

The Correlation between Energy and Carbohydrate Intake with Physical Fitness among Adolescent Students Who Practice Soccer

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Keywords: Physical Fitness, Energy Intake, Carbohydrate Intake, Soccer, Adolescent.

Abstract: A person's physical fitness is essential for sports practice or competition. A good of energy and carbohydrates intake can improve human physical fitness. This study aimed to analyze the correlation between energy and carbohydrate intake with the physical fitness of adolescent students who practice soccer. This study used a cross-sectional design with a sample of 65 adolescent students in Surakarta. The analysis used in this study is the Spearman Rank test. The results showed a connection between energy intake and physical fitness ($p=0.043$). The r -value is -0.252 , indicating that the correlation is weak. The negative connection suggests that the link between variables is inversely proportional, which means that the higher the energy intake, the lower the physical fitness of adolescent students. Furthermore, no correlation was found between carbohydrate intake and physical fitness ($p=0.746$). It is principal to broaden the information on balanced human nutrition, specifically energy and carbohydrate intakes, for adolescent students to achieve paramount physical fitness.

1 INTRODUCTION

The prevalence of students who enjoy soccer is relatively high, at 73.7% (Christiawan, 2019). Students interested in soccer must always be supported with good physical health since football is played in two rounds, each of which has a reasonably long game time of 45 minutes. Physical fitness is related to the health and ability of students to perform quality daily activities before getting tired (Kuswari & Gifari, 2020). One benchmark for assessing adolescent students' physical fitness is using maximal oxygen consumption ($VO_2\max$) (Millah & Priana, 2020).

Students with a low physical fitness level are still relatively common in Indonesia. According to Bayu (2017), the percentage of students with poor physical fitness is approximately 45%. Physical fitness is a person's ability to easily fulfil their daily task without getting excessively tired and still have the energy to carry out other activities (Giriwijoyo & Sidik, 2012). Low physical fitness may reduce the speed and skill of soccer players. Physical fitness is vital for soccer players to have good stamina, to survive the match (Utoro & Dieny, 2016).

One of the factors that can affect a person's physical fitness is nutrient intake. The body needs a source of energy to operate daily. One of the major nutrients in the form of energy is carbohydrates. An imbalance in nutrient intake may subside a person's physical fitness. To elaborate, both insufficient and excessive amounts of nutrient intake may have an unfavourable effect on the body's physiological function (Penggali, 2019; Pertiwi & Murbawani, 2012).

Adolescence is a developmental transition period between childhood and adulthood. The period typically begins at 12 and ends in the late teens or early twenties (Papalia *et al.*, 2001). Sports that are practiced regularly and in adequate amounts can improve a person's physical fitness (Bardiansyah, 2013; Sepriadi *et al.*, 2020). One practice that can improve physical fitness is soccer.

The novelty of this study is the research was conducted during the COVID-19 pandemic. This research was carried out with due regard to and implementation the health protocols imposed by the Ministry of Health of the Republic of Indonesia. Based on the description above, the researchers wanted to examine and observe the correlation

between energy and carbohydrate intake with physical fitness among students' who practice soccer.

2 MATERIALS AND METHODS

This research is an analytic observational study with a cross-sectional approach. This study aims to define the correlation of energy and carbohydrate intake with the physical fitness of students who practice soccer aged between 12-16 years. This research was conducted in October-November 2021 at the Bonansa Soccer Education Training Center of Sebelas Maret University, Solo, with a sample of 65 students gathered with the total sampling technique.

The independent variables in this study were energy and carbohydrate intake, whereas the dependent variable was physical fitness. Information on energy and carbohydrate intake was obtained by questioning respondents' eating habits in the past month using a Semi-Quantitative Food Frequency Questionnaire (SQFFQ). The data was then analysed to determine the average value of the respondents' daily energy and carbohydrate consumption by calculating each food ingredient's energy and carbohydrate amount using the Nutrisurvey 2007. Physical fitness data was acquired using the Multistage Fitness Test (MFT) method by requesting respondents to run back and forth on a 20-meter track.

Data analysis was performed using the SPSS program version 22. The univariate analysis was applied to describe the characteristics of the research subjects. The bivariate analysis used was the Spearman Rank test, this was because the distribution of data on energy and carbohydrate intake was not normal. The significance level used is $\alpha=0.05$.

3 RESULTS AND DISCUSSION

3.1 Results

3.1.1 Respondent Characteristics

The data in table 1 shows that 100% of the respondents in this study were male. The research subjects were adolescence between 12-16 years old, and most were 12 years old (58,5%). The frequency of the respondent's exercise is measured by asking the frequency of the respondent's exercise during the past month. The frequency of the respondent's exercise shows that most respondents have poor exercise frequency (60%). Most of the respondents had a

normal of energy intake (73,8%) and carbohydrates intake (58.5%). Then, most respondents had very poor physical fitness (47.7%).

Table 1: Distribution Frequency of Respondents Characteristics.

Characteristics of Respondents	(n)	(%)
Gender		
Male	65	100
Age		
12 years	38	58,5
13 years	15	23,1
14 years	9	13,8
15 years	2	3,1
16 years	1	1,5
Exercise Frequency		
Poor (< 12x/month)	39	60
Good (\geq 12x/month)	26	40
Energy Intake		
Deficit	16	24,6
Normal	48	73,8
Excessive	1	1,5
Carbohydrate Intake		
Deficit	27	41,5
Normal	38	58,5
Physical Fitness (VO ₂ max)		
Very Poor	31	47,7
Poor	12	18,5
Average	14	21,5
Good	7	10,8
Very Good	1	1,5

3.1.2 The Correlation between Energy and Carbohydrate Intake with Physical Fitness

The data in table 2 demonstrates that the results of the Spearman Rank test between energy intake and physical fitness show a significant correlation with weak correlation and a negative pattern ($p = 0.043$; $r = -0.252$), meaning that the data is inversely proportional, i.e., if energy intake increases, the physical fitness decreases. Contrastingly, the statistical tests between carbohydrate intake and physical fitness show no correlation, which was indicated by a p -value = 0,746.

Table 2: The Correlation between Energy and Carbohydrate Intake with Physical Fitness of Adolescent Students.

Nutrition Intake	Physical Fitness		
	Mean \pm SD	r	P
Energy	1923,79 \pm 179,67	-0,252	0,043
Carbohydrate	254,14 \pm 25,37	-0,041	0,746

3.2 Discussion

In this study, there was a significant connection between energy intake and physical fitness among adolescence students with soccer practices ($p=0.043$; $p<0.05$). This result conforms with the research of Muthmainah *et al.* (2019), which remarked a significant correlation between energy intake and physical fitness of the male adolescents at Harbi soccer school training. In addition, this study also corroborates the research conducted by Mustakim and Ahmad (2016) and Fitriani and Purwaningtyas (2021), which indicated a significant relationship between energy intake and physical fitness.

The interview result found that the respondent's nutrient intake fulfillment relies on the food served in their respective homes, either prepared by their families or bought from restaurants. This indication is rooted in the fact that every student only comes to the practice site during the scheduled time and goes home once their practice is finished. The variation of menus with different quantities will result in other caloric counts between respondents.

Good energy intake is an important component of a person's physical fitness because human muscles require energy to contract, which can enable a person to carry out daily activities. The energy used by muscles in the form of Adenosine Triphosphate (ATP) results from the oxidation of various nutrients found in food, including proteins, fats, and carbohydrates. Excessive energy intake can affect body weight. A person's body weight can affect nutritional status. Then, nutritional status can affect a person's physical fitness (Almatsier *et al.*, 2013). A person with excessive energy intake can also decline their physical fitness. Nutrients are required to provide energy for various activities (Penggali, 2019).

This study's statistical results showed no connection between carbohydrate intake and physical fitness ($p = 0.746$; $p>0.05$). The result is in line with Dewi and Kuswari (2013) research, which also revealed no correlation between carbohydrate intake and physical fitness. Pertiwi's research (2012) also proved no relationship between carbohydrate intake and physical fitness. This lack of connection maybe caused by other factors apart from food intake, one of which is the frequency of exercise.

Nevertheless, carbohydrate still plays a dominant role in improving one's physical fitness since they provide the highest amount of energy compared to protein and fat (Penggali, 2019). Human store carbohydrates in the form of glucose and glycogen inside the muscles and liver. The muscles then can

directly use that glycogen to form energy. Carbohydrate administration aims to replenish the muscle while the liver-stored glycogen is used for muscle contraction. A person with a low amount of glycogen will be prone to fatigue. If one does not consume enough carbohydrates daily, the body will reduce the amount of glycogen stored in the muscle and liver. A decrease in glycogen may decrease a person's physical fitness (Welis & Rifki, 2013). One gram of carbohydrates produces energy of 4 kcal.

In addition to food intake, the frequency of exercise also has a vital role in maintaining and enhancing a person's physical fitness. According to Budiwanto (2012), frequent exercise can maintain and improve physical wellness. The recommended amount of exercise is 3-5 times per week or at least 12 times per month. The study found a 60% prevalence of teenagers who exercise less than twelve times a month.

Furthermore, physical fitness can also be interpreted as the level of a person's aerobic capacity, which is obtained from the $VO_2\max$ value. $VO_2\max$ refers to the intensity of the aerobic practice and indicates the person's maximum capacity to transport and utilize oxygen during moderate-intensity exercise. $VO_2\max$ is the highest oxygen consumption level achieved during extreme exercise (Rancovic *et al.*, 2010).

4 CONCLUSIONS

This study concluded that there is a connection between energy intake and physical fitness of male adolescents with a negative proportionate relationship, the higher of energy intake, the lower the physical fitness is. On the contrary, carbohydrate intake does not correlate with physical fitness.

ACKNOWLEDGEMENTS

The researcher would like to express our gratitude to the director and coach of the Bonansa Soccer Training Center of Sebelas Maret University, Solo, for accommodating this research and to all the students and parents for participating in this study.

REFERENCES

- Almatsier, S., Soetardjo, S., & Soekatri, M. 2013. *Gizi Seimbang dalam Daur Kehidupan*. PT Gramedia Pustaka Utama
- Bardiansyah, S. A. 2013. *Kapasitas Vital Paru dan VO₂max Siswa SMP IT Roudlotus Saidiyah Semarang*. Universitas Negeri Semarang
- Bayu, I. M. A. 2017. Profil Tingkat VO₂max pada Siswa Sekolah Sepak Bola (SSB) Palembang Muda. *Wahan Didaktika*
- Budiwanto, S. 2012. *Metodologi Latihan Olahraga*. Universitas Negeri Malang
- Christiawan, Y. 2019. *Kesesuaian antara Minat Siswa dalam Mengikuti Program Ekstrakurikuler Sepak Bola dan Daya Dukung Sarana dan Prasarana SMP Negeri Se-Kecamatan Karanganyar Tahun Ajaran 2018-2019*. Universitas Sebelas Maret
- Dewi, E. K., & Kuswari, M. 2013. Hubungan Asupan Zat Gizi Makro dan Status Gizi terhadap Kebugaran Atlet Bulu Tangkis Jaya Raya pada Atlet Laki-laki dan Perempuan di Asrama Atlet Ragunan Tahun 2013. *Nutrire Diaita*
- Fitriani, A., & Purwaningtyas, D. R. 2021. Relationship between BMI, Energy Intake, Macro Nutrient Intake, and Cardiorespiratory Fitness among Female College Students in Jakarta. *Science and Technology Publication*
- Giriwijoyo, S., & Sidik D. Z. 2012. *Ilmu Kesehatan Olahraga*. PT Remaja Rosdakarya
- Kuswari, M., & Gifari, N. 2020. *Periodisasi Gizi dan Latihan*. PT Rajagrafindo Persada
- Millah, H., & Priana, A. 2020. Pengembangan Perhitungan Kapasitas Volume Oksigen Maksimal (VO₂max) menggunakan Tes Lari 2,4 KM Berbasis Aplikasi Android. *Gelanggang Olahraga Jurnal Pendidikan Jasmani dan Olahraga*
- Mustakim., & Ahmad, K. 2016. Nutritional Status, Nutrient Intakes, and Physical Activity in Relation to Physical Fitness. *KESMAS*
- Muthmainah, I., Ismail, A. B., & Prabowo, S. 2019. The Correlation of Energy Intake and Macronutrients (Protein, Carbohydrate, Fat) with Fitness (VO₂Max) in Teen Athletes at harbi Soccer School. *Jurnal Kesehatan Masyarakat Mulawarman*
- Papalia, D. E., Old, S. W., & Feldman, R. D. 2001. *Perkembangan Manusia (Human Development)*. Salemba Humanika
- Penggalih, M. H. S. T. 2019. *Respons Adaptasi Biokimia dan Fisiologi Atlet*. Gadjah Mada University Press
- Pertiwi, A. B., & Murbawani, E. A. 2012. Pengaruh Asupan Makan (Energi, Karbohidrat, Protein, dan Lemak) terhadap Daya Tahan Jantung Paru (VO₂maks) Atlet Sepak Bola. *Journal of Nutrition College*
- Rankovic, G., Mutavdzic, V., Toskic, D., Preljevic, A., Kocic, M., Rankovic, G. N., & Damjanovic, N. 2010. Aerobic Capacity as an Indicator in Different Kinds of Sports. *Bosnian Journal of Basic Medical Sciences*
- Sepriadi, Jannah, K., & Eldawaty. 2020. The Effect of Jogging Exercise to Improve Hemoglobin Levels. *Journal of Physics*
- Utoro, F. B., & Dieny, F. F. 2016. Pengaruh Penerapan Carbohydrate Loading Modifikasi terhadap Kesegaran Jasmani Atlet Sepak Bola. *Jurnal Gizi Indonesia*
- Welis, W., & Rifki, M. S. 2013. *Gizi untuk Aktivitas Fisik dan Kebugaran*. Sukabina Pres