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Analysis of Physiological Variables on Kerala Premier League Football Players Based on their Geographical Area

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Abstract: “Soccer” has got tremendous attention by the people around the world. Different levels of football leagues are held and Premier League in England, the La Liga in Spain, J-League in Japan and the Serie-A in Italy are some of the famous football leagues. ISL and I-League are some of the famous football leagues in India and Kerala Premier League is one of the professional football leagues in Kerala. Talent identification in league and professional club football were focused on the current performance of the players in Kerala and generally they disregard the parameters that can contribute elite development. According to Bailey and Morley (2006) it is a poor indicator, because it can be influenced by many different factors, such as geographical, physical, physiological, and socio-psychological variables. Hence the study on Analysis of Physiological Variables on Kerala Premier League Football Players Based on their Geographical Area were carried out. The subjects for the study consisted of ninety football players of Kerala Premier League. Thirty each from lowland, midland, and highland areas of Kerala were randomly selected from the teams such as Kerala State Electricity Board, Kerala Police, Titanium, State Bank of Travancore, Cochin Port Trust, Central Excise, Eagles FC and Accountant General. The variables selected for the study were Pulse Test, Beep test, Vital capacity and Blood pressure. Descriptive statistical analysis was done and the result of the study indicated that the geographical area of Kerala had significant effect on physiological variables among Kerala Premier League football players. Significant mean differences were found in the physiological variables of VO_{2max} , Systolic blood pressure, Diastolic blood pressure and Rate pressure product and no difference were found in the resting heart rate and vital capacity among lowland, midland and highland football players of Kerala Premier League.

Keywords: Kerala Premier League football players, Geographical Area, Physiological variables, Pulse Test, Beep test, Vital capacity, Blood pressure

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Introduction

Human development is the product of both heredity and environment. The development pattern of the children is determined by both heredity and environment. The essential characteristics inherited by all human beings are physical structure, reflexes, innate drives, intelligence, and temperament. Some biologists who claim that the difference in the traits or qualities of individuals or groups are due to the difference in their heredity. But there are others who explain that the variations of human beings and the societies are due to differences in environment (Krout, 1931). We are all born with specific genetic traits inherited from our parents, such as eye color, height, and certain personality traits. Beyond our basic genotype, however, there is a deep interaction between our genes and our environment: our unique experiences in our environment influence whether and how particular traits are expressed, and at the same time, our genes influence how we interact with our environment (Lobo and Shaw, 2008; Diamond, 2009). There is a reciprocal interaction between nature and nurture as they both shape who we become, but the debate continues as to the relative contributions of each.

So human beings have unique potentials at different places because growth is the result of continuous action of several geographical factors on the genetic potentials. The geographical conditions like different terrains, food habits, nature of work and living conditions, culture etc., make the human organism to adjust the self-condition that tend to alter normal size, shape, fitness, physiology and psychology.

“Soccer”, internationally known as football, which has got attracted more attentions by the people around the world. FIFA World Cup, Continental championships, League tournaments etc. made the game very famous. It is widely accepted that a scientific approach has to be applied for selecting potential players and training them for better performance. For International teams, players have been located scientifically by the expert team from the field of

sports and sports sciences. Therefore, during last thirty years or so a relationship has been grown between football and sports sciences.

Different levels of football leagues were held in the world. The Premier League in England, the La Liga in Spain, J-League in Japan and the Serie-A in Italy are some of the famous football leagues. ISL (professional) and I-League (domestic) are some of the famous football leagues in India.

Kerala Premier League is one of the professional football league organized by Kerala Football Association (KFA). Clubs participating in Kerala Premier League are Premier Tyres Kalamassery, Cochin Port Trust, Alind Kundara, Eagles FC, KSRTC, AG's Office, Young Challengers, Kerala XI, Titanium, Kerala Police, Kerala State Electricity Board, Central Excise and F. C. Cochin. The winner of this league tournament will take part in the I-League (National League Championship).

Talent identification in league and professional club football, including all age levels, focused on current performance of the players in Kerala and generally they disregard the parameters that can contribute elite development. According to Bailey and Morley (2006) it is a poor indicator, because it can be influenced by many different factors, such as geographical, physical, physiological and socio-psychological variables. Moreover, researchers agree that there is not a single type of factor leading to success, nor there is a model that could fit all countries or be applied to all sports (De Bosscher *et al.*, 2006). In this study Analysis of Physiological Variables on Kerala Premier League Football Players Based on their Geographical Area were carried out.

Materials and Methods

The subjects for the study consisted of ninety (n = 90) football players of Kerala Premier League. Thirty each from lowland, midland and highland areas of Kerala (Table 1). They were randomly selected from Kerala State Electricity Board, Kerala Police, Titanium, State Bank of Travancore, Cochin Port Trust, Central Excise, Eagles FC and

Accountant General. Players were then categorized into lowland, midland and highland based on their birth place located in a particular town. The tests were administered in three days by testing each variable per day in a different schedule of selected clubs and administered each subject separately based on the procedures given below (Table 2):

Pulse Test: The pulse rate of all the subjects were recorded in a sitting position in the morning. The subjects were asked to sit in the chair and relax for 15 min. Pulse oximeter was attached to player's middle finger and detected the pulse. 1 min pulse rate was recorded.

Beep test: To obtain VO_{2max} beep test administered. This test involves continuous running between two lines 20 m apart in time to recorded beeps. The participants stand behind one of the lines facing the second line, and begin running when instructed by the recording. The speed at the start is quite slow. The subject continues running between the two lines, turning when signaled by the recorded beeps. After about 1 min, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is reached before the beep sounds, the subject must wait until the beep sounds before continuing. If the line is not reached before the beep sounds, the subject is given a warning and must continue to run to the line, then turn and try to catch up with the pace within two more 'beeps'. The subject is given a warning the first time they fail to reach the line (within 2 meters), and eliminated after the second warning.

VO_{2max} obtained from multistage fitness test table.

Vital capacity: Vital capacity was measured with the help of wet spirometer. It was ensured that the pointer of the scale was at the zero mark at the beginning of the test. The subject took a deep breath before starting the test and then after the fullest inhalation the subject placed the mouthpiece attached to the hose connected to the

air escaped through the edges of the mouth piece. The subject exhaled slowly and steadily while slightly bending forward until the maximum volume of air could be expelled without taking a second breath. The subject was instructed that they should blow out only through the mouth not by the nose even partially. The nose of the subject was dipped by the clip to prevent the air from escaping through the nose. The score of vital capacity for each subject was recorded in liters.

Blood pressure: Sphygmomanometer and stethoscope is used to measure the systolic pressure (SP), diastolic pressure (DP) and rate pressure product (RPP). Each subject was asked to sit comfortably on the chair before the measurement was taken. The cuff of the sphygmomanometer was wrapped around the upper arm about one inch above the brachial artery. After the cuff is wrapped around the arm, a stethoscope is placed over the brachial artery in front of the elbow to obtain the reading. The cuff was inflated until the artery was fully collapsed to the extent that no arterial pulse could be heard. The cuff pressure was then slowly released as the investigator watched the gauge. When sound of the blood flow (Korotko sound) became audible the reading in millimeters of mercury (mm of Hg) at that instant was recorded as the systolic pressure. The pressure was further released gradually as the sound of the pulse changed in intensity and quality. The index of the diastolic pressure was noted in mm of Hg when the heart beat sound completely ceased. The first sound heard is the systolic value and the last sound heard is the diastolic value. The difference between the two numbers is called the pulse pressure. In a healthy adults, the difference is about 40 mm Hg. The normal range is between 30 and 50 mmHg. For example, if the systolic pressure is 118 and the diastolic pressure is 78, 118 minus 78 equals 40. The pulse pressure in this case is 40. Normal systolic blood pressure is <120 mmHg and diastolic blood pressure is <80 mmHg.

Scoring: Systolic pressure (SP) was applied by

Table 1: Physiography of Lowland, Midland and Highland of Kerala

Geographical Area	Elevation (m) Area (km ²)	Soil type	Cropping pattern	Temperature	Topographic	Population density
Lowland	0 - 700 3979.3 (10.24%)	Soil is sandy loam with alluvium on river banks. Swamps, lagoons and backwaters are seen.	Rice, and coconut form major crops. Fisheries and coir industry constitute the major industries.	Humid tropical climate and high temperature 30-40 ^o C	Plain, Lagoons Backwaters	2000/Sq. km
Midland	700 – 1400 16231.2 (41.76%)	Soil is chiefly laterite. Clayey and loamy soils also seen. The terrain is undulating with rivers and rivulets	Rice, sugar cane, tapioca, banana, ginger, coconut, arecanut, pepper, cashew, rubber etc.	Medium temperature 20-35 ^o C	Hills and Valleys Elas, Laterite	1500 /Sq. km
Highland	> 1400 18563.5 (48%)	Soils are forest loams with wide variation in depth and organic matter.	Forests, plantations of tea, coffee, cardamom and rubber	Temperature is low 17-30 ^o C	Hills	<500 /Sq. km

Source: Kerala Agricultural University (2003)

Table 2: Selection of Criterion Measures

S. No.	Variables	Equipment/Tests used	Criterion Measure
i	Resting heart rate	Manual	Rate/minute
ii	VO _{2max}	Multistage fitness Test (VO _{2max} table)	ml/kg ¹ /mn ¹
iii	Vital capacity	Spirometer	l/mn ¹
iv	Blood pressure: a) systolic blood pressure b) diastolic blood pressure c) rate pressure product	Sphygmomanometer and Stethoscope Product of Heart rate and Systolic blood pressure	mmHg

means of the pressure ball, and with the left hand palpating the pulse. The pressure was continued for about a further 10 mmHg, above the point of pulse disappearance. The stethoscope was applied to the brachial artery and releasing the pressure in the rubber compressor bag slowly and evenly by means of slight movement of the release screw of the control valve, care was taken to listen intently for the blood flow sounds.

Diastolic pressure (DP): The process was continued to release the pressure and the tone and volume of the sounds changed and finally

disappeared in a faint murmur.

Rate Pressure Product (RPP): Rate pressure product is also known as cardiovascular product. Myocardial workload was calculated as the product of pulse rate average (PRA) and systolic pressure (SBP) (RPP=PRA x SBP).

Physiological testing is commonly used to assess the overall fitness level of players that provide guidelines to set selection and individualized training. Among the various physiological testing parameters, heart rate, VO_{2max}, vital capacity and blood pressure form the

Table 3: Mean and Standard Deviation of Subjects Age, Height, Weight and BMI

Subjects	n	Age (years)	Height (cm)	Weight (kg)	BMI (Kg/m ²)
		Mean (S)	Mean (S)	Mean (S)	Mean (S)
Lowland	30	24.06 (3.46)	172.02 (4.47)	67.19 (6.80)	22.70 (2.18)
Midland	30	26.41 (3.33)	171.45 (4.36)	66.09 (8.05)	22.50 (2.78)
Highland	30	24.28 (3.17)	174.67 (3.76)	67.33 (4.63)	22.10 (1.72)
Total	90	24.92 (3.45)	172.71 (4.39)	66.87 (6.60)	22.44 (2.25)

basis to select the players and preparing the individualized training protocols.

Analysis and Interpretations of Data:

Kerala Premier League football players from the lowland, midland and highland areas of Kerala were taken as the independent variables (IV). The dependent variables (DV) for the study were resting heart rate, VO_{2max} , vital capacity, systolic blood pressure, diastolic blood pressure and rate pressure product. The dependent variables were measured by standardized tests and procedures. Numerical scores for each of these variables were taken as the data for this study.

The collected data was analyzed using one way ANOVA. The probability level above 0.05 ($p > 0.05$) accepted the null-hypotheses (H_0) and the probability level below 0.05 ($p < 0.05$) rejected the null-hypotheses (H_0). Homogeneity of variance was assessed by Levene statistic. Post hoc (LSD) analysis and used when the probability level found statistically significant ($p < 0.05$) to infer group comparisons. The data were analyzed using IBM-SPSS Version 20.0.

Results and Discussion

Mean and standard deviation of age, height, weight and body mass index of lowland, midland and highland football players of Kerala Premier League are shown in Table 3.

Table 4 reveals the physiological variables in descriptive statistics of total ninety ($n=90$) footballers from Kerala, representing lowland ($n=30$), midland ($n=30$) and highland ($n=30$). Mean and standard deviation of resting heart rate, VO_{2max} , vital capacity, systolic blood pressure, diastolic blood pressure and rate pressure product of lowland, midland and highland were found as follows: *lowland* - 60.87 ± 2.35 bpm, 47.03 ± 4.80 ml/kg¹/mn¹, $4.354 \pm .699$ l/mn¹, 115.17 ± 4.778 mm Hg, 73.53 ± 3.082 mm Hg, 7013.17 ± 450.349 mm Hg respectively, *midland* - 61.03 ± 3.18 bpm, 51.90 ± 4.76 ml/kg¹/mn¹, $4.342 \pm .759$ l/mn¹, 110.07 ± 7.201 mm Hg, 71.40 ± 3.470 mm Hg, 6710.00 ± 463.919 mm Hg and *highland* - 60.23 ± 3.66 bpm, 54.63 ± 4.19 ml/kg¹/mn¹.

The resting heart rate, VO_{2max} , vital capacity, systolic blood pressure, diastolic blood pressure and rate pressure product of lowland, midland and highland footballers of Kerala Premier League are presented graphically in Figures 1-6, respectively.

One of the thrust areas of research in football is to find out the factors influenced to improve further performance. The current study specifically focused to know the variations in physiological variables that influence lowland, midland and highland of Kerala Premier League

Table 4: Descriptive Statistics of Physiological Variables

Group	n	Physiological Variables					
		HR _{rest} (bpm)	VO _{2max} (ml/kg ¹ /mn ¹)	VC (l/mn ¹)	SBP (mm Hg)	DBP (mm Hg)	RPP (mm Hg)
		Mean (S)	Mean (S)	Mean (S)	Mean (S)	Mean (S)	Mean (S)
Lowland	30	60.87 (2.35)	47.03 (4.80)	4.35 (.70)	115.17 (4.78)	73.53 (3.08)	7013.17 (450.35)
Midland	30	61.03 (3.18)	51.90 (4.76)	4.34 (.76)	110.07 (7.20)	71.40 (3.47)	6710.00 (463.92)
Highland	30	60.23 (3.66)	54.63 (4.19)	4.71 (.70)	107.47 (4.75)	69.40 (2.49)	6472.90 (356.00)
Total	90	60.71 (3.10)	51.19 (5.53)	4.47 (.73)	110.90 (6.48)	71.44 (3.45)	6732.02 (476.39)

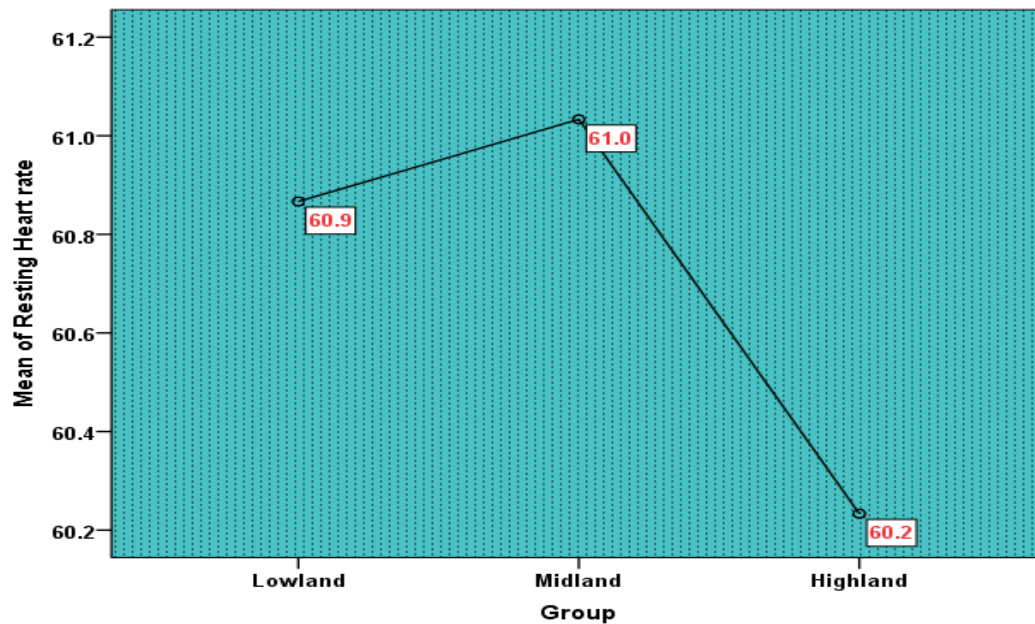


Fig. 1: Comparison of mean value of Resting heart rate.

footballers. Each physiological variable is discussed and compared based on the previous study findings.

The results of the study showed that there was no significance difference in resting heart rate among players based on their geographical area. This finding is in agreement with Sembulingam *et al.* (2015) who have studied comparison of

selected physiological variables of sea coast and high altitude living school students.

There was significant difference in VO_{2max} among players of different geographical area. Highland players of Kerala Premier League have better VO_{2max} than the midland and lowland players. Concomitantly midland players are better than that of the lowland players.

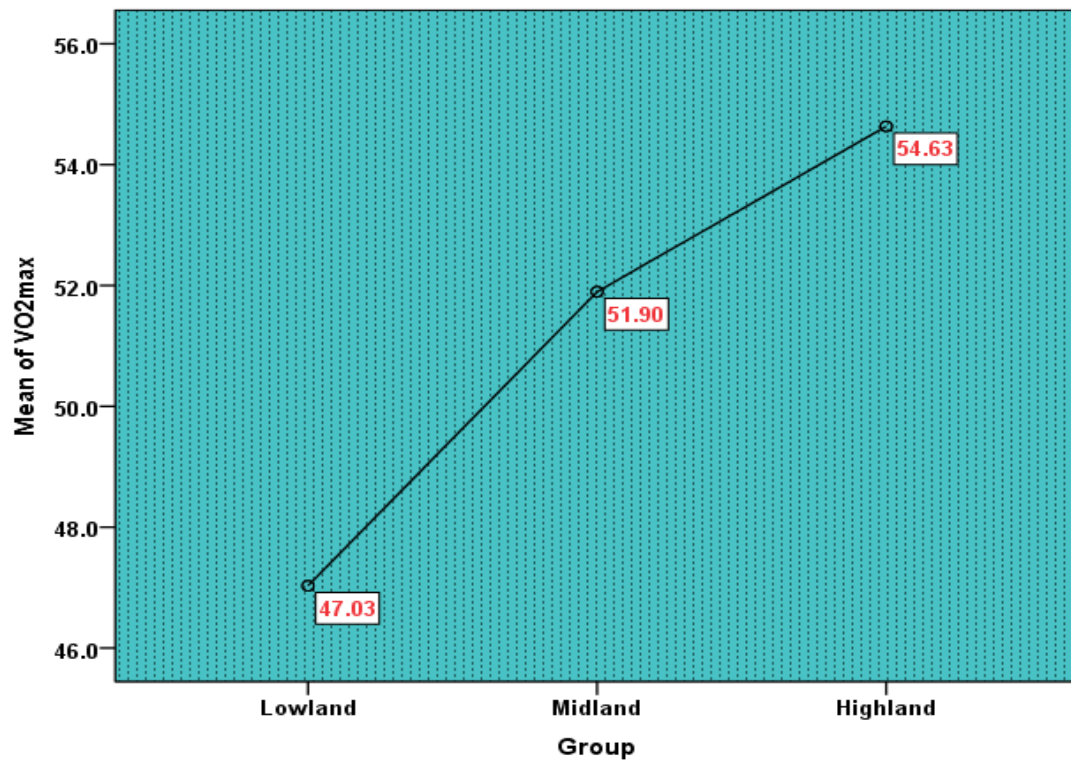


Fig. 2: Comparison of mean value of VO_{2max} .

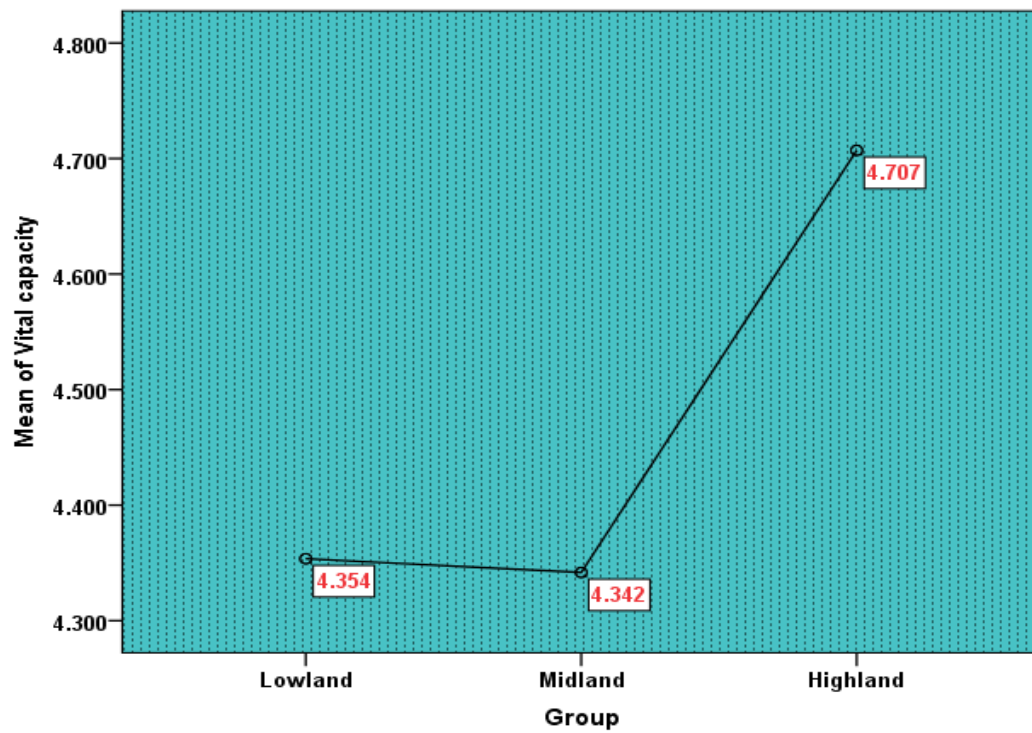


Fig. 3: Comparison of mean value of Vital capacity.

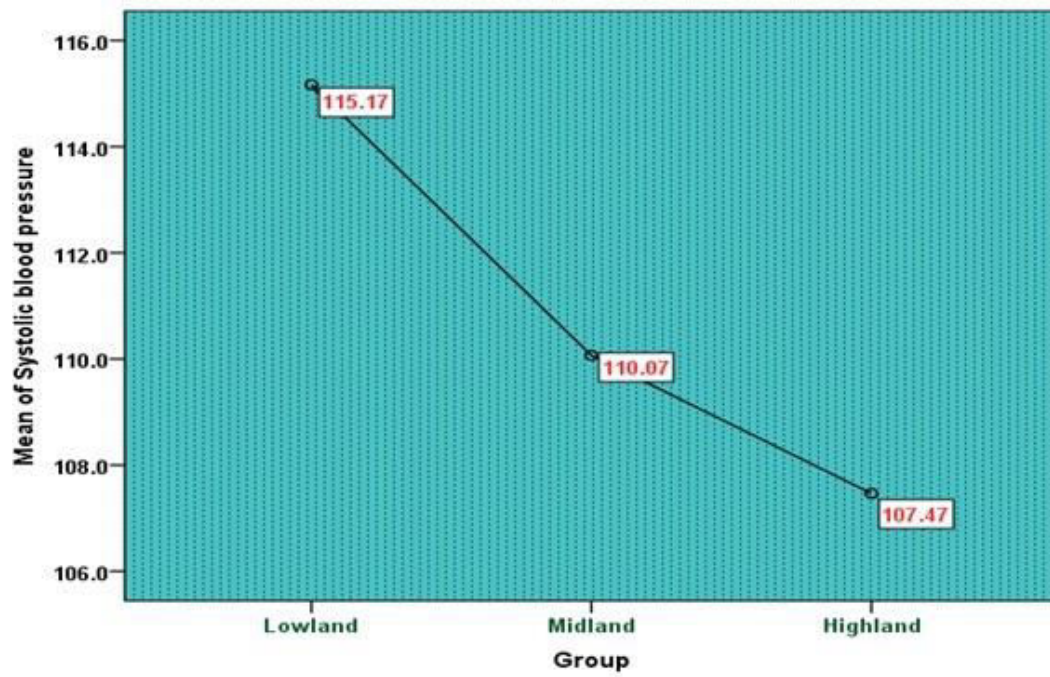


Fig. 4: Comparison of mean value of systolic blood pressure.

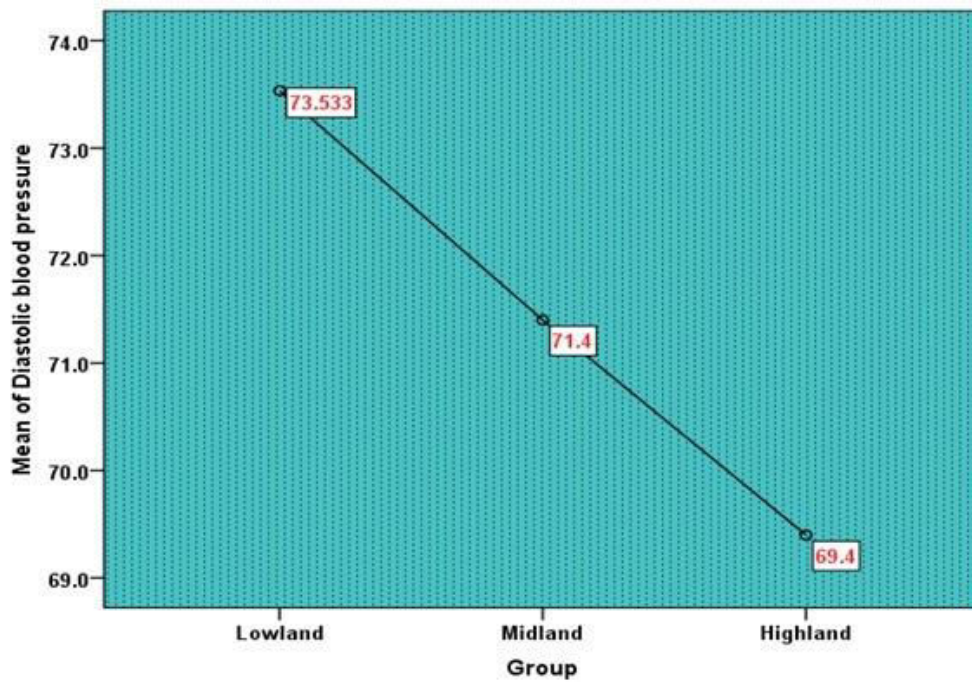


Fig. 5: Comparison of mean value of diastolic blood pressure.

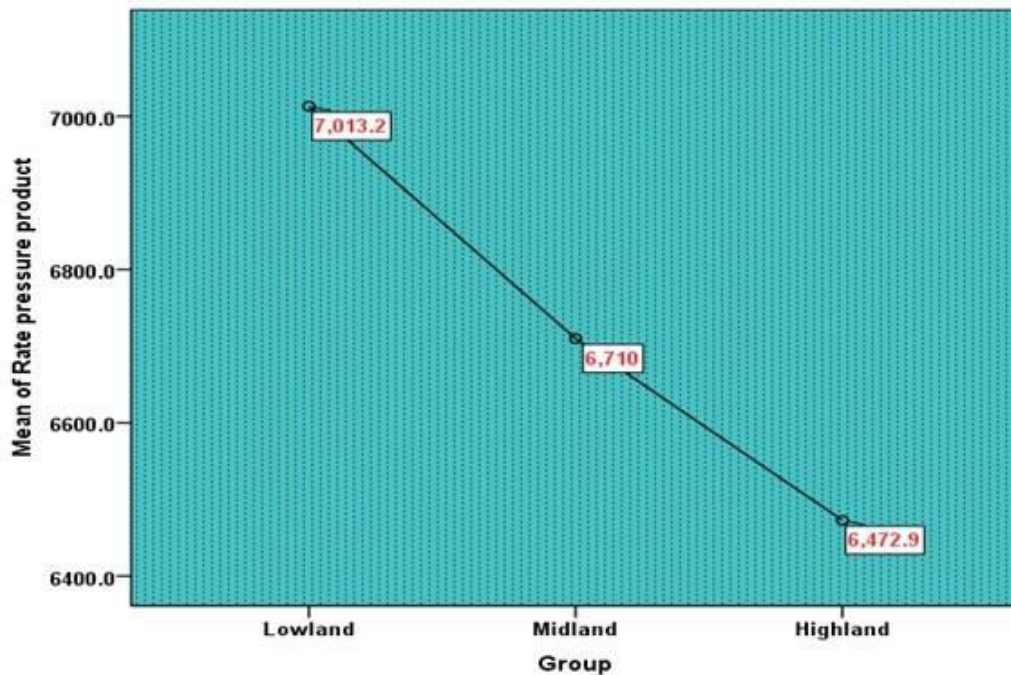


Fig. 6: Comparison of mean value rate pressure product.

The results of the study showed that there was no difference in vital capacity among players in different geographical area. This result is contrary to the result of other physiological variables like VO_{2max} , and blood pressure. It seems that the football players possess high vital capacity due to high specific training schedules to meet competition demands under varying fatigue conditions. This finding also agrees with studies of Singh and Singh (1983).

The results of systolic blood pressure showed difference among players based on their geographical area. Highland football players have better systolic blood pressure compared to lowland and midland. At the same time midland players have better systolic blood pressure than the lowland players. Similar results were also found in the case of diastolic blood pressure and rate pressure product due to the variation of blood pressure among players based on their geographical area.

The results of blood pressure (systolic, diastolic and rate pressure product) revealed that highland players have optimum blood pressure compared to lowland and midland. It may be due to exposed mountain terrains, humid atmosphere,

balanced and nutritious diet and low temperature that optimize systolic, diastolic and rate pressure product. Malhotra (1980) found in his study that living at higher altitude have higher vital capacity and larger chest measurement and high systolic, diastolic and rate pressure product than those living at lower altitude. This finding, also supported by Balke (1968) indicated that blood pressure changes at altitude are marked by individual differences, but a drop in peripheral resistance may cause a fall in diastolic pressure.

The results on analysis of variance of VO_{2max} , systolic blood pressure, diastolic blood pressure and rate pressure product were significant whereas pulse rate and vital capacity insignificant. These findings derive support from studies of Ningombam (2014) that the football players belonging to Northeast states were significantly superior in VO_{2max} , systolic blood pressure, diastolic blood pressure and rate pressure product to the other state football players. Effects of altitude on physiological changes also supported by Adhikari and Kumar (1995) who stated that a resident at higher altitude has definite development effect on anthropometric measurements and physiological

variables. The findings of physiological variables in this study agreed with Singh and Singh (1983). The study revealed significant differences in cardiorespiratory endurance and haemoglobin concentration which was high in high altitude population and no significant differences were found in resting heart rate and vital capacity.

Conclusion

The results of the study indicated that the geographical area of Kerala had significant effect on physiological variables among Kerala Premier League football players. Significant mean differences were found in the physiological variables of VO_{2max} , Systolic blood pressure, Diastolic blood pressure and Rate pressure product and no difference was found in the resting heart rate and vital capacity among lowland, midland and highland football players of Kerala Premier League.

Based on the above observations and conclusions drawn from this study, the following recommendations are made: (i) The results of this study will be useful for the coaches and trainers of Kerala Premier League clubs for generalization and categorization of players' on the basis of geographical area for the preparation of individual training schedule; (ii) The study recommended that, the tests and instruments used in this study could be used as selection criteria apart from performance evaluation tool; (iii) Based on the results, the present study revealed that rate pressure product can be considered as an index to assess the competency of myocardium in deriving the required myocardial oxygen consumption (MVO_2) at rest. This may help the trainees, trainers and physicians to determine the intensity and duration of exercise for developing physical

fitness without overloading the heart; (iv) Further study is recommended to compare the Kerala Premier League football players with players of other Indian States or National and International teams on the same dependent variable using the same instruments of this study; (v) A replica of the present study could be conducted on players in other football league championships; and (vi) A similar study could be conducted on players with regard to their playing positions.

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