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The Relationship between Selected Physical Fitness Variables with the Performance of Ethiopian Junior Sprinters and Middle Distance Athletes Across Genders

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***Abstract**: the present study has seriously made an attempt to discover the relationship between selected physical fitness variables with the performance of Ethiopian junior sprinters and middle distance athletes across Genders. The subjects for the present study consisted of 240 sprinters and middle distance athletes 14-20 years of age. For the purpose of the study, the total population have been included from three different athletics centres. To achieve the objectives of the present study, moments of Pearson correlation have been used. From the results it has been found that, 40m sprint speed has a positive relationship with 100m best performance for male and female athletes. However, sit and reach have a positive but broad jump has a negative correlation with female 100m best performance. Speed endurance was significantly correlated positively with 400m best performance for male athletes. However, wall squat sit has a negative and 40m speed test has a positive but both had a significant correlation with the performance of female athletes. 40m speed and 300m speed endurance have negative and significant correlation with male 800m performance. Whereas, only 300m speed endurance has a significant positive relationship with 800m best performance of female runner. Wall squat sit is found to be significantly correlated negatively to 1500m performance of male athletes. Other physical fitness variables have no correlation. However, none of the physical fitness variables used in this study have a relationship with the best performance of female athletes.*

***Keywords**: Correlation, Middle distance race, Performance, Physical fitness, and sprinting*

I. Introduction

From the earliest time running has been a natural part of man's existence. One of the earliest examples of competitive running can be found in the work of Homer, who tells of races ran in the 12^{th} century BC. Thus, man has been racing on foot for over three thousand years (Blacklock and kennett, 2000). It was the Greeks who elevated running to the level of their gods at Olympia and the spectacle of athletes running and engaging in other contest of exertion to sculptors of fertile images of human beauty. The revival of the Olympics Games in 1896 has resulted in standardization of events and competitions. The events have become all the more popular now and need scientific and structured training and practice. Ericsson's theory of deliberate practice states that the level of expertise obtainedby elite athletes is at least in part a function of the amount of structured practice. It was expected that children with a more extended training history would exhibit more pronounced anthropometric, physical fitness and motor coordination profiles matching the specific sport (Blacklock and kennett, 2000).

In athletics and track and field, sprints (or dashes) are races over short distances. They are among the oldest running competitions. A rapid movement from one place to another place is required in many athletic activity especially in sprint running (kukolj,Ropret, Ungarkovic and Jaric,2001; Pinero et al,2010). Sprinting is an ancient event in athletics starting in the first Greece Olympic Games and it is a human ability to perform a maximum running velocity (Haneda, Enomoto, Hogo and Fujii,2003). At the professional level, sprinters begin the race by assuming a crouching position in the starting blocks before leaning forward and gradually moving into an upright position as the race progresses and momentum is gained. The set position differs depending on the start.Body alignment is of key importance in producing the optimal amount of force. Ideally the athlete should begin in a four-point stance and push off using both legs for maximum force production. Athletes remain in the same lane on the running track throughout all sprinting events with the sole exception of the 400 m indoors. Races up to 100 m are largely focused upon acceleration to an athlete's maximum speed. All sprints beyond this distance increasingly incorporate an element of endurance (Pinero et al, 2010).

Middle-distance events are traditionally defined as the track events which fall between the short-distance (or sprinting) events, such as the 100m, 200m, 400m and hurdle events (110m and 400m) and the longer distance events such as the 10 000m, half-marathon (21.1km) and marathon (42.2km) distances. There is much debate over which events are defined as middle-distance, with some authors including distances up to 10 000m in this category (Brandon,2003 ;Snell, 2001). Traditionally, the 800m, 1500m and the mile are described as true middle-distance events but most authors would include the 3000m and 5000m as well as the steeple-

chase events (2000m and 3000m), in this category (IAAF, 2010; Snell, 2001). From a physiological perspective, it is clear that the shorter middle-distance events have large anaerobic and aerobic contributions (especially the 800m and 1500m), but as the distance and duration of the events increase, the aerobic component becomes dominant. For this reason, it may be erroneous to regard the 10 000m as a middle-distance event due to the large aerobic component required for success despite the high running velocity which must involve significant anaerobic energy. This notion is supported by Peter Snell, a former top middle-distance runner and more recently, a recognized academic in the field of exercise physiology (Brandon, 2003; Snell, 2001). Having this in mind about the conceptual understanding regardingsprinting and middle distance events from theoretical point of view; there are some researches' conducted at a global and regional levels. Hence, the views and works of the previous researchers who undertake research on the same topic of interest would have been assessed as below.
Kumagai et al. (2000) and Blazavich (2001) were separately focused on different dimensions or variables including the limb length, bone width, skin fold thickness, present body fat, somato type, muscular strength, flexibility, speed and anaerobic power in the studies of sprint athletes. According to Kumagai et al. (2000), the study found out that the anthropometric, muscular strength and power are poor predictors of the performance of initial acceleration and maximum speed phase during the sprinting while Blazavich (2001) stated that excessive stretching and flexibility my cause an increase in injuries and a decrease in performance. In addition, several studies were focused on the relationship between different jumping tests and sprinting performance (Habibi et al., 2010; Almuzaine and Fleck, 2008; Kale et al., 2009) stated that, jump power is the best indicator of sprinting ability. SurinderKaur, Dolly and Rajesh Kumar (2016), were also tried to assess different variables with the running performance of 800m athletes. Among the various variables that have been assessed, flexibility has been significantly correlated to performance. Similarly, shoulder, hip, and thigh girth have been significantly correlated. Furthermore, Veligekas, et al (2012) were the studies undertaken on the correlation between standing long jump test and middle distance runners' performance. However, from Ethiopia's perspective, there were no similar researches to date carried out this before on junior sprinters and middle distance runners exclusively.Therefore, the present research aimed to focus on exploringwhether or not there existsignificant relationship between physical fitness parameters and the performance of Ethiopian junior sprinters and middle distance athletes across genders.

II. Literature Review

Physical fitness has been defined as a measure of how well one performs physical activity. In other words, it can also be labelled as body movement produced by muscle action that increases energy expenditure (Kyrolainen et al., 2010). Physical fitness can be divided into health-related physical fitness and motor-related physical fitness. Health-related physical fitness includes muscular strength, muscular endurance, cardiorespiratory endurance and flexibility. Motor-related physical fitness consists of agility, power and balance (Heyward, 2002; So & Choi, 2010). Besides, Deane, Chow, Tillman and Fournier (2005) also indicated that muscular strength is one of the elements of physical fitness.

Different sports are required to have resistance training in order to improve the muscular strength. Although quadriceps, hamstrings and calf muscles are chiefly responsible for propelling the body forward during running and jumping exercise, hip flexor muscles also contribute to bring the free leg forward and upward during the sprinting in recovery phase. However, hip flexor muscles training was ignored or neglected by athletes and coaches. In addition, Kale et al. (2009) stated that jump power is the best indicator of sprinting ability. The lower limb power capability can be evaluated by the jump tests and they provide valid assessments of muscular power. Besides, some research studies showed that there is a high correlation between the leg power and sprint ability by using horizontal and vertical jump displacements as an indirect power measurement (Habibi et al., 2010; Bret et al., 2002).

Moreover, Habibi et al. (2010) found that the jump assessment of single leg hop for distance is strongly related to the sprinting performance (r=-0.76). In addition, Pinero et al. (2010) indicated that standing long jump test as a predictor to assess the lower body muscular strength is better than the vertical jump test. Standing long jump test is time efficient, practical, and lower in cost and equipment requirements and it could be considered as a general index of youth' muscular fitness. Furthermore, some researchers showed that the standing long jump ability with both sprinting acceleration and sprinting velocity have significant correlation (Peterson, Alvar& Rhea, 2006; Almuzaini& Fleck, 2008; Kale et al., 2009). Moreover, Jenkins and Beazell (2010) stated that flexibility is an individual variable, joint-specific, inherited characteristic that influences by age, gender and ethic group. Similarly, Wang et al. (2003) showed that gender, age, muscle size and warm up are the factors contributing to flexibility. The flexibility of females in hip abduction, flexion and extension are better than males associating with anatomy factors. He also pointed out that strength training caused muscle hypertrophy and limited the flexibility development. In addition, proper stretching can increase range of motion in particular joints in order to produce the optimum running performance and reduce the risk of injuries (Blazevich, 2001; Jenkins &Beazell, 2010). However, Blazevich (2001) stated that excessive stretching and flexibility may cause an increase in injuries and a decrease in performance.

III. Research Methodology

In this particular research, the researcher has intensively collected the data in person from a total of 240 junior sprinters (100m and 400m) and middle distance runners (800m and 1500m) aged 14-20. The total population of the research makes up athletes found in three different athletics centres in Ethiopia namely Ethiopian youth sport academy, TiruneshDibaba sport academy and Bokoji sport academy exclusively. For the purpose of the research, the total populations have been included in this study. Theinstruments used to collect the data include measurements such as flexible metric tape and stop watch. In order to undertake the statistical analysis the general moments of Pearson correlation have been used using statistical package for social sciences software version twenty. The result of the analysis has been presented in the form of tables.

IV. Analysis Result And Discussions

The Pearson correlation between the males and female athlete's performance and the measured variables were computed and shown in table form below.

Table1. Pearson correlation between males 100m sprint performance and the measured variables (N=30).

Variables	r	P
Broad jump	0.153	0.421
Wall squat sit	0.103	0.589
Sit and reach	0.053	0.781
Speed 40m	0.594**	0.001
Speed endu.300m	0.233	0.216

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

It is evident from table 1 that, most ofthe measured variables including broad jump, wall squat sit, sit and reach, speed endurance were not significantly correlated with male 100m sprint performance. However, there was a positive correlation between sprint speed and 100m performance of sprinters (r= .595, p<.05). This suggests that, the speed helps toincreases100m sprint performance.

Table 2. Pearson correlation between males 400m sprint performance and the measured variables (N=30).

Variables	r	P
Broad jump	-0.076	0.689
Wall squat sit	0.013	0.948
Sit and reach	- 0.288	0.123
Speed 40m	- 0.175	0.355
Speed endu.300m	0.360*	0.043

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

Table 2: clearly indicates that, broad jump, wall squat sit, sit and reach, speed, were not significantly correlated with male 400m best performance. However, speed endurance was significantly correlated positively with 400m best performance (r=.360, p<.05).it is evident that, speed endurance assist the performance of 400m male sprinters.

Table3. Pearson correlation between males 800m best performance and the measured variables (N=30).

Variables	r	P
Broad jump	-0.051	0.791
Wall squat sit	0.318	0.086
Sit and reach	0.369*	0.036
Speed 40m	- 0.596**	0.001
Speed endu.300m	- 0.370*	0.04

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

The measured variables explicitly, broad jump and wall squat sit, were not significantly correlated with 800m best performance. However, speed and 800m best performance were negatively correlated (r= -.596, p<.05). In addition, there was a positive relationship between sit and reach flexibility test and 800m best performance of an athlete (r=.369, p<.05). Furthermore, a negative significant correlation between speed endurance and 800m best performance were found (r= -.370, p<.05). Athlete who got highest performance in 800 meter test has significant relationship between the selected physical fitness variables (speed 40m, sit and reach and 300m speed endurance). It is proved that speed 40m, sit and reach and 300m speed endurance also help to increase 800 meter performance.

Table 4. Pearson correlation between males 1500m best performance and the measured variables (N=30).

Variables P	r	
Broad jump	-0.065	0.732
Wall squat sit	-0.374*	0.041
Sit and reach	0.164	0.441
Speed 40m	- 0.004	0.985
Speed endu.300m	0.353	0.55

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

From table 4 it is evident that, there was no significant relationship between male 1500m performance and broad jump, sit and reach, speed, speed endurance, Nevertheless, there was a negative relationship between wall squat sit and the performance of 1500m male athletes (r= -.374, p<.05). This implies that, as the strength of hamstring muscle decreases, the time taken to finish 1500m race increases. Hence, performance decreases.

Table 5. Pearson correlation between females 100m sprint performance and the measured variables (N=30).

Variables P	r	
Broad jump	-0.394*	0.031
Wall squat sit	-0.092	0.628
Sit and reach	0.592**	0.002
Speed 40m	0.609**	0.000
Speed endu.300m	-0.017	0.931

** Correlation is significant at 0.01 levels (2-tailed).

Table5 clearly shows that, there was a negative correlation between broad jump and 100m performance of female sprinters (r= -.394, p<.05). Furthermore, sit and reach was significantly correlated positively with the performance of 100m female sprinters (r=.592, p<.01). Moreover, there was a positive relationship between speed and 100m best performance (r=.609, p<.01). But, wall squat sit and speed endurance were not significantly correlated with the 100m best performance of female sprinters. Sprinter who got highest performance in 100 meter test has significant relationship between the selected physical fitness variables (speed 40m, sit and reach and broad jump). It is evidenced that speed 40m, sit and reach and broad jump also help to increase 100 meter sprint performance of female athletes.

Table 6. Pearson correlation between females 400m sprint performance and the measured variables (N=30).

VariablesP	r	
Broad jump	-0.128	0.499
Wall squat sit	-0.372*	0.042
Sit and reach	-0.104	0.585
Speed 40m	0.347*	0.044
Speed endu.300m	-0.062	0.743

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

The measured variables including, broad jump, sit reach, speed endurance, were not significantly correlated with the performance of 400m female sprinters. However, wall squat sit was negatively correlated with the performance of 400m sprinters (r= -.372, p<.05). Moreover, speed and 400m best performance were significant correlated positively (r=.357, p<.05).

Table7. Pearson correlation between females 800m best performance and the measured variables (N=30).

Variables P	r	
Broad jump	0.103	0.589
Wall squat sit	0.267	0.153
Sit and reach	-0.075	0.694
Speed 40m	0.297	0.111
Speed endu.300m	0.355*	0.046

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

Except speed endurance, which was significant correlated positively with the best performance of 800m female athletes (r=.355, p<.05), the remaining variables such as broad jump, wall squat sit, sit reach, and speed, were not significantly correlated with the best performance. Therefore, 300m speed endurance contributes for best performance 800m female athletes at 5% level.

Table 8. Pearson correlation between females 1500m best performance and the measured variables (N=30).

Variables	r	
Broad jump	-0.150	0.430
Wall squat sit	-0.028	0.884
Sit and reach	0.171	0.366
Speed 40m	0.102	0.590
Speed endu.300m	0.225	0.232

** Correlation is significant at 0.01 levels (2-tailed).
* Correlation is significant at 0.05 levels (2-tailed).

None of the measured physical fitness variables were significantly correlated with the best performance of 1500m female athletes. It is clearly indicated in table 8 that, the selected physical fitness variables are poor predictors of 1500m best performance for female athletes.

V. Conclusion

This research paper tried to highlight the relationship between the selected physical fitness variables with the performance of Ethiopian sprinters (100m, 400m) and middle distance runners (800m, 1500m) across gender. In each case best performance of male and female athletes were correlated with the selected physical fitness tests such as, broad jump, wall squat sit, sit and reach, 40m speed, and 300m speed endurance. The major limitations of the study are the participant's attitude towards the test effort and the poor understandings of some coaches about how to conduct the tests were challenges the researcher. The findings of this study would provide meaningful information to other researchers who are interested to conduct further study on the related topic. Help junior athletes and coaches to have better understanding and provide scientific information in order to analysis the current training structure and adopt or develop other training methods for improving the running performance.All circumstances exposed in this study may facilitate further research on selection of potential sprinters and middle distance athletes in Ethiopia.

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