Bishop Wordsworth's School

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Dear Parents/Guardians

University of Winchester – Sports and Exercise Consultancy Unit

I am writing to inform you of an exciting opportunity which I have advertised to both A Level PE groups. This Friday 26 February, the current Year 13 cohort has been invited to take part in an afternoon of Exercise and Physiology based testing and laboratory work at the University of Winchester.

I have managed to organise this event alongside Dr Stewart Cotterill who is the Head of Department of Sport and Exercise and we will be led through the programme by a combination of specialist lecturers and Masters' Students at the University. The session has been specifically tailored to target a number of sections within the A Level syllabus and will provide a terrific insight into the practical application of the theory which they would otherwise not be able to replicate here at school.

The event will run from 1pm – 4.30pm and further details are attached in the form of a programme. Each student will be required to complete a PAR-Q in order to clear them for the option of participating in different testing methods. Students are free to make their own travel arrangements to and from the University.

There is a charge of £16.50 for each student in order to cover the use of the laboratories, which are a highly sought after facility within the day to day scheduling of the University. It is a fantastic opportunity and one which has been offered to us very kindly during what is inevitably a busy time of year for the staff and students at Winchester.

PAYMENT OPTIONS:

Online: Via www.scopay.com. If you need a link code please email amh@bws.wilts.sch.uk
Debit/Credit card: Telephone Finance Office 01722 333851 ext. 260.

Yours sincerely

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SECU
SPORT AND EXERCISE CONSULTANCY UNIT

THE UNIVERSITY OF WINCHESTER

Bishop Wordsworth's School

Fri 26th Feb 2016

	Event	
13.00 – 13.20	Welcome and Introduction PAR-Q completion – Blood pressure measurement	
	Group 1	**Group 2**
13.20 – 13.55	Wingate testing	Biomechanics demonstration
13.55 – 14.30	Biomechanics demonstration	Wingate testing
14.30 – 14.45	Strength testing	Flexibility & jump height testing
14.45 – 15.00	Flexibility & jump height testing	Strength testing
15.00 – 15.30	Body fat analysis	VO_{2max} demonstration
15.30 – 16.00	VO_{2max} demonstration	Body fat analysis
16.00 – 16.30	Q&A	

Anaerobic testing - Wingate

Background

The Wingate Anaerobic Test (WAnT) was developed in the 1970s at the Wingate Institute in Israel. Since then it has been refined and further developed. It is one of a battery of tests used to assess anaerobic power and capacity. Participants have to pedal flat out on a cycle ergometer for 30 seconds against a fixed resistance, which is usually equivalent to 7.5% of body mass, using a Monark ergometer. It assesses the ability to supply energy for muscular activity during anaerobic metabolism and, therefore, encompasses both the ATP-PC and anaerobic glycolytic systems. In essence it provides information about the power, endurance and fatigability of muscle and is the most commonly used test to assess anaerobic power and capacity. In the past, the measurement of oxygen debt (elevated post-exercise oxygen consumption: EPOC) has been used to gain information about the ATP requirements of maximal exercise, although the validity of this method has been called into question in recent times. Therefore, the aim of this practical is to perform a 30 s maximal sprint (Wingate test), and evaluate the results gathered.

Procedure

The participant will complete a single 30-second all-out cycle test using a Monark ergometer. Blood lactate will be measured using a finger prick blood sample before the test, immediately after the test and 5 minutes post-exercise.

Pre-Test

1) Set up a new person on the computer and enter all relevant data into the computer, it is important weight is correct. Once set up, click 'run test' and ensure the load is set the load at 7.5% (this will tell you the mass that needs to go onto the ergometer pan).
2) Have the participant rest for 5 minutes, following which a blood lactate sample will be taken from the fingertip.
3) Warm-up the participant with a 5-minute cycle (1 kg load at 50 RPM), the pan itself weighs 1kg. After 5 minutes ask your participant to practice a few sprints for a couple of seconds each time.

4) Place the requisite load for the participant on to the pan and have the participant perform a practice start.
5) Pull the pulley on the pan and instruct the participant to increase their RPM to approximately 70. When they are ready they should press the button on the handlebar to release the weight and begin their practice start (just a few seconds of sprint cycling).
6) Rest the participant for 2 minutes.

Test

The requisite load should be on the pan and the participant and flywheel stationary. The pulley on the pan should be taught. Ensure a bucket is to hand in case the participant needs to vomit after the test.

1. The participant should be in the standing-start position.
1) Press start on the computer.
2) Pull the pulley on the pan and instruct the participant to increase their RPM to approximately 70. When they are ready they should press the button on the handlebar to release the weight and begin their 30 s maximal test.
3) Encourage the participant to pedal as rapidly as possible for as long as they can. **The participant must remain seated throughout.**
4) Once the 30 seconds are complete, remove 1–2 weights from the pan and instruct the participant to continue pedalling at 50 RPM for 2 minutes. Do not allow the participant to completely stop, as there is a significant risk of fainting. A blood lactate sample should be taken on immediate completion of the test.
5) At 5 minutes take another blood lactate sample.
6) Allow the participant to begin a further cool-down if required.
7) Record the WAnT test data from the computer.

Data Recording

Participant _____ Date _____ Time _____

Gender	
Mass (kg)	
Stature (cm)	
Sport	
Lab temperature (^{o}C)	
Lab humidity (%)	
Lab barometric pressure (mmHg)	

Mass to be applied _____ kg (7.5% of bodyweight)

Participant data	**Value**
Peak power	W
Minimum power	W
Time to peak	seconds
Fatigue index	%

Time	**Blood lactate (mM)**
Baseline (resting)	
End of test	
5 minutes post-exercise	

Biomechanics Demonstration

Visual analysis data capture

The Football kick

Background

Motion capture or visual analysis is the process of recording the movement of objects or people and is used in filmmaking, sports, medical applications and robotics. Passive optical markers that are coated with a retro-reflective material to reflect light are placed directly onto a person's skin on specific joints. The cameras pick up these reflective markers within 3 planes of motion creating a 3D image. The data from this image can be used to calculate joint angles, internal and external rotations, segment velocities and accelerations. Visual analysis is the most common tool used in biomechanics; it can help to improve performance and pick up potential causes of injury.

Aims

-To undertake properly prepared biomechanical filming.
-To film a football kick and look at the analysed data in a 3D format.

Procedure

1. Record the participant's name, age, height and dominance in the table provided.
2. Position your participant where you want them to kick the ball.
3. Think about where the ball is going to go once they kick it, and how much space is needed. Set up appropriate layout.
4. Attach body markers to appropriate anatomical landmarks. Think about the kicking action. Which landmarks/joints might you want to consider?

Data Recording

Name	
Age	
Height	
Dominance	

Electromyography (EMG) data capture
Muscle activation in the leg during a static jump

Background

Electromyography (EMG) is technique used for evaluating and recording the electrical activity produced by skeletal muscles. EMG is performed using an instrument called an electromyograph, to produce a record called an electromyogram. An electromyograph detects the electrical potential generated by muscle cells when these cells are electrically or neurologically activated. The signals can be analysed to detect medical abnormalities, activation level or recruitment order, or to analyse the biomechanics of human.

Aims

-To identify activation levels and recruitment order in the legs during a stating jump.

-To undertake properly prepared EMG, including site preparation.

-To collect data on the dominant leg during a static jump.

Procedure

1. Record the participant's name, age, height and dominance in the table provided.
2. Position your participant where you want them to jump. Think about arm swing and how they are going to jump, and therefore how much space is needed.
3. Attach EMG sensors to chosen muscles on the leg. Think about the jump action. Which are the main muscles in your upper and lower leg that you might you want to consider? (choose three to four muscles)
4. Record the muscle names, order of recruitment from 1-4 and activation level highest to lowest (1 high- 4 low)

Data Recording

Name	
Age	
Height	
Dominance	

Muscle Name	Recruitment order	Activation level

Strength testing

Name: _____

Age (yrs): _____

Height (m): _____

Mass (kg): _____

Grip Strength (kg): _____

Back Strength (kg): _____

Normative Data

- Grip strength (kg)
  - Male = 50
  - Female = 30
- Lower body strength (kg)
  - Male = 320
  - Female = 200

Flexibility & jump height testing

Name: _____

Age (yrs): _____

Height (m): _____

Mass (kg): _____

Normative Data

- Vertical Jump (inches)
  - Male
    - Excellent >26
    - Average = 20
    - Poor <16
  - Female
    - Excellent >24
    - Average = 17
    - Poor <14

- Sit and reach (cm) for 16-19 year olds
  - Male
    - Excellent >14
    - Average = 7-11
    - Poor <4
  - Female
    - Excellent >15
    - Average = 7-12
    - Poor <4

Body fat analysis

Background

- Different methods of analysing body composition;
  - BMI: Weight (kg) / height^2 (m)
  - Waist: Hip ratio: waist circumference (cm) / hip circumference (cm)
  - Bioelectrical impedance
- Essential body fat
  - Nerve tissues, bone marrow, organs, all membranes
  - Males = 3%
  - Females = 12% (higher due to childbearing and hormonal functions)
- Average body fat (essential plus storage body fat)
  - Males = 15-20%
  - Females = 24-30%

Waist-to-Hip Ratio (WHR) Norms				
Gender	**Excellent**	**Good**	**Average**	**At Risk**
Males	<0.85	0.85–0.89	0.90–0.95	≥0.95
Females	<0.75	0.75–0.79	0.80–0.86	≥0.86

Data Recording

Name: _____

Age (yrs): _____

Height (m): _____ Mass (kg): _____ BMI: _____

Waist circumference (cm) _____ Hip circumference (cm) _____ Waist: Hip ratio _____

	Your Value	Recommended Range
Fat (%):	_____	_____
Fat (kg):	_____	_____
Lean (kg):	_____	_____
Total (kg):	_____	_____
Water (%):	_____	_____

Note

Water percentage must be within the recommended range to make the test valid. This is because hydration status changes the composition of the body and can lead to incorrect lower body fat (%) results if dehydrated.

Laboratory Practical: Maximal Oxygen Uptake

Background

Maximal oxygen consumption (VO_{2max}) reflects the maximum amount of oxygen that can be consumed per minute during a progressive incremental test to exhaustion. This reflects the maximal ability to re-phosphorylate ADP to ATP using aerobic metabolism. Measurement of VO_{2max} is commonplace in exercise physiology laboratories and has traditionally been used as the gold standard for measurement of cardiorespiratory fitness. Until fairly recently it was assumed to be the single best indicator of cardiorespiratory functional capacity. However, it is more accurate to view VO_{2max} as a good indicator of aerobic fitness, providing information about the potential for aerobic performance and to a lesser extent training status. In spite of this, VO_{2max} may increase up to 15–20% per year with exercise training. However, the degree of improvement will depend upon an individual's initial level of fitness as well as other factors such as age, sex, body size and genetic characteristics. In addition to such demographic factors, VO_{2max} is also affected by exercise mode. For example, upper body exercise is associated with lower VO_{2max} values compared to lower body exercise.

Procedure

1. Prepare the equipment: Douglas bags, mouth pieces, tubing, heart rate monitor, treadmill harness.
2. Allow the participant a 5-min warm-up at a self-selected pace.
3. To start the test, allow the athlete to select a comfortable running speed and set the gradient of the treadmill to 1%. The treadmill is set to 1% as this best mimics outside running.
4. At the end of every minute the gradient should be increased by 1%.
5. After 4 minutes, the participant will run with the mouthpiece and expired gas should be collected in the last 45 s of each stage.
6. The participant will run to volitional exhaustion and they will decide when to terminate the test.
7. After the test has been terminated, a blood sample should be taken immediately to determine post-test blood lactate concentration.

Some points to remember:

- Test results can be influenced by environmental factors – record these!
- What other parameters would need to be recorded throughout the test, and how often?
- **Remember, VO_{2max} tests require maximal effort by the participant so you must encourage him or her, especially during the latter stages of the test!**

Criteria for attainment of VO_{2max} (BASES)

At least three of the criteria below must be attained for the maximal test to be valid. If less than three are achieved, the test would normally be repeated on another day.

1) Attainment of age predicted maximal heart rate (220 – age (yrs) $\pm$ 10 $b \cdot min^{-1}$).
2) A perceived exertion rating of 19 or more on the Borg scale of perceived exertion.
3) An increment of not greater than 2 $mL \cdot kg^{-1} \cdot min^{-1}$ oxygen consumption between the final two stages of the test.
4) A respiratory exchange ratio (RER) of >1.15.
5) Post-exercise blood lactate of greater than 8mM for females and 10mM for males.

Points to consider:

- Did your participant reach VO_{2max}?
- How does your participant's VO_{2max} compare to age group norms and their own sporting group?
- Was the protocol the most applicable test to conduct on your participant and would another test have been more applicable?

Normative Data (up to 19 years old)

- Male: 47 – 56 $ml \cdot kg \cdot min^{-1}$
- Female: 38 - 46 $ml \cdot kg \cdot min^{-1}$

If you have any questions about your visit to the Department of Sport and Exercise at Winchester University, please contact us:

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