

## COMPARATIVE ANALYSIS OF THE START REACTION TIMES IN SPRINT OR HURDLES EVENTS IN VARIOUS AGE GROUPS

ALEXE Dan Iulian, RAȚĂ Gloria, ALEXE Cristina Ioan

“Vasile Alecsandri” University of Bacău, ROMANIA, alexedaiulian@yahoo.com

### Abstract

According to the up to the present data, the reaction time is the interval of time between the application of a stimulus to the receptors of the sensory systems and the detection of a behavioral response.

### Purpose

The main aim of the present paper is to point out the comparative analysis of the reaction times in male and female athletes in sprint and hurdles events at two major national competitions: the finals of the University National Indoor Championships, Bacau 2010 (a competition for students, young and senior athletes) and the National Contest *Dorin Melinte Memorial*, Bacau 2010 (for juniors).

### Methods.

This paper presents a comparative overview of the reaction times registered by the official start system (*Alge timing StartJudge SJ*) in different events (flat sprint, hurdles), a time comparison between girls and boys, and the comparison of the best reaction times in two age groups (senior and junior athletes). Registered reaction times (rounds, finals) at both competitions: 125. Subjects included in the analysis: 197.

**Keywords:** track and field, sprint events, reaction times, reaction speed

### Introduction

The reaction time (also called the latent time of motor reaction) is specific to the discriminatory ability and efficiency of afferent systems under various stimulation conditions.

According to the available data, the reaction time is the interval of time between the application of a stimulus to the receptors of the sensory systems and the detection of a behavioral response

The behavioral response is represented by the perceivable reaction of an individual.

Reaction time depends on the number of stimuli and their signification, on their intensity and frequency, on the functional state of sensory systems and on the dispositional factors.

According to some specialists in the field of psychology (A. Jensen, 2006), the reaction time is an index of processing speed. The processing speed is considered to be an index of processing efficiency of the involved sensory systems.

At present, there are various researches which investigate the relationship between the reaction time and the quantity of information extracted from the stimulatory environment.

Throughout the years, the research studies have established that the reaction time is fastest when there is only one possible response (simple reaction time) and slower when there are more options of response (choice reaction time). According to Hick's law, choice reaction time increases in proportion to the logarithm of the number of response alternatives. This law (named after the British psychologist William Edmund Hick or Hick-Hyman law, according to Ray Hyman) describes the period of time necessary for a person to make a decision as a result of the available alternatives.

From the physiological point of view, the reaction time (reaction speed, latency time) consists of five elements (Zațiorschi, Matveev quoted by A.Dragnea,

2002 and T.Bompa, 2002): stimulus occurrence, excitation at the receptor level, transmission of codified excitation to the central nervous system, analysis of codified excitation and its re-codification for elaborating the response, the effectual signal, signal transmission through motor tracts, from the central nervous system to the muscle, and the muscle stimulation in order to perform the work.

A. Nicu et al. (1993) state that this complete cycle of codified excitation is of 200 m/s on the average, and 50% out of this value is performed at the central level for the message analysis and synthesis and for elaborating the response.

Athletes' reactions as well as common people's reactions can be simple or complex. According to T.Bompa and A.Dragnea (2002), a simple reaction is the conscious and correct response to a pre-established signal, previously known, which occurs instantaneously, suddenly (for instance, the sound of the starting gun).

There is clear distinction between the reaction time and the reflex response time (unconscious response to a stimulus, for example the reflex response to the tendon tap).

In athletics, the simple reaction time is analyzed in relation to the crouch starting position in sprint events by using the specific electronic devices which measure both the simple reaction at a previously known start sound (the startgun) and the attempt "to cheat" the start ("false", wrong start). According to the IAAF regulations, a start is considered to be false if the athlete starts faster than the 100/1000 of a second after start.

The visual motor reaction in sprinters is of 150-200 m/s (this value is of 200-300 m/s in common people); when an acoustic signal is used this time is 110-140 m/s in athletes, and 170-200 m/s in non-athletes.

### Objective of research

The main aim of the present observational research was to emphasize the differences between the start reaction times related to two categories of athletes: juniors and youth- seniors.

### Subjects of research

The research involved 173 male and female athletes who participated in the sprint events (60m flat and 60m hurdles) at two traditional competitions: University National Indoor Championships, Bacau 2010 and the National Contest *Dorin Melinte Memorial*, Bacau 2010. The table no.1 presents the participating subjects classified according to gender criteria, specific event and competition.

### Research tools

The false start analysis system *Alge timing StartJudge SJ* consists of: starting blocks with attached motion sensors, startgun Arminius 9 mm STP, printer P5", microphone SM8, central unit "Start Judge Controller SJC", amplifier PA888.

### Results of research

For the 173 athletes who participated in both competitions there were recorded only 125 reaction times (heats and finals), which means a percentage of 72.25% of the total number of possible recorded times.

We present the descriptive analysis of the recorded times for our research subjects in the above-mentioned sports competitions.

## I. University National Indoor Athletics Championships, Bacau 2010

### Recorded times in Women's 60m hurdles

Seven female sprinters (students) were present in the 60m hurdles race, and all of them succeeded in registering their starting reaction times. Due to the fact that there were only 7 athletes registered for that event, the organizers decided to send them directly into the final race.

The female sprinters in the hurdle event at the University National Indoor Championships 2010 recorded the following start times: 0,202s / 0,204s / 0,202s / 0,212s / 0,192s / 0,188s / 0,211s.

Thus the average time for the female athletes, all of them university students and practicing athletics, is of **0.202 seconds**.

### Times recorded in Men's 60m hurdles

As far as the reaction times of male athletes (university students) in the hurdles event are concerned, the values are as follows:

- 60 m hurdles heats: 0,241s / 0,196s / 0,199s / 0,136s / 0,230s / 0,182s / 0,151s / 0,184s / 0,216s / 0,154s. The average value: **0.189 seconds**.
- 60m hurdles finals: 0,204s / 0,275s / 0,190s / 0,190s / 0,216s / 0,212s / 0,211s. The average value: **0.214 seconds**. These starting reaction times were recorded after a false start; the poor values were due to the fact that all athletes avoided the disqualification.

Only 7 instead of 8 sprinters participated in the final race; two out of 10 sprinters competed *hors*

*concoirs* (HC) and one athlete abandoned after the start (but his reaction time was recorded).

As a rough value, the average of the reaction times (17 heat and final times) in hurdles sprinters is of **0.199 seconds**.

### Times recorded in Women's 60m flat

As far as the reaction times of the female athletes (students) in the flat event are concerned, the values are as follows:

- Heat I – 7 sprinters: no impulse / 0,217s / 0,190s / 0,225s / 0,271s / 0,185s / no impulse. The average value: **0.217 seconds**;
- Heat II – 6 sprinters: no impulse / no impulse / no impulse / 0,210s / 0,175s / 0,212s. The average value: **0.199 seconds**;
- The average values of the 8 recorded times in both heat races is of **0.211 seconds**.

Taking into account the times of the women's 60m flat final (university students: 0,199s / no impulse / 0,195s / 0,229s / 0,232s / 0,164s / 0,168s / 0,168s), the average time is of **0.194 seconds**.

The values recorded in the heats and in the final races (15 reaction times) show a rough arithmetic mean of **0.203 seconds**.

### Times recorded in men's 60m flat

The recorded reaction times (male students) in the 60 m flat heats are as follows:

- Heat I – 7 sprinters: 0,271s / 0,188s / 0,211s / 0,195s / 0,193s / 0,161s / 0,180s. The average time: **0.199 seconds**;
- Heat II – 7 sprinters: 0,236s / 0,165s / 0,211s / 0,237s / 0,211s / 0,193s / 0,188s. The average time: **0.205 seconds**;
- Heat III – 8 sprinters: 0,292s / 0,183s / 0,203s / 0,219s / 0,149s / 0,189s / 0,150s / 0,218s. The average time: **0.200 seconds**;
- The average values of all 22 recorded times: **0.202 seconds**.

The values of the recorded reaction times of the eight 60m sprinters (male students) in the final race are as follows: 0,160s / 0,205s / 0,181s / 0,203s / 0,186s / 0,183s / 0,155s / 0,142s. The arithmetic mean of the recorded times in the final is of **0.177 seconds**, which is a good value if we take into account that these reaction times were recorded after one false start.

The values recorded in the heats and in the final races (30 reaction times) indicate a rough arithmetic mean of **0.195 seconds**.

## II. "Dorin Melinte" Memorial 2010

### Times recorded in Girls' 60m hurdles

From a total number of six girl athletes (one born in '94 - Juniors II; three athletes born in '95- '96 - Juniors III; two sprinters born in '97 age - Children I) who were present at the two starts, one start was repeated after the girls' reaction before the gun start ("false start"), only one girl (Junior III) succeeded in recording her reaction time by means of the starting blocks. The other five girls did not exert enough force against the starting blocks.

The times recorded by the girl sprinter, Junior III, are: 0.153 s and 0.175s (the 2<sup>nd</sup> start). The average is of **0.164 seconds**.

The conclusion is that the athletes of the junior age category either did not develop enough force specific to the crouch position or did not learn an effective modality to start the race (a start that maximizes the support of the blocks).

#### Times recorded in **Boys' 60m hurdles**

Five athletes (71.43%) out of seven sprinters (3 born in '91-'92 – Juniors I and 4 born in '95-'96 – Juniors III) who participated in the 60m hurdles and succeeded to record their reaction times at start.

The times recorded by the *junior hurdles sprinters* are as follows: 0,138 s / 0,159 s / 0,208 s / 0,146 s / 0,195 s. The average time (related to the 5 recorded times) of the junior athletes analyzed within this research is of **0.169 seconds**.

The other two athletes (Juniors III) either did not develop enough impulse specific to the crouch position or did not learn an effective modality to start the race (a start that maximizes the support of the blocks).

#### Times recorded in **Girls' 60m flat**

From a total number of 46 girls present at start (two sprinters born in '91-'92 – Juniors I, one sprinter born in '94- Juniors II, 20 sprinters born in '95-'96 – Juniors III and 23 born in 1997 and after – Children I and II) who could have been recorded 46 reaction times, only *10 girl athletes* (21.7%) have triggered the sensors for the starting reaction.

Three out of these ten sprinters were Children I, a fact which indicates that in comparison with other girl juniors they have an improved starting method even if their reaction times were slightly poorer (0,214s / 0,216s / 0,244s).

The other 36 junior athletes (78.26%) did not record their reaction times in blockstarts.

The recorded times for the girl juniors and girl-children in the *60m flat race* are: 0,228s / 0,178s / 0,203s / 0,234s / 0,188s / 0,214s / 0,216s / 0,185s / 0,197s / 0,244s. The average values (computed by taking into account the 10 reaction times recorded) is of **0.209 seconds**, which is not a very appropriate one for this kind of sprint events.

The other 36 girl sprinters either did not manifest the ample driving force in blockstarts or did not acquire the crouch starting position which implies a strong setting and push against the blocks at the auditory signal.

#### Times recorded in **Boys' 60m flat**

Total: *61 participating athletes* in 9 series:

- 13 athletes born in '91-'92 – Juniors I category
- 15 athletes born in '93-'94 – Juniors II category
- 24 athletes born in '95-'96 – Juniors III category
- 9 athletes born in '97-'98 – Children I category

#### *Juniors I*

From a total number of 13 sprinters ('91-'92 age category – juniors I) presented at the 60m hurdles race start and from a total of 13 possible recorded times, *12 athletes* recorded their starting reaction times.

The recorded times of the *junior I sprinters in the 60m flat race*: 0,202s / 0,247s / 0,160 s / 0,184s / 0,248 s / 0,175s / 0,169s / 0,195s / 0,166s / 0,170s / 0,147s / 0,175s.

These values point out an average value (computed by taking into account the 12 recorded times) of **0.186 seconds** for the junior I athletes presented at the 60m flat race start and analyses in the present paper.

#### *Juniors II*

Only *12 athletes* out of 15 sprinters ('93-'94 age category – juniors II) present at the start of the 60m hurdles event have recorded their reaction times.

The recorded times of the juniors II in the *60m hurdles race*: 0,209s / 0,214s / 0,210s / 0,162s / 0,220s / 0,195s / 0,166s / 0,146s / 0,203s / 0,274s / 0,174s / 0,214s.

The average value of the Juniors II participants in the 60m flat event is of **0.199 seconds** (computed by taking into account the 12 available times)

#### *Juniors III and Children I*

There were 33 sprinters (born in '95-'98 – juniors III and children I) at the 60m hurdles race start but only *15 athletes* (45.45%) have triggered the sensors for the starting reaction.

The recorded times of the juniors III and children I in the *60m flat race* are as follows: 0,214s / 0,192s / 0,279s / 0,215s / 0,165s / 0,146s / 0,174s / 0,175s / 0,153s / 0,206s / 0,209s / 0,298s / 0,243s / 0,257s / 0,199s.

The average value of the juniors III and children I in the 60m flat event and analyzed in our research (from a total of 15 reaction times) was of **0.208 seconds**.

Twenty-two out of 61 sprinters who were present at start (one junior I, three juniors II, and 18 juniors III and children I), which means a percentage of 36.06%, either did not develop enough start impulse from the blocking starts, either did not acquire the effective starting technique (a start which maximizes the impulse from the block pads)

The general average value of all times recorded by the „*Alge timing StartJudge SJ*” system in the 60m flat event is of **0.198 seconds**.

Analyzing the relationship between the total number of subjects and the recorded times (Table no.1), it can be noticed that the participants at the university student competition (youth-senior age category) have succeeded in a percentage of 100% to use the block starts and thus to record their reaction times.

Unlike the students, the children and juniors (I, II, III) have a lower percentage in recording their reaction time by using the blockstarts. In our opinion, this fact can be explained by the lack of competition experience and the lack of training as far as the effective crouch starting position performing is concerned.

Analyzing the best reaction times in the two investigating categories (Table no.3) and the average

values (Table no.2), it can be noticed that the values recorded by the junior participants are close to the values recorded by the university students, and sometimes the juniors' results are even better than students' results (girls' 60m hurdles; boys' 60m flat).

### Conclusions

The descriptive and comparative analysis of the recorded values leads to the conclusion that despite the fact that there were recorded some good results, the junior athletes still need a training for improving their starting reaction and the crouch starting techniques (the presence of many "no impulse" values indicate either not enough propulsion following the auditory signal or not enough strength developed at the lower limbs level or strength values which are incorrectly used from the technical point of view).

As far as the values recorded in the youth-senior athletes (university students) are concerned, these athletes have taken advantage of the impulse from the block starts (the motion sensors were triggered) but their reaction times are not quite good, with few exceptions (the situation is the same with the junior athletes).

The analysis of all values related to the competition performances (heat times, final times) pointed out the fact that the training methodology of sprint-hurdles athletes must be improved, especially concerning their physical training, psychological training and reaction time.

### Bibliography

- BOMPA, T., 2002,** *Periodizarea: teoria și metodologia antrenamentului*, Ex Ponto Publishing House, Bucharest (translation CNFPA);
- DRAGNEA, A.,C., TEODORESCU, S., M., 2002,** *Teoria Sportului*, FEST Publishing House, Bucharest;
- JENSEN, A. 2006,** *Pontaj minte: cronometrie mentală și diferențele individuale*, Elsevier Publishing House, Amsterdam;
- NICU, A., ET AL., 1993,** *Antrenamentul sportiv modern*, Editis Publishing House, Bucharest.

**Table no. 1**  
Repartition of subjects' reaction times in both sports competitions

Event	University National Indoor Championships		"Dorin Melinte" Memorial - Juniors		Total	
	Subjects	Recorded times (heats, final)	Subjects	Recorded times (heats, final)	Subjects	Times
W 60 m hurdles	7	7	6	2	13	9
M 60 m hurdles	10	17	7	5	17	22
W 60 m flat	14	15	46	10	60	25
M 60 m flat	22	30	61	39	83	69
	53	69	120	56	173	125

**Table no. 2**  
Average values recorded in the four events at the two studied competitions

Event	Best value University National Indoor Championships	Best value "Dorin Melinte" Memorial - Juniors	Difference
W 60 m hurdles	0.202s female students	0.164 girl Juniors	0,038 s
M 60 m hurdles	0.199s male students	0.169 boy Juniors I	0,030 s
W 60 m flat	0.203s female students	0.209 girl Juniors	0,006 s
M 60 m flat	0.195s male students	0.198 boy Juniors	0,003 s

**Table no. 3**  
Fastest reaction times in the two competitions

Event	Best value University National Indoor Championships	Best value "Dorin Melinte" Memorial - Juniors	Difference
W 60 m hurdles	0.188s female student	0.153 girl Junior III	0,035 s
M 60 m hurdles	0.136s male student	0.138 boy Junior I	0,002 s
W 60 m flat	0.164s female student	0.178 girl Junior II	0,014 s
M 60 m flat	0.149s male student	0.147 boy Junior I	0,002 s