ORIGINAL ARTICLE

Physiological profile in relation to playing position of elite college Gaelic footballers

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Objective: To examine the physiological profile, and its relation to playing position, of elite college Gaelic footballers.
Method: The subjects were 28 elite Gaelic footballers (12 backs, 12 forwards, and four midfielders; mean (SD) age 21 (1.67) years), who won a major intervarsity tournament (Sigerson Cup) three times in succession.
Results: There was general similarity among the members of the team, probably the result of a typical, common training programme. The team means for stature (1.81 (0.05) m), body mass index (81.6 (6.5)) and percentage body fat (14.5 (3.1)%), power output by Wingate test (absolute power 912 (152) W or 10.72 (1.6) W/kg) and sit and reach test (22.3 (5.5) cm) displayed no significant differences when analysed according to playing position. However, midfielders did have significantly larger body mass than backs ($p<0.05$) and greater maximal oxygen consumption ($p<0.01$) and greater vertical jumping ability than backs and forwards (vertical jump power output, $p<0.01$; vertical jump, $p<0.01$). Midfielders also had greater absolute handgrip strength ($p<0.01$).
Conclusion: The differences exhibited by midfielders despite identical training suggests that they stem from physiological adaptation to competition rather than training.

Gaelic football, an ancient game, is the national sport of Ireland. It is only played non-professionally, governed by the Gaelic Athletic Association. It can be described as a mixture of soccer and rugby played on a rectangular pitch. Each team has 15 players composed of a goalkeeper, six defenders, two midfielders, and six forwards. A score is recorded when the ball is kicked or hand passed over the cross bar, which is worth one point, or when a goal is scored, which is worth three points.

To date there are few empirical physiological data on elite Gaelic footballers, although an initial review of physical characteristics of Gaelic footballers has been conducted.[1] As yet, there is no study examining the physiological profile of Gaelic footballers in relation to playing position. The aim of this study was to examine the physiological profile of an elite intervarsity Gaelic football team, who went on to win the Sigerson cup, with respect to playing position.

METHODS

Physiological and anthropometric assessments were conducted on 28 elite college Gaelic footballers: 12 backs (mean (SD) age 21 (1.67) years), 12 forwards (22 (1.34) years), four midfielders (21 (2.58) years).

Height was measured to the nearest 0.1 cm using a stadiometer. Body mass was measured to the nearest 0.1 kg using analogue scales (Seca, Hamburg, Germany). Percentage body fat was estimated by Harpenden skinfold callipers (Quinton Instrument, Seattle, Washington, USA), using the four site method as outlined by Durnin and Womersley.[2] Vertical jump was performed using a Takei (Toyko, Japan) vertical jump meter. Each subject performed three jumps, and the maximum score was recorded. Power in the vertical jump was calculated from the formula proposed by Fox and Mathews.[3] Peak power was measured using the 30 second Wingate test on a Monark 824E (Monark Exercise Ab, Varberg, Sweden). The subjects performed a warm up at 100 W before undertaking a maximal test at a workload of 7.5% body weight. Flexibility was measured using a sit and reach box (Cranlea, Birmingham, UK). Three trials were performed and the maximum was recorded. Handgrip strength was recorded using a Taeki handgrip dynamometer, in a standing position with the arm extended by about 170°. Each subject performed three trials on both right and left sides. The maximum score was recorded for each side, and the average calculated.

Maximal oxygen uptake ($VO_{2}MAX$) was measured using a continuous running test[4] performed on a Powerjog treadmill (Birmingham, UK). All subjects were familiarised with the testing procedures before data collection. After a five minute warm up at 3.13 m/s (0% grade), the subject began running at a velocity of 3.58 m/s. Every two minutes thereafter, the grade was increased by 2% until volitional exhaustion. Metabolic and respiratory measurements were obtained using a Metamax gas analyser (Borsdorf, Germany). The protocol and criteria as set out by the British Association of Sport Sciences[5] was implemented for each subject. All results were analysed using standard descriptive statistics. Analysis of variance was used to examine between group variability.

RESULTS

Midfielders were the tallest of all the playing positions, but no significant differences were recorded between any of the playing positions. Midfielders were found to be significantly heavier than backs ($p<0.05$), whereas the body mass of forward players was similar to both backs and midfielders. There were no differences in terms of body mass index and percentage body fat. Midfielders produced greater power during the vertical jump than backs and forwards ($p<0.01$), and they also had significantly greater levels of vertical displacement ($p<0.01$). There were no differences for the Wingate test in relation to both absolute and relative power scores. There was no difference in flexibility for any of the playing positions in the sit and reach test. Midfielders had significantly greater handgrip strength and aerobic fitness scores than both backs and forwards ($p<0.01$).

Table 1 Body size and performance in relation to playing position for elite Gaelic footballers

	Backs	Forwards	Midfielders
Height (m)	1.79 (0.05)	1.81 (0.04)	1.86 (0.01)
Body mass (kg)	78.35 (7.7)**	82.3 (4.2)	87.45 (1.18)
Body mass index	24.28 (2.68)	25.06 (1.38)	25.34 (0.57)
Body fat (%)	15 (3.13)	14.45 (3.07)	14.16 (3.04)
Vertical jump (W)	1298 (112)*	1279 (131)*	1506 (75)
Vertical jump (cm)	54 (7.2)*	56 (6)*	65 (4)
Wingate (W)	933.75 (174)	855.48 (150)	983.75 (83)
Wingate (W/kg)	10.68 (1.7)	10.88 (1)	10.45 (3)
Sit and reach (cm)	21.02 (9.07)	21.81 (7.76)	21.62 (5.81)
Handgrip strength (kg/F)	47.4 (6.3)*	45.2 (6.5)*	53.1 (5.3)
Aerobic fitness (ml/kg/min)	56.8 (5)*	59.6 (5)*	65.8 (5)

*p<0.01, **p<0.05 compared with midfielders (analysis of variance).

DISCUSSION

Midfielders were slightly leaner than their team mates in the attacking and defensive positions, but this was not significant (p = 0.190). Bell and Rhodes[11] and Ramadan and Byrd[12] investigated body fat with respect to playing position in soccer. They found very little difference in body fat percentage among the different outfield positions, although midfielders tended to have lower body fat levels. Midfield is a position in which players need to be mobile, as they are involved in many aspects of play. They also cover more ground than their defensive and offensive team mates. Keane *et al*[13] investigated the distance covered by a group of soccer players. They divided the team into midfielders and defensive and offensive players. Midfielders covered more ground (9137 (977) m) than defenders (8523 (1175) m) and offensive players (8490 (673) m). They were also reported to have higher work rates than Australian soccer players and Australian rules players. Furthermore excess adipose tissue is unwanted as it acts as dead weight when body mass is repeatedly lifted against gravity and it may also affect the agility of a player.

Performance in the Wingate test was very similar among the various playing positions. Bell *et al*[16] reported a similar trend when measuring peak power in an international rugby union team. They found that absolute power output values were greatest in hookers and back row players (1388 (315) W) and lower in props and locks (1342 (261) W). When the data were standardised in relation to body size, the backs produced the highest power values. However, a study by Brewer *et al*[17] found no differences in absolute peak power output when comparing forwards and backs (15.9 (1.4) *v* 14.3 (1.4) W/kg) in rugby union. The backs were found to be the fastest group of players, a characteristic that is compatible with their role of running with the ball.[18] Doyle and Reilly[19] reported on the leg power output of elite rugby players. They found values in the region of 865 (71) W. Brewer *et al*[17] reported higher values for peak power of 1111 (112) W for forwards and 1114 (176) W for backs. In general, the Sigerson team exhibited peak power scores comparable to other studies. Coupled with the scores from the vertical jump, this reflects a good capacity to generate power for the activities of sprinting and generating force for vertical displacement. The greater absolute scores generated by midfielders have been attributed to their greater body mass, and the lack of a difference between weight corrected scores and playing position has been attributed to a generic power and strength training programme used by the squad.

Midfielders' strength scores were significantly different from both backs and forwards. This has also been reported by Tong and Mayes[20] who found that the grip strength differed significantly between the front row, second row, and back row (p<0.01). It is important for players to have great upper body strength to resist physical challenges. ''Shouldering'' is a tackling skill that is used very often throughout the field of play. The relative strength of midfielders is significantly different from both backs and forwards, and the fact that midfielders are both taller and heavier than their team mates may somewhat influence the relative strength scores. Indeed, this is the case when the difference is analysed with respect to body weight, as there was no difference in handgrip strength scores relative to the weights of the players (p = 0.375).

What is already know on this topic

Very few studies exist on the physiological profiling of elite Gaelic footballers. However, anthropometric and aerobic power values have previously been reported. Both characteristics have been linked with playing position and level of competition.

What this study adds

The study comprehensively evaluates the physiological profiles of a group of successful Gaelic footballers. It provides an insight into the various physiological characteristics relative to each playing position. It also presents valuable data on the requisites for the elite game and the reconditioning of injured footballers.

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ELECTRONIC PAGES

Online short reports

The following electronic only articles are published in conjunction with this issue of *BJSM* (see also pages 253 and 297)

High strain mechanical loading rapidly induces tendon apoptosis: an ex vivo rat tibialis anterior model

A Scott, K M Khan, J Heer, *et al*

Background: The role of apoptosis, or programmed cell death, has only recently been explored in tendon.

Objective: To investigate the development of apoptosis after high strain loading of rat tendon.

Methods: The right tibialis anterior tendons of three rats were prepared for mechanical loading, and left tendons were prepared identically as non-loaded controls. Tendon was loaded with 20% strain for six hours using a 1 Hz longitudinal sine wave signal. The following were used to assess apoptosis: (a) a monoclonal mouse antibody (F7-26) to label single stranded DNA breaks; (b) a rabbit polyclonal antibody that specifically recognises the cleaved form of caspase-3.

Results: Light microscopy confirmed that the high strain protocol induced a stretch overload injury. Control tendons showed little or no staining with the F7-26 antibody, but the loaded tendons displayed numerous apoptotic cells. The percentage of apoptotic cells (20%) in the loaded tendon was significantly greater than in the control tendon (1%) ($p = 0.000$). The labelled cells colocalised with abnormal nuclear morphology, including nuclear fragmentation. The staining against cleaved caspase-3 was positive in loaded tendons only, and localised both to nucleus and cytoplasm.

Conclusion: This experiment extends knowledge of human tendon apoptosis by showing that apoptosis can occur in response to short term, high strain mechanical loading. This is the first report of mechanical loading of intact tendon causing excessive apoptosis (221 w).

(*Br J Sports Med* 2005;**39**:e25) http://bjsm.bmjjournals.com/cgi/content/full/39/5/e25

The kick with the kite: an analysis of kite surfing related off shore rescue missions in Cape Town, South Africa

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Background: This study analyses kite surfing related off shore rescue missions in Cape Town, South Africa with the aim of providing more information on the frequency, pattern, and severity of kite surfing related injuries.

Methods: The observation period for this study started on October 1, 2003 and ended on May 1, 2004 and included 30 air rescue missions. Data and information were collected prospectively.

Results: The Air Mercy Service in Cape Town Province responded to 30 requests for help. Twenty five accidents were attributed to inability to detach the kite from the harness. Injuries occurred in five incidents and included fractures of the upper arm, ribs and ankle, and lacerations and contusions to the head and neck. Two patients suffered from hypothermia and one experienced severe exhaustion. All surfers were rescued successfully and there were no fatal accidents.

Discussion: The risk potential of this new sport is unclear. Dangerous situations can occur despite proper training and safety precautions due to unpredictable conditions and difficulties with equipment. Safety should be stressed. Surfers should sailing with a fellow kiter and should wear a life vest. More efforts must be taken to make this booming new water sport safer.

(*Br J Sports Med* 2005;**39**:e26) http://bjsm.bmjjournals.com/cgi/content/full/39/5/e26