A Kinematics comparison of the technique of the hurdle clearance in 110m hurdle race of Inter College Athletics championship of H.N.G. University

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Abstract:

Aims: The purpose of this study was to a kinematics comparison of the techniques of hurdle specialist decathletes in 110 m hurdles of Inter college championship of H.N.G. University players.

Materials and Method: For the purpose of this study, three specialist hurdler & three Decathletes hurdler of the different college of H.N.G.University. Kinematics parameters were determined by using a video kinematics analyzer.

Key words: Kinematics, hurdles, techniques, take-off, landing, decathletes.

Introduction:

Using modern science and technology to sports is an attempt to analyze and improve the performance and this is not a new concept. Such efforts draw very little attention until the innovative countries begin to arrange programs that are dedicated to the scientific development of Olympic athletes. The globe of sports then took interest within the sports science areas of biomechanics, physiology, sports psychological science and medicine and the application of practical methods together with blood doping, weight training, circuit training, carbo loading, special diet plan, slow analysis attitude training, interval training, relaxation techniques and lots of others. It was soon realized that sports sciences offered the foremost vital role to athlete domination.

Method:

The purpose of this study was to a kinematics comparison of the technique of the hurdle specialist and decathletes in 110 m hurdles of Inter college championship of H.N.G. University players, For the purpose of this study, three specialist hurdlers & three Decathletes hurdlers of the different college of H.N.G.University. Who was participated in 26th Inter college Athletic championship organized by Physical education department of H.N.G. University Patan dated 5th to 8th December 2015 were selected as subjects.

For the purpose of the study, data are collected over 6 male Inter college players divided in to 3 hurdle specialist age: 21.67 ± 0.77 years, body weight 69 ± 1.4 kg., standing height: 1.79 ± 0.00 m., and decathletes (decathletes hurdler) age: 22.30 ± 66.90 years, body weight 73 ± 1.6 kg., standing height: 1.81 ± 0.00 m.

Selection of Variables:

To obtain variable Measurements, standard and calibrated equipments

like high-definition video cameras (SONY PMW 200) series, steel tape, weighing machine, and specialized motion analyzing software (APAS-Ariel performance Analysis system.- U.K.) were used.

Physical variables:
1.   Age
2.   Body weight
3.   Standing height

Kinematical Variables:
1.   The take-off distance at the front of the hurdle.
2.   The stride length at over the hurdle.
3.   The landing distance at behind the hurdle.
4.   The length of the 1st stride of the post hurdle.
5.   The height of the C.G. at the contact before the hedge attack.
6.   The height of the C.G. at the take-off while attacking the hedge.
7.   The max height of the C.G. at crossing the hedge.
8.   The height of the C.G. at the landing of the post hurdle.
9.   The flight time of over the hurdle.
10.   The height of the C.G. at the take-off in the 1st stride of the post hurdle.
11.   The support time of the 1st stride of the post hurdle
12.   The flight time of the 1st stride of the post hurdle.
13.   The performance (entire hurdle race time)

Filming Protocol:

[FIGURE - 1]
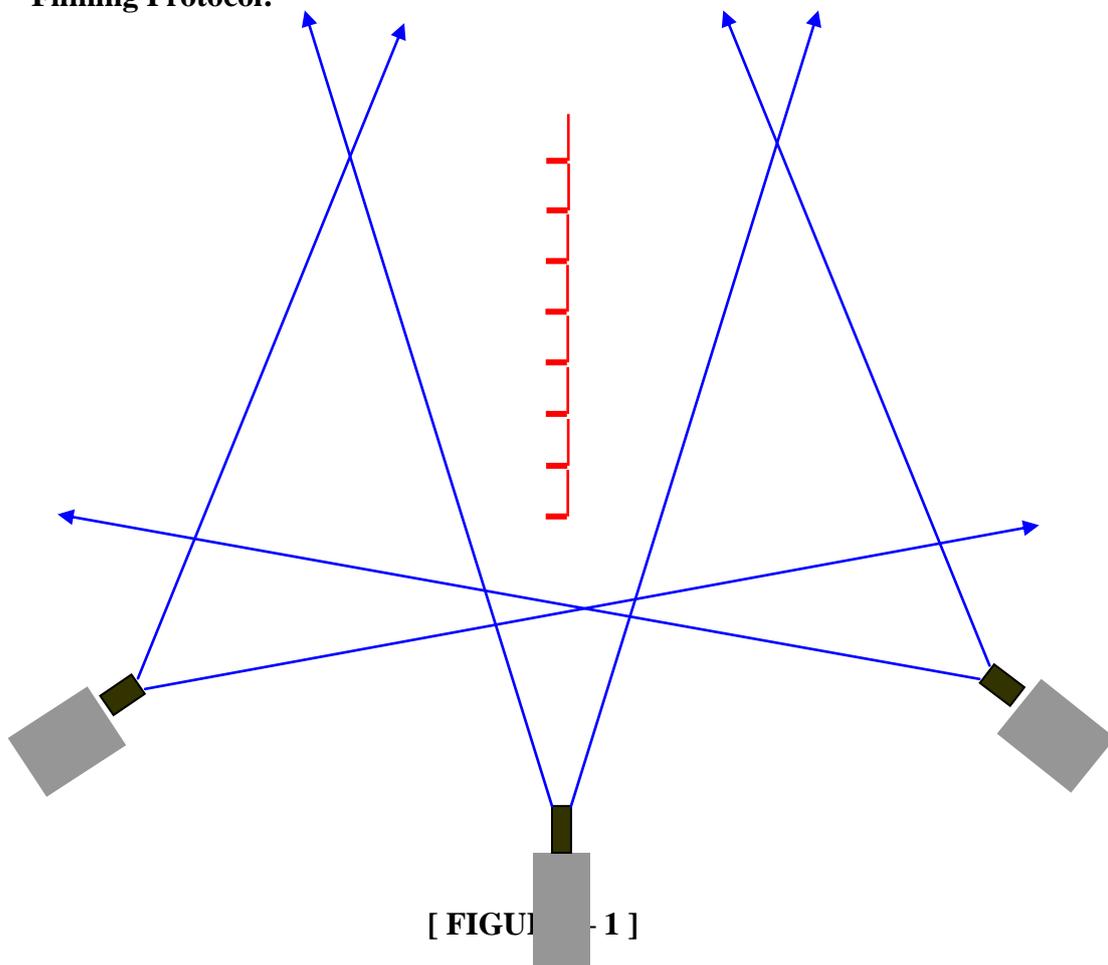
Three synchronized high definition video (SONY PMW 200 series) cameras using by Researcher. The subjects were filmed in Sagittal plane only. Only one hurdle clearance and stride before or after the clearance were registered for analysis purposes, the filming zone was wide enough to accommodate the required sequence of movement. The camera was positioned near the 1st hurdle. The frequency of the cameras was 120 Hz, Manual filming system was used to record the performance of the subject. The performances were recorded in 1/100 of a second. The subjects were filmed during the competition only. The cameras were placed on the tripod. Cameras and the filmed target was 11 m. whilst the height of its attachment was 1.27 m and remained un-change during the recordings.

The captured video film was adding into the APAS-Ariel performance Analysis system, software and it gives an appropriate treatment for the comparison of the athletes and decathletes kinematics variable.

Statistical procedures:

For the statistical calculation of the physical and kinematics variables, Independent t-test was used to examine the difference between the athletes and decathletes. The mean and standard deviation of two groups' physical and kinematics variable were calculated with the SPSS (V. 16) software, in all statistic analysis, the significance threshold was set at $p < 0.05$.
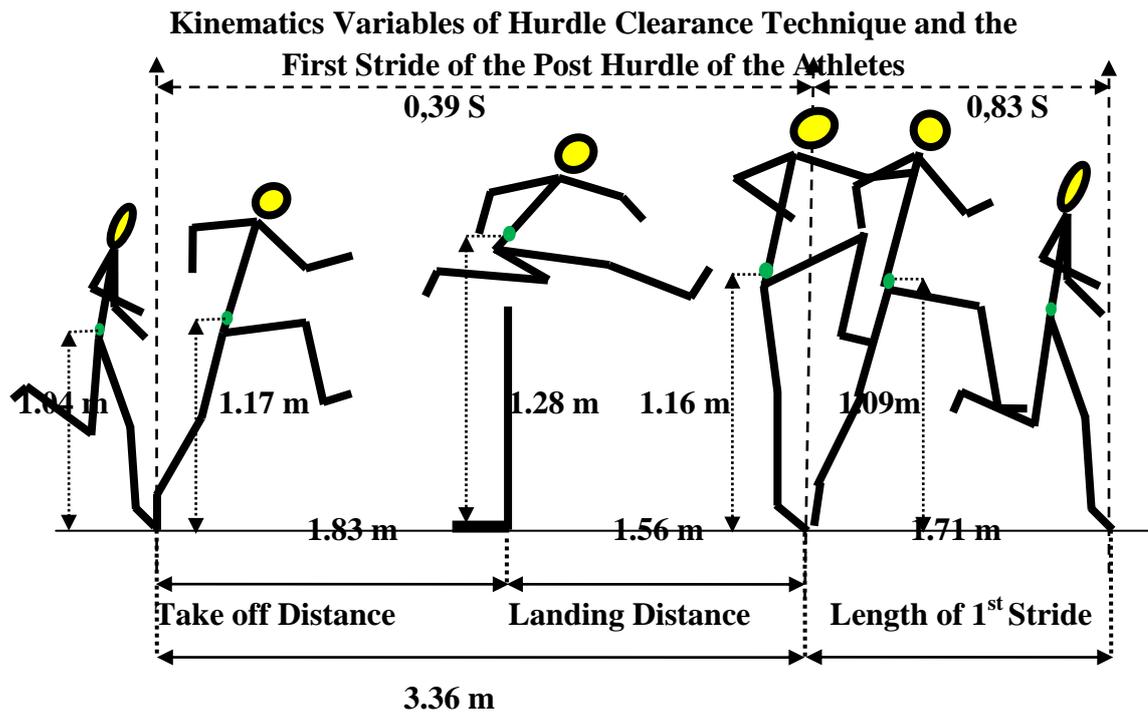
Result:

The Performance of 110m hurdle race achieved by the athletes (HS) was significantly better than those decathletes ($p < 0.05$). The relative value was respectively 16.75 ± 0.55s and 19.25 ± 0.83seconds.
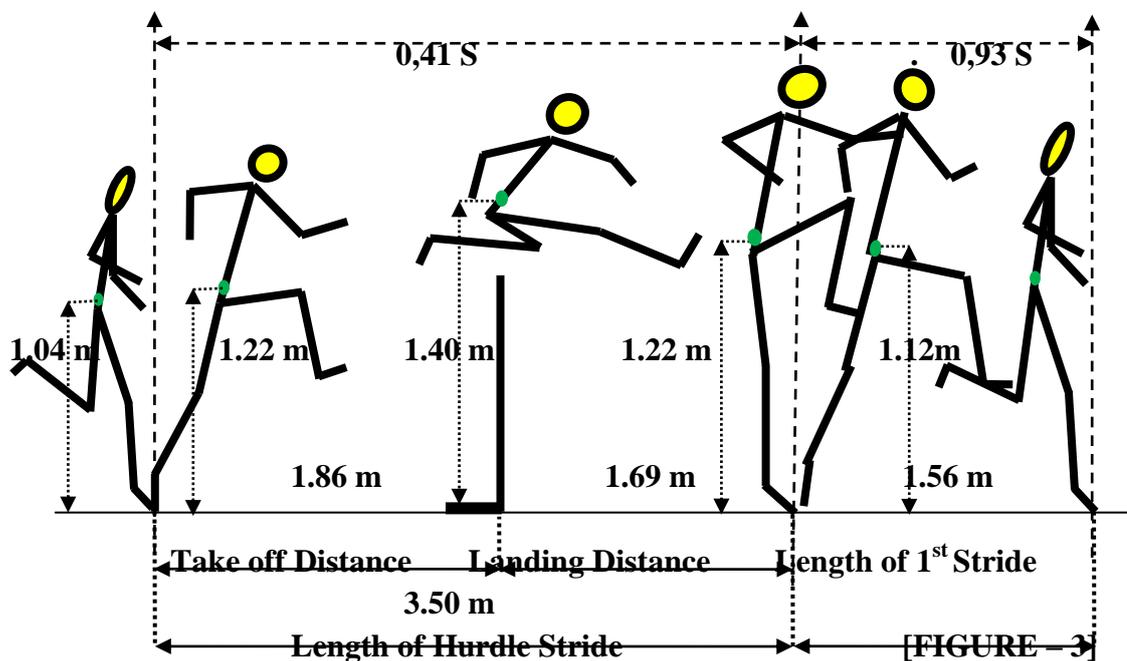
Kinematic variables comparison of athletes and decathletes

Table-1

Parameter	HS (n = 3)	DH (n = 3)
The take-off distance at the front of the place of the hurdle	1.83m	1.86m
The stride length at over the hurdle	3.36m	3.50m
The landing distance at the behind the hurdle	1.56m	1.69m
The length of the 1st stride of the post hurdle.	1.71m	1.56m
The height of the C.G. at the contact before the hedge attack	1.04m	1.04m
The height of the C.G. at the take-off while attacking the hedge	1.17m	1.22m
The max height of the C.G. at the crossing the hedge	1.28m	1.40m
The height of the C.G. at the landing of the post hurdle	1.16m	1.22m
The flight time of over the hurdle	0.39s	0.41s
The height of the C.G. at the take-off in the 1st stride of the po hurdle	1.09m	1.12m
The support time of the 1st stride of the post hurdle	0.10s	0.12s
The flight time of the 1st stride of the post hurdle	0.83s	0.93s

Kinematics Variables of Hurdle Clearance Technique and the First Stride of the Post Hurdle of the Athletes

0,39 S   0,83 S

1.04 m   1.17 m   1.28 m   1.16 m   1.09m

1.83 m   1.56 m   1.71 m

Take off Distance   Landing Distance   Length of 1st Stride

3.36 m

Length of Hurdle Stride   [FIGURE

Kinematics Variables of Hurdle Clearance Technique and the First Stride of the Post Hurdle of Decathletes

0,41 S   0,93 S

1.04 m   1.22 m   1.40 m   1.22 m   1.12m

1.86 m   1.69 m   1.56 m

Take off Distance   Landing Distance   Length of 1st Stride

3.50 m

Length of Hurdle Stride   [FIGURE – 3]

1.   The take-off distance at the front of the hurdle:

The take-off distance was1.83m in the athletes and 1.86m in the decathletes that represents 56.46% and 53.14% of the whole hurdle stride length. Both groups were equal, there were not significant.

Not Significant at $p < 0.05$.

2.   The stride length at over the hurdle:

The stride length at over the hurdle was 3.36 ± 0.02m in the athletes

and 3.50 ± 0.01m in the decathletes, there was slightly larger than the athletes. But both groups were equal, there were not significant.

Not Significant at $p < 0.05$. 3. The landing distance at the behind the hurdle:

The landing distance at behind the hurdle was 1.56 ± 0.01m in the athletes and 1.69 ± 0.01m in the decathletes which represents 46.42% and 48.28% of whole hurdle stride. There was a significant difference between the athletes and decathletes.

Significant at $p < 0.05$.

4. The length of the 1st stride of the post hurdle:

The length of the 1st stride of the post hurdle was 1.71 ± 0.01m in the athletes and 1.56m in the decathletes, there was a smaller than the athletes. There was a significant difference between the athletes and decathletes.

Significant at $p < 0.05$.

5. The height of the C.G. at the contact before the hedge attack:

The height of the C.G. at the contact before the hedge attack was1.04 m in the athletes and 1.04m in the decathletes, which represents 58.10% and 57.45% of their body height 1.79 m and 1.81m. the decathletes Both groups were equal, there were not significant.

Not Significant at $p < 0.05$.

Significant at $p < 0.05$.

6. The height of the C.G. at the take-off while attacking the hedge:

The height of C.G. at the take-off while attacking the hedge was 1.17± 0.02 m in the athletes' and1.22 ± 0.01 m in the decathletes, which represents 65.36% and 67.40% of their body height 1.80 m and 1.84 m. Both groups were equal, there were not significant.

Not significant at $p < 0.05$.

7. The max height of the C.G. at crossing the hedge:

The max height of the C.G. at the crossing the hedge was 1.28 ± 0.02 m in the athletes and 1.40± 0.02 m in the decathletes. There were higher than that in the athletes, body position above the hurdle was also higher in the decathletes. There was a significant difference between the athletes and decathletes.

Significant at $p < 0.05$.

8. The height of the C.G. at the landing of the post hurdle:

The height of the C.G. at the landing of the post hurdle was 1.16m in the athletes and 1.22 m in the decathletes, there were higher than that in the athletes, body position at the landing (touchdown) was also extra higher in the decathletes. There was a significant difference between the athletes and decathletes.

Significant at $p < 0.05$.

9. The height of the C.G. at the take-off in the 1st stride of the post hurdle:

The height of the C.G. at the take-off in the 1st stride of the post hurdle was 1.09 m in the athletes and 1.12 m in the decathletes, there were higher than that in the athletes, body position at the take-off in the 1st stride of the post hurdle was also extra higher in the decathletes. There was a significant difference between the athletes and decathletes.

Significant at $p < 0.05$.

10.   The flight time of over the hurdle:

The flight time of over the hurdle was 0.39s in the athletes and 0.41s in the decathletes. Both groups were equal, there were not significant.

Not Significant at $p < 0.05$.

11.   The support time of the 1st stride of the post hurdle:

The support time of the 1st stride of the post hurdle was 0.10 ± 0.02s in the athletes and 0.12 ± 0.02s in the decathletes. Both groups were equal, there were not significant.

Not Significant at $p < 0.05$.

12.   The flight time of the 1st stride of the post hurdle:

The flight time of the 1st stride of the post hurdle was 0.83 ± 0.00s in the athletes and 0.93 ± 0.00s in the decathletes. There was no significant difference between the athletes and decathletes.

Not significant at $p < 0.05$.

The result of this study showed there was not statistically significant difference in all kinematics parameters between the athletes (HS) and decathletes (DH) but there was a significant difference in most of the kinematics parameters. Efficient hurdle clearance is defined by the length of the stride before hurdle clearance and after hurdle clearance. The entire hurdle stride length of the athletes was 3.36 meters and the decathletes were 3.50-metres. The take-off distance was 1.83 meters in the athletes and 1.86 meters in the decathletes, that represent 56.46% and 53.14% of the entire hurdles stride length. The landing distance was 1.56 meters in the athletes groups and 1.69 meters in the decathletes, that is 46.42% and 48.28% of the entire hurdle stride length. We can see that the athletes have a slightly shorter stride before hurdle clearance and a slightly shorter after hurdle clearance.

The take-off in the front of the hurdle is one among the elements of vital importance to best hurdle clearance since it directly defines the flight of the movement. The quality of hurdle clearance is directly related to the height of the C.G. in the take-off phase. From the aspect of a kinematic, an efficient hurdling is that the one in which vertical oscillations of the C.G. are as small as possible. The hurdler must maintain a high position of the C.G during the take-off. The athletes' height of the C.G. at the end of the propulsion phase is 1.17 meters, and 1.12 meters in the decathletes, that represents 63.53% and 63.58% of their body height (BH=1.79 m and 1.81m). The raising of the C.G. from the braking phase to the propulsion phase amounts to 13cm. in the athletes and 18cm. in the decathletes. The max C.G. height so depends on the technique of the take-off in the front of the hurdle and on the anthropometrical characteristics of the flight.

The criterion of an efficient hurdle clearance technique is that the shortest possible time of the flight phase (hurdle clearance time) since the hurdler loses speed in the air. The length of the flight of the C.G. of athletes is 3.36m, and 3.50m, in the decathletes. The flight time is 0.39 seconds in the athletes and 0.41 seconds in the decathletes. The height of the C.G. over the hurdle is in positive correlation with the hurdle clearance times. As a rule, the higher the trajectory of the

flight of the C.G., the longer the flight phase, in the athletes, this value is1.36 m, and the decathletes this value is 1.41m, that in this case the foremost efficient trajectory of the flight of the C.G over the hurdle. The raising of the C.G relative to the take-off phase is so 1.17 m, in the athletes and 1.22 m, in the decathletes, that is maybe the results of a comparatively short take-off distance of the athletes.

The landing phase is one among the foremost vital elements of the hurdling technique. This phase has the largest reserve potential for improving the competition result. In the landing phase, it's necessary to carry out as efficiently as possible the transition from hurdle clearance to running between hurdles. This transition from acyclic movement into cyclic movement needs a high degree of technical knowledge; the support time in the 1st stride of the post hurdle was a 0.10s in the athletes and 0.12s in the decathletes. The athletes' maintain a C.G. position of 1.15 meters and therefore the decathletes don't maintain a C.G. position. The decathletes C.G. position at the time was a 1.22 meters, it was much more than the athletes'. Soft landing of the hurdler after hurdle clearance is indicated by the vertical velocity that may be a negative influence. The maintenance of the horizontal velocity of the C.G. after hurdle clearance and that may be a requirement for an efficient model of running to the next hurdle.

The length of the post stride allows to achieving best speed between the hurdles. The athletes' 1st stride of the post hurdle length was 1.54 meters and 1.60 meters in the decathletes. The height of the C.G. at the take-off in the 1st stride of the post hurdle was 1.08m in the athletes and 1.11m in the decathletes, there were higher than that in the athletes, body position at the take-off in the 1st stride of the post hurdle was also extra higher in the decathletes. These divergences, conformation between the support time duration of the 1st stride of the post hurdle

On the basis of this parameter, it can be established that the athletes' were an efficient hurdle technique according to the result, the researcher found that improving the performance in hurdle race involves a number of reduction must be required in kinematics parameters.

The result of this study to showed that the athletes are distinguished by rational and efficient hurdle clearance techniques which were expressed in the better outcome of the latter.

1.   A similar study may be conducted by selecting kinetic and angular kinematics variables.
2.   A similar study may be attempted by junior age group hurdler.
3.   A similar study can also be conducted on female hurdler.
4.   The study may be undertaken with large number of variables.
5.   A similar study may be undertaken to analyze the other games and event players.
6.   A similar study may be conducted by more sophisticated equipment of different sports.

Results: Some of the most important variable have been determined it was found that the hurdle specialists are distinguished from the decathletes by a shorter stride length over the hurdle, a Shorter flight time over the hurdle, a lower C.G. in the take-off to landing, a shorter supporting time in the 1st stride of the post hurdle, a shorter 1st stride of the post

hurdle, a shorter flight time in the 1st stride of the post hurdle.

Conclusion: The result of this study showed there was not statistically significant difference in all kinematics parameters between the hurdle specialists and the decathletes but there was a significant difference in most of the kinematics parameters.

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