

ON A PROBLEM OF BIOMECHANICAL STABILITY OF A HUMAN BODY

BILENKO A.G. ; IVANOVA G.P.
Lesgaft Institute of Physical Culture
Leningrad
USSR

The experimental comparison of a human body stability on an immovable support with the stability on a slightly movable pendulum base is given. The comfort parameters of postural control are discussed.

To carry out the investigations the experimental setup used: 1) strain measuring stabilograph, 2) movable platform, 3) electromyograph, 4) magnetograph "Schlumberger", 5) computer "Plurimat".

The movable platform was equipped by a coloured light indicator for balance violation in each direction. The oscillations of the upper movable platform relative to the lower one were provided by the experimental setup in three different angular ranges: A- up to 0,3deg, B- 0,75deg, D- 1,5deg. The torque moment changes of base surface were performed by using different stiffness coefficients for springs which fastened the two platforms: $C_1 = 1 \text{ N/mm}$, $C_2 = 2 \text{ N/mm}$, $C_3 = 4 \text{ N/mm}$.

The stability of human subjects was registered directly by stabilography. The movable platform was mounted on the immovable one. The subject stood on toes on the movable platform in different dynamic regimes (C_1 , C_2 , C_3) and different oscillation angles (A, B, D). The postural stability was checked by indicator and without it.

During the balancing process the electrical activity of two muscles of each leg was registered (a.tibialis anterior and a.gastrocnemius).

The stabilograph signal was obtained in two directions on the sagittal and frontal axes. Total signal, low frequency and high-frequency components were analysed. From the stabilograms there were defined the integral areas under the curves, the curve lengths and the power spectrum. Electromyogram was analysed on the basis of envelope behaviour, in each experiment the integral activity of each muscle and the average activity over four muscles were calculated.

The minimum area under the stabilogram and the curve length were reliably obtained at 0,75deg and the spring stiffness coefficient 2N/mm. Maximum muscle activity was reliably detected with springs of mean stiffness at angles of 0,75deg and 1,5deg. The experiments showed no differences in ECG of leg muscles with or without postural correction according to the indicator.

Those who have been trained on the movable platform beforehand displayed then reliably better stability results on the immovable platform.

Relying on subjective comfort estimations on balancing process one may conclude from the experimental results that postural control on the slightly movable platform was based on proprioceptive feedback with minimum muscle tensions corresponding to 0,75deg. Within small muscle tensions the postural control strategy is defined by the short range muscle stiffness.

STATISTICAL MODELS FOR ANALYSIS OF SPORT PERFORMANCE

BLAHUŠ, P.
Charles University
Faculty of Physical Education and Sports
Prague
Czechoslovakia

Statistical analysis of various factors influencing sport performance is one of the tools of recent sport research methodology. Statistical methods are to be applied in a general methodological frame which makes it possible to use proper methods for different purposes of monitoring sport performance. It is suggested to accept the systems theory approach to solve this problem. The approach allows for classifying statistical methods according to different purposes. The most popular one of these is the statistical relationship between training as input and performance as output. Different statistical models for solving this task are: multivariate regression, factor analysis, test theory models etc. The most powerful tool however consists of complex models such as structural equation models and path analysis with latent variables (such as RAM, LISREL, COSAN) which

allow for one to discover causal dependence of sport performance with different factors of training and other circumstances.

THE ECONOMICAL RACING--MOVEMENT OF SPORTSWOMEN AT VARIOUS LEVELS OF PERFORMANCE

DUBININ, G.V.; KRYAZHEV, V.D.
Institute of Physical Culture
Smolensk
USSR

The investigation was carried out on a training-stand "Tredban". During the running parameters such as: breathing, stride length and stride frequency, time of support time of flight, vertical oscillations and impact (shocking) accelerations were recorded.

The economical level of running was calculated as the cost of oxygen charge for one metre of running at a speed 4 m/sec.

During the experiment it was revealed that the sportswomen at the "elite level" had the most economical level of running. Qualified runners had a level 8-12% below, and the beginners- 20-30% below the level of the elite performers.

The analysis of biomechanical parameters characterises the non-optimal running-pattern of the beginners. More qualified runners use a step 5% longer, and the beginners 7-12% longer than those of the most qualified (elite) runners.

The beginners were identified by the high values of vertical oscillation and by the quantities of acceleration. The data of the investigation indicates that the most economical level of running was performed by the sportswomen of the "elite" group as compared to that of the runners of the lower qualification group.

TRAINING OF SPORTING MOVEMENTS OF CHILDREN ON THE BASE OF BIOMECHANICAL ANALYSIS

GUBA, V.P.
State Institute of Physical Culture
Smolensk
USSR

The aim of the work is to carry out biomechanic analysis of the motor habits formation in 2-3 years-old children, such as: running, walking, jumping and throwing. All together about 1,000 children of both sex took part in the experiment during 10 years. The methods of investigation included pedagogical test, anthropometry, synchronous filming, tengodinamography, building of training devices for tests and instructions. The results which turned out witness that movement of 3-4 years old children can be defined as the period of the beginning of differentiative distinction between walking and running phases. Walking is already formed well, a phase of flight is appearing when running is being formed.

The formation of jumping and throwing movements is being formed at this age; in a short period of time the results are being increased 2-2.5 times in boys and girls support reactions change. Anthropometric measures allow to receive parameters of children's bodies from the beginning of the test and during the investigation. It is found that more than 80% of children have a strict genetic order of morphology, but child's morphology influences greatly the results of sports skills, in which given signs are significant.

So, the formation and perfection of children's skills in different locomotions depends on a child's sex, support reaction indices, length and frequency of steps, which make different contribution in the perfection of children's motor habits.