ARC Journal of Research in Sports Medicine
Volume 1, Issue 1, 2016, PP 9-14
www.arcjournals.org

Nutritional Habits in Under 18 Elite Rugby Players

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Abstract:

Purpose: *Physical training involves not only consistent and rigorous exercise but also a balance of dietary intake. One of the keys to improving performance is having correct nutritional habits. Although the physiological cost of rugby players has been already studied, remains unknown whether young rugby players have good dietary habits.*

Methods: *22 young rugby players completed 24-hour dietary recalls during a training day, a rest day and a day with a game during one week of the rugby season. Total energy intake, energy derived from macronutrients and micronutrients were analysed using the Progetto Dieta nutrition software. Body composition analysis was measured with skinfold thickness.*

Results: *The dietary habits were incorrect in according to international guidelines: total energy intake was low, carbohydrate intake was low (4.2 ± 1.6 g/kg) and protein was high (1.8 ± 0.5 g/kg) during a training day. Calcium and magnesium intake (694.4 ± 336. 4 mg; 109.3 ± 49.4 mg) were below that of request. The ratio of Ω6: Ω3 was high (6.7 ± 3.0). Body composition was found to be in the normal range.*

Conclusion: *Results obtained suggest that development of a nutrition programme might be helpful to maintain health and to improve the team's performance.*

Keywords: *Nutrition, body composition, rugby, sport nutrition.*

1. INTRODUCTION

The link between correct nutritional habits and health was an interest since the origin of the earliest societies and cultures. Scientific study of the relationship between eating habits and health began in the eighteenth century, when long sea journeys led sailors to have poor and monotonous diets that caused deficiency diseases [1]. Today, this concern is apparent when you consider the increasing demand for nutritional information related to sport and physical activity. There is no such thing as a complete, perfect, and magical food [2]. The ideal formula should involve choosing a variety of foodstuffs that, when combined, would provide a balance for the proper functioning of the metabolism. This balance must be adequate to meet the demands of concerted effort, for instance, a rugby game.

It is well known that food intake influences an athlete's training and thus his performance levels. Sport performance is linked to the proportions of basic nutrients in the daily diet and the attention that athletes pay to their diet should go beyond the day of a competition or match; their dietary concerns must embrace every day of their lives. In particular, nevertheless, the food eaten before a competition or game merits attention [3]. Nevertheless, interest in nutrition with a view to improving performance in general is relatively recent [4, 5].

In rugby and in team sports in general, one of the most important factors in athletic performance is recovery from fatigue after training and competitions. This is especially the case for sports in which participants train and compete with little recovery time. The recovery process is influenced by numerous elements. One of the most important of these is nutrition, but its effectiveness depends on many variables, including the specific competition and the sex, training and nutritional status of the athlete [6,7].

In rugby, the activities performed during a match vary depending on playing position, which are typically categorised as forwards (prop, back row) and backs (fullback, winger, centre) [8]. While backs cover greater absolute distances than forwards, total distance covered relative to match time (m min−1) is similar between positions (~90–95 m•min^{-1}) [9].

On average, forwards are also involved in around one physical collision (tackle or being tackled) with the opposition per minute of playing time, whereas this occurs less frequently for backs [9,10].

International guidelines regarding sport nutrition recommend intakes of about 5 to 10 g/kg of body weight for carbohydrates, when the sport's intensity is moderate/high, 1.2 to 2.0 g/kg from the protein intake and the equivalent of 20 to 35% of the total energy intake for fats [11,12].

The primary aim of this study was to analyze the eating habits of members of the Under 18 National Academy of Prato rugby team on training, rest and game days to determine whether their intake was consistent with that which would be appropriate for athletes in that type of sport. Our secondary aim was to assess diet and body composition according to position to reveal potential differences.

2. MATERIALS AND METHODS

2.1. Subjects

We studied dietary habits during a typical week for 22 youth national rugby players (age 17.6 ± 0.5 yrs, height 1.82±0.08 m) that belong to the Under 18 National Academy of Prato (Italy). Based on different physiological demands we have subdivided the group into forwards and backs. The assessments were performed after receiving a written informed consent from all athletes included in this study.

The study was carried out according to the ethical standards laid out in the 1975 Declaration of Helsinki and was approved by the local ethical committee.

2.2. Procedures

Dietary Habits

The participants were asked to complete a 24-hour dietary recall on training (TRAIN), rest (REST) and game (GAME) days. They were asked to indicate all the consumed foods and the ingestion time.

In order to facilitate the completion of the recall and to improve its accuracy, a diet journal was provided to each participant. The energy intake and food choices were qualitatively and quantitatively assessed using the Progetto Dieta software (Progetto Dieta 2.0.22213 Beta software, Italy). Specifically, we assessed macronutrients, carbohydrates (CHO), protein (PRO) and fats (FAT) in % and g•kg^{-1}•day^{-1}. We also assessed micronutrients, minerals (calcium, iron, zinc and magnesium) and vitamins (B_1, B_2, B_6, B_{12}, C, D and E).

From FAT we have analyzed the Ω6: Ω3 ratio.

Body Composition and Anthropometric Assessment

Anthropometric measurements were taken following "The International Society for the Advancement of Kinanthropometry" (ISAK) protocol [13]. Additionally, all anthropometric measurements were taken by the same researcher. His technical error was 5 % and 1.5 % for skinfolds and all other measurements, respectively.

Height (cm) and Weight (kg) were measured using a scale (SECA®) with rod. BMI was calculated using the formula BM/ height^2 (kg/m^2).

Biceps girth, waist girth and hip girth (cm) were measured with a narrow, metallic and inextensible measuring tape (Lufkin® model W606PM; precision = 1 mm).

Skinfolds were measured with a Holtain® skinfold caliper (Holtain Ltd, Crymmych, UK; precision = 0.2 mm) at nine anatomical sites around the body (triceps, subscapular, biceps, iliac crest, suprailiac, pectoral, abdominal, thigh, calf). Equations were then used to convert skinfold values [14].

2.3. Statistical analysis

The Friedman test followed by multiple comparison (Conover test) and Cuzick trend test were applied to longitudinal data, whereas Mann–Whitney's U-test was used for comparisons of independent data. All statistical analyses were performed using IBM-SPSS® version 22.0 (IBM Corp., Armonk, NY, USA, 2013) and StatsDirect statistical software version 2.7.2 (StatsDirect Ltd, Altrincham, Cheshire, UK, 2008). A two-sided p-value <0.05 was considered significant.

3. RESULTS AND DISCUSSION

Total energy intake for all subjects was is 2975 ± 572 kcal in TRAIN, 2767 ± 598 kcal for REST and 2784 ± 704 for GAME; for GAME, forwards consume more energy compared to backs (3078 ± 698; 2438 ± 559; p=0,03; Table 1).

Table1. *Energy intake subdivided to field position and type-day. In day of the match forwards introduce more energy respect to backs († 3077,8 ± 697,8 kcal; 2438,2 ± 559,3 kcal; p= 0,03)*

	Training (kcal)	Rest (kcal)	Game (kcal)
Total Group	2974,5 ± 571,6	2766,6 ± 597,5	2787,1 ± 703,8
Forwards	3077,25 ± 698,0	2992,6 ± 667,4	3077,8 ± 697,8 †
Backs	2851,3 ± 368,7	2495,4 ± 372,5	2438,2 ± 559,3 †

Energy from the macronutrients for TRAIN, REST and GAME are reported in Table 2 and micronutrients are reported in Table 3. Intake for CHO, PRO and FAT was 4.2 ± 1.6, 1.5 ± 0.5 and 1.0 ± 0.3 g•kg-1•day-1, respectively. Calcium and magnesium intake were below guidelines for TRAIN, REST and GAME. For backs, iron intake was below guidelines for REST (9.1 ± 3.9 mg) and GAME (9.3 ± 3.0) while vitamin D intake was below guidelines for REST (1.8 ± 1.4 µg). Furthermore, vitamin E intake was below guidelines for forwards for GAME (8.0 ± 4.5 mg), for backs for REST (8.1 ± 3.8 mg) and for the total group for REST (9.4 ± 1.3 mg). The Ω6: Ω3 ratio was 6.7 ± 2.9.

Table2. *Energy intake derived from macronutrients reported in g/(kg•day) and %. CHO=Carbohydrates; PRO= Protein; TRAIN= Training. In a week, waiting of the game, total group reduce protein intake g/(kg•day)(† p=0,001)*

	CHO g/(kg·day)			PRO g/(kg·day)			FAT g/(kg·day)		
	TRAIN	REST	GAME	TRAIN	REST	GAME	TRAIN	REST	GAME
Total Group	4.3 ± 1.4	3.9 ± 1.6	4.4 ± 1.7	1.8 ± 0,5 †	1.4 ± 0.5 †	1.4 ± 0.4 †	1.0 ± 0.3	1.0 ± 0.3	0.9 ± 0.3
Forwards	4.0 ± 1.4	3.6 ± 1.5	4.4 ± 1.5	1.8 ± 0.5	1.5 ± 0.6	1.4 ± 0.3	0.9 ± 0.2 †	1.1 ± 0.4	0.9 ± 0.3
Backs	4.7 ± 1.3	4.4 ± 1.6	4.4 ± 2.1	1.8 ± 0.5	1.4 ± 0.4	1.3 ± 0.4	1.1 ± 0.3	1.0 ± 0.3	0.9 ± 0.2
	CHO %			PRO %			FAT %		
	TRAIN	REST	GAME	TRAIN	REST	GAME	TRAIN	REST	GAME
Total Group	51.9 ± 14.4	50.3 ± 17.8	56.6 ± 21.0	21.4 ± 6.2	19.0 ± 7.7	17.8 ± 4.5	26.7 ± 6.7	30.8 ± 10.2	27.2 ± 8.7
Forwards	51.9 ± 17.1	47.3 ± 19.0	57.3 ± 20.0	22.7 ± 6.9	20.5 ± 8.4	18.1 ± 2.6	25.2 ± 6.2	32.3 ± 9.5	27.1 ± 8.5
Backs	51.8 ± 10.0	54.5 ± 16.3	55.5 ± 19.8	19.6 ± 4.0	17.4 ± 5.5	17.4 ± 5.5	28.7 ± 7.5	28.7 ± 8.9	27.2 ± 7.7

Table3. *Minerals and Vitamins intake of Forwards, Backs and Mean Total Group subdivided in TRAIN (training), REST and GAME*

	Detected intake			Recommended intake
Minerals	Calcium			
	TRAIN	REST	GAME	1000-1200 mg
Forwards	880.1 ± 260.9	756.3 ± 347.1	676.8 ±466.5	
Backs	736.5 ± 225.4	593.9 ± 360.0	477.1 ± 302.6	
Total Group	814.8 ± 250.6	682.5 ± 354.2	586.0 ± 404.5	
	Iron			
Forwards	14.2 ±4.2	13.7 ± 9.5	12.6 ± 4.5	10-15 mg
Backs	15.1 ± 6.4	9.1 ± 3.9	9.3 ± 3.0	
Total Group	14.6 ± 5.2	11.6 ± 7.7	11.1 ± 4.2	
	Zinc			
Forwards	15.6 ± 3.8	14.2 ± 5.6	12.7 ± 6.6	10 mg

Backs	14.5 ± 1.8	11.0 ± 2.7		11.6 ± 4.4	
Total Group	15.1 ± 3.1	12.7 ± 4.7		12.2 ± 5.6	
	Magnesium				
Forwards	137.0 ± 55.1	135.7 ± 82.4		89.4 ± 32.1	150 - 500 mg
Backs	118.5 ± 33.3	83.9 ± 35.8		84.2 ± 34.3	
Total Group	128.6 ± 46.4	112.1 ± 69.3		87.0 ± 32.4	
Vitamins	Group	Detected intake			Recommended intake
		TRAIN	REST	GAME	
Vitamin B_1 (mg)	Forwards	2.2 ± 1.0	1.9 ± 0.9	1.4 ± 0.4	1,2 mg
	Backs	1.7 ± 0.4	1.6 ± 0.9	1.4 ± 0.7	
	Mean Total Group	2.0 ± 0.8	1.8 ± 0.9	1.4 ± 0.5	
Vitamin B_2 (mg)	Forwards	2.4 ± 0.6	2.3 ± 0.8	1.7 ± 0.6	1,6 mg
	Backs	2.2 ± 0.5	2.0 ± 1.3	4.2 ± 8.7	
	Mean Total Group	2.3 ± 0.5	2.2 ± 1.0	2.9 ± 6.0	
Vitamin B_6 (mg)	Forwards	3.9 ± 1.5	3.0 ± 1.1	2.3 ± 1.0	1,5 mg
	Backs	3.2 ± 0.9	2.4 ± 1.2	2.2 ± 1.0	
	Mean Total Group	3.6 ± 1.3	2.8 ± 1.2	2.3 ± 1.0	
Vitamin B_{12} (mg)	Forwards	6.2 ± 2.2	13.2 ± 29.0	3.7 ± 2.8	2,0 mg
	Backs	16.9 ± 23.7	4.0 ± 2.8	3.5 ± 3.1	
	Mean Total Group	11.0 ± 16.5	9.0 ± 21.6	3.6 ± 2.9	
Vitamin C (mg)	Forwards	89.1 ± 67.5	75.9 ± 46.5	64.2 ± 43.0	60 mg
	Backs	84.3 ± 57.7	74.7 ± 72.5	75.1 ± 93.7	
	Mean Total Group	86.9 ± 61.8	75.4 ± 58.2	69.1 ± 69.0	
Vitamin D (µg)	Forwards	3.2 ± 1.5	5.9 ± 9.7	3.0 ± 4.1	2,5 µg
	Backs	3.4 ± 1.8	1.8 ± 1.4	2.7 ± 3.0	
	Mean Total Group	3.3 ± 1.6	4.0 ± 7.4	2.8 ± 3.6	
Vitamin E (mg)	Forwards	10.0 ± 6.8	11.0 ± 4.9	8.0 ± 4.5	10,0 mg
	Backs	12.8 ± 3.6	8.1 ± 3.8	13.0 ± 5.5	
	Mean Total Group	11.4 ± 5.3	9.4 ± 4.3	10.8 ± 5.4	

Body composition and anthropometric assessments for the total group and according to position are reported in Table 4. A significant difference between forwards and backs was observed for all measurements.

Table4. *Anthropometric parameters and body composition of Forwards, Backs and Total Group*

	Total group	Forwards	Backs	P-value
Weight (kg)	91.5 ± 15.0	101.3 ± 9.6	79.6 ± 11.1	0.000
Waist (cm)	86.3 ± 8.2	91.8 ± 6.0	79.7 ± 5.0	0.001
Hip (cm)	102.3 ± 8.4	107.3 ± 6.9	96.3 ± 5.5	0.004
Biceps (cm)	29.7 ± 2.1	36.5 ± 2.9	32.2 ± 2.1	0.001
∑7sk (mm)	90.6 ± 33.1	108.1 ± 29.8	69.5 ± 23.8	0.005
FM (%)	14.9 ± 4.2	17.3 ± 3.4	12.2 ± 3.5	0.006
FM (kg)	14.2 ± 5.9	17.7 ± 4.7	10.0 ± 4.1	0.002
FM/h (kg/m)	7.8 ± 3.2	9.6 ± 2.7	5.5 ± 2.1	0.002
FFM (kg)	77.3± 9.9	83.6 ± 6.1	69.6 ± 8.0	0.000

This study is the first to investigate the nutritional practices during game, training and rest days in young rugby players. Our results show an increased total energy intake during a training day compared with a rest and match day, however are below respect of energy demand to play rugby [15]. Getting the right amount of energy to stay healthy and to perform well is key. Too little and performance falls, injuries increase, and illness results.

Dietary Habits

Interestingly, the increased total energy intake on training days for this group of rugby players was primarily a function of their protein intake, which was higher than recommended levels (1.8 ± 0.5 $g•kg^{-1}•day^{-1}$) [11,16,17]. There is evidence that protein needs to be increased athletes restrict calories. Protein needs for energy-restricted resistance-trained athletes are likely between 2.3–3.1g/kg of FFM scaled upwards with severity of caloric restriction and leanness. However, in a longer time this condition can bring a FFM loss [18]. However, protein intake reduces when the match is incoming (Table 2) (After Iman & Davenport p= 0,0004; Cuzick's trend test, two side p= 0,01).

This is an aspect that is very interesting and the data collected shows that CHO intake increases on a match day (4,4 ± 1,7 g•kg-1•day-1) though are below compared to international guidelines (11,16,17). This increased CHO consumption joins up with the results recently obtained by Teixera and collaborators [19].

Importantly that young rugby players should recover energy from CHO and not only proteins.

This result effectively suggests their ability to adapt the relative contribution of each macronutrient (reduction, albeit non-significant of the proportion of energy derived from the fat and protein intake and an increase of the CHO intake) in response to a physiological and energetic demand.

Such an increase in CHO might effectively reflect the need to compensate for the important glycogen depletion induced by the game by refilling stores, insuring a better recovery process but only if the CHO intake respected the request.

Intake of micronutrients is lacking: calcium and magnesium are below suggested requirements. Calcium is important for growth, maintenance, and repair of bone tissue; regulation of muscle contraction; nerve conduction; and normal blood clotting [20]. Magnesium is involved in numerous processes that affect muscular function including oxygen uptake, energy production and electrolyte balance. There is evidence that marginal magnesium deficiency impairs exercise performance and amplifies the negative consequences of strenuous exercise (e.g., oxidative stress) [21]. With respect to vitamins, insufficient intake can have negative implications for supporting athletic performance. A growing number of studies have documented the relationship between vitamin D status and injury prevention, improved neuromuscular function, increased type II muscle fiber size, reduced inflammation, decreased risk of stress fracture, and acute respiratory illness [11].

The Ω6: Ω3 ratio we observed in these rugby players was higher than the recommended value. For athletes, especially those at an elite level, the appropriate Ω6: Ω3 ratio is important because Ω3 has anti-inflammatory properties. Excessive radical formation and trauma during high-intensity exercise leads to an inflammatory state that is made worse by the increased amount of Ω6 in Western diets [22].

Body Composition

We found a significant difference between body-fat percentage for forwards compared to backs, but values for both groups were within normal ranges. This is normal because the physiological demands of field rugby position are different [23]. We found that forwards have a greater percentage of body fat than backline players (Forwards: 17,3 ± 3,4; Backs: 12,2 ± 3,5; p=0,006) such as reported in literature [24].

4. Conclusion

In summary, we found numerous inadequacies in dietary composition for elite U18 rugby players that might reduce the ability to perform and/or increase the likelihood of injury. Consequently, improving the eating habits of these athletes with attention paid to meeting recommended values for macronutrients and micronutrients, has the potential to improve (and possibly optimize) performance. Moreover, the health-related repercussions of improved eating habits could provide benefits that extend well beyond the end of their competitive careers.”

Professional athletes have specific metabolic demands; therefore, the choice of the energy substrate must be specifically chosen and dosed following scientific international references.

Acknowledgment

The authors thank F.I.R. (Federazione Italiana Rugby) for their availability in providing the subjects for the study.

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