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Effects of Complex sap Training on Body Fat and Physical Performance among Young Male Basketball Players

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Abstract: *Basketball is ranked in the top three team sports, it requires movements in multiple planes. Moreover the body fat in male basketball players might be limited to physical performance. There are many training programs that focus on improving the physical performance but only a specific training, while complex training is combining multiple training components. Sixty young male basketball players has divided into 2groups; 1) the experimental group (n=30)performed the SAP training for 3 days/week (60 mins/day) and regular training for 8 weeks consecutively, 2) the control group (n=30) performed in regular training. Independent sample t-test used in the analysis. After 8-weeks of SAP training, participants had likely 2.82 kg decreasedinbody fat mass (p>0.05) which had greater decreased than the control group. Moreover they had a vertical jump, agility significantly differed from the counterpart. Body fat mass was negative correlated (r=-0.503; p<0.01) with agility and vertical jump(r=-0.789; p<0.01). The SAP training can decrease body fat mass in young male basketball players, Moreover, show the greater improving the skill-related physical performance in young male basketball players, it can be one of exercise program to promote level the decrease body fat mass relate with physical fitness.*

Keywords: *Body composition, Adolescence, SAP training*

Abbreviations: SAP: Speed, Agility and Plyometric training

1. INTRODUCTION

Sport and exercise promotes physical activity and overweight/obese prevention[1]. While, exercise intensity has a strong association with weight controlin young adults [2].Basketball is a popular team sport [3]that requires multiple planes of movement as well as rapid transitions from jogging to sprinting, and to jumping. Moreover, it requires a movement changes in every 2 seconds that associated to speed, agility, and power. The importance of developing a suitable conditioning programs based on specific physiological demands is considered asa key factor to success in sport [4, 5]. In particular with weight control, the excessive weight in basketball players might be limited to physical fitness [6].While the rate of childhood overweight and obesity in Asia has increase rapidly.[7]

Percent of body fat is the proportion of fat compared to body weight, and used a criterion for overweight and obesity [8].Influence to decline of physical fitness and fat free mass (muscle mass) represents the metabolic active tissue and can provide the physical performance[9]. Moreover, body fat constitutes a valid measurement for define obesity in athletes[10].

There has 3 components to improve physical performance in basketball players are speed, agility and power. Speed is the ability of the muscle tension in the composition of motor units to move the body or body part along the longer distance in the shortest possible time [11]. Agility is defined as a physical skill that enables individuals to rapidly and efficiently decelerate, change direction, and accelerate in an effort to react appropriately to task-relevant cues [12]. Power is a specialized, high-

intensity training technique that enables an athlete muscles to deliver as much strength as possible in the shortest period so that power development can take place [13]. The previous literatures have confirmed that all of the mentioned training can increase strength and agility for athletes [14, 16, 17]as well as effective in reducing body fat [18].

Complex training is a combination of training in difference activities with various goals. There is an alternating training difference of intensity [19].Combining multiple training times together makes it interesting to practice and may give better results than only specific training [20].

To the best of knowledge, there has no study investigate on the effect of SAP training on reducing of body fat with associated physical fitness among young male basketball players. The purpose of the study was therefore to determine the correlation of body fat and physical performance after "SAP training" among young male basketball players.

2. MATERIALS AND METHODS

Sixty young-male basketball players (n=60) from public secondary schools who agreed to participated in the study. Participants were systematic randomly assigned into 2 groups: the SAP group (n=30); and the control group (n=30)(Table 2).Participants provided written informed consent. This study protocol has approved by KhonKaen University Ethics Committee in Human Research (Reference No#HE582280).

The following tests were performed before training, after 4-weeks training and after 8-weekswereconducted:

2.1. Body Weight, Height

Subjects wearing light clothes and no shoes or socks to measured using a digital scale. (Omron Body Composition Monitor HBF-375,Japan)and height was measured using a portable standiometer (SECA 242; Hamburg, Germany). Body mass index (BMI) was calculated by using a weight-to-height ratio (kg/m^2) and is used to classify adults who are underweight, overweight or obese[21].

2.2. Body Fat Mass *(*Percent*)*

Body fat mass was evaluated by body composition monitor using a digital scale (Omron Body Composition Monitor HBF-375, Japan). Participant stand and back straight and look straight ahead. The arms are horizontally raised, and the elbows are extended straight. Extend your arms straight at a 90° angle to your body. [22]

2.3. Vertical Jump

Reach height was measured on all participants prior to vertical jump testing. Subjects stood flatfooted and reached as high as possible with one arm. The highest point reached on the vertical jump pole (Swift Yardstick, Australia) was considered reach height (cm.). Individuals were allowed an arm swing down and up while jumping off both feet and reaching as high as possible with one arm to displace the highest possible vane. Vertical jump was calculated as the distance from the initial reach and the highest point reached during the jump. Participants performed 3 maximal vertical jump, with approximately 2 minutes recovery between them [23].

2.4. Agility

Agility test is set up with four cones forming the agility area (10 meters long x 5 meters wide). Cone at point A marking the start. Cone at B & C to mark the turning spots. Cone at point D to mark the finish. Place four cones in the center of the testing area 3.3 meters apart. Start lying face down with the hands at shoulder level. On the "go" command, athlete begins and time starts when they cross the photocells. Get up and run the course in the set path (left to right or right to left). On the turn spots B and C, be sure to touch the cones with your hand. Trial is complete when you cross the finish line and when no cones are knocked over (sec.) [24].

The participants in SAP group trained 60 mins/day, 3 days/week with 8 consecutive weeks. There was consisted of 15-mins warm-up (7-mins jogging after which static stretching). Moreover, all training in

maximum effort and allowed a 2-mins rest between set [25] and 3-mins rest between sessions (Arazi et al., 2012).The SAP group training, it consisted of speed, agility, plyometric training. The protocol of the SAP training has presented in Table 1.While, the control group received a regular training.

Table1. *SAP training program*

Week	SAP training	Times/set	Set/day
1-4	**Speed (S)** Run-Through Run throughalternatingfast legs **Agility (A)** Z-Pattern Run Four-Point Pop-up To 20-yard Shuttle **Plyometric (P)** Split Cycle Squat Jump (L,R) Pike Jump	10	3
4-8	**Speed (S)** Run throughalternatingfast legs Partner-Resisted Start A-Form Runs **Agility (A)** Sprawl-to-Stand PopUp to Squirm Forward Roll over Shoulder (Speed & Cartwheel (Speed & Agility) **Plyometric (P)** Squat Jump, Pike Jump Single leg Vertical Power Jump (L,R) Single Leg Tuck Jump (L,R) DoubleLegVerticalPower Jump	10	3

Adapted from [27]

2.5. Statistical Analysis

Descriptive statistics are presented in baseline characteristics. Independent sample t-test was used to compare of dependent variables (body weight, body fat mass, vertical jump and agility) between the experiment and the control groups in time periods. Pearson correlations were usedto analyze the relationship between body weight, BMI, body fat mass and physical performance. Level of statistical significant was set at $p<0.05$. All data analysis was performed using the Statistic Package for the Social Sciences program (SPSS) version 17.0 (Chicago, Illinois).

3. RESULTS AND DISCUSSION

Descriptive characteristics of the participants are presented in Table 2. All participants were young male basketball players.

Table2. *Demographic characteristic of the participants*

	Total(n=60)		**SAP group (n=30)**		**Control group (n=30)**		**p-value**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Age (year)	16.53	1.01	16.50	1.00	16.56	1.04	0.802
Weight (kg.)	62.64	9.1	63.77	9.44	61.51	8.86	0.343
Height (cm.)	172.56	3.93	172.73	3.75	172.40	4.17	0.746
BMI (kg/m^2)	21.04	3.02	21.36	3.01	20.72	3.05	0.89

Note: There was no significant difference between SAP group and control group was performed by Independent sample t-test ($p>0.05$); BMI: Body mass index

The result between the pre-test, after 4 weeks and after 8 weeks test in both groups after training program presented in Table 3.The means differences, SD between the 2 groups for body weight, body fat mass, vertical jump and agility. After 8-weeks of SAP training, body fat mass in SAP group had likely decreased2.82 kg ($p>0.05$); whereas vertical jump, agility significantly differed control group.

Table3. *Comparison of body weight, body fat mass and physical performance between the 2 groups in pre-test, after 4 weeks and after 8 weeks test.*

	Pre test					4 weeks					8 weeks				
	SAP		**Control**		p-value	**SAP**		**Control**		p-value	**SAP**		**Control**		p-value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Body weight (kg)	63.77	9.44	61.51	8.86	0.34	62.83	9.31	60.90	8.7	0.41	61.74	9.12	60.56	8.73	0.61
Body fat mass (%)	15.15	2.28	15.31	1.98	0.76	14.10	2.02	14.92	1.95	0.11	12.33	1.76	14.10	1.84	0.00**
Vertical jump (cm.)	54.40	2.90	53.97	2.26	0.52	56.98	2.90	54.90	2.28	0.01**	59.23	2.90	55.91	2.30	0.00**
Agility (sec)	18.94	1.45	18.50	1.48	0.25	17.79	1.49	18.25	1.48	0.24	16.93	1.48	17.94	1.48	0.01**

*Note: ** Significantly different between the experiment and the control group by Independent sample t-test* ($p<0.05$)*; SAP: SAP group, Control: Control group*

After 8 weeks of training, it was shown that the percentage of body fat mass in SAP group decreased significantly, resulting in improved physical fitness in the vertical jump agility of young male basketball players. The Pearson's correlation presented in Table 4 indicated that body weight and body fat mass has positive correlation (r=0.77; p<0.01) while body fat mass was negatively correlated (r=-0.789; p<0.01) with vertical jump. Moreover, body fat mass was positive correlated (r=-0.503; p<0.01) with agility.

Table4. *Correlations among body weight, body fat mass and physical performance after 8 weeks of intervention*

	SAP			Control		
Variable/Week	Body Weight	Body Fat mass	Vertical Jump	Body weight	Body fat mass	Vertical jump
Body Weight						
Body Fat mass	0.83**			0.77*		
Vertical Jump	-0.849**	-0.729**		-0.67**	-0.79**	
Agility	0.779**	0.892**	-0.704**	0.52	0.50**	-0.56**

** Correlation was significant at p < 0.05*

*** Correlation was significant at p < 0.01*

The correlation between body weight, body fat mass decreased and physical performance in both groups was show the significance positive correlation but in the SAP group, physical performance tended to be better.

The main findings from this study showed the 8-weeks of SAP training was significant decreased in body weight and body fat mass. Correlate in accordance with previous studies in Greek young basketball players elite has 11.4 ± 0.5% of body fat[28]. While body fat mass of European elite young basketball players were 13.23 [29]. On the other hand, there has an increase in the height of the vertical jump and agility. Many factors may contribute to the reduction of weight and body fat including physical fitness that could improve in the skill's performance.

The SAP training was designed to develop muscle strength by focusing on changing the speed and direction of movement combined with the plyometric training that allows coach to save time, allowing athletes to practice multiple purposes at the same time. Plyometric training can improve the production of testosterone [30] and decreasing the concentrations of cortisol in long term [31]. However, the increase of vertical jump and agility in SAP training may involve the effect of training program rather than hormone effects.

The intensity of the SAP training in this study may also contribute to the results, which decreased the body fat mass and body weight and increased the physical performance. The continuous of training and the time each station in day affect to body metabolism of fat. Although in the control group there is a lower of decreased body fat mass rate less than experimental, regular basketball training can help

reduce body fat mass of young male basketball players as well [32] involves the physiological adaptation of athletes [33] in regular exercise. Table 4shows that the decrease in body weight and body fat mass in the experimental group and the control group having a positive correlation in the physical performance such as vertical jump and agility. This results has a better effects in the SAP group, compared to the control. This enhancement may related to some adaptive change in neuro-muscular function and improved in nerve-based command to muscles of agonist group, intermuscularcoordination, modification of muscle size and changes in mechanism of single-fiber. The interventional program has apositive influence to the overall outcome of leg strength that linked with the results of previous studies.

Future studies recruiting populations should be young male overweight or obese for significant effect of SAP training and control food intake in participants to the benefit of SAP training.

4. CONCLUSION

Body fat mass is one of important variable that linked to basketball's player performances. While SAP training can decrease body fat mass in young male basketball player and, there has a great correlation with their physical performance.

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