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Physical Fitness Characteristics of Interscholastic Football Teams of Different Ethnic Background and Sporting Performance in Ethiopia

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ABSTRACT

*The purpose of this study was to measure and compare physical fitness parameters of Interscholastic Football teams participating in schools' sports competition at national level from different States and ethnic groups of Ethiopia. Study groups (Aksum-TG, Hossana-HD, Jimma-OR, Gondar-AM, Sodo-WL, Gambella-GM, and Jigjiga-SM) were selected based on ethnic and demographic characteristics using stratified random sampling technique. Published table of sample size for ±5% precision levels where confidence level is 95% was used to determine sample size. A total of (N=140) one hundred forty participants with mean age 19.77 and Std. deviation ±1.121 were tested. All the twenty (20) footballers in each team were participated in the study. A total of four variables were assessed both in the exam room and in the field. Agility and Speed (**AgSp**) was assessed using a 20m-Agility-Shuttle Test from a stationary start and the maximum time scored using Standard Stop Watch. To assess Upper Body Muscle Strength and Endurance (**UMSE**), Cadence (90^o Push-Up) Test was administered using audio cadence provided by cooper institute. The Vertical Jump was an excellent measure of lower body power administered to assess hip and leg Explosive Power (**EPw**). To measure lower Back and Hamstrings Muscles Flexibility (**BAHMF**), Sit-and-Reach Test was given. SPSS; version 20.0 was used for the data analysis. To compare means differences, One-Way Analysis of Variance ("F" Ratio) was applied. To test the significant mean difference LSD Post Hoc Test was applied. The level of significance was set at 0.05. The results indicated that on all variables, significant difference were found where Aksum-TG, Hossana-HD, and Jimma-OR showed superior performances followed by Gondar-AM and Sodo-WL. Gambella-GM and Jigjiga-SM were the least performers on the Tests provided. It has been concluded from this study that difference in physical performance exist among ethnic groups supporting similar results of recent studies (Institute of Medicine, 2012; Roos and Roos, 2012). The researcher recommended further investigation involving more physical fitness dimensions and large samples size.*

Key Words: *Physical Fitness, Ethnic Groups, Interscholastic Team*

INTRODUCTION

Physical fitness refers to the organic capacity of the individual to perform the normal task of daily living without undue fatigue having reserve of strength and energy available to meet satisfactorily any emergency demands suddenly placed upon him (Meswaniya, 2012).

Physical fitness is used broadly to mean the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy remaining to enjoy leisure-time pursuits and to meet unusual situations and unforeseen emergencies. The expression "Physical Fitness" is used nowadays to describe a person's ability to utilize the machinery of his body in sports and exercise (Council of Europe, 1983).

Physical Fitness relates to a set of attributes that provide the individual with the ability to perform physical activity. It is imperative that these terms are used correctly in the Field of exercise science (Birch et. al, 2005).

Fitness is important at all levels of the game, whilst being essential for top level players; it is beneficial for beginners who will improve both their effectiveness and enjoyment through good standards of fitness. Fitness enables a player to cope with the physical demands of the game as well as allowing the efficient use of his various technical and tactical competencies throughout the match (Meswaniya, 2012).

Physical fitness is a vital one for the sports excellence. In general physical fitness level of higher performer is higher in comparison with low performers (Rathnamma and Gandhi, 2014). Clearly, physical fitness is one of the main factors for an athlete's success. It has been shown that a high level of the elements of physical fitness such as cardiovascular endurance, muscular strength and endurance, flexibility and speed is useful and effective in achieving success in different sports. Nowadays, before being sent to competitions, teams are given a test for the evaluation of the physical status of their members **(**Zar et. al., 2007). The performance of a sportsman in any game or event also depends on muscular strength, agility, power, speed and cardiovascular endurance. Along with these physical variables, physiological and psychological components also play an important role in the execution of the performance (Gaurav et al., 2011).

The effectiveness of many physical performances is related to various basic traits found in boys and girls including their maturation, body size, and physique type. Many of these traits are related to heredity; others, such as body weight have hereditary implications, may also be

affected environmental influences, including the nature and amount of exercises, nutritional practices and health habits (Mazumdar et. al., 2012).

Physical fitness is categorized into specific (skill-related) and general (health-related) fitness (Patel and Datta, 2014). The former includes agility, balance, coordination, speed, power, and reaction time. The latter includes Cardio respiratory endurance, body composition, and musculoskeletal fitness, which includes flexibility, muscular strength, and muscular endurance (Nieman, 2011). Skill-related fitness components are assessed with performance measures. Such components as reaction time and speed are considered by some to be more related to heredity than healthy lifestyles, especially in children (President‘s Council on Physical Fitness and Sports 2010).

Motor fitness factors are estimated by measures of success. These factors, such as speed, vary over inherited predisposition rather than healthy lifestyles, especially among children (Ruiz et al., 2009 as cited in Cvejić et. al., 2013). Studies have shown that physique and certain performance capacities are inherited and genetically established. Analysis of the physical development of young athletes has shown that a particular physique depends, besides morphological characteristics, also on the activities performed during the developmental years (Aule and Loko**,** 1982).

METHOD AND MATERIALS

For data collection first permission was taken from respective sources. All the necessary information about the study (purpose, procedures, etc.) was explained for the participants in advance. Consent Form and Physical Activity Readiness Questionnaire (PAR-Q) were prepared and administered including items recommended by ACSM and Canadian Society for Exercise Physiology (David Nieman, 2011). Consent was obtained from the participants by filling every requirement explained in the consent form and having signed, they returned it back. Participants were reported to join the Fitness Exam Room for the measurement of physical fitness parameters. But for vo_{2max} and Agility and Speed, *Multistage 20-M Shuttle Run Test* and a *20-M Sprint Test* were administered outside the exam room (field) respectively. The tests were administered after pretest screening for health purposes using the PAR-Q and consent obtained.

Having experts, instruments for measuring purposes, and facilities, light warming up exercises were done and necessary data were collected using standardized procedure by administering

physical fitness tests already selected. Taking Canadian Physical Activity, Fitness & Lifestyle Appraisal (CPAFLA) and young men's Christian association (YMCA) recommendations into consideration, tests were administrated in proper sequences as planned in a way that participants can accomplish comfortably. Standardized equipments were used for the tests. All the tests were conducted with the approval of Institutional Review Board (IRB) of Aksum University, Aksum, Ethiopia.

The physical fitness tests chosen for this study were selected based on their suitability, ease of administration, access to equipment, reliability and validity. As recommended by various Fitness Testing Programs test administration tips were followed while conducting the research.

To standardize the testing procedure and ensure accuracy and reliability of the tests and measurements, the following conditions were controlled during test administration:

Preparation for each test included instructions and practice in pacing and techniques for heart rate monitoring;

A warm up exercises were given thoroughly before performing physical fitness tests for about 5-10 minutes of light aerobic exercise followed by stretching to the entire major muscle groups;

The order of the fitness tests was kept. Short tests were given first and then accordingly;

Tests and measurements were done in similar environmental conditions to avoid technical error.

The same equipments were used throughout the testing schedule making sure it is properly calibrated before each testing session;

The tests measurements were taken with the same examiner;

Participants were advised to take meal before three hour of the test administration;

Tests were conducted in accordance with the Presidential Youth Fitness Program (PYFP, 2013) and Fitness gram /Activity gram Reference Guide (Welk and Meredith, 2008). Agility was assessed using a ***20m Agility Shuttle Test*** from a stationary start and the maximum time scored using standard stop watch. To assess Upper body muscle Strength, ***Cadence Push-Up Test*** was administered using audio cadence provided by cooper institute. The ***Vertical Jump Test*** was an

excellent measure of lower body power (hip and leg explosive power) and it was administered for the athlete to perform with a low-risk of injury. To measure lower back and hamstrings flexibility, ***Back-Saver Sit-and Reach Test*** was performed.

Techniques of Data Analysis and Interpretation

The Statistical Package for the Social Sciences (SPSS; version 20.0) was used for the data analysis. To compare mean difference on selected attributes and variables between different groups, *One-Way Analysis of Variance, ANOVA* ("F" Ratio) was used. To test the significant means differences *LSD Test* was applied. The level of significance was set at 0.05. Descriptive statistics such as mean and standard deviation were analyzed to describe the physical characteristics of the study subjects.

The results concerning the significant mean difference on the physical fitness parameters between different interscholastic football teams were analyzed using one-way analysis of variance (ANOVA) and presented as follows.

Table 1: Demographic Characteristics of the Groups

As presented in the table 1**,** Participants were at the mean age of 19.77 with Std. Deviation ± 1.121 which seems they were at a proper schooling age level except some ethnic groups/regions from which schooling starts lately. All study subjects completed the tests safely.

Table 1: Agility and Speed (AgSp)

ANOVA					
AgSp (sec)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.866	6	2.978	2.971	.009*
Within Groups	133.277	133	1.002		
Total	151.143	139			

**p significant at 0.05*

Table 1, indicated significant difference for the Agility and Speed (AgSp) between groups. But in between some groups no significant mean difference found. The result from the *20m Shuttle*

Run Test suggests that Hossana-HD and Jimma-OR performed the test in a shortest time than those groups (Jigjiga-SM, Gambella-GM and Gondar-AM). On the same test for AgSp Sodo-WL demonstrated better performance completing the task in a shorter time than Jigjiga-SM. It was almost same performance between some groups (Aksum-TG, Jigjiga-SM, Gambella-GM and Gondar-AM) since no significant mean difference was found. See figure 1 below, Graphic representation portrays performance differences in agility and speed between groups

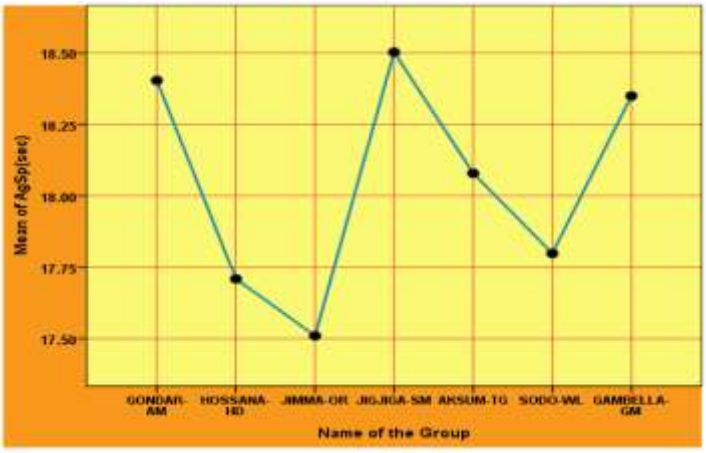

Figure 1: Graph of Mean values for Agility and Speed (AgSp) between Groups

Table 2: Back and Hamstring Muscles Flexibility (BAHMF)

ANOVA					
BAHMF (cm)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2828.371	6	471.395	8.056	.000*
Within Groups	7782.100	133	58.512		
Total	10610.471	139			

**p significant at 0.05*

Results from table 2, showed significant difference between groups for BAHMF since calculated "F" ratio is greater than tabulated "F" value at 5% level of significance. *LSD Post Hoc Tests* applied to test significance of mean difference between groups revealed that Aksum-TG had demonstrated highest mean difference in comparison with the other groups followed by Gondar-AM, Jigjiga-SM, Hossana-HD, Sodo-WL and Jimma-OR as compared to Gambella-GM, where

it showed the least means difference on this variable. But between other groups no significant differences demonstrated. The result suggests that lower body muscles such as lumbar muscles, hamstring muscles, etc were highly flexible for Aksum-TG than its counterparts. Contrary, these muscles were less flexible for Gambella-GM than Aksum-TG, Gondar-AM, Jigjiga-SM, Hossana-HD, Sodo-WL and Jimma-OR. But for some groups the degree of flexibility of back and hamstring muscles was in the same extent. The results implied that it is in agreement with the previous studies that there are differences in flexibility based on gender and ethnicity. Results of the Georgia survey also suggest differences by race/ethnicity (Institute of Medicine, 2012). See figure 2, Mean difference for flexibility between groups depicted graphically below.

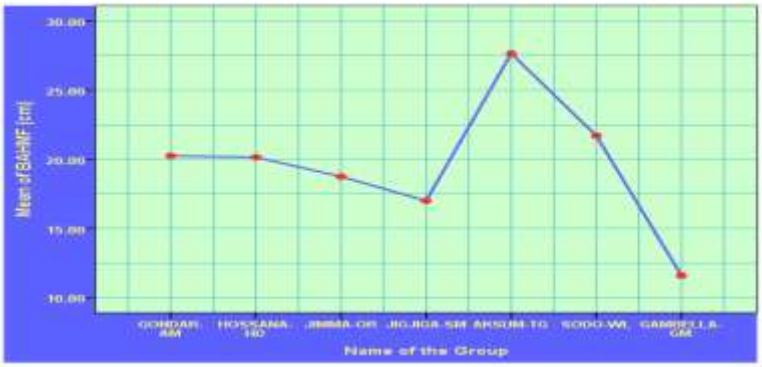

Figure 2: Graph of Mean values for BAHMF between Groups

Table 3: Explosive Power (EPw)

ANOVA					
EPw (cm)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	869.962	6	144.994	2.952	.010*
Within Groups	6532.991	133	49.120		
Total	7402.952	139			

**p significant at 0.05*

Table 3, depicted that there was significant difference between groups for Explosive Power (EPw). Aksum-TG, Gondar-AM, Sodo-WL, and Jimma-OR demonstrated higher mean difference on the EPw compared to Jigjiga-SM. In contrast, Jigjiga-SM showed the least mean difference as compared to these groups. But Hossana-HD and Gambella-GM did not show significant mean difference as compared to other groups. Only Jigjiga-SM was able to jump to

reach less vertical height than Aksum-TG, Gondar-AM, Sodo-WL, and Jimma-OR. In another word, Aksum-TG, Gondar-AM, Sodo-WL, and Jimma-OR were able to reach farther height than Jigjiga-SM. Mean difference on *Vertical Jump Test* for EPw shown graphically below (Figure 3).

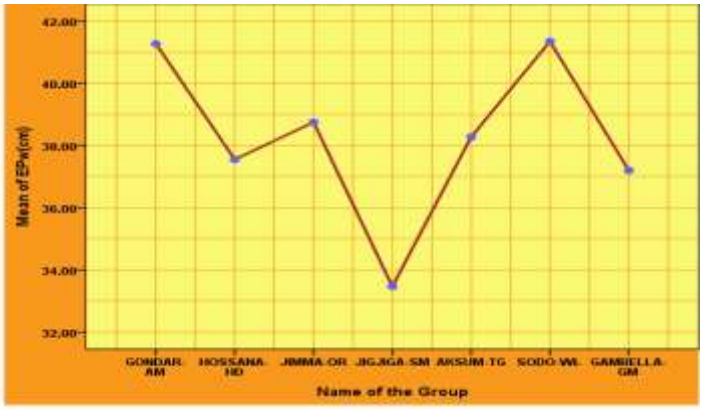

Figure 3: Graph of Mean values for EP_W between Groups

Table 4: Upper Muscles Strength and Endurance (UMSE)

ANOVA					
UMSE(#push up)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2007.300	6	334.550	4.828	.000*
Within Groups	9215.350	133	69.288		
Total	11222.650	139			

**p significant at 0.05*

As shown in the table 4 above, ANOVA showed significant difference for UMSE between groups in which calculated "F" Ratio was 4.828 whereas tabulated "F" value was 2.17 at 0.05 level of significance (i.e. calculated F ratio is greater than tabulated "F" value). The results obtained from *LSD Post Hoc Tests* indicated that Aksum-TG, Gambella-GM, Gondar-AM, Hossana-HD, Sodo-WL, and Jimma-OR demonstrated higher mean difference than Jigjiga-SM. In another way, the least mean difference found for Jigjiga-SM compared to the rest groups. No significant mean difference obtained between some other groups. On the *90^o Push-Up Test administered to assess* upper muscles strength and endurance, Aksum-TG, Gambella-GM, Gondar-AM, Hossana-HD, Sodo-WL, and Jimma-OR completed the task successfully than Jigjiga-SM. As it was scored in EPw, Jigjiga-SM showed similar poor performance on this test.

See figure 4 below, Graphic representation which portrays performance differences in Upper Muscles Strength and Endurance between groups.

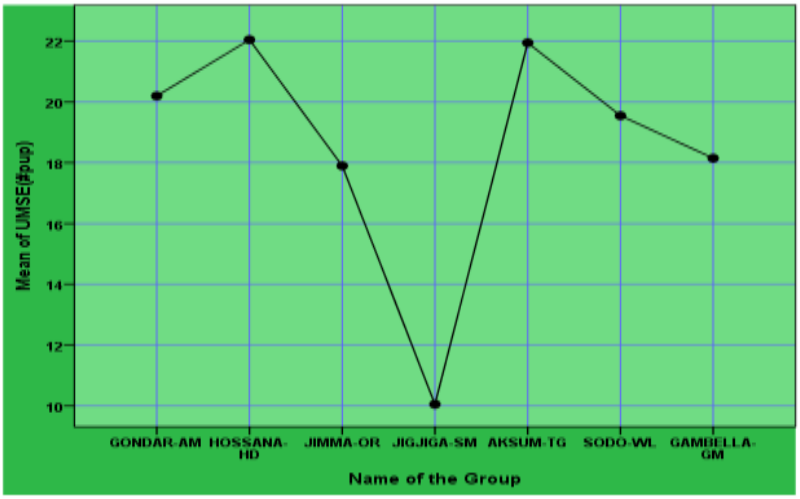

Figure 4: Graph of Mean values for UMSE between Groups

RESULTS AND DISCUSSIONS

The identification of physical characteristics in a sport modality contributes to its success and enables to spot differences among athletes of different modalities, which is of great interest for both sport coaches and scientists Jeyaraman et al. (2012) and Irving et. al (2013) explained that no study has attempted to trace the ethnic or environmental background of world class athletes by demographics determine the possibility that they might share a common ethnic or environmental origin. Taking this into account, the purpose of this study was to test and compare physical fitness parameters of interscholastic football teams in terms of ethnicity and geographic distribution. Study groups selected from different ethnic and environmental condition completed four Physical Fitness Tests administered: *20m-Shuttle Run Test for* Agsp, *Sit-And Reach Test* for BAHMSF, *Vertical Jump Test* for EPw, and *90^{o} Push-Up Test* for UMSE. Significant difference demonstrated for all variables but in between some study groups no differences in performance observed. The significant mean difference was revealed by applying *LSD Post Hoc.*

Agility is critical in any sport that requires rapid changes in direction, deceleration, and acceleration, such as basketball, football, and gymnastics (Wood, 2011). The result obtained on agility and speed (Agsp) from the *20m Shuttle Run Test* suggests that Hossana-HD and Jimma-OR performed the test in a shortest time each than those groups (Jigjiga-SM, Gambella-GM and

Gondar-AM). On the same test for Agsp Sodo-WL demonstrated better performance completing the task in a shorter time than Jigjiga-SM. It was almost same performance between Aksum-TG, Jigjiga-SM, Gambella-GM and Gondar-AM since no significant mean difference was found.

The other variable tested was back and hamstring muscles flexibility (BAHMF). Flexibility is of high importance for diving, but low to moderate for long distance speed skating. Gymnastic events require substantial joint flexibility (Wood, 2011). The result implied that lower body muscles such as lumbar muscles, hamstring muscles, etc were highly flexible for Aksum-TG than its counterparts as Aksum-TG had demonstrated highest mean difference in comparison with the other groups. Contrary, these muscles were less flexible for Gambella-GM than Aksum-TG, Gondar-AM, Jigjiga-SM, Hossana-HD, Sodo-WL and Jimma-OR since it showed the least mean difference for the same variable. But for some groups the degree of flexibility of back and hamstring muscles was same as there was no significant difference demonstrated. The results suggest that it is in agreement with the previous studies that there are differences in flexibility based on gender and ethnicity (Institute of Medicine, 2012). Aksum-TG, Gondar-AM, Sodo-WL, and Jimma-OR demonstrated higher mean difference for EPw compared to Jigjiga-SM. In contrast, Jigjiga-SM showed the least mean difference as compared to these groups except for Hossana-HD and Gambella-GM about which no significant means difference obtained.

Explosive skills require power fitness, which involves exerting force with marked acceleration. Olympic lifting and shot putting are examples that show a rapid rate of force development (Wood, 2011). In this study hip and leg explosive power (EPw) of each group was tested. Only Jigjiga-SM was able to jump to reach less vertical height than Aksum-TG, Gondar-AM, Sodo-WL, and Jimma-OR while between Hossana-HD and Gambella-GM other groups no mean difference demonstrated. In another word, Aksum-TG, Gondar-AM, Sodo-WL, and Jimma-OR were able to reach farther height than Jigjiga-SM. Performance is likely to result from a combination of many factors including genetics, but also skill level, work ethic, environmental factors, and history of training and conditioning **(**Roos and Roos, 2012).

On the *90^o Push-Up Test administered to assess* upper muscles endurance and strength (UMSE), Aksum-TG, Gambella-GM, Gondar-AM, Hossana-HD, Sodo-WL, and Jimma-OR completed the task successfully than Jigjiga-SM as they demonstrated mean difference higher than Jigjiga-SM. Jigjiga-SM showed similar poor performance on this test where least mean difference was found

for it. These upper muscles such as biceps, triceps, pectoralis, deltoid, etc are critical in many sports, including football, basketball and track and field (Sree, 2013). On all of the Tests administered, significant differences observed for all variables between interscholastic Football teams from different ethnic and geographic location. Aksum-TG, Hossana-HD, and Jimma-OR showed superior performances followed by Gondar-AM and Sodo-WL. Gambella-GM and Jigjiga-SM were the least performers on the Tests provided.

It was hypothesized that there will be no significant differences in physical fitness between interscholastic football teams in relation to ethnicity and demographics. Analyzing raw data using analysis of variance (ANOVA), *LSD Post Hoc* test was applied to test the significant mean difference in order to prove the hypothesis already stated. The findings of this study clearly indicated that at 5% level of significance, there is enough evidence to support the claim that there were statistically significant differences obtained on all physical fitness variables between interscholastic football team of different ethnic groups since "F" calculated is greater than "F" tabulated value; this is enough evidence to reject the null hypothesis. In concluding the results, differences resulted in physical performance across ethnic groups.

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