The Comparison of Player Movement in Global Positioning System (GPS) Based Basketball Game

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Abstract: This research is about intensity motion about basketball players in every position. Intensity motion covers distance travelled, calories used, and average speed of players to be taken during the competition. The aim of this research is to compare intensity motion of basketball player based on its position. Method used in this research is comparative method. Samples used in this research were 16 players of extracurricular basketball team, selected by using the total sampling technique. A parametric statistical analysis of One-Way Anova on calories and average speed groups. Then, the Kruskall-Wallis non-parametrical statistic on group of distance travel. Results analysis show that the sig value on distance is 0.33 $p > 0.05$, on full calories is0.77, $p > 0.05$, and on speed 0.71, $p > 0.05$. It can be concluded that there is a significant difference of distance travelled, calories used, and average speed travelled by every player based on its position. No existence difference is probably because of some in the field and training provided.

1 INTRODUCTION

The basketball is a game team and one of the characteristic is dyniamic (Hoffman and Maresh, 2000). There are five positions of players in basketball, which are: point guard (PG), shooting guar (SG), small forward (SF), power forward (PF), and center (C) (National Basketball Association, 2003). During the match, players always running, stopping, and do movements, depending on the situation in the game. So it is important to objectively understand the intensity of players' movements during the game in ordert o enhance the perfromance of players (Oba and Okuda, 2009).

Research about intensity motion has been done by various branch of sports. On a handball game, there is a significant difference on volume and intensity between motion player with its position as a back player (backcourt player), wings player (wings), pivot players (pivots), and guard wicket (goalkeeppers) (Šibila, Vuleta and Pori, 2004). Beach soccer is a sport that has high intensity because only on the first half start, the players' physiological profile shows intensity that reaches more than 90% of heart rate (Castellano and Casamichana, 2010).

On basketball, analysis about inetensity motion is done to know the performance of players and the activity profile in various positions of different players. The performance analysis of movements on male and female basketball players on 4 categories show that players spent 34.1 % of time to run and jump, 56.8% to walk and 9% to stand (Narazaki, Berg, Stergiou and Chen, 2009). The use of calories for female basketball players for Female Regional Sport Week (PORDA) West Java, is known that position 4 (Power Forward) and position 5 (Center), mainly move in the field compared to other positions, because those positions released more calories than other positions. However, previous researches hasn't yet leads in detail on analysis of intensity motion on basketball players in the field (Arisandi, 2015). Then, with the use of vision computer technique, it is known that intensity movement of player and speed on all position of basketball players spend more than 60 % of the total time movement with low intensity and speed less from 1.4 m / s (Erčulj, Vučković, Perš, Perše and Kristan, 2008).

Global Positioning System (GPS) is a navigation satellite system that uses 27 satellites that orbit the earth (Larsson, 2003). The GPS system can be used

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to analyze the training process of sport especially outdoor sports (Leser, Baca, Ogris, Science and Gmbh, 2011). The use of of GPS has been implemented on various type of sports among others are Australian Football, Criket, Hockey, Rugby and Soccer (Aughey, 2014).

Based on description above, researchers want to compare distance traveled, calories used and average speed of basketball players based on its position with the use of GPS approach.

2 METHOD

2.1 Design

A research with comparative approach to find out the comparison of distance traveled, calories used and average speed on players based on their position (Junior, Misuta and Mercadante, 2017).

2.2 Participants

Samples of this research used the total sampling method consists of 16 male students from basketball extracurricular on high school level that followed the Regular Basketball competition on provinces level in Indonesia. Samples were divided according to their position: 3 point guards, 3 small guards, 4 small fowards, 3 point fowards, and 3 centers.

2.3 Instrument

Instruments used is polar GPS RC3 and polar V800 GPS. Data obtained through implementation of simulation matches, and on every player installed Polar GPS that has been synced to the web polarpersonaltrainer.com. After obtaining the value of distance traveled, calories used and average speed of players then the data is analyzed using One-Way Anova for distance travel and calories used and Kruskall -Wallis for distance travel. Game was conducted in 4x10 minutes and played at the outdoor field.

3 RESULTS AND DISCUSSION

Table 1: Distance covered, calorie and velocity range based on player positions.

Player	Position	Distance Covered (km)	Calorie (kcal)	Velocity range (km h^{-1})
1	PG	2.56	640.00	2.00
2	PG	2.47	711.00	2.80
3	PG	2.80	796.00	2.30
Average		**2.61**	**715.67**	**2.37**
4	SG	2.64	605.00	3.00
5	SG	2.40	671.00	2.60
6	SG	3.60	780.00	2.30
Average		**2.88**	**685.33**	**2.63**
7	SF	2.81	699.00	3.10
8	SF	2.70	718.00	3.00
9	SF	2.96	716.00	2.80
10	SF	2.72	758.00	2.20
Average		**2.80**	**722.75**	**2.78**
11	PF	2.49	496.00	2.80
12	PF	2.16	672.00	2.40
13	PF	2.44	792.00	2.10
Average		**2.36**	**653.33**	**2.43**
14	C	2.88	740.00	2.40
15	C	2.74	723.00	3.10
16	C	2.00	726.00	2.10
Average		**2.54**	**726.33**	**2.53**

In table 1 shows that the average distance travel, calories and average speeds for PG are 2.61, 715.67, and 2.37. SG is 2.88, 685.33, and 2.63. SF is 2.80, 722.75, and 2.78. PF is 2.36, 653.33, and 2.43. C is 2.54, 726.33, and 2.53.

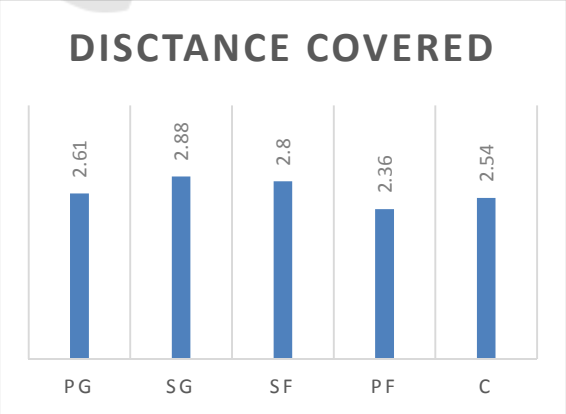

Figure 1: Average of distance covered based on player positions.

On Figure 1 shows the highest average distance travel is on SG position, 2.88 km and lowest is PF position, 2.36 km.

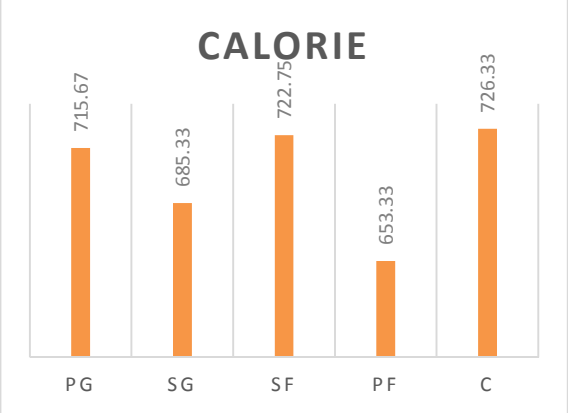

Figure 2: Average of calorie based on player positions.

On Figure 2 shows that the highest average usage of calories is on position C, 726.33 kcal and lowest is PF position, 653.33 kcal.

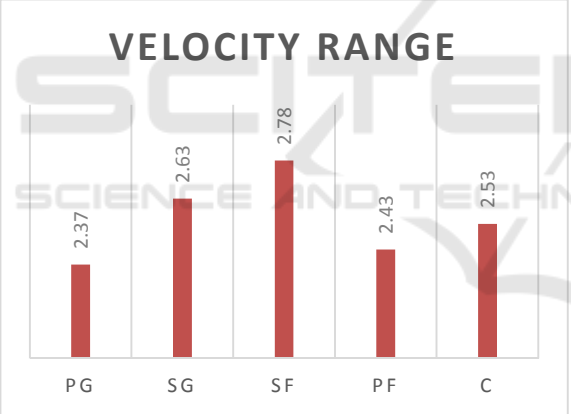

Figure 3: Average of calorie based on player positions.

On Figure 3 shows the highest average speed is on SF position, 2.78 km h -1 and Lowest is PG position, 2.73 km h -1.

Table 2: One Way Anova test of distance covered, calorie and velocity range based on player positons.

	F	dF	Sig.	Conclusion
Distance covered	1.03	15	0.43	No difference
Calorie	0.44	15	0.77	No difference
Velocity range	0.54	15	0.71	No difference

Based on table 2, the significance values from to three group, if compared with the alpha level is 0.05, then all significance value is bigger from 0.05, so it could be concluded that there is no significant difference in heart rate, distance, calories used, and average speed of male basketball players in various position. However, for data on distance is not yet concluded, because the data is not homogeneous so statistics nonparametric kruskall-wallis was used. However on all group a test was conducted using Kruskall-Wallis, for the result tob e compared with the testing of one way Anova. Following is the results analysis of Kruskall-Wallis‘ nonparametric statistics use.

Table 3: Kruskal Wallis test of distance covered, calorie and velocity range based on player positions.

	Chi-Square	dF	Sig.	Conclusion
Distance covered	4.61	4	0.33	No difference
Calorie	1.41	4	0.84	No difference
Velocity range	2.47	4	0.65	No difference

On table 3 is known, the value of chi-square distance 4.61 with sig value 12:33, chi-square value of calories 1:41 with sig value 0.84, as well value chi-square speed 2.47 with sig value 0.65. Based on value significance from those three groups, if compared with the alpha level 0.05, then all value‘s significance is bigger than 0.05, so it could be concluded that there is no significant difference in distance, calories used, and average speed of men‘s basketball players in various positions.

According to the results of data processing and analysis, obtained results that there is no significant difference between heart rate, players‘ travelled distance, calories usage, and average speed traveled for competition from every inter position basketball players. The movement in basketball game is categorized as dominating slow movement, however this depends from individual perception when they watch or see the basketball competition (Vučković, Dežman, James and Erčulj, 2010).

The center position also has the highest average of calorie. On previous research, the value of calories for every position is significantly different, especially on Center and power forward position (Garrett and Kirkendall, 2000), however there is no significant difference on this research, with the highest value is on Center and followed with small forward position. It is because of position center and small forward do more activities, such as jumping to block the ball in the field since the have the weight to protect the ring from opponent, meanwhile power forward position is yet to understand about task they should do.

Based on information obtained from the coach of concerned basketball team, there is no significant

difference of players‘ intensity motion because of the same exercise factor. Volume and physical exercise intensity given to player is not differentiated based on the position. Specific exercises are only given during the technical exercise to point guard position. It is aimed to order all players on the pitch issued maximum performance, and have a good endurance power.

4 CONCLUSIONS

Researchers could conclude that there is no significant difference of distance traveled, calories used, and average speed onmen‘s basketball player in all various positions. In order to gain maximum performance during a competition, coach should give patterned exercises that are in line with players in all positions.

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