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Demographic, Anthropometric and physical Fitness as a Predictor of Race Performance of Burayu, Legatafo and Sebeta Town Athletics Project Trainers

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Abstract

This research was aimed to investigate demographic, anthropometric and physical fitness as a predictor of race performance of Burayu, Legatafo&Sebeta town athletics project trainees. Cross-sectional, stratified, systematic sampling techniques was used to collect data from the athlete (n = 151). Mean, tables, charts, standard deviation, Pearson product moment correlation coefficient, stepwise multiple regression analysis were used as statistical tools for analysis of the data. An important finding emerged in this study is that athlete's leg explosive power and their leg length shown significant low relationship with Athlete's personal best time. In contrary to our expectations, this research did not find significant relationship with age, height, weight, marital status, muscular endurance, hamstring and low back flexibility and speed. The study has shown that only leg length of an athlete is explaining 6.2% of athlete's personal best time. This study is confirms that age, height, weight, marital status, leg explosive power, muscular endurance, hamstring and low back flexibility and speed of the athlete did not explain athlete's personal best time. Further research will involve a larger sample in order to show the relationship between selected anthropometric, physical fitness and athletes demographic variables and athlete's personal best time.

Keywords:

Anthropometric;
Demographic;
Hamstring;
Physical fitness;
Race.

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1. Introduction

Athletics is an important corner stone of all sport activities. The fundamental goal in all running events is to maximize average running speed over the course of the race. To achieve this aim in the sprint events the athlete must focus on reaching and maintaining maximum velocity. In the hurdle events the focus is the same with the added requirement of clearing the hurdles. In the longer events optimizing the distribution of effort is of primary importance.

Anthropometry is defined as measurement of the human body (Tak, 2011). Anthropometric profile was assessed by stature, mass, skeletal breadth, segment lengths girths and skin folds are used to describe human size, proportions, shape, compositions and symmetry (katralli& Goundar,2012).

The issue performance enhancement is an increasingly important issues of today's athlete (Marahma, 1999). On the other hand, recent literature revealed that a plenty challenges adversely affect athletes performance. These includes: demographic, anthropometric and physical fitness's (Salah, Verla and Tongo, 2012). Similarly, numerous studies have agreed that the performance of elite young athlete has been focused on physical, demographic and anthropometric factors related to age (Willam, 2011). Correspondingly, a considerable amount of literature has been published in order to support anthropometric factors appeared to influence the race performance of highly trained and elite runners performance. (Saunders et al, 2004).

However, there has been different published literature argued that body mass index, body weight, skin fold thickness, circumference of extremities, skeletal muscle mass and body fat have no influence on race performance time was not significantly influenced by height, leg length, body mass and average skin fold (Knechtle, 2007). Therefore, the researcher hypothesized that demographic, anthropometric and physical fitness variables will significantly affect the athletes race performance.

A considerable amount of a research has been in the area of physical education and sport which deal with the structure and proportion of the body (agan&Dougals, 2002).

A vast number of literature show that medical doctors are interested and attracted of the physical fitness of the individual since their profession is allied with physical education and sport (hopper &Elliot,1995).As a matter of fact measuring, developing and promoting athletes performance has been the world wide issue which knocks the house of every athletes, coaches, scientific community and the entire community starting from 1961(Johnson & Nelson,1996). Previous literature indicate that different anthropometric characteristics, training characteristics and physiological variables have been identified as important predictor of variables for race performance (Knechtle, 2014:72)

A very recent publication suggests that race performance is closely linked to a variety predictive variable. In fact performance of athlete's has been significantly confronted by athletes' leg length, weight, height arm length, body mass, thigh girth (singh& yadav,2010). Previous

research has been proven that demographic, anthropometric and physical fitness athletes has been done separately and independently (slevenson, Hamer& Finch, 2000; Salah,Verta&Tanga,2012 &Katralli&Goudar,2012). However, there is a previous study reported, from athletics club even the athletics project was established in 2012. Therefore, the researchers were excited to see the cumulative effects of independent variables in explaining the race performance of the Oromia athletics club. Beside this, the researcher will be delightful to find the relationship between the dependent and independent variables. The following hypothesis and questions will be tested in this study:

1. What is the extent of the relationship between independent and dependent variable?
2. What will be the joint effect of predictor variables in explaining the race performance of the athlete?
3. What will be the most contributors to the performance of the athlete?

2. Research Method

2.1. Study Design

Cross-sectional research design was used. The data were collected from athletes at once.

2.2. Sample Size

Geographically players were found in three different stratums as a cofounder (Cochran, 1997). The research in tended to use stratified sampling techniques. In such a way that subject were screened using systematic random sampling.

Table 1. Sample size determination of subjects

No	Name of the clubs	Population	sample	Remarks
1	Burayu athletics project center	58	51	
2	LagaTafo athletics project center	50	48	
3	Sebeta athletics project center	60	52	
	Total	168	151	

Krejcie&Morgan(1970) & Hill(1998)

2.3. Procedure of Test Administration

The researcher were used proper planning for test administration to increase the likehood of smooth and efficient testing sessions and obtaining valid and reliable scores. Accordingly, the tests were administered during athlete's training time.

3.3.1 Securing material and preparing the test area

Obviously, testing area definitely affects the performance of players' maximum performance (Alan and Douglas, 2002). The investigators were able to identify the area when the tests were administered and have to clear the testing area. The materials, such as stopwatch metric tape, boundary cones, chalks and markers were used in our context.

2.3.2 Training testers and pretesting test items

The researchers trained the data collectors in order to develop their technical skills, which was necessary to administer the test. Beside this, test takers were informed well in advance about the upcoming tests, so that they can prepare themselves accordingly.

2.3.3 Recording, converting, interpreting and evaluating the score

Initially, the data were be written on individual sheet card. Secondly, the data had been transferred from individual score sheet to the role sheet. Thirdly, the data which were written on the role sheetwas converted to percentile. Fourthly, the converted data were interpreted into meaningful manner. Finally, the recorded data were evaluated.

2.3.4. Standardized Warm-Up Procedures

All participants performed a standardized warm up, followed by the testing protocol for all four tests. The standardized warm up were included: dynamic movements in order to properly warm up the body before testing. Sub-maximal jumps, active and dynamic stretching, and dynamic motions emphasizing quadriceps and hamstrings as agonistic muscle groups are included in the sport specific warm up. All athletes experienced warm up exercise following the standard protocol prior to any testing procedures to limit the potentially confounding effect of using different warm-up procedures. All participants were asked to not participate in any physical activity 24 hours prior to testing.

2.4. Ethical Consideration

All participants signed Jimma University ethical clearance guideline and approved written consent form that indicated they understood the purpose of the study, were healthy enough to perform various vigorous physical activity and wer willing to participate in the experimental procedures. Furthermore, participants had filled Physical Activity Readiness Questionnaire (PAR-Q).

2.5. Identification of Variables

2.5.1. Dependent variables

Athletes' personal best: Athletes' running time recorded using stopwatches in their respective discipline.

2.5.2. Independent variables

Based on the relevance with the research title, the following were discussed as follows:

Power: standing long jump test was taken from athlete using metric tape.

Muscular endurance: wall sit test was employed to collect the data of athlete using stopwatches.

Flexibility: sit and reach test at home was used.

Leg length: the length from the hip joint to inner ankle was taken by metric tape.

Speed: 50meter dash running performance was taken using metric tape.

Weight and height: Athletes' body mass and height was measured by digital height weight scale

Age: chronological age of athletes were recorded

Gender: the athletes sex was identified as male or female

Educational background: academic status of athletes were identified by asking them.

Marital status: Athletes' marital status were categorized as single, married, widowed and divorced.

2.6. Method of Data Analysis

Statistical analysis was performed using the statistical package for social science (SPSS.20). Mean and standard deviation was computed for power, muscular endurance, flexibility, leg length, speed, body mass/weight, age, gender, educational background, training experience, marital status, athlete's personal best and height of an athlete. Bar charts, histograms, and pie charts were used to compare different data samples and categorize data.

Moreover, Pearson product moment correlation coefficient was used to examine the relationship between power, muscular endurance, flexibility, leg length, speed, body mass/weight, age, gender, educational background, training experience, marital status and height of an athlete with athlete's personal best.

Furthermore, stepwise multiple regression analysis was used to identify power, muscular endurance, flexibility, leg length, speed, body mass/weight, age, gender, educational background, training experience, marital status and height of an athlete as a predictor athlete's personal best

3. Results and Discussion

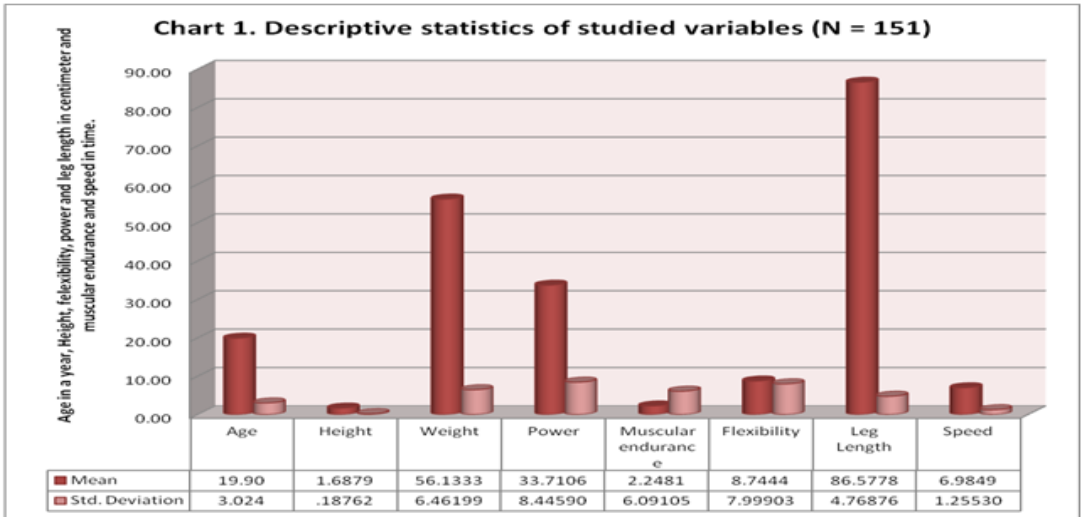

Figure 1. *Descriptive statistics of studied variable of athletes, 2014/15*

From the above figure it can be seen that mean athlete's age 20± 3 years old (6years difference) height 1.69± 0.19cm(0.38cm difference),weight 56.13± 6.46 kg (12.92kg difference), power 33.71± 8.45cm (16.9cm difference), muscular endurance 2:24:81± 00:60:91 minute (01: 31: 82 minute difference), flexibility 8.74± 7.9cm, leg length 86.58 ± 4.77cm and sprinting speed 06:98 ± 01:26 sec (02:52 seconds difference).

As mentioned earlier, the athlete's age, height, weight, power, muscular endurance, flexibility, leg length and speed swings from 17-23years old, 1.50 -1.88cm high, 50-62kg heavy, and 25.26-

42.16cm long, 01:53:10 – 02:85:75 minute, 0.84 – 16.64cm long, 81.81 -91.35cm high and 05:26-05:70 sec respectively.

The above analysis indicates that athletes of the training centers were found to be under a well performing stage, they had athletic height and weight, less powered, excellent muscular endurance, averaged in flexibility and leg length and below average in their sprinting speed. Sub section should be written without bold type. The result and analysis are presented by present form. Please avoid too many paragraph in this section.

3.1. Relationship between Predictors' Variable and the Criterion variables

Table 2. Pearson product moment correlation coefficient matrix (N = 151)

S.N.	Independent variables	Athlete's personal best time (dependent variables)
1	Sex	-.161
2	Age	-.028
3	Height	-.096
4	Weight	-.134
5	Marital Status	.053
6	Power	-.245*
7	Muscular endurance	.021
8	Flexibility	-.047
9	Leg Length	-.248*
10	Speed	.850

From the above aforementioned table, independent variable (athlete's leg explosive power and their leg length) shown significantly (P <0.05)low relationship with dependent variable (Athlete's personal best time).Whereas, age, height, weight, marital status, muscular endurance, hamstring and low back flexibility and speed of the athlete depicts insignificant relationship with athlete's personal best time.

The overall measurement results summarized in Table 3, found that only athlete's leg explosive power and their leg length had significantly low negative relationship with athlete's personal best time. However, age, height, weight, marital status, muscular endurance, flexibility and speed of the athlete's depict insignificant (P <0.05) relationship with athlete's personal best time.

Athlete's personal best time was in a good agreement with athlete's leg explosive power and their leg length. Both of the independent variables were found to be the good predictor of dependent variable. Whereas, there

3.2. Predictor variables explain the race Performance of the Athlete

Table 2. Model summary of predictor's variables explaining athlete's performance, 2014/15

Model characteristics	Standardized beta coefficient	R	R-square	Adjusted R-square	F	t	Sig.
Constant		-0.248	0.062	0.51	5.711	5.078	0.000
Leg length	-0.248					-2.390	0.0189

The stepwise multiple regression result shows that only leg length of an athlete's explain 6.2% of athlete's personal best time at P< 0.05. However, age, height, weight, marital status, leg explosive power, muscular endurance, hamstring and low back flexibility and speed of the athlete did not explain athlete's personal best time. As mentioned above, the researchers were confident enough that athlete's performance variation by 6.2% was due to athlete's leg length.

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Discussion on Findings

Various studies portrays, height and weight were the most important determinant factors in challenging athlete's athletic performance (Knechtle et al, 2007, Temfemo et al, 2008 and Singh and Yadav, 2010). Current research shows that biological factors, mainly muscular strength and leg length are determining athletes' potential (http://www.scienceofrunning.com/2010/11/stride-speed-length-x-frequency.html.retrieved on Feb.26,2016). With this regard, KenenisaBekele (Ethiopia) had longer stride length than Mathathi (Kenya) and SileshiSihine (Ethiopia); however, He is shorter than both of them. A considerable amount of literature depicts that Kenney and Hodgson (1985) body mass was related to race performance in a varieties of athletics discipline. Barandum et al (2012) and Rust, Knechtle and Rosemann (2012), argued that marathoners found no association with race times. Swain (1994) discussed that body height was also related to race performance in road cyclists.

However, a variety of disciplines showed no association between body height and race performance (Knechtle, Rust and Rosemann, 2011). In a similar fashion, Swain (1994) discussed that body height was also related to race performance in road cyclists. However, a variety of disciplines showed no association between body height and race performance (Knechtle, Rust and Rosemann, 2011). The results obtained by (Roecker et al, 1998 and Scott and Houmard, 1994) suggest that peak running velocity was highly predictive of distance running performance in highly trained endurance athletes. In this study as well, there were anthropometric predictive variable and physical fitness variable, such as, athlete's leg explosive power and their leg length shown significant low relationship with Athlete's personal best time.

Research conducted by Gabbett and Pezet (2007) suggest that while physiological and anthropometric characteristics do not discriminate between successful and less successful rugby

league players, a high level of physical fitness contributes to effective playing ability in these athletes. A game-specific training program that incorporates both physical conditioning and skills training may facilitate a greater transfer of physical fitness to competitive performances in rugby league.

In the same fashion, Maćkała and Antti (2013) demonstrated that Bolt's anthropometric advantage (body height, leg length and liner body) is not questionable and it is one of the factors that make him faster than the rest of the finalists from each three competitions. Additionally, Bolt's 20 cm longer stride shows benefit in the latter part of the race. Despite these factors, he is probably able to strike the ground more forcefully than rest of sprinters, relative to their body mass; therefore, he might maximize his time on the ground and to exert the same force over this period of time. This ability, combined with longer stride allows him to create very high running speed - over 12 m/s (12.05 – 12.34 m/s) in some 10 m sections of his three 100 m performances. This assumption confirmed the application of Ballerieich's formula for speed development. In most 10 m sections of the 100 m sprint, the step length was the parameter that significantly determined the increase of maximal running speed, therefore, distinguishing Bolt from the other finalists.

Professor Steve Harridge of Kings College London quoted "To be a great sprinter you need leg muscles that are dominated by fast-twitch muscle fibres because they shorten the muscle quickly and generate power,"

Recent study shows, athlete's age and leg length and sex were found to be statistically insignificant in determining athlete's athletic performance (Leyk, 2006). In our finding, athlete's age and leg length and sex were found to be statistically insignificant in determining athlete's athletic performance. Since all the athletes were the same in their age. This research investigation will be fruitful and taken into generalization, if the coming researchers incorporate more variables and population for their further investigation. Recent literature suggested by Ben and Boldon (2011) Usain Bolt's long legs give him such an edge, why haven't there been more tall sprinters? Traditionally, height has been seen as a detriment to sprinting. The formula for speed is stride length times stride rate. If the longest legs always won the race, then Yao Ming would have the world record in the 100, and lions wouldn't eat giraffes. Gangly guys, the thinking has always gone, don't win short races because they can't master the smooth form required to generate rapid leg turnover. Sprinters are supposed to be compact and muscular.

Similar findings were suggested by Grant, Brian and Timothy (2011) the values were correlated with the athletes' body masses and heights ($p<0.01$). The results indicated a limited relationship between height and mass with stride rate in the early stages of the run. However, a significant, positive correlation existed between stride length and height at all points from 3 km to the end of the run. Those triathletes who were taller used longer strides.

In contrary other research output revealed by Sharma, Malhotra and Mohd (2012) there was no correlation of tibia length with any of the performances either. The performance of athlete cannot be determined by only evaluating him by his height or body segment length. There are many other factors which play major roles in deciding his performance.

4. Conclusion

An important finding that emerged in this study is that athlete's leg explosive power and their leg lengthshown significant low relationship withAthlete's personal best time. In contrary to our expectations, this research did not find significant relationship with age, height, weight, marital status, muscular endurance, hamstring and low back flexibility and speed.

The study has shown that only leg length of an athlete is explaining 6.2% of athlete's personal best time.This study is confirms that age, height, weight, marital status, leg explosive power, muscular endurance, hamstring and low back flexibility and speed of the athlete did not explain athlete's personal best time.

5. Recommendations

Further research should be done on age, height, weight, marital status, muscular endurance, hamstring and low back flexibility and speed, since they hadinsignificant relationship with athlete's personal best time in our context.

Correspondingly, more research is needed in order to better understand, age, height, weight, marital status, leg explosive power, muscular endurance, hamstring and low back flexibility and speed, in a view of the fact that they did not explain athlete's personal best time.

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