ASSESSMENT OF THE STRENGTH QUALITIES OF AN INTERNATIONAL RUGBY SQUAD

G. Cometti[1], M. Pousson[1], M. Bernardin[2], J.L. Brullebaut[1].

1) Unite de Formation et de Recherches en Sciences et Techniques des Activités Physiques et Sportives, Université de Bourgogne, Dijon Cedex, France.

2) Fédération Francaise de Rugby.

1 Introduction

The training of top rank sportsmen and women increasingly requires control and appraisal of performance. This study provides an example of scientific control over training using reliable measuring facilities with an international rugby squad.

2 Method

Four series of tests were carried out on the French Armed Services Rugby Squad (n = 32):

- quadriceps strength tests with a Biodex type isokinetic ergometer (Biodex Corporation, Shirley, NY, USA) over a range of 8 velocities (-120°, -60°, 60°, 120°, 180°, 240°, 300°, 360" per second);
- spring tests using the Bosco ergojump (squat jump, counter-movement jump, drop jump and 15-second power test);
- field tests (speed over 20 and 50 m, squat, rugby press);
- measurements with an ergopower device (Bosco System by Globus) fitted to a leg-press.

The results involved comparing 3 sets of players: backs (N = 14), first and second line forwards (N = 12) and 3rd line forwards (N = 6). Statistical comparison was carried out using the non-parametric Man Whitney "U" test.

3 Results

3.1 Biodex Tests

The results show no significant difference between 3rd line forwards and backs and between 3rd line forwards and 1st and 2nd line forwards. In contrast though, figure 1 does show significant differences ($p < 0.05$) between backs and 1st and 2nd line forwards for eccentric torque (-120" and 60°/s) and concentric torque (240" and 300°/s). There are therefore two different types of players in terms of quadriceps strength. Difference in torque at -60° and 60°/s, i.e. eccentric-concentric difference at 60°, was also computed. The data showed no significant difference between positions (fig. 2). Schmidbleicher (1985) argues that a large difference (over 30 %) means athletes are failing to make proper use of their strength potential . The players in our study have good values at 60°/s (approx. 20 % of concentric force). The same calculations were made at 120°/s. No significant distinction between groups was recorded. Finally for concentric values the difference in torque between 60°/s and 360°/s indicates the ability of players to develop great strength at high speed. The narrower the gap, the greater the explosive strength of the players. From figure 2 it can be seen that 3rd line forwards are the most explosive. This result is not validated statistically though.The results show no significant difference between 3rd line forwards and backs and between 3rd line forwards and 1st and 2nd line forwards. In contrast though, figure 1 does show significant differences ($p < 0.05$) between backs and 1st and 2nd line forwards for eccentric torque (-120° and 60°/s) and concentric torque (240° and 300°/s). There are therefore two different types of players in terms of quadriceps strength. Difference in torque at -60° and 60°/s, i.e. eccentric-concentric difference at 60°, was also computed. The data showed no significant difference between positions. Schmidbleicher (1985) argues that a large difference (over 30 %) means athletes are failing to make proper use of their strength potential . The players in our study have good values at 60°/s (approx. 20 % of concentric force). The same calculations were made at 120°/s. No significant distinction between groups was recorded. Finally for concentric values the difference in torque between 60°/s and 360°/s indicates the ability of players to develop great strength at high speed. The narrower the gap, the greater the explosive strength of the players. It can be seen that 3rd line forwards are the most explosive. This result is not validated statistically though.

3.2 Ergojump spring tests

The standard series of tests developed by Bosco (1985) was used. The results (fig. 2) show the backs are very clearly superior to 1st and 2nd line forwards ($p < 0.05$) at squat jumps and above all counter-movement jumps ($p < 0.01$). The only other significant difference involves 3rd line forwards who stand out from the other forwards at counter-movement jump ($p < 0.05$). In contrast the vertical spring "jump and reach" test shows no difference. Use of the arms in the test may make up for shortcomings in the legs. Figure 2 again shows the backs were superior to the 1st and 2nd line forwards at drop jumps ($p < 0.01$), at the 15-second power test ($p < 0.05$) and for average height during the power test ($p < 0.01$). The 3rd line forwards come between the backs and other forwards for all three tests although the deviations are never significant.

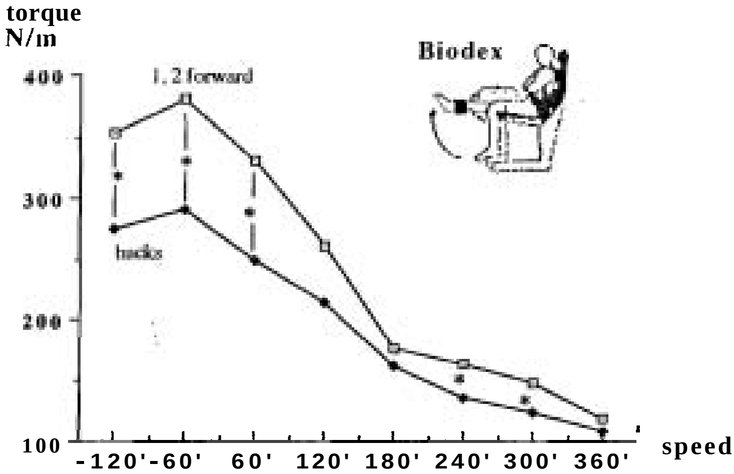

Figure I: comparative torque-speed graphs for forwards and backs

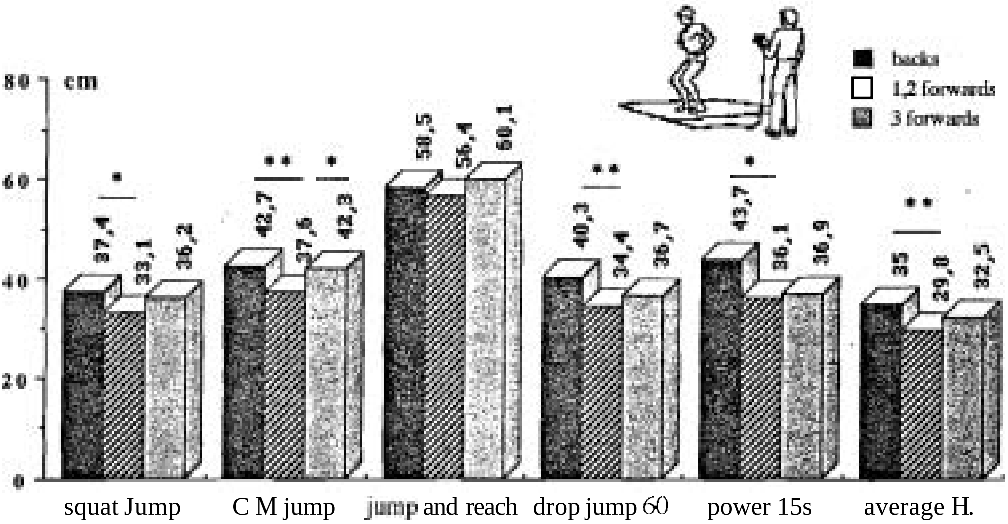

Figure 2 : Squat jump, counter-movement jump , jump and reach , drop jump (60 cm), 15-second Bosco power test and average height during power test.results for three sets of players.

Spring tests thus show the backs are more effective than 1st and 2nd line forwards.

3.3. Field tests

The maximum load raised in the leg flexion-extension (squat) movement and the maximum isometric force on a special machine for rugby players in thrust position ("rugby press") were measured. Figure 3 clearly shows that there is no difference between three groups for squats. In contrast there is a clear difference with the rugby press between backs and 1st and 2nd line forwards ($p < 0.001$) and between backs and 3rd line forwards ($p < 0.05$). This simply confirms the playing requirement made on all the forwards to perform this type of thrust. Speed was measured with photoelectric cells over 20 and 50 m. The results (figure 4) show over both distances a very clear advantage for backs over forwards ($p < 0.001$) and 3rd line forwards over 1st and 2nd line forwards ($p < 0.05$ over 20 m and $p < 0.01$ over 50 m). The speed factor is therefore a decisive criterion in distinguishing playing positions.

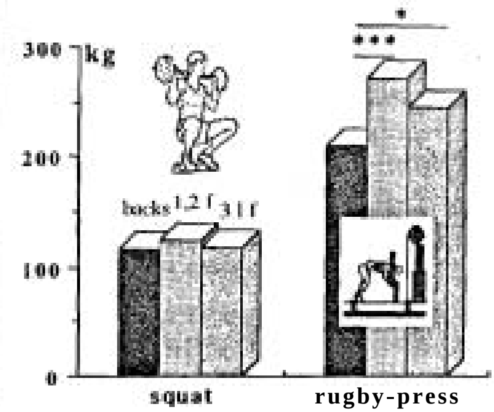

Figure 3 : Squat and rugby press results.

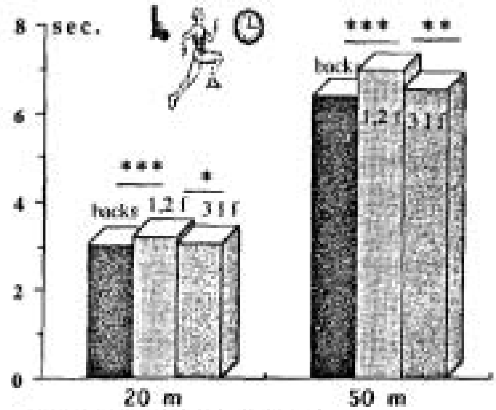

Figure 4: 20 and 50 m speed tests.

3.4 Ergopower tests (Bosco system by Globus)

The ergopower device was used on a leg-press. This equipment measures the speed of load movement on a standard weight machine and so mean and maximum power can be deduced. The protocol consisted in measuring power with increasing loads from 40 to 200 kg. Figure 5 shows mean power versus load for each set of players. Although the graphs reveal differences, in particular with the backs coming out on top, working up 930 W at 160 kg, no significant difference appears from the statistical analysis.

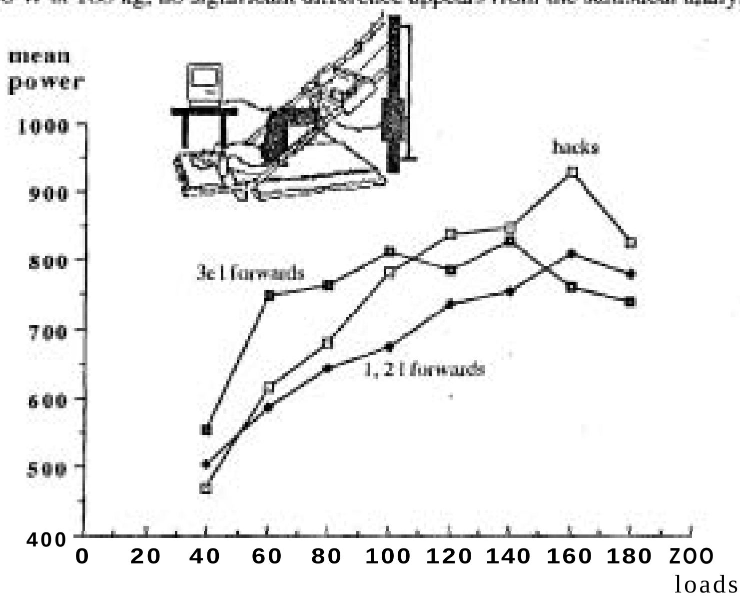

Figure 5: Load versus mean power for the different sets of players.

Figure 6 shows maximum power versus load. It is interesting to note that this time the maximum value is achieved by the 1st and 2nd line forwards (1 888 W at 160 kg), but here again no significant difference appears between groups. Finally figure 7 shows the graph of load versus speed. The three curves tend to overlie one another but a significant difference can be noted between the 3rd line forwards and backs at 40 kg. The 3rd line forwards are therefore swifter at this load.

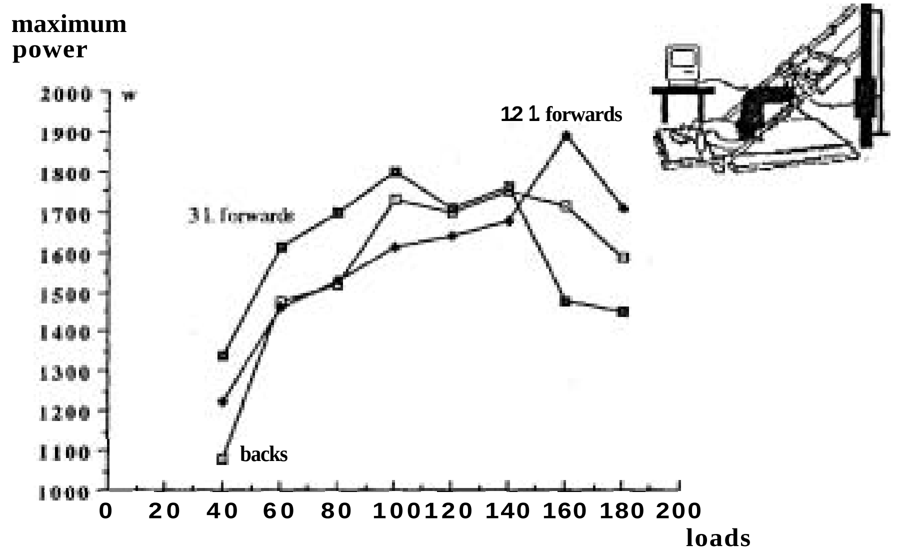

Figure 6: Load versus maximum power for the different sets of players.

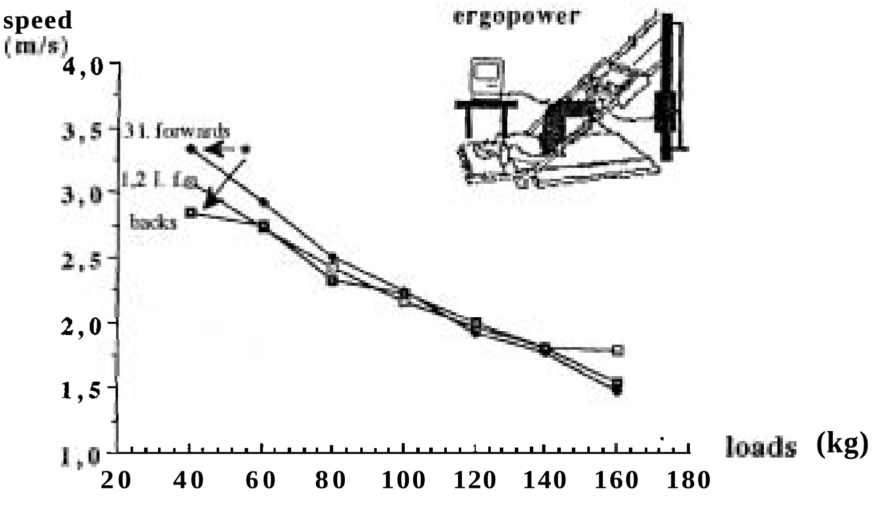

Figure 7: Load versus speed by playing position.

4. Conclusion

An accurate assessment of this sort means training can be organised to suit the specific nature of each playing position. It is further possible to monitor changes in each parameter according to the training given. It was possible lor electrical stimulation training to be arranged and different modifications to be observed.

5. References.

Bosco C. **(1985)** Elasticita moscolare e forza esplosiva nelle attivita fisico-sportive, Roma: sociéta stampa sportiva.

Cometti, G.(1989) Les méthodes modernes de musculation: Données théoriques.et pratiques. Compte rendu du colloque de novembre 1988 h I'UFRSTAPS de Dijon. Ed : Université de Bourgogne.

Schrnidbleicher D, **(1985)** Entrainement de la force 2e partie. analyse structurelle de la force motrice et son application à l'entrainement, Science et Sport, **14-16.**