Effect of Zone’s Diet Modification in Level of Oxidative Stress and Performance of Athletes

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Abstract. This study aimed to prove which modification of Zone diet can improve the performance of athletes and may reduce levels of oxidative stress in the body of the athlete, especially a sprinting athlete. Used draft "Randomized Control Group Pretest Posttest Design". The 20 sample taken from people who has the criteria for inclusion and exclusion of 30 athletes sprint teenagers Persatuan Atletik Seluruh Indonesia (PASI) East Java. This study used an experimental method and observation. Data collected by result of running measurement technique using finish camera and laboratories to determine activity levels of oxidative stress (MDA) in the blood. Data were analyzed with multivariate techniques (Manova) method Hotelling's (T2). Data analysis included descriptive analysis, data normality, homogeneity of variance and analysis Manova form Paired Comparisons Hotelling's method (T2). Hypothesis testing using α 0.05. Result and conclusion of the study, that the normal diet had no effect on the variable performance of athletes and level of oxidative stress (MDA). While modification Zone diet can lowering the level of oxidative stress(MDA) minimum 0.0371 μml and an average reduction of level of oxidative stress caused modification Zone diet at least 0.010 μml lower than normal diet but no effect to performance of athletes.

1. Introduction
The physical condition is becoming a foundation in tactic, technical, strategy and mental improvement and an important element [1]. One important factor to achieve optimal physical condition is proper nutrition [2]. Talented and high motivated athlete will never achieve his best potential result without select his diet promptly [3]. This suggests that the nutritional aspects very supports athletes achieve optimal performance. Total calories recommended for most people is a diet that contains 55-60% carbohydrate, no more than 35% fat (saturated fat less than 10%) and 10-15% protein, and it is also the optimum diet composition for athletes to support performance athletes and health [2,3,4].

However, the current low-carbohydrate diet with high protein or fat widely recommended. The use of these diets among athletes can alter body composition, but its effect on the athlete's performance has not been known. One of them is the Zone diet, conducted by Barry Sears , is a pattern menu is said to increase the performance of athletes, as reported by Sears, that diet has been tested on swimmer at Stanford University, and won 8 medals gold in Barcelona and won numerous championships in the US [5]. The Zone Diet contains the macronutrient composition of 40% carbohydrate, 30% protein and 30% fat, rich in fruits and vegetables, with the number of calories 1735 calories for athletes [6]. Although some studies deny success to the performance talent Zone diet, low-carb diet but the models need to be
considered. Thus in doing modifications to the Zone diet, tailored to the caloric needs of athletes and a menu according to the Indonesian people, the ratio of carbohydrates 30%, protein 40% and fat 30%, and rice is the carbohydrate source is replaced with vegetables and fruits, while fulfillment protein derived from animal and vegetable protein, calorie counts 3,000 cal / day.

As noted above, that the diet for an athlete to be able to support good health in addition to supporting performance [2], it is one of the efforts of health care is to observe the effects of these diets on free radicals that occur due to physical exercise, then expected to nutrition it can counteract free radicals that occur. Free radicals large enough to cause damage to cells and tissues, which can impair the health of an athlete and also degrade the performance of athletes, which can be viewed either by measuring the effect on running speed.

Modifications Zone diet is a diet that is low in carbohydrates, high in protein and rich in fruits and vegetables, while the antioxidants in general is an enzyme that is formed by the protein, diets that provide more fruits and vegetables as a source of energy, of course, contain antioxidants enough to ward off free radicals [7].

It is known that exercising causes an increase in oxygen use mainly by muscles to contract, causing an increase in the leakage of electrons from the mitochondria that will be ROS / Rons (radicals) that can be followed by events oxidative with all the negative consequences that might occur as the pain, damage cells and performance [8,9,10]. One form of anaerobic exercise is sprinting. Sprint is running at maximum speed, regardless of the distance [11,12]. Sprint ability is a weapon of athletes for various events in the field and an assortment of sports [12]. As reported by Jowko (2014) that the sprints are an exercise maximum in the short time that cause cell damage that is sufficiently large that stimulate oxidative stress, as indicated by the increase in malondialdehyde (MDA) plasma, and can be prevented with antioxidant supplements [12,13].

Based on above explanation, this research was aimed to investigate the influence modification of Zone diet to the performance of athletes and oxidative stress in the body of the athlete, especially a sprinting athlete.

2. Research methods

This research is a quasi-experimental, with randomized pretest-posttest control group design. In this research there are two groups, control group and experimental group. Research population is all of East Java, Indonesia Athletes Unity (PASI)’s athletes, male and female, who joined exercise in regional training center (Puslatda) in KONI Surabaya’s at April-August 2015. Research subject is a part of population that fulfilled inclusion criteria, they are normal liver condition, normal kidney condition, and did not have diabetes mellitus then they willing to participated in this research and sign the informed consent. Research subject are 20 sprint athletes. Researcher prepare menu and organoleptic test of menu. Zone Diet is a combination of menu that consist of 3 times snack and 3 meals time which calculated by total 3000-4000 calories for each day, concerning to training and matches schedule. The variation of menu was arranged for 7 days that served for 2 weeks, included which traditional Indonesian menu, and western menu that calculated energy source Carbohydrates 30-40%, Protein 20-30%, and fat 20-30 & that consist of protein, vegetables and fruits and without rice.

Menu composition in Zone’s Diet Modification contain 30-40% protein, 20-30% carbohydrate, 20-30% fat, Mostly consist of western diet or Indonesian food without rice which serve in a day, depend on how much counting energy expenditure for training.

Menu composition in normal/traditional diet contain 15-20% protein, 50-60% carbohydrate, 20-30% fat, that serve same food with diet zone which rice, and fruit juice replace with sugary drink (lemonade flavor which look like lemon juice, strawberry which look like guava juice etc.).

Athlete’s performance: Measure time needed for 60 meters running with photo finish. While data MDA (degree of oxidative stress) obtained by laboratory tests using blood serum, with Bioxytech laboratory using MDA-586 with units of μ / ml.
The data were analyzed using the techniques of Multivariate Analysis of Variance form Paired Comparisons Hostelling’s method (T2).

3. Result and Discussion

Table 1. Comparison Food intake between normal diet and Zone modification diet

| Nutrition     | Normal diet |          | Zone modification diet |          |
|---------------|-------------|----------|------------------------|----------|
|               | Average Plan | Actual intake/day | Average Plan | Actual intake/day |
| Energy (kal)  | 2235,3      | 2191,62  | 3035,93                | 2927,65  |
| Protein (gram)| 146,0       | 142,69 (26,2%) | 216,28                | 205,61 (30,2%) |
| Fat (gram)    | 90,7        | 89,84 (37,2%) | 155,08                | 151,63 (50,2%) |
| Carbohydrate (gram) | 204,7 | 198,80 (36,6%) | 141,82 | 132,99 (19,2%) |

Table 2. Results Descriptive Analysis Difference pretest posttest Normal Diet group and Modification Zone diet

| Varian | Diet                  | Normal diet | Modification Zone |
|--------|-----------------------|-------------|-------------------|
| 1      | Performance (run 60m) | 0,3090 s    | 0,1460 s          |
| 2      | Stres Oxidatif (MDA)  | 0,0010 μm   | -0,0500 μm        |

3.1. Data Analysis

To know the change in the dependent variable due to normal diet performed paired comparison analysis techniques. Based on the analysis technique Hostelling’s paired comparison method, obtained T2 = 0.5141, while Tu (p, n-1) = T0, 05 (4.9) = 27.202. Because T2 = 0.5141 <27.202 = T0, 05 (4.9), then H0 is accepted. Thus concluded that there is no increase in variable performance of athletes, antioxidants and no impairment of oxidative stress and markers of inflammation due to normal diet.

To see the change in the dependent variable due to diet Zone modification techniques paired comparison analysis Based on the analysis technique Hostelling’s paired comparison method, obtained T2 = 33.326, while T0,05 (4.9) = 27.202. Because T2 = 33.326 > 27.202 = T0, 05 (4.9), then H0 rejected and H1 accepted. Thus there are components of vector μ that is not zero. To investigate the which components are not μ 0 is used simultaneous 95% confidence intervals. The results of the analysis are presented in table 3.
Table 3. The Analysis Simultaneous Confidence Intervals (α 0.05) dependent variables to Modification Zone diet

| Diet          | Dependent Variable             | Average Coefficient | Simultaneous Confidence Intervals 95% | Confidence Lower limit | Confidence Upper limit |
|---------------|--------------------------------|---------------------|-------------------------------------|------------------------|------------------------|
| Modification Zone | Performance (run 60m)          | 0.146 s             | -0.3852 s                           | 0.6772 s               |
|               | Stres Oxidatif (MDA)           | -0.05 μml           | -0.1371 μml                         | -0.0371 μml            |

To the degree of oxidative stress its average value for the population ranged from -0.1371 to -0.0371 μml, this means that there is a decrease of at least 0.0371.

Table 4. Simultaneous Analysis Results Confidence Intervals (α 0.05) Variable-Depending on the variables in the Normal diet and Zone diet modification

| Diet          | Dependent Variable             | Average Coefficient | Simultaneous Confidence Intervals 95% | Confidence Lower limit | Confidence Upper limit |
|---------------|--------------------------------|---------------------|-------------------------------------|------------------------|------------------------|
|               | Performance (run 60 m)         | 0.129 s             | -0.798 s                           | 1.416 s                |
|               | Stres Oxidatif (MDA)           | -0.025 μml          | -0.050 μml                         | -0.010 μml             |

From the table 4 the analytical results as shown in the table can be summarized as follows: there was no significant difference between normal diet and the Zone diet dietary modifications in terms of increased speed sprint. There are significant differences between normal diet and the Zone diet dietary modifications in terms of decreasing the degree of oxidative stress and further average reduction in the degree of oxidative stress caused by Zone’s diet modification greater than that caused by normal diet. The average decrease in the degree of oxidative stress caused by diet modification Zone diet at least 0.010 μml lower than the average decline in the degree of oxidative stress caused by a normal diet [14].

4. Discussion
Diet zone given with the largest portion of serving was side dishes and almost no rice in each menu. It was similar with food pattern of American. Its diet zone was difficult to be applied because in Indonesia almost all of menu consist of high protein dishes and high rice portion. When choosing food depends on taste which is affected by culture and food value [15]. Most likely wasn’t due to type of menu, but because of some Indonesian teenage rarely consume vegetables in daily. Therefore, intervention efforts to reduce non preference food still need time to meet the expectation.

Long treatment given in this study was conducted for 15 days, both for nutrition and exercise. Determination of 15 days is based on the research that has been done by Barry Sears with the Zone diet is, that with this diet in two weeks will begin to accrue life changes dramatically, addicted to carbohydrates will be lost, mental focus will increase, physical performance will improve [5]. And according Bompa after the exercise program for two weeks will begin no increase performance of athletes [16]. Results of another study also states that the duration and intensity of exercise that causes neural adaptations that can improve muscle strength starts from 15-20 days endurance exercise[17]. Likewise, the study by Fleming et al, 2003, long treated for 6 weeks [18] and Vogt et al, 2003, with a 5-week long treatment [19]. Additionally know that training for a competition, it takes a full year, six months, or twelve weeks [20]. So the time needed for an exercise program to generate increased performance, it takes a short time. Thus has been described that period of 2 weeks is the earliest start to
a change or an increase in physical performance, then it is likely that change has not appeared on
narakoba, so it takes longer for these changes actually appear.

MDA levels in the blood to measure the level of oxidative stress did not show any significant
differences in normal diet group, it indicates that the diet consumed is not able to provide enough
antioxidants to counteract the formation of free radicals. This shows that food intake in normal diet
group less able to provide antioxidants to counteract free radicals that are formed than in the treatment
group.

Obtained by the average value of the degree of oxidative stress to the population declines of at least
0.0371 μml, Zone diet modification effectively reduce the degree of oxidative stress (MDA). But there
is no change in the variable running speed athletes. In the Zone diet modification group the time it takes
to run a distance of 60 m, did not demonstrate a statistically significant change. But in this treatment
group can cover a distance of 60m with a shorter time, which is 2.8% decrease in speed than the normal
diet group decreased by 4.06% rate. This suggests that the high-protein diet rich in fruit and vegetables
(Zone diet modification) gave a positive influence on the running speed, because the training given to
both groups.

A decrease in the speed of both normal group and modification Zone diet is likely due to less training
time so that the physical state sample have not reach to peak. And the volume and intensity of exercise
is lacking [20]. Besides the possibility of psychological factors is included. The idea that psychological
factors play a role in performance in sports is nothing new. Several centuries ago Dudley (1888) stated
that winning and losing in sport is often depends on the quality of mental athletes [21]. Intrinsic and
extrinsic motivation is used as the most prominent factor that is believed to have a positive influence on
the performance of athletes and provide great benefits to the athlete [22].

It is known that oxidative stress is associated with decreased physical performance, muscle fatigue,
muscle breakdown and overtraining [22]. Some facts indicate supplementation with antioxidants may
protect against muscle damage caused by oxidation [23,24]. Which will accelerate the recovery phase
of athletes, especially endurance exercise and consequently improve the performance of athletes.
Therefore, the Zone diet modification group which is capable of lowering the level of oxidative stress
(MDA) giving effect to the increase in running speed of athletes, although not statistically significant.
Supplements are not a substitute for dietary fiber. Including the use of FVB [25], these supplements
cannot replace the daily intake of fiber is 20-35 g per day [22]. A complete food containing more than
one antioxidant is more effective to increase the antioxidant capacity [26]. So that a diet that contains
natural antioxidants is high, it is better for an athlete than the use of supplements.

So dietary modifications Zone diet is low in carbohydrates, high in protein and rich in fruits and
vegetables can be recommended for athletes, to increase the running speed and improve his health
through a reduction in the degree of oxidative stress, because it means the rate of cell damage caused by
free radicals formed during exercise can be derived, so menurangi fatigue, reduce recovery time, reduce
injuries, so as to support the athletes to be able to achieve the highest achievement.

5. Conclusion

- Normal diet may not increase running speed and reduce the degree of oxidative stress in athletes
  sprint.
- Diet Zone diet modifications can decrease the degree of oxidative stress at a minimum of 0,037
  μml but had no impact on the running speed sprint athletes.
- Modify the Zone diet more effective reduce the degree of oxidative stress at least 0,010 μml
  lower than the average decline in the degree of oxidative stress due to normal diet, but nothing
  is more effective between Normal diet and diet Zone diet modification to the running speed of
  the athlete.

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