A COMPARISON OF THE STANDING START WITH THE CROUCH START IN SPRINTERs

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WITH THE CROUCH START IN SPRINTERS

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ABSTRACT

The purpose of this study was to determine if there was a significant difference between performance times of sprinters using a standing start and sprinters using a crouch start.

The subjects selected for this study were members of the 1973 University of Wisconsin-La Crosse track team and members of the Professional Activities Track & Field class. The subjects were selected on the basis of proficiency in the crouch start. Each subject participated in a two week training session in the mechanics of the standing start.

Each subject was then required to participate in maximum starts and sprints using both methods of starting. Each subject was timed for three trials using each method of starting. Three times were recorded for each trial. The three times recorded for each trial were: drive time--the period of time required for a subject to react to the starting pistol and clear the starting blocks, 15 yard acceleration time--the period of time elapsed from the start until the subject covered 15 yards, and 30 yard acceleration time--the period of time elapsed from the start until the subject covered 30 yards. A mean time for each distance was determined from the three trials.
The statistical method utilized to treat the data was a t-test to determine the difference between means. The .05 level of confidence was established as the critical value for the rejection or acceptance of the null hypothesis.

The statistical analysis permitted the following conclusions:

1. Drive times did not differ significantly when using either a crouch start or a standing start.
2. A significant difference was found between 15 yard acceleration times when using a standing start as compared to a crouch start in favor of the standing start.
3. There was no significant difference between acceleration times in the 30 yard dash when the variables were the crouch start and the standing start.
ACKNOWLEDGEMENTS

The writer would like to express his sincere appreciation to Dr. Wayne Kaufman, thesis committee chairman, for his valuable assistance throughout the duration of this study. Appreciation is also expressed to Dr. William Floyd and Dr. Thomas Hood, thesis committee members, for their help.

The writer would also like to thank coach Ralph Jones and members of the 1973 University of Wisconsin track team for their time and cooperation as subjects for this study.
# Table of Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>THE PROBLEM</td>
<td>2</td>
</tr>
<tr>
<td>NEED FOR THE STUDY</td>
<td>2</td>
</tr>
<tr>
<td>LIMITATIONS</td>
<td>3</td>
</tr>
<tr>
<td>DEFINITIONS OF TERMS</td>
<td>4</td>
</tr>
<tr>
<td>HYPOTHESES</td>
<td>5</td>
</tr>
<tr>
<td><strong>II. REVIEW OF LITERATURE</strong></td>
<td>6</td>
</tr>
<tr>
<td>CROUCH START</td>
<td>6</td>
</tr>
<tr>
<td>STANDING START</td>
<td>8</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>11</td>
</tr>
<tr>
<td><strong>III. EXPERIMENTAL PROCEDURE</strong></td>
<td>12</td>
</tr>
<tr>
<td>SELECTION OF SUBJECTS</td>
<td>12</td>
</tr>
<tr>
<td>PRELIMINARY PROCEDURES</td>
<td>13</td>
</tr>
<tr>
<td>STANDING START BLOCKS</td>
<td>13</td>
</tr>
<tr>
<td>TEACHING THE STANDING START</td>
<td>14</td>
</tr>
<tr>
<td>TEACHING THE CROUCH START</td>
<td>14</td>
</tr>
<tr>
<td>DATA COLLECTION PROCEDURES</td>
<td>15</td>
</tr>
<tr>
<td>TIMING EQUIPMENT</td>
<td>16</td>
</tr>
<tr>
<td>DRIVE TIMER</td>
<td>16</td>
</tr>
<tr>
<td>ACCELERATION TIMER (15 YARDS)</td>
<td>17</td>
</tr>
<tr>
<td>THIRTY YARD ACCELERATION TIME</td>
<td>17</td>
</tr>
<tr>
<td>STARTING EQUIPMENT</td>
<td>18</td>
</tr>
<tr>
<td><strong>IV. ANALYSIS OF DATA</strong></td>
<td>20</td>
</tr>
<tr>
<td>DRIVE TIME DATA ANALYSIS</td>
<td>20</td>
</tr>
</tbody>
</table>
### Table of Contents

**Chapter IV. CONTINUED**

- 15 YARD ACCELERATION TIME DATA ANALYSIS ........ 21
- 30 YARD ACCELERATION TIME ANALYSIS ............. 22
- DISCUSSION ........................................ 23

**Chapter V. SUMMARY AND CONCLUSIONS** ............. 25

- SUMMARY .............................................. 25
- FINDINGS ............................................. 26
- CONCLUSIONS ......................................... 26
- RECOMMENDATIONS .................................... 26

**BIBLIOGRAPHY** ........................................ 29

**APPENDIX A--TEACHING THE STANDING START** ....... 32

**APPENDIX B--EXPERIMENTAL DATA** ................. 35

**APPENDIX C--STARTING EQUIPMENT** .................. 38
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.  DRIVE TIME TABLE</td>
<td>21</td>
</tr>
<tr>
<td>II. 15 YARD ACCELERATION TIME TABLE</td>
<td>22</td>
</tr>
<tr>
<td>III. 30 YARD ACCELERATION TIME TABLE</td>
<td>23</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Sprinters of today seem to have reached the ultimate time in the 100 yard dash. Several current sprinters have been on the threshold of a 9.0 second hundred, but it seems unlikely man will ever go faster. In recent studies of sprinting speed at San Jose State, men have run 9.0 second hundred yard dashes with the aid of running starts. Therefore, it seems logical that if we can shorten the time required for a sprinter to reach full speed; we can break the 9.0 second hundred yard dash barrier.

The crouch start has been widely used since the turn of the century. During this time numerous studies have been conducted analyzing the proper mechanics of the crouch start and numerous attempts have been made to vary the crouch start to obtain a faster start. The block placement has seen considerable changes from the short bunched start to the wide spread elongated start. Foot and hand placement, the angle of the knees, and distribution of foot force have been analyzed in search of the faster start. Experimenters have always worked with the mechanics of the crouch start because it was believed to be the best method.

Recently there has been considerable interest in the possibility that a standing start in the sprint and hurdle events may be more effective than the traditional crouch start. Recent experiments in South Africa, supported by several coaches in the United States, find that faster sprint starts may be possible by mastering the standing start. (7)
THE PROBLEM

The purpose of this study was to determine whether a standing start can be more efficient and faster than the traditional crouch start.

NEED FOR THE STUDY

The crouch start requires an explosive movement to be converted into a sprint. The crouch requires that the sprinter straighten his body to the up position from the set position to obtain the optimum sprinting position. The explosive movement the crouch start permits requires the first several strides to be short in order for the sprinter to maintain balance, thus wasting time needed to reach full stride. The crouch starter must transfer his arms from a supporting position to a positive driving arm action. All these conversions must be made before a sprinter can reach an optimum sprinting position and full sprint speed. Therefore, if one can eliminate the need for these conversions one would have a faster start. (2)

The standing starter starts in a position that is higher than that which will permit the greatest acceleration. During the first stride from the blocks, the standing starter must lower his trunk position to achieve the optimum sprint position. (7)

The optimum sprint position can not be attained at the start, no matter which method of starting he uses. The real question is: Can the standing starter lower his body into the optimum sprint position faster than the crouch starter can raise his body to achieve that optimum position?
LIMITATIONS

The following are limitations of this study:

1. The subjects for this study were members of the 1973 University of Wisconsin-LaCrosse varsity track team and students of the Professional Activities Track and Field course (PE 252).

2. Each subject was given two weeks of instruction in the mechanics of the standing start.

3. Subjects were allowed to use any variation of the crouch start that they were most successful with and no further instruction was given in the mechanics of the crouch start.

4. The subjects practiced both methods of starting during the two training programs.

5. A standard track starting pistol was used to start the subjects during the testing period.

6. Times were recorded to the nearest one one-hundredth of a second for three distances. The first time was recorded for the length of time spent in contact with the starting block. The second time was recorded for fifteen yards and the third time was recorded for thirty yards.

7. All timers were activated by the starting pistol. The three timers used were: a Data Time photo-electric timer and two Dekan Automatic Performance Analyzers.

8. The subjects were randomly placed into two groups for testing purposes. Group one was tested in the standing start the first day and the crouch start the second day. Group two was tested in the crouch start the first day and the standing start the second day.
9. All experiments in this study were conducted in the Mitchell Hall Fieldhouse.

DEFINITION OF TERMS

Subjects: The subjects were individuals who were utilized in this study for the comparison of the standing start and the crouch start.

Starting Blocks: Blocks or pedals mounted on a frame to insure a rigid surface against which the feet may be braced to start a race.

Trial: An attempt of a start.

False Start: Refers to the act of a subject starting his movement before the pistol was fired.

Drive Time: The period of time required for a subject to react to the starting pistol and clear the starting blocks.

15 Yard Acceleration Time: The period of time elapsed from the start until the subject covered 15 yards.

30 Yard Acceleration Time: The period of time elapsed from the start until the subject covered 30 yards.

Weight Distribution: The distribution of body weight within the area of the body's supporting base.

Set Position: Position assumed prior to starting.

Roll: Initial movement of the standing start from the set position. You push off with your back leg, letting your body roll forward until your center of gravity is well ahead of your drive leg.

Thrust: The power phase of the start where the drive is used to the fullest extent of your power.
NULL HYPOTHESES

It was hypothesized that there would be no significant difference in the performance times of the subjects using the standing start and the performance times of the subjects using the crouch start.
CHAPTER II

REVIEW OF LITERATURE

The Crouch Start

During the early years of amateur athletics, almost all running was limited to matches between two men. As there were only two contestants, the method of starting was rather crude.

Many methods of starting had been cunningly devised to give an advantage to the expert. These experts traveled from town to town setting up matches against the town's best. After beating the town champion, these experts would try to win additional money by devising some sort of handicap.

One of these handicaps was the "lying down start". The expert would lie on his back with his head at the starting line. The novice assumed his normal position. To most bystanders it seemed that the novice was a sure win with this advantage. But it was not so; for at the sound of the gun, the expert turned over on to his stomach and rose to his hands and feet to a position similar to the present day crouch start. This entire movement gave his opponent only about a five yard advantage which he easily made up. (4)

However, the crouch start as we know it, did not begin until 1887. Mike Murphy, the Yale and Olympic track coach, first introduced the crouch start at the Rockaway Hunt Club games, May 12, 1888. Charles H. Sherrill was the first of Murphy's athletes to use it. He was laughed at when he first used it. But not for long, as he soon demonstrated its superiority. (19)

The crouch start did not catch on immediately, but by the 1900's
it was being developed in the form as we know it. Arthur Duffey, champion from 1900 to 1903, used a crouch start that was almost identical to that of sprinters today. (11)

Throughout the years there has been a great deal of experimentation with the positions of the feet and hands and weight distribution in the set position.

In 1935, Larry Snyder, Jesse Owens' coach, believed that a position that crowded the starting line gave the sprinter an advantage over one who used a longer start. (21)

In the 1920's the Australian start (bunch start) placed the feet further from the line; the front foot being as much as 19 inches from the starting line and the back foot being as much as 12 inches behind the front. This start seemed to place the sprinter further behind the starting line. But in 1934, A.D. Dickinson proved that this position provided the fastest clearance of the blocks. (6)

In 1952, research concluded that although this position gets the sprinter out of the blocks the quickest, he does not have the momentum or the balance to reach a full sprint as quickly. Franklin M. Henry states that the 16 and 21 inch toe-to-toe distance is the best all around position for the crouch start. (13)

In 1961, Malcolm Stock compared different starting positions using the crouch start on the influence they had on speed and acceleration. He timed his subjects for 20 and 50 yards using an elongated, medium, medium-high, and bunch starts. He found that a medium or medium-high starting position allowed the greatest acceleration. (22)

Further research of block spacing in 1968 by Charles Beck at Illinois State University found that a 16 inch block spacing, toe-to-
toe distance, was the most effective starting position using a crouch start. (1)

The first stride when starting can greatly influence the time required to reach full speed. Micheline Gagnon found in 1969, studying the biomechanics of the sprint start, that the starting position affected the time required for the first stride. A starting position that placed the center of gravity ahead of the front foot provided the quickest first stride. This same study determined that a shorter distance between the starting line and the front block resulted in faster performance times. (8)

Karen Dix did a cinematographic analysis of a woman sprinter using the crouch start. She found that the fastest start analyzed had a markedly longer first and second stride. The fastest start also had a greater velocity of the drive arm. (5)

The Standing Start

It is natural for a person to start running from an upright position because he walks upright. In the beginning, the standing start was the only accepted method of starting. Records of early Greek Olympics studied by E. Norman Gardiner included conditions for running events. The competitors assumed a standing position at the starting line which was usually a rope or stick that could be pulled aside. The start was a trumpet blast or a call of "go". Those who sought an unfair start were always beaten because they never were allowed to finish. (9)

Gradually, stand-up starters began to use a "dab step". The body weight was positioned well over the forward foot with the same arm forward, such as, right arm and right leg. At the start, a very
short and fast step (dab) was taken with the forward foot as the opposite arm was driven forward. It was believed that the acceleration created by the "dab step" was greater than the action of the back leg. (6)

In later years it was discovered that the more forceful action of the back leg and a normal arm swing provided for a more efficient start. This style of start was used until the crouch start was accepted. And in 1890 (well after the introduction of the crouch start) John Owen, using an upright start, became the first man to run 100 yards under 10 seconds. At Analostan Island, Washington, D.C., he ran an official 9.8. Although tied seven times, Owen's record was not broken until 1902. (20)

For years the success of the crouch start over-shadowed the standing start. In 1967, Bob Clark--trainer-equipment designer, San Diego, California--began to search for a better start. From a study of the body mechanics of the crouch start, he discovered that the explosive thrust was often weakened by a short jab step caused by the low angle of the knees.

He also discovered that force was wasted in raising the body into a running angle as the sprinter was driving forward. The explosive thrust was not being concentrated in forward momentum.

In order to prevent this wasted motion, Clark felt the answer lay in positioning the runner's body in almost a standing start and concentrating the forward thrust by redesigning the starting blocks. The blocks that Clark designed have a full wedge-brace rear block that provides support for the whole foot including the heel. The forward block is tapered so that the ball of the foot can be braced against it. The top of the forward block flattens out to provide a good foundation for the arch and heel during the set position. (2)
In 1968, Lloyd L. Kolker found that vertical starting blocks produced a statistically significant improvement in both starting and performance time. (17)

Studies of the standing start revealed that existing starting blocks would not work. Bob Clark's Gym Service redesigned the front block so that it would provide a good foundation in the set position and still provide maximum drive. This adapter block is flat on top to permit good balance, yet tapered in the front so the ball of the foot can be braced against it.

Clark's Gym Service found that a standard rear block worked well with the new adapter block. But better results were obtained when the rear block supported 80% of the foot, and was at an angle of 80°. This larger rear block stopped the back lash of the foot when driving off the blocks. (3)

Research on the standing start analyzed by Tom Ecker and Dr. Jim Hay have convinced many that the standing start may be faster than the traditional method. Ecker and Hay have found that the greatest acceleration can be reached by achieving an optimum trunk position. The crouch starter starts lower than this optimum position and the standing starter starts above the optimum position. But the trunk position of the standing starter is closer to the optimum position than that of the crouch starter. Consequently, the standing starter should achieve this optimum position faster than the crouch starter. (7)
Summary

Considerable research has been done to find a better start. Until recently, most research was concentrated on modifying the crouch start rather than developing a better method. The standing start may prove to be the better method of starting. It is the aim of this study to compare the standing start to the crouch start to determine whether a significant difference exists.
CHAPTER III

EXPERIMENTAL PROCEDURE

The purpose of this study was to determine whether a standing start using modified starting blocks could be more efficient and faster than the conventional crouch start. Ten subjects were taught the mechanics of the standing start (Appendix A). Each subject was then required to participate in three maximum starts and sprints on two occasions. During one occasion the subjects were required to use a crouch start. On another occasion the subjects were required to use a standing start for sprinters. The data collected from the two experimental starts was used to determine if one method of starting was more efficient and faster than the other method.

Chapter III, "Experimental Procedure", is presented as follows: (1) selection of subjects, (2) preliminary procedures, (3) data collection procedures, and (4) timing equipment.

SELECTION OF SUBJECTS

Ten volunteers from the 1973 University of Wisconsin--LaCrosse track team and the Professional Activities Track and Field course (PE 252) were utilized as subjects for this study. The subjects were selected on the basis of proficiency in the crouch start. The subjects were also informed that they would be required to attend practice sessions in the mechanics of the standing start for two weeks before the actual data collection.
PRELIMINARY PROCEDURES

Standing Start Blocks

The purpose of this study was to compare the crouch start with the standing start using starting blocks. Because of the body position in the standing start, a conventional starting block is not functional. Bob Clark redesigned the front block to provide the runner with a good foundation and still provide maximum drive from the front block. Clark's standing start adapter block is tapered so that the ball of the foot can brace against it, then flattens out on top to permit stability. The adapter block was used to replace the front block on a conventional Pacer American starting block. The standard rear block worked well with the front adapter block.

It was found during a trial period of the standing start blocks, that Clark's adapter block did not permit the runner a stable foundation during the "set" position. Runners using a standing start were unsteady in the "set" position and consequently, had a tendency to roll out of the blocks before the gun. The investigator modified Clark's adapter block by adding a 2 X 4 block cut to the angle of the adapter (30°) and fastened on top of the adapter block. This modification provided an extended angle on the front block which permitted full foot support rather than just partial foot support. Runners using this modified front block were able to assume a "set" position and hold it steadily without rolling off the blocks. This new block did not sacrifice any drive (thrust) for the added stability it provided.
Teaching the Standing Start

The ten subjects were required to participate in a two week training program where they were taught the fundamentals of the standing start by the investigator. Each subject was given a copy of the fundamentals of the standing start. (Appendix A) The investigator required each subject to practice a minimum of five standing starts each night for a two week period. The investigator was present at all practice sessions to aid and coach the subjects.

Teaching the Crouch Start

Teaching and coaching of the fundamentals of the crouch start were not conducted by the investigator. All subjects had previously participated in high school track programs and received instruction in the fundamentals of the crouch start. The subjects were also not required to practice the crouch start during the two week training program sessions. Requiring the subjects to practice the crouch start during the training sessions would have doubled the practice time in the use of the crouch start. Subjects that were members of the University of Wisconsin--LaCrosse track team practiced the crouch start as part of their daily work out. Subjects that were pupils in PE 252 practiced the crouch start as part of their course work. The investigator felt that additional practice in the crouch start was not necessary.
DATA COLLECTION PROCEDURES

Two consecutive days were established for collection of all experimental data. The ten subjects were randomly divided into two groups—Group A and Group B. On the first day of data collection, Group A was tested in the use of the standing start and Group B was tested in the use of the crouch start. On the following day, Group A was tested in the use of the crouch start and Group B was tested in the use of the standing start.

Each subject was required to run three 30 yard sprints with each method of starting. Three times were recorded for each trial. A drive time was taken to determine the time required by the runner to clear the starting blocks. A 15 yard time was taken as a measure of acceleration. This second time is significant, in that, the distance to the first hurdle in high hurdle races (also indoor low hurdles) is 15 yards and the hurdler usually achieves his maximum acceleration in this distance. The final time recorded for each trial was a 30 yard time. According to studies conducted by Malcolm Stock, and Ronald Menely & Robert Rosemier, most sprinters reach maximum acceleration after 25 to 35 yards. (18,22) This 30 yard time then recorded each sprinter at his greatest speed without producing fatigue.

Three times were recorded for each trial by the investigator and his assistants. All times recorded were to the nearest 1/100th of a second. (Appendix B)

Test Instructions

The subjects were given running instructions prior to each trial. They were given instructions to sprint all out for the entire test
length and also starting procedures. The investigator (a WIAA starter) gave all instructions and acted as starter for all trials.

Each subject, when starting, was directed to "Take your marks". At this signal, the subject immediately assumed his proper position on the starting line. After the subject had taken his position and was steady, he was instructed to "Set". At this command the subject assumed his full and final set position in such a manner that no part of his body touched on or over the starting line. After approximately two seconds, when the subject was set and motionless, the investigator fired the gun. Subjects having a false start were recalled by either a whistle or a second shot. (WIAA Manual)

TIMING EQUIPMENT

Drive Timer

A drive time was taken for each subject. This time measured the length of time required for the subject to react to the starting signal until his foot cleared the front block.

Drive time was measured with a Dekan Automatic Performance Analyzer (Model 631). The basic unit was built around a time indicator that is calibrated in and accurate to, time in 1/100th of a second. The equipment was designed for the purpose of measuring movement, reaction, or both by the recording of time intervals. It can be operated automatically or manually. The many jacks and accessories make this equipment versatile and easy to set up in short interval timing procedures.

To measure drive time in sprint starts, a Dekan Switch Mat was placed under the front block of the starting blocks. The Switch Mat is a floor type mat that has a cord and jack plug attached. The
Switch Mat will stop the timer on momentary release of contact pressure when plugged into: STOP ON BREAK CONTACT. This timer enabled the investigator to record the time required for the subject to lose contact with the starting block.

**Acceleration Time (15 Yards)**

The second time recorded for each trial was an acceleration time for 15 yards. Acceleration time included the time from the start until the subject passed a 15 yard mark.

A Data Time Photo-electric Timer (Model HPA-1A) measured the 15 yard acceleration time. The basic unit is built around a digital time indicator that is accurate to, time in 1/1000th of a second. The many starts and stops make this equipment versatile for short interval timing.

To measure the 15 yard acceleration time of the subject, a photo-electric cell was placed on a four foot standard 15 yards from the start. A light beam, parallel and directly above the 15 yard line, was aimed on the photo-electric cell. If the light beam was cut off from the cell by an object breaking through the beam (the torso of a sprinter) the Data Timer stopped.

The use of a photo-electric timer permitted the investigator to record acceleration time without hampering the sprinter's style or speed.

**Thirty Yard Acceleration Time**

The third and final time recorded for each trial was a 30 yard dash time. This time measured the time elapsed from the start until the finish (30 yards). Full sprint is usually achieved after 25 to 35 yards therefore a 30 yard time recorded approximately the time required to obtain full speed.
Thirty yard acceleration time was measured with a second Dekan timer placed at the finish. The timer was stopped by a Line Control Accessory. The Line Control Accessory is a small aluminum box that has a jack plug on the bottom and a switch arrangement on the top. The switch arrangement will accommodate the spacer on the control line. The control line is a slender green line that can be made into any desired length with a spacer and an alligator clip fastened on the ends.

The Line Control Accessory will stop the timer as the spacer is drawn from position in the switch arrangement when the line control accessory is plugged into: SPECIAL STOP. The control line served as a finish line that the subject ran through to record a 30 yard time for each trial.

Starting Equipment

Automatic electric timing devices were used to provide precise timing without the common faults of human error. To prevent premature starting of any timer, all three timers were activated by the same source, the starter's pistol. An Iver Johnson 32 caliber starter's pistol was used to start each trial.

A Vibration Start Accessory was fitted on the barrel of the pistol. This start accessory picked up the barrel vibration created by the firing of the blank cartridge and sent an impulse through a control cord to the Data Timer. The vibration start accessory started the Data Timer the instant the pistol was fired. (Appendix C)

The Dekan Timers could not be activated by a vibration starter, so another method had to be designed by the investigator. A control cord (22AWG, 3 conductor plastic jacketed cable) was plugged into the SPECIAL START jack on each Dekan Timer. The control cord from the
first Dekan Timer was approximately ten feet long and the control cord from the second Dekan timer was approximately 90 feet long. The ground wires of the two control cords were wired and taped together. The "live" wire from the first control cord was fastened with a screw to the butt of the starter's pistol. A ten inch piece of 18 AWG, M&W Hook-Up wire was wired and taped to the "live" wire of the second control cord.

This Hook-Up wire was taped to the side of the pistol and along the top of the barrel and chamber. One-half inch from the end a 90° bend was made so that the wire could be inserted into the groove at the back of the pistol that receives the hammer. The insulation was shaved off the outer \( \frac{3}{4} \) of the inserted wire permitting the exposed wires to be struck by the hammer. Therefore as the pistol was fired and the hammer struck the hook-up wire a circuit was completed through the pistol thus activating the two Dekan Timers. All Dekan Timer controls are operated at 12 volts; therefore there is no danger involved in coming into contact with them. (Appendix C)
CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to determine any difference in performance times of a standing start and a crouch start. Each subject was required to run three trials using each method of starting. A mean time was determined for each subject from his three trials.

The experimental data was divided into standing start data and crouch start data. Each group was further sub-divided into drive times, 15 yard acceleration times, and 30 yard acceleration times. Mean times were computed for drive, 15 yard acceleration, and 30 yard acceleration times for each subject. Therefore, each subject had three times recorded for each method of starting.

The statistical analysis used to treat the data was a t-test to determine the difference between means. The .05 level of confidence was established as the critical value for the rejection or acceptance of the null hypothesis. A Hewlett-Packard Time Sharing Computer was utilized in the statistical analysis.

Chapter IV, "Analysis of Data", will be presented as follows: (1) Drive Time Data Analysis, (2) 15 yard Acceleration Time Data Analysis, (3) Thirty yard Acceleration Time Data Analysis, and (4) Discussion.

DRIVE TIME DATA ANALYSIS

A drive time was recorded for each subject when using both methods of starting. Drive time recorded the elapsed time from the start until the runner cleared the starting block.

After analyzing the drive time for the crouch start, it was
determined that a mean drive time of .424 second was utilized by a subject to clear the starting block. The standard deviation for the crouch start drive time was .062.

Analysis of standing start drive time determined that a mean drive time of .420 second was needed to clear the blocks. The standard deviation for the standing start drive time was .103.

Application of a t-test to determine the difference between means revealed a "t" ratio of .1831 at 8 degrees of freedom. The critical value of significance at the .05 level of confidence was 2.306.

TABLE I

<table>
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<td>.062</td>
<td>.1831</td>
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<tr>
<td>Standing Start</td>
<td>.420</td>
<td>.103</td>
<td></td>
</tr>
</tbody>
</table>

* Critical Value for "t" was 2.306

15 YARD ACCELERATION TIME DATA ANALYSIS

Acceleration times were recorded for each experimental trial. Acceleration time for 15 yards measured the elapsed time from the start until the subject passed a 15 yard mark.

Analysis of 15 yard acceleration time required for the crouch start found a mean acceleration time of 2.60 seconds. The standard deviation for the crouch start 15 yard acceleration time was .160.

Acceleration time for 15 yards using the standing start was
computed to have a mean of 2.516 seconds with a standard deviation of .160.

Application of a t-test to determine if there was significant difference between means revealed a "t" ratio of 2.391 at 8 degrees of freedom. The critical value for significance at the .05 level of confidence was 2.306.

TABLE II

<table>
<thead>
<tr>
<th>Start Method</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>&quot;t&quot; ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crouch Start</td>
<td>2.60</td>
<td>.160</td>
<td>2.391</td>
</tr>
<tr>
<td>Standing Start</td>
<td>2.516</td>
<td>.160</td>
<td></td>
</tr>
</tbody>
</table>

* Critical Value for "t" was 2.306

30 YARD ACCELERATION TIME ANALYSIS

A 30 yard acceleration time was recorded for each subject. The 30 yard acceleration times were used to determine which method of starting would produce the fastest dash times.

Analysis of acceleration times for the crouch start revealed a mean 30 yard time of 4.233 seconds. The standard deviation for the crouch start dashes was .2368.

The mean time computed for 30 yards using the standing start was 4.158. The standard deviation for the standing start dashes was .2493.

A t-test analysis of the mean 30 yard acceleration times found a "t" ratio of 2.0908 at 8 degrees of freedom. The critical value
of significance at the .05 level of confidence was 2.306.

TABLE III

<table>
<thead>
<tr>
<th>Start Method</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>&quot;t&quot; ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crouch Start</td>
<td>4.233</td>
<td>.2368</td>
<td>2.0908</td>
</tr>
<tr>
<td>Standing Start</td>
<td>4.158</td>
<td>.2493</td>
<td></td>
</tr>
</tbody>
</table>

* Critical Value for "t" was 2.306

DISCUSSION

The purpose of this study was to determine whether there was one starting method that was more efficient for sprinters to use. After analyzing the data of the two starts studied, it is noted that no significant difference was found between means of drive time and means of 30 yard acceleration times. Therefore, the null hypothesis was accepted for drive time and 30 yard acceleration time when using either a crouch start or a standing start.

The null hypothesis was accepted by the investigator for drive time because there was no significant difference in drive times using a crouch start and drive times using a standing start.

The null hypothesis was also accepted for 30 yard acceleration times. The investigator found that statistically there was no significant difference in 30 yard times between the standing start and the crouch start. The "t" ratio obtained in the analysis of data was 2.0908 indicating some difference in 30 yard acceleration times in favor of the standing start. The critical value for
rejection of the null hypothesis was 2.306.

The null hypothesis was rejected at the 15 yard acceleration data level. Analysis of data collected for a 15 yard interval showed that there was a significant difference between the standing start and the crouch start in favor of the standing start.

It is worth noting that 15 yards is the distance to the first hurdle in most standard hurdle races. A hurdler gains the greatest amount of acceleration in the first 15 yards of the race. Therefore, the method of starting that would provide the greatest acceleration in 15 yards would be highly beneficial to the hurdler. According to this study, the standing start provides the fastest 15 yard acceleration.

Of the two methods of starting investigated, the crouch start provided the fastest drive time. The fastest time recorded for 15 yard acceleration was obtained while using the standing start. And the fastest 30 yard time was also recorded by a standing starter.
CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to determine whether there was a significant difference between performance times when using a crouch start and a standing start.

The subjects were taught the mechanics of the standing start during a two week training session. The subjects were then timed during maximum sprints using both the crouch start and the standing start. The difference in performance time was measured by recording three intervals of time for each subject. A drive time, 15 yard acceleration time and 30 yard acceleration time was recorded for each trial.

The ten subjects used in this study were members of the 1973 University of Wisconsin--LaCrosse track team and the Professional Activities Track and Field course. Each subject practiced the standing start two weeks before being timed for 30 yard sprints. Each subject was timed for three trials using the crouch start and three trials for the standing start.

From the trials, a mean time was determined for drive, 15 yard acceleration, and 30 yard acceleration times for both methods of starting. The statistical analysis used to determine the difference between the two starts was a t-test. The .05 level of confidence was established as the critical value for the rejection or acceptance of the null hypothesis.
FINDINGS

From the data collected, the following results were obtained:

1. There was no significant difference at the .05 level of confidence between drive times using a crouch start and a standing start.
2. There was a significant difference at the .05 level of confidence between 15 yard acceleration times using a crouch start and a standing start.
3. There was no significant difference at the .05 level of confidence between 30 yard acceleration times using a crouch start and a standing start.

CONCLUSIONS

The following conclusions can be drawn from this study:

1. Drive times did not differ significantly when using either a crouch start or a standing start.
2. A significant difference was found between 15 yard acceleration times when using a standing start as compared to a crouch start.
3. There was no significant difference between acceleration times in the 30 yard dash when the variables were the crouch start and the standing start.

RECOMMENDATIONS

The investigator recommends the following topics for further study.

1. A study could be conducted using junior high school boys, who have had no previous experience with either the standing or crouch start, to determine which method of starting is better.
2. A study could be conducted which would analyze the mechanics of the crouch start and the standing start by stop-action photography.

3. A study could be conducted comparing the different block designs and block spacings for the standing start.

4. A study could be conducted with hurdlers using a standing start. Most hurdlers reach their maximum acceleration in the interval from the start to the first hurdle (15 yards).

5. A study might be conducted to determine whether or not height and body type of athletes might make a difference in performance times between the crouch start and the standing start.
BIBLIOGRAPHY


APPENDIX A

TEACHING THE STANDING START
Front leg should support approximately 75% of your weight.

Rear leg should be bent slightly.

Hands are not on the track, if right leg is forward then your left arm is forward in extreme running position.

At the sound of the gun start your roll by kicking off from the back trigger foot and start your arm drive at the same time.

Do not start your drive from your front leg till your knee is lowering to approximately 45° as shown in the drawing.
After you rolled over with your front leg at 45° to the track and with your head down.

Start your forward drive.

If you hold your head down through this drive you will not straighten up and you get a second drive off your next step.
APPENDIX B

EXPERIMENTAL DATA
**EXPERIMENTAL DATA**

**Crouch Start**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Drive</th>
<th>15 yd. Acceleration</th>
<th>30 yd. Acceleration</th>
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</thead>
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* Subject #9 was not included in the analysis of data because he did not complete the two week training session.*
**EXPERIMENTAL DATA**

Standing Start

<table>
<thead>
<tr>
<th>Subject</th>
<th>Drive</th>
<th>15 yd. Acceleration</th>
<th>30 yd. Acceleration</th>
</tr>
</thead>
<tbody>
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</table>

* Subject #9 was not included in the analysis of data because he did not complete the two week training session.
APPENDIX C

STARTING EQUIPMENT