SOME TRENDS IN THE DEVELOPMENT OF BIOMECHANICS OF SPORTS IN POLAND

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Predominantly, faculties of physical education deal with the biomechanics of sports, and they have good relationships with biomechanics work at Technical and Medical Schools. Close relationships of Polish biomechanics with its world centers are due to the existance of the International Society of Biomechanics (ISB). The 7th International Congress of Biomechanics took place in Warsaw in 1979.

BIOMECHANICS AS A SUBJECT AT ACADEMIES OF PHYSICAL EDUCATION AND COURSES FOR COACHES

Biomechanics is a required discipline of physical education studies, and thus there are Biomechanics Labs at all of the six Academies of Physical Education in Poland. The program of biomechanics for students is taught during 60 hours of lectures and classes. This program is an introduction to the detailed biomechanics of sports events, and it comprises the characteristics of structure and function of both the active and the passive motor system, as well as mass and inertia parameters of a human body. Moreover, measurements of muscle torques and kinematic and dynamic characteristics of human motion are conducted. The aim of the classes is, among others, the familiarization with methods of biomechanical investigation and especially with biomechanics cinematography. Biomechanics as a subject is conducted after the courses of anatomy and physiology. Seminars for Master's degrees and in some Academies doctorate studies are carried on within the field of biomechanics of sport. Apart from the physical education studies, biomechanics is an obligatory subject at 2-year for coaches.

BIOMECHANICS AND OTHER SPORTS SCIENCES

The task of Biomechanics Labs is to carry on the teaching process and scientific studies. The most developed biomechanics centers in Poland are Biomechanics Labs at the Academies of Physical Education in Wroclaw and Poznan, and the Institute of Sport in Warsaw.

Taking into account the two main intermingling trends in the word biomechanics--mechanical and biological, the latter is the prevailing trend in Poland. This fact is due to the origin of biomechanics in Poland during the years 1950-1960 on the basis of anatomy and physiology. However, some balance between those two trends has been observed lately, which has resulted in a more frequent presence of specialists of technical sciences in Biomechanics Labs.

The term "biomechanical" is understood in a slightly different way in Poland than in some of the western countries. As a science concerning biological and mechanical aspects of human motions, its application to sport is limited to the investigation of the technique of motion (sports technique). The difference is based upon the fact that it does not comprise problems such as physical skill or physical growth. Physical skill and motor development are the domain of the theory of physical education; physical growth is the subject of anthropology studies. The development of motor features such as force, speed, and endurance is the domain of the theory of training (Naglak, 1974). However, taking into account methodology of experiments, as well as technical instrumentation equipment which has been created in biomechanics, one can notice that it deals in some way with those disciplines of human motion activities because they are closely connected to sports technique (Fidelus, 1970).

APPLIED STUDIES

The applied studies are under constant control and care of sports authorities and scientific labs. As an example, this can be seen through the discussions organized by the editorial staff of "Sport Wyczynowy" (Competitive Sport), a journal popularizing the results of such studies among coaches (Nauka - Praktyka Sportowa; Science and Sports Practice, 1980). The five years' applied studies project in sport is in progress now.

Studies on sports technique are conducted in various centers. For several years, studies on rowing (Kabsch et. al., 1978) have been conducted in Poznan where, as in Wroclaw, scientists concentrate on investigating the technique of swimming and conduct experiments on boxing and judo. The Warsaw center specializes in experiments on weight-lifting, canoeing, and pole-vaulting. These studies are very often part of a much wider program of the inter-disciplinary studies.

Biomechanical experiments in sport, in Poland, are not limited to the recognition of sports technique, but they also refer to the training process of technique and motor features. Bober (1973,1979) worked on the change of technique under the

influence of various loads. Wit (1981) worked out extensive monographs on factors conditioning force development in a training unit, in a twenty-four hour cycle, in a week's cycle, and in a year's cycle of practice. Wachowski (1977) published his monograph on the influence of the amount of work and power on the development of strength and body build of young competitors. Those works are symptomatic of the new trend in sports biomechanics. On the one hand, we can observe interdisciplinary studies based also on methodology of experiments in biochemistry and physiology of exercise, and on the other, problems connected with the need of sports practice are undertaken. While investigating sports technique, it has been noticed that its recognition is not a sufficient factor of progress in sport. An important threshold is the method of teaching the sports technique and basic motor skills. Thus, the idea of combined seminars of scientists dealing with biomechanics and those dealing with the methodology of physical education has emerged. Annual "Biomechanics and Teaching Sports Skills" seminars, under the auspices of the Research Committee ISCPE, have been organized at the Academy of Physical Education in Wroclaw since 1981.

TRENDS IN BASIC STUDIES

In the biomechanics circles in Poland, there dominates a view that the investigation of motion has a wide aspect of neuromuscular control, and it requires some widening of the area of the investigation so as to include the biological basis of motion coordination. Fundamental studies are conducted in various centers, and among the subjects, the following can be enumerated: the relationship of force and velocity of muscles work conducted in Warsaw, the problem of the strength changes as a function of time in ontogenesis, overloading of the spinal column in sport and work, and the neuromuscular control of human motion conducted at the Academy of Physical Education in Poznan. What distinguishes the Warsaw center is the fact that it combines biomechanical problems with the physiological and biochemical phenomena while examining the technique of human motion. For several years Wroclaw Biomechanics Lab has been conducting experiments on the process of balance regulation of man, neuromuscular basis of human motion coordination, the use of elastic energy of muscles in sports technique and some problems connected with the mechanics of a muscle. The less popular experiments are the experiments based upon mathematical and physical modelling of motion, though they have already been applied in studies on the pole vault (Morawski et. al., 1978) and body balance (Golema, 1981).

Further development of biomechanical experiments in Poland is connected with the research program on biomechanical investigation on the static and dynamic potential of man's motion. This program is coordinated by the Wroclaw center.

REFERENCES

Bober, T., 1973. Biomechaniczne zalozenia treningu technicznego (The biomechanical principles of sports technique practice). Rozprawy Naukowe AWF we Wroclawiu, X, pp. 5-50.

Bober, T., 1979. Biomechaniczne kryteria skutecznosci techniki sportowej (Biomechanical criteria of effectiveness of sports technique). Sport Wyczynowy, Nr 9-10, pp. 15-22.

Fidelus, K., 1970. Miejsce i znaczenie techniki ruchu w teorii sportu (Position and meaning of motion technique in theory of sport). Sympozjum Teorii Techniki Sportowej, pp. 16-22, Sport i Turystyka, Warszawa.

Golema, M., 1981. Biomechaniczne badania regulacji rownowagi u czlowieka (Biomechanical Analysis of the Balance Regulation Process by a Man). Studia i Monografie AWF we Wroclawiu Nr 2.

Kabsch, A., L.Dworak, W.Lambui and A.Lisiecki, 1978. Characteristics of kinematic and dynamic parameters of the rowing pool and rowing ergometer. Roczniki Naukowe AWF w Poznaniu, z.26, pp. 65-73.

Morawski, J., M.Buczek, K.Wiklik and M.Sliwinski, 1978. Badania pewnego modelu skoku o tyczce (Preliminary model research in pole vault). Wychowanie Fizyczne i Sport, Nr 4, pp. 43-61.

Naglak, Z., 1974. Trening Sportowy. Teoria i Praktyka (Sports Training. Theory and Practice). PWN Warszawa-Wroclaw.

Nauka - praktyka sportu (dyskusja redakcyjna), 1980. (Science and sports practice relationship) (discussion at the editorial board). Sport Wyczynowy, Nr 8-9, pp. 2-15.

Wachowski, E., 1977. Wplyw pracy i mocy uzytecznej na wybrane cechy motoryczne i morfologiczne (The influence of useful work and useful power on selected motorial and morphological traits). Monografie, Podreczniki i Skrypty AWF w Poznaniu seria: Monografie Nr 94.

Wit, A., 1981. Zagadnienia regulacji w procesie rozwoju sily miesniowej na przykladzie zawodnikow uprawiajacych podnoszenie ciezarow (Control on development process of muscle strength on the example of weight lifters). Ed.: AWF Warszawa.