CORRELATION OF ENERGY AND PROTEIN CONSUMPTION LEVELS WITH PHYSICAL ENDURANCE OF RHYTHMIC GYMNAST ATHLETES

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Abstract

Appearance of a gymnast will score additional point in competition. This study aimed to understand the correlation between consumption level of energy and protein with physical endurance of rhythmic gymnast athletes at Wimilia gymnasium in Semarang on 2010. This was an applied study. The study samples are 7 rhythmic gymnasts at Wimilia gymnasium in Semarang. We used total sampling technique. Our analysis found a strong correlation between independent variables and dependent variable. $X_1Y_1 = 0.97$; $X_2Y_2 = 0.77$; $X_3Y_3 = 0.97$; $X_4Y_4 = 0.96$; $X_1Y_1 = 0.94$; $X_2Y_2 = 0.79$; $X_3Y_3 = 0$, 97 and $X_4Y_4 = 0$, 96. Research data suggested that gymnastics Wimilia coach and rhythmic gymnast trainers were to pay more attention to the correlation between dependent variable's static balance.

Introduction

In the life process of a human, from beginning of conception, growth period until elder, nutrition is an indispensable factor. Deficiency or excess in any form will cause significant influence in growth. Adequate nutrients, especially energy and protein, is considered important to meet physical need for activities in daily life and avoid diseases (Lutviana, 2010). Deficiency of energy and protein for a certain period will decrease weight and cause nutritional deprivation state that will impact physical endurance (Supariasa, 2002).

Rhythmic gymnastics is an artistic and aesthetic sport with a certain training process, with young athlete and exercise process that started prior to bone maturation, high intensive training hours per week, numerous repetitions, and have high level of difficulty (Marta, 2013). The success of rhythmic gymnastics athletes was influenced by the visual appeal and aesthetics of the body that was indirectly driven by the demands of the Code of Point FIG. In addition to that, other major reasons such as body size, body shape, and body composition affected athlete's performance (Tijana, 2013). Another important thing that should be possessed by gymnasts is physical ability, including strength, power, formation, flexibility, agility, endurance, and coordination between hands and eyes (Rehab, 2017).

Athlete's performance plays a key role in athlete's achievement. Things that affect the performance of athletes, especially rhythmic gymnastics are as follows: technical aspects, psychological factors, training process as well

as physical and biological conditions. Other factors such as beauty, assessment criteria, jury different assessment, eating disorder, and diet could also affect the performance of rhythmic gymnast athletes during the competition (Marta, 2013).

Rhythmic gymnastics uses age grouping as follows; pre-junior group (age 12 and under), junior group (age 13-15 years), and senior group (age 16 years and above). Helen (2008) mentioned that the golden age of a female gymnast to reach peak performance was at an age of 17, which belonged to senior age group.

Based on preliminary study, found unique diet on rhythmic gymnast athletes at Wimilia gymnasium in Semarang city, in which they limit source of carbohydrates such as rice, bread, etc. and increase vegetables portion. This implementation for gymnastics athletes, especially rhythmic gymnastics athletes, was because they should have ideal body shape, preferably a slim one. Besides, appearance of a gymnast will score additional point in competition.

Nutritional status is an expression of a state of balance in a specific form or embodiment of nutriture in the form of a specific variable (Supariasa, 2002). Nutritional status, according to Hapsari, has a positive correlation with human physical quality. According to Indrawita, nutrient intake is used for energy sources in activities or jobs (Ridwan, 2017). Nutrient deficiency and malnutrition in the book SK Anthropometry (2010) is a nutritional status based on weight by age (W/A) index which is equivalent to the term underweight (nutrient deficiency) and severely underweight (malnutrition). Study showed that factors related to nutritional status were: energy consumption (p = 0.001), protein consumption (p = 0.001), infectious diseases (p = 0.001), knowledge (p = 0.002), education (p = 0.001), and income (p = 0.002) (Lutviana, 2010). Other studies found that there is a significant correlation between level of physical fitness and work productivity (p = 0,033) also nutritional status with work productivity (p = 0,020) (Adrianto, 2010).

Carbohydrates are an important nutrient for athletes. Carbohydrates are converted into glucose and glycogen to maintain blood glucose levels and delay fatigue in athletes (Tony, 2011). Carbohydrates are macronutrients consisting of carbon, hydrogen, and oxygen atoms that can be divided into several categories based on their structure, such as monosaccharides, disaccharides, and polysaccharides. The term "saccharide" describes molecules that are sugar or sweet, and are often used as carbohydrate synonym (Marina, 2009). A study on 75 bicycle athletes showed carbohydrate intake of 0.6 gr/kg BW bananas could increase performance by 5%, and save metabolism by 50% (David, 2015).

Protein is a nutrient that is often associated with formation of muscle mass for athletes. High consumption of protein in athletes not only aims to avoid deficiency, but also aims to improve adaptation to training stimulus (Philip, 2011). In the field of sports, chemical energy is transformed into mechanical energy used by athletes while exercising. The necessary energy sources are mainly derived from carbohydrates, fats, and protein undergoing chemical processes. Energy derived from nutrients breakdown is used for the formation of ATP in the muscle, which is a ready to use energy for activities (Sudiana, 2010).

Physical endurance is body's ability to resist fatigue and recover rapidly after exercise. We performed measurements using the following methods: (1) Togok flexibility, (2) sit and reach test, (3) static balance, using a stork stand test, that is a one-legged standing test, (4) durability of abdominal muscles, using lute-knee-sit-up sitting tests, and (5) 30-meter running speed (Janssen, 1999).

This study aimed to determine correlation between the level of energy and protein consumption with physical endurance of rhythmic gymnast athletes at Wimilia gymnasium in Semarang city.

Method

This is an explanative study, which explains the relationship of several variables through hypothesis testing in the field of community nutrition. The method used is a test survey with correlational approach, which means the nature of the relationship of the variables is unclear which one was the causal or effect variable. We conducted the study at the Wimilia gymnasium in Semarang, on FIK

UNNES Laboratory, and took all the athletes of rhythmic gymnast there as study subject. We obtained data directly from subjects as follow: (1) we collect level of energy and protein intake data by recalling sample food for three days, and (2) we obtained physical endurance data by measuring the flexibility of Togok, static balance, abdominal muscles endurance and running speed of 30 meters.

The data was obtained, edited, and checked for any errors in writing and data processing using SPSS and FP 2 software. We processed the data as follows: (1) by recalling 24 hours for three days and using manual calculation with weight correction, we obtained energy consumption level data of gymnastics athletes to calculate average energy consumption daily, then compared it to Recommended Dietary Allowances (RDA) expressed as percentage and (2) by recalling 24 hours for three days and using manual calculation with weight correction, we also obtained data of protein consumption level. The formula we used to obtain data of average protein consumption daily which was then compared to RDA expressed as percentage, were as follow:

RDAi : Ba/Bs x RDA
DILi : DIi/RDAi x 100%
Ba : Actual Body Weight
Bs : Standard Body Weight
RDA : Recommended Dietary Allowances
DIL : Daily Intake Level
DI : Daily Intake
RDAi : Individual Recommended Dietary Allowances.

Result and Discussion

We presented correlation coefficient values for each pair of cells in the following table: The following are discussion of the results, based on the recapitulation of correlation coefficient value of each pair of cells shown in table 1.

The first independent variable (X_1) paired with the first dependent variable (Y_1) had a correlation coefficient value of 0.97. This means that the strength of the relationship between the pair was near perfect (close to 1.0). Furthermore, it can be interpreted that for this first pair of correlations, each addition of 1 unit in the first variable would be followed by an

addition of 0.97 units in the other. One could assume if the energy consumption variable (X_1) rise 1 unit, it will be followed by a 0.97 units increase in the Togok flexibility variable (Y_1). Therefore, the correlation between energy consumption with the flexibility of Togok on rhythmic gymnast athletes at Wimilia gymnasium was strong.

The first independent variable (X_1) paired with the second dependent variable (Y_2) had a correlation coefficient value of 0.77. This means that the strength of the relationship between the pair was strong. Hereafter, it could be interpreted that for this second pair of correlation, each addition of 1 unit in the first variable would be followed by an addition of 0.77 units in the other. It could be said that if the energy consumption variable (X_1) rise 1 unit, it will be followed by an increase of 0.77 units in the static equilibrium variable (Y_2). Therefore, the correlation between energy consumption and static equilibrium on rhythmic gymnast athletes at Wimilia gymnasium was strong.

The first independent variable (X_1) paired with the third dependent variable (Y_3) had a correlation coefficient value of 0.97. This means that the strength of the relationship between the pair is near perfect (close to 1.0). Hence, it could be interpreted that for this third pair of correlations, each addition of 1 unit in the first variable would be followed by an addition of 0.97 units in the other. Apparently, if energy consumption (X_1) variable rise 1 unit, it would be followed by an increase of 0.97 units in the endurance of abdominal muscles variable (Y_3). This means that the correlation between energy consumption with abdominal muscle endurance on rhythmic gymnast athletes at Wimilia gymnasium was strong.

The first independent variable (X_1) paired with the fourth dependent variable (Y_4) had correlation coefficient value of 0.96. This means that the strength of the relationship between the pair is near perfect (close to 1.0). Furthermore, it could be interpreted that for this fourth pair of correlation, each addition of 1 unit in the first variable would be followed by an addition of 0.96 units in the other. It could be said that if the variable of energy consumption (X_1) rise 1 unit, it would be followed by an increase of 0.96 units in the speed of 30 m run

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Table 1. Research Results Related to Rhythmic Gymnastics and Nutritional Status

No	Researcher	Research Title	Years	Research Variable	Results
1	Siti Cholidah	Correlation Between Nutritional Status with Level of Nutritional Consumption on Adolescent Rhythmic Gymnast Athletes at Radin Inten Gymnastic Building in Jakarta	2008	Nutritional status, level of nutritional consumption	Study found correlation between nutritional status and level of energy consumption. There is no significant correlation between nutritional status and level of carbohydrate, lipid, protein, calcium, and Fe consumption.
2	Pipit Mayasaroh	Correlation of Nutritional Status and Supplement Consumption with Physical Endurance of Gymnast Athletes in Semarang	2008	Nutritional status, supplement consumption, physical endurance	Study found no correlation between nutritional status and physical endurance. There is a correlation between supplement consumption and physical endurance and there is also correlation between controlled supplement consumption using physical activity with physical endurance.
3	Reni Farenia, Dwi Putri Larasati	Muscle Strength Profile, Muscle Endurance, Muscle Burst Potential and Flexibility of Rhythmic Gymnast Athletes in Bandung based on KONI Standard (Indonesia National Sport Committee)	2009	Muscle strength, muscle endurance, muscle burst potential and flexibility	Large portion of rhythmic gymnast athletes classified as: excellent for endurance of arms and shoulder muscle, average for endurance of stomach muscle, under standard for (grip strength/hand strength), average for arm and shoulder strength, good and very good for back muscle strength, average for foot muscle strength, below average and average for arm and shoulder strength, very good for foot strength, excellent for flexibility

Table 2. Recapitulation of Correlation Coefficient Value for Each Pair of Cells

Korelasi	Y_1	Y_2	Y_3	Y_4
X_1	0.97	0.77	0.97	0.96
X_2	0.94	0.79	0.97	0.96

X_1 : Energy Consumption
X_2 : Protein Consumption
Y_1 : Togok Flexibility
Y_2 : Static Balance
Y_3 : Endurance of Stomach Muscles
Y_4 : 30 m Running Speed

(Y_4). This means that the correlation between energy consumption and the speed of 30 m running on rhythmic gymnast athletes at Wimilia gymnasium was strong.

Our study was in line with a study by Rika (2005), about Food Consumption, Energy Expenditure, and Physical Endurance of Taruna Police Academy in Semarang which reported that there was correlation between the energy consumption levels of Taruna with physical endurance. In contrast, Ridwan (2017), who studied energy intake, physical activity and physical fitness of 89 students in fifth year elementary school and stated that there was no significant relationship between energy intake and physical activity and physical fitness.

The second independent variable (X_2) paired with the first dependent variable (Y_1) had correlation coefficient value of 0.94. This means that the strength of the relationship between the pair is near perfect (close to 1.0). Furthermore, it could be interpreted that for this fifth pair of correlation, each addition of 1 unit in the first variable would be followed by an addition of 0.94 units in the other. It could be said that if the protein consumption variable (X_2) rise 1 unit, it would be followed by an increase of 0.94 units in the togok flexibility variable (Y_1). This means that the correlation between protein consumption with the togok flexibility on rhythmic gymnast athletes at Wimilia gymnasium is strong.

The second independent variable (X_2) paired with the second dependent variable (Y_2) had correlation coefficient value of 0.79. This means that the strength of the relationship between the pair is quite strong. Furthermore, it could be interpreted that for this sixth pair of correlation, each addition of 1 unit in the first variable would be followed by an addition of 0.79 units in the other. It could be said that if the protein consumption variable (X_2) rise 1 unit, it would be followed by an increase of 0.79 units in the static balance variable (Y_2). This means that the correlation between protein consumption with static equilibrium on rhythmic gymnast athletes at Wimilia gymnasium is strong.

Paul (2016), studied 140 women in New York about administration of various sizes of protein interventions in multi-component exercises to improve physical performance, and reported that there was a significant increase in the flexibility measured using the sit and reach after high protein intervention were given to subjects, although there were no differences between groups. Significant increases also occurred in the balance variables after intervention, although there were no differences between groups.

The second independent variable (X_2) paired with the third dependent variable (Y_3) had correlation coefficient value of 0.97. This means that the strength of the relationship between the pair is near perfect (close to 1.0). Furthermore, it could be interpreted that for this seventh pair of correlation, each addition of 1 unit in the first variable would be followed by an addition of 0.97 units in the other. It could be said that if the protein consumption variable (X_2) rise 1 unit, then it would be followed by an increase of 0.97 units in the stamina endurance variable (Y_3). This means that the correlation between protein consumption with endurance of abdominal muscle on rhythmic gymnast athletes at Wimilia gymnasium is strong.

The second independent variable (X_2) paired with the fourth dependent variable (Y_4) had correlation coefficient value of 0.96. This means that the strength of the relationship between the pair is near perfect (close to 1.0). Furthermore, it could be interpreted that for this eighth pair of correlation, each addition of 1 unit in the first variable would be followed by an addition of 0.96 units in the other. It could be said that if the protein consumption variable (X_4) rise 1 unit, it would be followed by an increase of 0.96 units in the speed of 30 meters running (Y_4). This means that the correlation between protein consumption and the speed of 30 meters running on rhythmic gymnast athletes at Wimilia gymnasium is strong.

This study was in line with the theory from Nicolaas (2014), that reported that the decrease in muscle mass would affect physical strength and endurance. This condition could be countered with good nutritional intake, which is with adequate intake of protein and energy. Combined proteins was assumed to be optimal to maintain muscle function so physical strength and endurance could be maintained.

Conclusion

Based on the recapitulation results of

correlation coefficient value from each pair of cells, we concluded that there is a significant relationship between the level of energy and protein consumption with physical endurance level on rhythmic gymnast athletes at Wimilia gymnasium in Semarang.

Our data suggested that trainer and coach on rhythmic gymnast athletes at Wimilia gymnasium in Semarang should pay attention to the athlete's diet so energy requirement is always fulfilled. Things to note are the selection of foods that must be customized to needs. Carbohydrate sources for example, could be selected from complex carbohydrates types such as whole grains, brown rice, corn, and others. Complex carbohydrate requires slower metabolic rate than simple carbohydrates such as fruit, sugar, honey, and others. This would be useful as a prolonged energy reserve for rhythmic gymnast athletes.

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