players reported taking a vitamin/mineral supplement. Although suboptimal intakes of calcium and iron, which are necessary for growth and development during adolescence, have been reported in nonathletic adolescents (Haymes, 1991), adequate intakes are observed among those involved in sport as a result of the increased amount of food they consume for energy (Hickson et al., 1987; Rico-Sanz et al., 1998). Furthermore, an increase in requirements for adolescent athletes above the recommended dietary allowance is not supported by scientific evidence (Hunt, 1996; Margaritis & Rousseau, 2008; Meyer, O’Connor, & Shirreffs, 2007; Petrie et al., 2004).

The prevalence of creatine use among young rugby players observed in the current study, especially those less than 18 years old, is cause for concern. There are no data documenting the safety of creatine use in children and adolescents (Metzl, Small, Levine, & Gershel, 2001). In terms of both efficacy and safety, the short- and long-term effects of its routine use are unknown. The American College of Sports Medicine, therefore, discourages the use of creatine in adolescents younger than 18 years (Calfee & Fadale, 2006). In Ireland, the IRFU strongly advises against the use of ergogenic aids, in particular creatine, in rugby players under 18 years of age (IRFU, 2008).

With the overall use of dietary supplements in the current study higher than previously reported in the literature, the reasons for such behavior need further investigation. Dietary supplement users had levels of overall nutritional knowledge similar to those of nonusers, and their specific knowledge about dietary supplements and protein was similar to that of nonusers. Attitude toward dietary supplement use more strongly predicted their use than knowledge, with 63.8% of those taking supplements believing that they were necessary to support training performance.

Although almost all players in this study agreed that increasing muscle mass was essential to improving rugby performance, this belief was equally prevalent in those using dietary supplements and those not doing so (85% vs. 83.4%). A similar proportion of supplement users and nonusers disagreed that heavier players (i.e., greater muscle mass) are more successful than lighter players in rugby (59.2% vs. 63.8%). These findings highlight the confusion among young players about the role of muscle mass in rugby and how best to increase it.

One concern in the findings from the current study was the high proportion of these young Irish players (87.7%) who reported drinking alcohol. The prevalence of underage drinking was high, with 81.8% of those under 18 years of age, and 83.1% of 16-year-olds, claiming to drink alcohol. These levels of alcohol consumption are significantly greater than those observed in other studies of Irish adolescent males (Health Promotion Agency of Northern Ireland, 2004; Nic Gabhainn, Kelly, & Molcho, 2007). However, a limitation of the study is that the quantities and patterns of alcohol consumption were not investigated. Research into the alcohol-consumption patterns of young sports players, however, indicates that...
athletes drink more hazardously than their nonathletic counterparts (Martens, Labrie, Hummer, & Pedersen, 2008; O’Brien, Ali, Cotter, O’Shea, & Stannard, 2007; Yusko, Buckman, White, & Pandina, 2008). Possible reasons for frequent episodes of heavy drinking include heightened physical and psychological stress, a desire to conform socially, and the facilitation of social interactions (O’Brien et al., 2007; Yusko et al., 2008).

Because athletes are continually seeking a competitive edge (Cotunga, Vickery, & McBee, 2005) and have been reported as being interested in nutrition (Shifflett et al., 2002), they may be more likely to seek information about nutrition. This is evident in the current study, in which nearly two thirds ($n = 121$) of the young rugby players have previously sought nutritional advice relevant to their sport. Although health care professionals were referred to for nutritional advice by 10 rugby players, the accuracy of sports nutrition advice from a dermatologist or physiotherapist may be questionable. Coaches were the most frequently reported source of such information (66.9%, $n = 81$), a finding similar to that previously reported by Dietitians of Canada, the American Dietetic Association, and the American College of Sports Medicine (2000) and Bass and Inge (2006). However, the knowledge scores of those who received nutritional advice were similar to those who had not been given advice. Moreover, despite being advised most frequently on the protein requirements for sport, this was not possible within the timeframe of the study. The nutritional knowledge questionnaire was developed using questions taken from previous studies previously reported by Dietitians of Canada, the American Dietetic Association, and the American College of Sports Medicine (2000) and Bass and Inge (2006). The additional nonvalidated questions were included in the questionnaire. The questionnaire was piloted to establish the clarity of the questions, but it cannot be deemed fully reliable without test–retest analysis. In addition, a reference group was not included in the population (e.g., sports dietitians or nutritionists or similar group), so an acceptable nutritional knowledge score was not established. Although we recognize that direct comparisons cannot be made between the nutrition knowledge scores of subjects in the current study and those of previous studies, nonetheless this study highlights that the nutritional knowledge, attitudes, and practices of adolescent boys playing rugby at a senior level in Ireland appear to be suboptimal and provide data on which to develop nutritional resources for this group of athletes.

The second limitation of the study data is the use of BIA to assess body fat, which imposes several constraints on the body-composition data obtained. First, although players were given instructions with regard to hydration, diet, and exercise practices before testing, it was not possible to fully control for these factors. In addition, we recognize that independent methods of assessing hydration status such as urine specific gravity and urine or serum osmolality are a more accurate reflection of hydration status than hydration status assessed by BIA. Second, although the use of BIA has been validated in adolescents (Houtkooper, Lohman, Going, & Howell, 1996), it only provides a “snapshot” of an individual’s body composition and does not take into account a player’s stage of maturation. For boys, the adolescent growth spurt in body mass is primarily the result of gains in muscle and skeletal tissue (Kerr & Ackland, 2006), so in this study, those with higher PBF may be at an earlier stage of maturation than those with lower PBF. Future studies among this population group may wish to involve a skilled clinician to assess an individual’s stage of maturation, so that more conclusive results can be drawn. Third, body-composition analysis in this study did not differentiate between visceral and peripheral body fat—an important factor for assessing an individual’s future health risks (Després & Lemieux, 2006). The additional use of waist-circumference measurements in this group may, therefore, be a useful adjunct to BIA for monitoring future health risks.

**Conclusion**

This is the first study to provide a description of the body composition of adolescent Irish rugby players playing at a senior school level and to present information regarding their dietary behaviors, knowledge, and attitudes about nutrition. Despite limitations to the use of BIA in adolescent athletes and the use of reported questionnaire data necessitating caution in the interpretation of the study results, it would appear that the dietary practices among this group of rugby players are poor. In addition, players possess insufficient nutritional knowledge to
References


**Personal Information**

Age: ________  
Date of birth: ________  
Weight: (don’t fill in) ______ kg  
Height: (don’t fill in) ______ m  

**Your Training Schedule**

1. Position you play: ________

2. Your school training schedule:  
   Number of hours per week  
   Swimming, pitch, fitness ________  
   Weights ________  

3. Details of training outside of school:  
   Number of hours per week  
   Swimming, pitch, fitness ________  
   Weights ________
Your Eating and Drinking Habits

4. How often do you eat a breakfast?
   a. Every day
   b. 2–3 days per week
   c. Less than 2 days per week
   d. Never

5. What type of lunch do you normally eat?
   a. Packed lunch from home
   b. I go home for lunch
   c. School meals
   d. I buy lunch outside school
   e. I don’t have a lunch

6. What type of dinner (i.e., main meal) do you normally eat?
   a. Homemade meal
   b. Takeaway
   c. Other________________________
   d. Meal from restaurant
   e. I don’t have a dinner

7. Do you usually snack between your meals?
   a. Yes
   b. No

8. If yes, what type of snacks do you eat?
   a. Biscuits, cakes, sweets
   b. Crisps, popcorn, pretzels
   c. Fresh fruit
   d. Breakfast cereal, cereal bars
   e. Scone, bread, crackers
   f. Other________________________

9. Tick any of the following fluids that you usually drink just before, during, and after exercise:
   (a)  Before exercise
   (b)  During exercise
   (c)  After exercise
   i. Water
   ii. Diluted squash (e.g., Mi-Wadi)
   iii. Soft drinks (e.g., Coca-Cola)
   iv. Diet drinks (e.g., Diet 7up)
   v. Pure fruit juice (e.g., Squeez)
   vi. Sports drinks (please specify brand)
   vii. Other (please specify)________________
   viii. None

10. Do you drink alcohol, e.g., beer, alco-pops, etc?
    a. Yes
    b. No

11. How soon before a match or training do you last eat?
    a. Within the 1 hour before
    b. More than 1 hour before

12. How soon after a match or training do you first eat?
    a. Within 1/2 an hour after
    b. More than 1/2 an hour after

13. Please tick any of the following foods that are typical of the last food you eat before you exercise and the first food you eat after you exercise:
    (a) Before exercise
    (b) After exercise
    i. Meat, fish, chicken
    ii. Beans
    iii. Cheese
    iv. Eggs
    v. Bread, bagel, rolls, wrap
    vi. Potatoes (other than chips)
    vii. Chips
    viii. Pasta, rice
    ix. Breakfast cereal
    x. Yogurt, milk
    xi. Scone
    xii. Biscuit
    xiii. Chocolate
    xiv. Fruit
    xv. Vegetables
    Other (please specify):
    xvi. __________________________
    xvii. __________________________

14. Tick any of the following nutrition supplements that you are currently taking:
    a. Protein supplements (amino acids)
    b. Herbal products, e.g., ginseng, Echinacea
    c. Vitamins, minerals
    d. Slim Fast, Complan, Build-up
    e. Creatine
    f. Other (please specify) ____________

Your Attitudes Toward Nutrition

How do you rate the importance of what you eat and drink to your performance?
   (a) Very important
   (b) Important
   (c) Of some importance
   (d) Of no importance
15. As part of your training program?
   i. what you eat
   ii. what you drink
16. As part of your match preparation?
   i. what you eat
   ii. what you drink
17. As a rugby player, I have
   i. Different nutritional requirements than other people my age
   ii. The same nutritional requirements as other people my age
   iii. Don’t know
18. Tick the following statements that apply to you:
   a. I have trouble knowing what I should eat.
   b. I feel my diet meets my nutritional requirements.
   c. I try and follow a diet plan that I believe will improve my sporting performance.
   d. I feel under pressure from teammates, coaches, and others to follow a particular diet.
19. Read the following statements and tick the box that best describes what you think:
   i. Increasing muscle mass (bulk) is essential to improving rugby performance.
      a. Strongly agree
      b. Agree
      c. Disagree
      d. Strongly disagree
   ii. Heavier (i.e., greater muscle mass) players are more successful than lighter players in rugby.
      a. Strongly agree
      b. Agree
      c. Disagree
      d. Strongly disagree
   iii. I think supplements are necessary to support my training program.
      a. Strongly agree
      b. Agree
      c. Disagree
      d. Strongly disagree

Your Knowledge of Nutrition

20. After training or a match:
   a. You should wait 2–3 hours before eating, to allow your body recover
   b. You should eat immediately to start refueling
   c. Don’t know

21. Which of the following food choices are good ones for before and after exercise? Tick one box for each food choice
   (a) Yes
   (b) No
   (c) Don’t know
   i. Sausage and chips
   ii. Chicken with pasta and tomato sauce
   iii. Steak and salad
   iv. Ham sandwiches and fruit
22. You shouldn’t eat carbohydrate (e.g., bread, pasta, potato) after 5 p.m. or you will get fat.
   a. True
   b. False
   c. Don’t know
23. From what you eat and drink, you should get most of your energy (calories) from carbohydrates (e.g., bread, pasta, potato).
   a. True
   b. False
   c. Don’t know
24. During exercise of longer than 1 hour, sports drinks are better than water (e.g., Lucozade Sport, Powerade, Gatorade).
   a. True
   b. False
   c. Don’t know
25. You only need to drink when you’re thirsty.
   a. True
   b. False
   c. Don’t know
26. Dehydration can reduce performance.
   a. True
   b. False
   c. Don’t know
27. It is better to get vitamins and minerals from supplements than from foods.
   a. True
   b. False
   c. Don’t know
28. You can trust all of the claims made about supplements, e.g., “this rapidly builds muscle.”
   a. True
   b. False
   c. Don’t know
29. Most people can’t get all the vitamins and minerals they need from food, so they should take a supplement.
   a. True
   b. False
   c. Don’t know

30. Muscles get most of their energy for exercise from protein.
   a. True
   b. False
   c. Don’t know

31. If you eat more protein than you need, it is likely to be stored as fat.
   a. True
   b. False
   c. Don’t know

32. The more protein you eat, the more muscle you build.
   a. True
   b. False
   c. Don’t know

Nutritional Information You Have Received

33. Have you ever looked for dietary advice for sport?
   a. Yes
   b. No

34. If yes, where did you look for this advice?
   a. Magazines, books
   b. Internet
   c. Sporting organizations
   d. Friends, teammates
   e. Family member, parents
   f. Coach, trainer
   g. Other (please specify) ___________________

35. If you have been given advice about diet, what were you told to do?

36. Do you think the advice you received is useful?
   a. Yes
   b. No

37. Do you feel you could benefit from advice about nutrition?
   a. Yes
   b. No

38. If yes, what areas do you think you need most information on?
   a. Advice on losing weight
   b. Match-day dietary advice
   c. Advice on gaining weight
   d. General healthy eating advice
   e. Suitable snacks
   f. Recipes, cooking skills
   g. Training-day dietary advice
   h. Other ___________________

39. How would you like this information to be delivered?
   a. Information sheets
   b. Internet Web site, links
   c. Information talks
   d. School magazine
   e. Group discussions
   f. Through coaches
   i. Other ___________________

40. Have you any comments to add? __________