INTRODUCTION

High jump as an athletic discipline did not exist during the Ancient games in Greece. There is only a record that members of a tribe in Watusi in Africa jumped up with a take off from anthills, with the aim to jump more than they are tall in order to prove their maturity (manliness).

Modern high jump appears at the end of the 18th century in Germany as a children’s physical activity. It develops as a competition in England (Scotland) in the middle of the 19th century, and as an athletic discipline it has existed since the first Modern Olympic Games.

Throughout the history, high jump went through the biggest changes out of all athletic disciplines. High jump technique had numerous changes from contracted over step across technique (scissors), double scissors (sweeney), Western roll (horine), straddle to contemporary Fosbury- flop technique. The goal of this paper is to extend and to complete the knowledge of Athletics as a subject, as well as to understand the spirit of high jump and its development. The aim of this paper is also to enable a student to decide and choose athletics as “the queen of sports” which he/she will enjoy and go in for the whole life as a basic sport, addition to other sports or as recreation with a possibility of making a career. Descriptive method on the level of theoretical analysis and generalization was used in this paper.

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Descriptive method on the level of theoretical analysis and generalization was used in this paper. Primary and secondary sources of information were used, as well as domestic and foreign literature, expert papers, Internet and other sources of information.

Technique

In 1965, Bami Vagner, a University of Oregon coach, while studying variants of high jump techniques, created a new variant which at first was known as flop (to jerk) and afterwards got the name after jumper Dick Fosbury. He broke the Olympic record in Mexico from 1968 by using this new high jump technique.

All top jumpers use this high jump technique. Height of jump depends on speed of approach and take off, take off angle and jump off impulse, swing of free limbs and height of raising body’s centre of mass after jump off at the expense of compensatory movements in

ANNEX TO THE TRAINING TECHNIQUES HIGH JUMP: FOSBURY - FLOP

Rade Stefanović
Faculty of Sport and Physical Education, Leposavić, Serbia

Abstract

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Keywords: Descriptive method, anthropological characteristics, mobility abilities, longitudinal dimensionality of the body, morphological characteristics, functional abilities
a flight phase.

Fosbury variant of high jump technique consists of four parts:
- approach (run-up)
- jump off
- flight and
- landing.

**Approach (run-up)**

Purpose of run-up is to realise optimal quantity of moving which in a jump off phase should be transformed most efficiently into a vertical component of moving of a body’s centre of mass after jump off finishes.

A run-up phase belongs to a cyclical part of high jump movement, and 7-9 or 9-11 steps are most often used for a run-up, whereas take-off length can vary depending on a jumper from 9 to 13 steps. It depends on a jumper’s height and his/her fitness. Run-up (approach) can be divided in two phases - straight and arch.

**Straight phase**

Running straight part of run-up at 90° to the bar and moved away in the field from the position of the non-jump off (free) leg.

**Arch phase**

It is performed along the 8-12m radius arch for top high jumpers, 6-10m for women and 6-7m for beginners. This technique is similar to short distance running technique in curves. Arch running produces centrifugal force (which tends to draw a rotating body away from the centre of rotation), which means that jumper in the arch phase of run-up is leaned towards the centre of circumference.

This bending depends on the speed of run-up, radius of arch phase of run-up and high jumper’s body height. The faster high jumper is in run-up and taller he/she is, there is more need for a high jumper to lean more towards the centre of arch run-up and vice versa. A jumper’s leaning towards the centre of circumference automatically lowers body’s centre of mass for 10-15cm.

Jump success depends mostly on the last 2-4 strides. It is here where re-coordination of activities of arms and indirect preparation for as active jump-off as possible is done. The largest length of steps is achieved in the last three steps, and speed before jump-off does not depend only on the length of steps, but also on tempo of running. The greatest speed is achieved in the step before the last, at the moment of setting non-jump off leg on the ground (7.8 to 7.3 m/s). There is, in the last step, a particular decrease of the already achieved horizontal speed (6.6 to 7.3 m/s) because of specific preparation for jump-off and shortening of length of steps (about 45cm) which enables a high jumper to jump-off faster and more efficiently.

**Jump-off**

Jump-off phase consists of two subphases:
- amortization
- active jump-off.

Jump-off phase begins at the moment of setting the jump-off leg on the ground, when the body leans vertically backwards for 10-20 degrees. It is necessary to set the leg on the front, external part of the foot with the knee stretched (the angle in the knee joint is 170-178 degrees). The angle at which a jumper’s jump-off leg faces the ground is 15-67 degrees. Takeoff point is 8-120 cm away from the bar. A lot of jumpers try to set their feet parallel to the bar where possibility of rotation of a body round vertical axis is decreased.

**Amortization** is a phase of jump-off which is a result of pressure of the ground on a jump-off leg. At that moment the reaction force of the ground reaches value of 350-600kg. Amortization subphase is characterised by forced bending of a jump-off leg where the angle of a knee is decreased to 135-145 degrees. In this phase, general body’s centre of mass, although lowered, still keeps relatively high level.

Degree of efficiency of transformation of horizontal into vertical speed, first of all depends on muscular connective tissue which fixes "breaking / crucial points" (ankle, knee, elbow and pelvis). When we talk about top athletes, horizontal speed of general body’s centre of mass, which at the moment of setting is 5.8m/s - 6.20m/s, at the end of amortization phase decreases for 47%, but it increases again in the take-off subphase, and at the moment when a foot of a jump-off leg leaves the ground it is for 24- 27% lower than the initial phase. Characteristic time of jump-off is from 0.120 - 0.129 sec.

In active jump-off subphase, the leg is stretched simultaneously at pelvis and knee joints and it ends in juncture of the ankle. In this subphase the emphasis should be on maximally fast extension of a jump-off leg and also on swings of arms and a leg which supports take-off.

**Phase of flight**

Phase of flight begins at the moment when a jump-off leg leaves the ground, and it lasts till the moment...
when a jumper’s body lands on a landing mat. At this part a high jumper performs a sequence of compensatory movements of his/her body parts in order to clear the bar successfully. There are rotations round vertical and front axes during the flight.

Flight can be divided into three phases:
- take-off
- clearing the bar
- landing

**Take-off**
After jump-off, a high jumper is in a take-off phase. The initial speed of a take-off depends on run-up (approach) speed. Body’s centre of mass moves upwards and forward depending on a jump-off angle and take-off speed. Four ways of moving arms are possible in this phase:
- when the arm at the side of a non-take off leg passes the bar first – most often used
- when a high jumper performs two arm swing to approximately the same height and clears the bar
- when both arms are held by the side where in fact body overtakes the arms, so that clearing the bar begins with the head
- when clearing the bar is realised first by arm at the side of a jump-off leg.

**Clearing the bar**
At the moment when a high jumper begins clearing the bar by shoulder or arm, head is back and there is hyperextension in joints of spinal column and hips. The non take-off foot waits for the take-off foot and then a high jumper finishes rotation round vertical body axis, approaching the bar backwards with the aim to keep legs as low as possible. It looks as if a high jumper pulls lower legs under him/herself while lifting his/her hips as high as possible, making a specific position of a bridge. Critical moment is passing gluteal body part and lower legs over the bar.

**Landing after passing over the bar**
When hips pass over the bar, they are in a “sitting” position, head rises and chin is positioned at the front part of a neck. Jump control, final twitch of lower legs upwards and their passing over the bar are enabled in this way. It is a consequence of action and reaction principle. Arms move from in front of a body or upward positions to sideway position.

**Landing**
High jumpers land on specially constructed mat on thoracic part of the back. Chin is in the front and on the neck or arms or beside the body.

**Anthropological characteristics of high jumpers**
Out of all anthropometrical characteristics of jumpers, longitudinal dimensionality of the body has the most important role in high jump, because a result depends to the great extent on initial height OCTT.

Mobility dimensions influence high jump results most:
- speed of explosive power
- speed of alternative and simple movements
- coordination

Flexibility of lumbar part of pelvis also has has a significant role because it is necessary for efficient twist.

Evaluation of importance of anthropological characteristics in relation to successful high jump:

1. **Morphological characteristics**;
   - longitudinal dimensionality of a skeleton, transversal dimensionality, body volume, subcutaneous fat tissue
2. **Mobility abilities**;
   - Coordination, precision, balance, flexibility, speed of alternative movements, basic body strength, explosive power, maximum power of attempted movements.
3. **Functional abilities**;
   - anaerobic capacity, range of oxygen transport system

**CONCLUSION**
Modern high jump appeared in Germany in the 18th century as a part of physical education of children, and it developed as a sports competition in England in the 19th century. Evolutional development of high jump technique had a lot of modifications, from legs-up technique, step across (scissors) technique, double scissors or Sweeney (Eastern cut-off) technique, contracted or Horine (Western roll) technique, Straddle technique to backwards or Fosbury- Flop technique.

High jump had the most changes within technique of performance and modifications of the very technique of performance out of all athletic disciplines. Those changes influenced increase of speed of approach and take-off, angle of take off, jump off impulse, swing of free limbs and height of lifting body’s centre of mass after jump off, at the expense of performing compensatory movements in a phase of flight.

Improvement of techniques of performance, from legs-up technique to backward or Fosbury- Flop technique, as well as anthropological characteristics of jumpers, caused continuous lifting of the bar and better results, starting from the first recorded result in England achieved by H. Gook - 175 cm, to the current world record achieved by Javier Sotomayor in 1993 – 2.45 m.

**REFERENCES**


Correspondence:
Rade Stefanović
University of Pristina
Faculty of Sport and Physical Education
Dositej Obradović bb, 38218, Leposavić
Kosovo i Metohija, Serbia
E-mail: stefanovicrade@gmail.com