IMPACT OF AEROBIC AND ANAEROBIC FIELD TESTS ON PHYSICAL FITNESS OF UNIVERSITY LEVEL FEMALE ATHLETES

Comment [f1]: Need to revise

ABSTRACT

Background: Success in team sports requires psychological and physical well-being as well as fine motor skills, tactical qualities, style of play, individual and team motivation. Of the determinants that affect athletic performance, fitness may be the most important.

Objectives: This study was conducted to analyze the impact of aerobic and anaerobic fitness on physical fitness of female athletes.

Methodology: This study was aimed to analyze the impact of aerobic and anaerobic fitness on physical fitness of female athletes. The null hypothesis was formulated as "there will be no significant impact of aerobic and anaerobic fitness of female athletes". The study employed experimental research design in which only female players of two different universities took part. Stratified Random sampling technique was employed to recruit participants in the study. Demographic data and physical health status were collected through questionnaire and an equal number of participants were allocated to control group (n=52) and experimental group (n=52). The training program was started with pre-test and training was implemented for three times a week for 8 weeks followed by post-test of all the physical tests. Mean comparisons were done under descriptive analysis and Multivariate Analysis of Variance was done for hypothesis testing.

Comment [f2]: Need to edit and revise

Results Mean comparisons were made for different variables including age (M=20.86, SD=1.42), (M=20.92, SD=1.46); height (M=164.19, SD=9.04), (M=164.19, SD=9.04); weight (M=54.55.86, SD=.67), ((M=54.55, SD=.67); cardiorespiratory endurance (M=1.09, SD=.21), (M=1.02, SD=.04), muscular strength (M=1.50, SD=0.67), (M=2.10, SD=0.99); flexibility (M=9.39, SD=4.14), (M=13.18, SD=5.13); speed (M=1.03, SD=.09), (M=1.16, SD=1.14), agility (M=13.92, SD=1.81), (M=13.36, SD=1.81), muscular endurance (M=30.66, SS=8.13), (M=36.35, SD=9.61); aerobic fitness (M=12.90, SD=1.89), (M=13.55, SD=2.25) anaerobic fitness (M=13.90, SD=1.70), (M=14.54, SD=2.05); physical fitness (M=42.97, SD=4.57),

(M=49.14, SD=8.85); BMI (M=20.12, SD=3.32), (M=20.10, SD=3.31) for control and experimental group respectively. Multivariate analysis of variance indicated a significant impact of aerobic fitness on physical fitness of female athletes (p=0.000, CI=95%) and a significant impact of anaerobic fitness on physical fitness was also found (p=0.014, CI=95%).

Key words: *Aerobic, Anaerobic, Physical Fitness, 20 M Shuttle Run Test, Speed, Agility, Power, Strength*

Introduction

Success in team sports requires psychological and physical well-being as well as fine motor skills, tactical qualities, style of play, individual and team motivation. Of the determinants that affect athletic performance, fitness may be the most important as reported by Argiriou, (2014). Physical fitness (PF) is defined as the "ability to perform daily activity with vitality and acuity, without undue fatigue, being able to appreciate the interests of leisure time and cope with unforeseen emergencies" as explained by Gamble, (2011). It is the combination of health and skill related aspects of PF that is imperative in shaping people in sports or games. Basketball and netball are two competitive sports, which require a high degree of PF for an easy and efficient execution of the technical and tactical skills.

Comment [f3]: Style of reference ?

The health-related components of PF are body composition, cardiorespiratory fitness, flexibility, muscular strength, and muscular endurance. Motor potential for physical activity in terms of speed, agility, power, balance, coordination, and reaction time is described by skill-related PF. As with most team sports, there are many components of PF that are important to success in basketball and netball which include speed and agility but so are aerobic and anaerobic fitness. Having a very good level of aerobic fitness is a very important attribute and on the other hand being very fast and agile is also very important (Sinclair, 2020). Player position also affects the relative importance of these fitness components. The following suggested tests reflect this comprehensive fitness requirement for basketball and netball players.

The shuttle run test would usually be the most appropriate test for testing a basketball or netball teams. There are many other aerobic fitness tests which are also suitable. There are a number of studies that have reported the correlation between running performance and directly measured VO2 max in adolescents as concluded by Althoff, (2017). The most grounded connections happen when the standard run distance is around 1600-2400 m, or for coordinated runs when the standard test term is around 9-15 min (Maruo and Murphy, 2018). Execution on longer distance running tests because an additional time cost for both analyzer and in this way the member. Trial of significant distance or span could even be less plausible and will take away from inspiration, particularly in young athletes (GRIVAS, 2020).

Best case scenario, something like more than 50% of the difference in distance run execution is clarified by VO2 max. Running economy, partial usage, VO2 max energy, lactate limit, anaerobic limit, maximal running rate, fat mass, and psychosocial factors, such as pacing, self-adequacy, and inspiration, have all been related with distance running execution in kids and young people (Zinner, 2016). Besides, unique distance run tests force different physiological and psychosocial requests (Randers, 2017) for instance, factors like VO2 max energy and anaerobic limit are becoming generally more significant for more limited distance runs. The impact is becoming tiny over distances of very a few hundred meters and pinnacle VO2 moderately more significant for broadened distance runs. Distance and planned running tests are profoundly dependable. during an audit of 10 dependability investigations of distance and time running tests, Barr, (2018) revealed an example weighted normal coefficient of assurance as strong as (r=0.80). These data compare favorably to reliability data on criterion measures of aerobic level.

It’s also conceivable that differences within the actual test name like run test or run/walk test could end in differing types of performance. Environmental factors like temperature, humidity, and ground conditions are rarely controlled or reported by testers and are, therefore, likely to extend performance variability (Cazzola, 2016). Distance run performance improves as children grow. Analysis of data cumulated across 10 studies shows that between the ages of seven and 16 years, there's an age-related improvement of 35% and 21% in 1600-m run performance of boys and girls, respectively. Boys’ performance continues to enhance until about the age of 15 years whereas girls’ performance stabilizes around the age of 13 years (Tønnessen, 2015). But the explanations behind age-related performance improvement are unclear. Examination of age-related changes in factors which underscore distance run performance may provide some clues. While VO2 max explains a moderate to a large proportion of distance running performance by cross-sectional studies little insight compared to longitudinal studies (Joyner, 2017).

The reviews of Armstrong (2019) indicated that as children grow, mass-specific VO2 max remains relatively stable in boys and declines by about 30% in girls. On the opposite hand, cross-sectional and longitudinal studies examining the level of running efficiency in children indicated that older children were more efficient than the younger ones. This suggests that older children can perform longer at an equivalent speed, or faster over an equivalent distance. Another answer may roll in the hay fractional utilization. Barnes, (2015) reported that the 9-min running performances of older boys were partly explained by their better ability to sustain a better fraction of VO2 max.

The test comprises of an assortment of stages and additionally called levels, each going on around 1 min and containing an assortment of 20-m laps, paced by signals on a tape (Welsman, 2019). At each stage, the predefined running pace increments, until the member can't arrive at the 20-m distance on signal. Each stage incorporates at least seven laps, depending on the predefined running rate and accurate convention utilized as reported by Kolimechkov, (2018). The test has been demonstrated to be a solid and substantial technique for assessing VO2 max in youngsters and teenagers.

Sprint running tests ranging from 20 to 100 m have been described, with 30–50-m sprints the most commonly used to measure anaerobic fitness (Haugen, 2019). Generally, sprint running tests can not only be performed outdoors on a grass field or a running track but can also be performed indoors, provided there is sufficient room for the sprint run and post-run braking (Verschuren, 2014). It is common for the sprint run to be performed only once, using a standing start, with the time taken recorded to the nearest 0.01 s. While few studies have reported on the validity and reliability of sprint running tests, general face validity has been accepted. Verschuren, reported a very high correlation between peak power measured on a cycle force–velocity test and 30-m sprint performance in 7- to 12-years old boys and girls,

Like any other field test, sprint's performance depends heavily on the test method used. Although the common procedure for all field tests is outlined above, the performance of the spirits is particularly affected by differences in recording methods, scoring methods, and sprint starting position (Attene, 2016). Consider the differences in recording methods first. Traditionally, handheld stop watches have been used to record sprint times, but in recent years, the popularity of electronic timers has grown. Limmer (2018) reported that the correlation between electronic and stopwatch times in 37-m sprint performance of basketball players was nearly perfect (r = 0.98) and it was also reported by Haugen, (2019). The effect of this will be quantitatively larger for shorter sprint runs (Larsen, 2015). This difference might account for as much as 10 percentile points (Healy, 2016). Second, despite that most test protocols recommend scoring sprint performances based on a single sprint, some protocols recommend the use of multiple trials. It is, therefore, conceivable that differences in scoring methods could lead to systematic differences between performances. However, data from several reliability studies of the 46-m sprint show no practice effect. Third, while it is conceivable that differences in starting positions could systematically affect sprint performances, no quantifiable data are available ((Erkol, 2019).

Literature Review

Comment [f4]: Not need

A few studies on the quality and legitimacy announced an example weighted normal coefficient of assurance of (r=0.51) for legitimacy comparative with straightforwardly estimated VO2 max (Leger, 1989: Liu, 1992; Aandstad, 2011). Today, the 20mSRT is the preeminent generally utilized OCA preliminary with kids and youngsters. Comparative with distance and time based running tests, the 20mSRT offers a few benefits. These benefits were depicted by Wlsman in 2019, which included right off the bat, the running course for the 20mSRT is more limited; subsequently, less space is required; besides, the 20mSRT is regularly directed inside, where the natural conditions (for example temperature) are frequently more handily controlled; thirdly on the grounds that the 20mSRT is remotely paced, mental parts of maximal require execution are more averse to be significant lastly, members are regularly more firmly checked by testing staff.

Furthermore, there are frequently a few distinct tapes utilized for a comparable convention. Strategic minor departure from these tapes (for example calling the stage number toward the start versus the completion of each stage; utilizing just entire minutes versus both entire minutes and half minutes to point finished stages) implies indistinguishable exhibitions are accounted for in more than one way (Kolimechkov 2019). Also, the variety in conventions, there has been variety in how results are accounted for. Individual outcomes are accounted for in light of the quantity of finished stages, the running pace at the last finished stage, the quantity of finished laps, the quantity of minutes the test endured, or as an expected VO2 max upheld relapse conditions (Mora-Gonzalez 2017) to constrict systemic fluctuation, analysts suggest the usage of single-test convention (for example Leger's unique convention), or at least that the convention utilized ought to be precisely announced, which 20mSRT exhibitions ought to in a perfect world be communicated as running velocity at the last finished 1-min stage.

World percentile positions for the 20mSRT at the last finished 1-min stage among solid 9-to 19-year-old young men and young ladies (Domone, 2016). The 20mSRT information were gathered utilizing the 1-min stage convention normalized to Leger's convention on 418,000 youngsters from various nations somewhere in the range of 1981 and 2003. Higher percentile esteems address predominant 20mSRT execution (Buchan, 2018). Over the 1981-2003 period, pediatric 20mSRT exhibitions declined around the world at 0.48% onetime per year. It is, consequently, probable that these information, with a middle estimation in the year of 1999, would misjudge 20Msrt exhibitions in 2007 by roughly 4% as reported by Yang, (2019) like distance run exhibitions, 20mSRT exhibitions improve as youngsters develop, albeit the advancement is fairly less for 20mSRT execution than for distance run execution (Casado, 2019). Between the ages, young men's 20mSRT exhibitions improved by around 30%, expanding per annum matured until 19 years. In young ladies, the age-related improvement is a more modest sum than half as extraordinary as 13%, with execution settling from about the age of 15 years (Welsman, 2019).

Sprint running tests have generally been utilized as a proportion of maximal running rate, and accordingly they are remembered to respond brief span, maximal-force anaerobic power (Altmann, 2019). Instinctively, this seems OK, in light of the fact that the term of the most regularly utilized runs running tests is commonly not exactly around 12 s, leaving exhibitions profoundly reliant upon anaerobic energy sources as announced by Haugen, (2019). Run running tests are exceptionally simple to manage and can be performed with negligible hardware, inside or outside, and in brief period. Running, such as hopping, is a characteristic movement for youngsters and youths and is regular of numerous athletic undertakings as concluded by Kliszczewicz, (2016). Nonetheless, considering that power is the result of power and speed, run running tests can't be viewed as a genuine power test on the grounds that the power part isn't estimated.

Information for the world percentile positions for the 50-m runs among sound 7-to 18-year-old young men and young ladies were gathered utilizing a similar convention like stopwatch-planned runs from a standing beginning on youngsters and youths from nine nations somewhere in the range of 1980 and 2003 (Padulo, 2016). Higher percentile esteems address unrivaled run running execution. Over the 1980-2003 period, pediatric run running exhibitions declined all around the world at - 0.05% p.a. It is, accordingly, possible that these information, with a middle estimation year of 1990, would misjudge 50-m run running exhibitions in 2007 by roughly 0.9% (Tottori, 2019).

Numerous other factors, such as stride length itself a function of increases in body size, force production, muscle strength, muscle fiber typing, and neural factors, have also been implicated (Tieland, 2018). Furthermore, while sprint running is highly dependent on anaerobic energy supply, adult data suggest that anaerobic capacity is not rate limiting. Therefore, it appears that physical factors, rather than metabolic factors, are primarily responsible for the age-related performance improvements.

Methodology

Comment [f5]: Materials and method instead of that

This study was aimed to analyze the impact of aerobic and anaerobic fitness on physical fitness of female athletes. The null hypothesis was formulated as "there will be no significant impact of aerobic and anaerobic fitness of female athletes". The study employed experimental research design in which only female players of two different universities took part. Stratified Random sampling technique was employed to recruit participants in the study. Demographic data and physical health status were collected through questionnaire and an equal number of participants were allocated to control group (n=52) and experimental group (n=52). The training program was started with pre-test and training was implemented for three times a week for 8 weeks under direct supervision of trained coaches. Scoring of each training session for each participant for all the tests were recorded and post-test was carried out after 8 weeks of training. Aerobic fitness was measured through 20 meter shuttle run test. Whereas anaerobic fitness was measured through agility and speed tests. Mean scores of all the fitness tests were calculated to determine physical fitness of the participants. Their BMI was also calculated as one of the components of physical fitness. Mean comparisons were done under descriptive analysis and Independent Samples T-Test was done for hypothesis testing at 95% CI.

Results

Mean comparisons were made for different variables including age (M=20.86, SD=1.42), (M=20.92, SD=1.46); height (M=164.19, SD=9.04), (M=164.19, SD=9.04); weight (M=54.55.86, SD=.67), ((M=54.55, SD=.67); cardiorespiratory endurance (M=1.09, SD=.21), (M=1.02, SD=.04), muscular strength (M=1.50, SD=0.67), (M=2.10, SD=0.99); flexibility (M=9.39, SD=4.14), (M=13.18, SD=5.13); speed (M=1.03, SD=.09), (M=1.16, SD=1.14), agility

(M=13.92, SD=1.81), (M=13.36, SD=1.81), muscular endurance (M=30.66, SS=8.13), (M=36.35, SD=9.61); aerobic fitness (M=12.90, SD=1.89), (M=13.55, SD=2.25) anaerobic fitness (M=13.90, SD=1.70), (M=14.54, SD=2.05); physical fitness (M=42.97, SD=4.57), (M=49.14, SD=8.85); BMI (M=20.12, SD=3.32), (M=20.10, SD=3.31) for control and experimental group respectively. Multivariate analysis of variance indicated a significant impact of aerobic fitness on physical fitness of female athletes (p=0.000, CI=95%) and a significant impact of anaerobic fitness on physical fitness was also found (p=0.014, CI=95%). Thus, null hypothesis of this study was rejected.

Table-1

Mean Comparisons of Different Variables

Group		Aerobic Fitness	Anaerobic Fitness	Physical Fitness	BMI
Control	Mean	12.9330	13.9066	42.9704	20.1250
	N	104	104	104	104
	Std. Deviation	1.89992	1.70001	4.57316	3.32594
Experimental	Mean	13.5561	14.5414	49.1468	20.1058
	N	104	104	104	104
	Std. Deviation	2.25054	2.05244	8.85794	3.31492
Total	Mean	13.2445	14.2240	46.0586	20.1154
	N	208	208	208	208
	Std. Deviation	2.10093	1.90666	7.68319	3.31242

Mean differences were observed for aerobic fitness for control group (M=12.90, SD=1.89), and experimental group (M=13.55, SD=2.25); similarly, mean differences were observed for anaerobic fitness for control group (M=13.90, SD=1.70) and experimental group (M=14.54, SD=2.05); and also for physical fitness for control group (M=42.97, SD=4.57) and (M=49.14, SD=8.85) for experimental group; no differences were observed for BMI for control group (M=20.12, SD=3.32) and for experimental group (M=20.10, SD=3.31) as shown in Table-1.

Table-2

Impact of Aerobic and Anaerobic Fitness on Physical Fitness

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Physical Fitness	7304.493[a]	130	56.188	2.697	.000
	BMI	1292.175[b]	130	9.940	.782	.892
Intercept	Physical Fitness	156747.511	1	156747.511	7524.919	.000
	BMI	33079.692	1	33079.692	2601.626	.000
Aerobic Fitness	Physical Fitness	2581.946	52	49.653	2.384	.000
	BMI	273.385	52	5.257	.413	1.000
Anaerobic Fitness	Physical Fitness	1846.235	51	36.201	1.738	.014
Aerobic Fitness * Anaerobic Fitness	Physical Fitness	193.524	8	24.190	1.161	.333
	BMI	116.379	8	14.547	1.144	.344
Error	Physical Fitness	1603.945	77	20.830		
	BMI	979.056	77	12.715		
Total	Physical Fitness	401960.949	208			
	BMI	86434.000	208			
Corrected Total	Physical Fitness	8908.438	207			
	BMI	2271.231	207			

Multivariate analysis of variance indicated a significant impact of aerobic fitness on physical fitness of female athletes (p=0.000, CI=95%) and a significant impact of anaerobic fitness on physical fitness was also found (p=0.014, CI=95%). Thus, null hypothesis was rejected.

Figure-1

Comparison of Control Group and Experimental Group

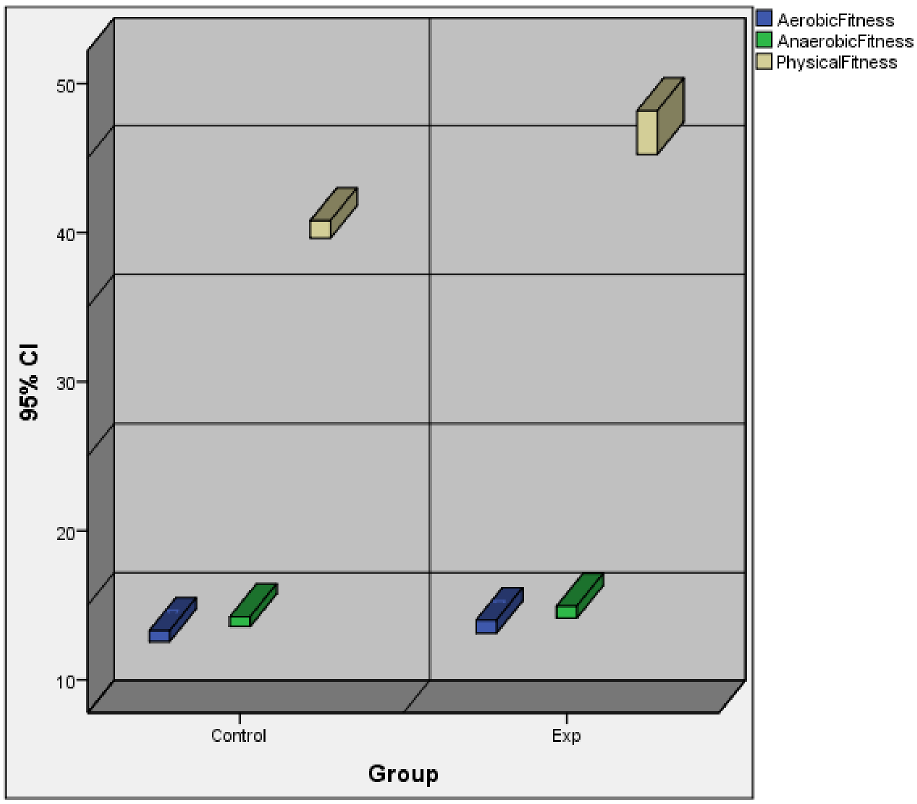

Figure1, indicates a significant impact of 8 weeks training on physical fitness of female athletes.

Discussion

The exercise practice provided change in the regular PA as Haugen, (2019) claims that practicing exercises in a structured environments provides countless benefits to physical and mental health. He states that students who engage in regular involvement in PA are less likely to get into negative lifestyle and present positive results related to PF. Hence, engaging in group level training may promote the adherence to the PA practice and lifestyle changes, consequently preventing diseases associated with inactivity. It was observed in the current study that the regular PA practice increased overall PF in female athletes. Therefore, a structured training plan may be applied as a non-pharmacological way to improve strength and increase power, which results in lowered level of BMI as reported by Larsen, (2015).

Before the intervention, the participants were assessed according to their PF level for cardiorespiratory capacity (M=1.02), muscular strength (M=1.53), flexibility (M=9.89), speed (M=1.02) and agility (M=12.70). After training during 8 weeks, there was an increase in the PF related components as cardiorespiratory capacity (M=1.09), muscular strength (M=2.07), flexibility (M=12.68), speed (M=1.16) and agility (M=13.64). The improvement in PF and cardiorespiratory levels was resulted as a combined effect of aerobic and anaerobic fitness level. Paired sample t-test indicated significant improvement from pre-test to post-test for all the PF related components (p=0.000, CI=95%) which indicates a positive impact of training on PF of female athletes.

Based on the findings, the training was observed to cause an increase in all components of PF and significant differences were found in the PF related components. It was found that aerobic and anaerobic training caused a high level of difference in terms of VO2 max, and thus increased aerobic capacity. Another result from the training program is that, following the exercise period there exists no change in BMI. Randers, (2017) displayed that continuous and interval exercises conducted for three days a week for eight weeks; interval exercises had no impact on BMI. In this study as well, even though positive impacts of aerobic and anaerobic fitness are seen, it holds no influence on BMI. Another study of similar nature, found an increase of 16% statistically relevant and meaningful VO2max levels, following a ten-week exercise with extensive interval method conducted in male basketball players (Buchan, 2018). Present study points towards similar results with an increase of relative VO2max levels. According to another result obtained from present study; it was observed that aerobic training had a positive effect on anaerobic capacity, anaerobic power and the fatigue index. Although aerobic training results in an increase in aerobic capacity of approximately 8%, this increase was not significant. Limmer, (2018) found a 9% increase in the aerobic capacities of the participants following an aerobic exercise program of for months in a study. The same study displayed no difference in BMI. In present study, since the study period was limited to 8 weeks, it was observed an increase in aerobic capacity. In line with these results, it is conceivable that aerobic capacity can be increased with aerobic exercise method through an extended/long exercise program. However, present study displayed no decrease in BMI in contrast of the other study. This discrepancy could have been caused by the utilization of the treadmill exercise, which uses more muscle groups (Sinclair, 2020).

Many other studies indicate aerobic exercise has no meaningful impact on aerobic capacity, and the exercise period of these studies are reported to be between six and eight weeks (Tottori, 2019). Another study of similar nature by Welsman, (2019) reports the benefits of high and low intensity interval exercises carried on for ten weeks on VO2max levels through continuous exercise. When the difference between the posttest pre-test parameters are examined according to the differences between the aerobic and anaerobic training groups; Anaerobic Capacity and Aerobic Capacity values in favor of the anaerobic training group compared to the aerobic training group. According to this result, it can be said that anaerobic training has more effect on both anaerobic and aerobic capacity according to aerobic training.

Conclusion

The results of the study concluded that aerobic and anaerobic field fitness tests significantly improved selected physical fitness variables, cardiovascular endurance, muscular strength, muscular endurance flexibility and agility of the participants with no significant effect on BMI.

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