

SPORT PERFORMANCE, SPORTS SCIENCE & COACHING

Dr. Gulbahar Khan * Devarshi Kumar chaubey**

ABSTRACT

Over the years, sport science has mainly been viewed by coaches as inaccessible, too technical, or in many cases, non-applicable to the actual sport setting. The field of coaching, however, is multidisciplinary and would benefit from the services that sport science has to offer to optimize the athletic environment. With the recent number of athletic deaths being attributed to the competitive environment, and rising concern for player safety, these brief, sport-specific instruments would allow coaches and athletic departments the opportunity to assess accurately an athlete's response to acute physical demands that could be used to monitor the influence and efficacy of various sport programs on subsequent rate and severity of injury. It is the marriage of sports science and coaching that will allow today's athletes to not only excel and compete at much higher levels but also allow the athlete to prevent injury and maintain a much healthier career.

* Assistant Professor, Noida College of Physical education Noida (U.P.)

** Research Scholar, Department of Sports and Physical education, Sarguja University, Ambikapur (CG)

INTRODUCTION

The athletes of today, whether recreational or elite, run and swim faster, throw farther, and jump higher than their competitors from the past. These improvements have been attributed to several factors related to smarter nutrition; a greater understanding of biomechanics of sport movement, better training techniques, advances in psychological support, and improvements in coaching education. Continuing efforts to extend laboratory research into the sport-specific field setting have resulted in the identification of several variables deemed necessary for successful performance in several sports^{1,2}. The adoption of this marriage of 'science and sweat' has been slow for a variety of reasons. Typically, sport performance testing has been expensive and limited to facilities at the elite levels of sport, generally out of the general public's reach and the every day coach's budget. However, because of a greater focus on prevention of injuries and on enhancing performance at the younger levels of play, the opportunity to combine cutting-edge sport science technology with the traditional field and court assessment has never been easier, and is much more readily accessible to today's progressive thinking coach. This article describes and revisits some scientific areas and tools to add to a coach's present arsenal of tests, and discusses the advantages, complexities, and pitfalls to avoid in this continually evolving area of sport science.

Biomechanical analysis

Coaches and athletes have traditionally used video cameras and videocassette recorders (VCR) to scrutinize and improve their performances. Today, computers and high-tech devices are available to retrieve, analyze, replay, edit, and print the desired performance into a three-dimensional (3D) stick figure image that is analyzed from different angles without the need for a VCR. An endless number of athletic movements can be digitally assessed in the indoor, outdoor, or underwater environment. This PC-based program and display gives the coaching staff another way to examine objectively stroke patterns, center of mass, reaction/response time, change of direction, stance, symmetry of gait, and optimal angles and velocity of movement from module systems consisting of multiple cameras, synchronized force platforms, and electromyography (EMG) analysis. As well as enhancing

sports performance, these computer-generated figures can be used to analyze how injuries occur and, most importantly, how sport trauma can be minimized.

The key is the ability to merge both the experience of the coach with the objectivity of the analyzed sport movement to create a plan for athletic enhancement. There are numerous sport skills that have been successfully analyzed. These include the soccer kick, softball and baseball hitting, the football pass, the golf swing, and of course, baseball pitching. With the recent advent of smaller digital cameras, a more accurate evaluation through biomechanical analysis will allow injury prevention to come to the forefront. Not only will the athlete have the advantage of immediate analysis through computerized re-enactment, but will also have printed hard copies that will enhance the diagnostic and prescriptive value of filming for more efficient training.

Sport Performance Testing

Another relationship to performance enhancement is that of sports physiology/exercise performance testing. To be competitive, the key is to select tests that provide information specific to the particular sport, position, or event.³ Coaches should consider important test components including indirect calorimetry, anaerobic testing, body composition assessment, range of motion (ROM) testing, pulmonary function evaluation, nutritional analysis, electrocardiographic work-up, and total blood chemistry as adjuncts to the training regimen and weight room assessment.

Indirect calorimetry involves the athlete running on a treadmill during respiratory and metabolic gas analysis, with results providing information on an athlete's peak aerobic power (VO₂peak), endurance capacity, anaerobic threshold (AT), and ventilatory response. Anaerobic testing provides information on an athlete's peak power (PP), mean power and capacity to maintain a workout load (MP), and the rate of decline in power, also referred to a fatigue index (FI) during a competitive challenge. Since decreased muscular strength and excess body fat has been shown to compromise health, and decrease performance in many sports requiring endurance, quickness, flexibility, and agility,^{4,5,6,7} body composition assessment can provide feedback on lean body mass (LBM) and percent body fat. Range of motion (ROM) testing, typically reserved to injury rehabilitation, is especially useful prior to

the season to obtain information on an athlete's degree of flexibility, to detect any deficiencies in bilateral symmetry, and to identify musculoskeletal restrictions that could lead to injury.

Services that are readily attracting coaches are the evaluation of pulmonary function, nutritional analysis, electrocardiographic work-up, and total blood chemistry. Pulmonary function analysis can provide information on the athlete's lung capacity, ventilatory efficiency, and the potential for pulmonary obstruction such as asthma. Computerized nutritional analysis allows the sport scientist to recognize over 2,000 foods grouped into 22 categories that an athlete may consume during any season. A simple 3-day written recall provided by the athlete allow food portions to be entered using an unit of measure, and can succinctly provide feedback on the athlete's caloric intake, quality of the diet, nutritional excesses and deficiencies, and recommended daily allowance (RDA) for vitamins and minerals. A simple, preseason 12-lead electrocardiographic work-up involves checking the activity of the athlete's heart at rest, during a running challenge, and throughout recovery. Results provide information on status of cardiac conduction, assist in identifying cardiac abnormalities, and aid in determining the health risk status of the athlete's heart. Total blood chemistry can detect anemia, electrolyte imbalances or underlying preventable health problems.

By defining these parameters, one can make some predictions regarding performance capabilities, assess an athlete's predisposition to injury, critically review the effect of current training protocols, and provide the coach with additional insight and a competitive edge over those programs relying primarily on subjective criteria.⁸ These tests are supervised by sports medicine physicians, sport physiologists and other sport science personnel, and are generally available from exercise and sport science programs on most university campuses to assist coaches from the collegiate to youth sport levels of competition.

Sport Psychology Assessment

One of the focuses for the future in sport psychology will be the increasing use of athletic personality profiling. Athletes involved at all levels of sport experience unusually high levels of expectations and physical challenges within a short span of time. The

psychological stress is exacerbated with the need to learn play systems quickly, move up on the depth charts, and establish themselves with the coaches and teammates going into the competitive season. Significant life-changes and continual daily stress of this magnitude have been linked to sport injury in both contact and noncontact activities.^{9,10} As the stress mounts during practice, an athlete loses the ability to think clearly. This may result in irrational risk-taking, inadequate attention to coaching, and inattention to fundamental skills required to perform successfully and safely during competition.^{11, 12}

Various psychometric instruments such as the Athletic Coping Skills Inventory (ACSI), the Profile of Mood States (POMS), and the Sports Inventory for Pain (SIP) have been utilized by an increasing number of sport scientists, medical personnel, and coaches to assess coping skills, motivation, self-esteem, pre-competitive anxiety, and mood relevant to sport. In regards to sport trauma and rehabilitation, coaches and athletes have consistently mentioned a strong relationship between level of pain and physical/psychological dysfunction in several studies. Others have reported that strategies for coping with pain (i.e., diverting attention, ignoring pain) were associated with the ability to function physically and psychologically. Therefore, an athlete's attitude toward pain and the strategies he or she uses while experiencing sport pain may subsequently be reflected in his or her level of athletic performance and adherence to prescribed medical care.¹³ A coach taking a proactive approach through psychological assessment to better understand an athlete's response to injury prior to actual trauma, rather than simply attributing physical trauma to the inherent nature of contact sports, would enhance the opportunity to avoid risk factors to athletes. Although the use and validity of such instruments for use in athletic selection have been questioned in the scientific literature, it appears that a consensus is growing supporting the successful utilization of these instruments under certain conditions to predict athletic performance and avoid injury.¹⁴

Numerous studies have indicated several areas that would benefit both athlete and coach as a result of utilizing sport psychology assessment. These include substantiating an athlete's present mind-set to maintain areas of success and focus on areas to improve, identification of potential overtraining, assessing response to sport injury, and monitoring psychological demands of injury rehabilitation. Other benefits include allowing for more

effective teaching of anxiety management, mental preparation, and other coping skills,^{15,16.}

Testing Considerations

In order to utilize effectively the available sport science support, coaches should keep several things in mind. Communicate with the sport science staff and select testing variables that are relevant to your particular sport. The mode of testing, the rate of motion, the physical resistance selected, the specific muscles used, and the range of motion experienced by the athlete should closely imitate the actual sport¹⁷ Tests should be challenging, but not to the point where test termination is effected by excessive body temperature, dehydration, or fuel depletion. Select testing techniques that are valid and reliable, rather than based simply on familiarity or tradition, and insure that tests are conducted in a safe and productive atmosphere to optimize player safety, concentration, and instruction. In addition, both the coach and the sport science staff must ensure that valid and appropriate feedback is provided the athlete is in a timely manner by those he/she trusts. Finally, the human rights of all athletes during testing must be respected.

REFERENCES

- Anderson M. B, & Williams J. M.** "A model of stress and athletic injury: prediction and prevention". Journal of Sport and Exercise Psychology 10 (1988) : 294-306.
- Anshel M. H.** "Qualitative validation of a model for coping with acute stress in sport" . Journal of Sport Behavior 2001; 24(3): 223-246.
- Crossman J.** "Psychological rehabilitation from sports injuries". Sports Medicine 1997; 23: 333-339.
- Goreman K.** "The use of talent-predictive factors in the selection of track and field athletes". In Gambetta V (Ed.), The Athletic Congress's Track and Field Coaching Manual. pp. 31-36. Champaign, IL: Leisure Press, 1989.
- Hergenroeder A.C. & Klish W. J.** "Body composition in adolescent athletes". Pediatric Clinics of North America 1990; 37: 1057-1083.
- Katch FI, McArdle W.D, Czula R, & Pechar G.S.** "Maximum oxygen intake, endurance running performance, and body composition in college women". Research Quarterly 1973; 44: 301-312.
- Meyers MC, Sterling J.C.** "Physical, hematological, and exercise response of collegiate female equestrian athletes". Journal of Sports Medicine and Physical Fitness 2000; 40: 131-138.
- Muller E, Benko U, Raschner C, Schwameder H.** "Specific fitness training and testing in competitive sports". Medicine and Science in Sports and Exercise 2000; 32(1): 216-220.
- Terry P. C.** "The efficacy of mood state profiling with elite performers: a review and synthesis". The Sport Psychologist 9 (1995) : 309-324