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Original Article

The comparison of offline and online nutrition education on body mass index in rugby athletes during the Covid-19 Pandemic (The Body Mass Index profile of Jakarta athletes during Covid-19 Pandemic)

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Abstract:
The Covid-19 pandemic has brought many changes to athletes' habits, such as being at home more often, overeating and reduced physical activity that may increase the risk of increased BMI in Rugby athletes during the pandemic. This may have a major impact on athlete's performance. Nutrition education interventions carried out during a pandemic must also change. Education that is usually done using the offline method must now also be modified into nutrition education using the online method. Nutrition education has been proven to increase knowledge and body mass index in athletes, but no one has compared body mass index from online and offline nutrition education. The aim of this study was to compare the body mass index of Rugby athletes in offline and online nutrition education. The author conducted offline nutrition educations in March 2019, and online nutrition educations in December 2020. After the end of the nutrition educations, the body mass index of Rugby athletes were measured. From 30 Rugby athletes, there were 23 athletes who took part in both nutrition education activities, so the data of these 23 athletes were used in this study. The data were analyzed using General Linear Model Repeated Measures. The result showed significant differences between body mass index of Rugby athletes after offline nutrition educations 24.78 ±2.78, to body mass index after online nutrition educations 25.73±2.24. This study showed that offline nutrition educations were significantly better than online nutrition educations ($F=5.147$, $p<0.05$). Our findings indicate that nutrition education methods are important to affect body mass index in athletes. It implies that the sport nutrition team should consider to prioritize the athletes with nutrition educations using the offline methods. Hence, further research needs to be carried out to examine athletes' level of knowledge, training patterns and nutrition intake of athletes before and during the pandemic
Key Words: - **Nutrition Intervention, Team Sport, Knowledge, Anthropometrics Measurement**

Introduction

The new SARS-CoV-2 virus that causes the Corona virus disease 2019 (COVID-19) was identified for the first time in China (Wuhan) since December 2019. COVID-19 spreads rapidly throughout the world and became the world's largest known pandemic. On January 30, 2020, the World Health Organization (WHO) declared that the novel COVID-19 outbreak was a public health emergency of international concern. The outbreak has caused governments in various countries to take swift and protective action. Health Authorities have issued safety recommendations to take simple precautions to reduce exposure and transmission of the virus. These measures include travel restrictions, social isolation at home, home sports, school closings, etc. (Wu & McGoogan, 2020).

COVID-19 was identified in Indonesia approximately in the beginning of March 2020. The pandemic COVID-19 has caused many changes in human life. Previous research data showed an increased BMI in athletes during the pandemic as much as 70.3% due to a decrease in physical activity during the semi-lockdown (Richard Guessogo et al., 2021). These changes also have an impact on athletes in Indonesia. DKI Jakarta regional Rugby athlete is one of the athletes that is affected by the COVID-19 pandemic. One of the changes that has to be adapted by most of the athletes is training at home and monitored online by the coach. Changing habits of being more frequent at home, overeating and reduced physical activity, cause increase risk of BMI gain in Rugby athletes during the pandemic. In return this will have a major impact on athlete's performance. It is necessary to provide effective nutritional interventions to control BMI of athletes. Furthermore, an increase in BMI can be a risk for ankle sprain injuries. Research by (Hartley et al., 2018) showed that low Y-balance test performance scores and high BMI increased the risk of ankle sprain injuries.

One of the nutrition interventions that can be done is providing nutrition education. Nutrition education interventions are programs designed to increase knowledge and modify eating habits in target populations. Providing nutrition education is an intervention that has often been applied to team sports athletes and has shown

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promising results. Boosting nutritional knowledge can produce substantial positive changes in eating habits in team sports athletes. As a consequence, good eating habits can improve athlete's performance. Therefore, nutrition education interventions are a key strategy for optimizing the performance of team sports athletes (Sánchez-Díaz et al., 2020). Nutrition education interventions can be useful to improve eating habits and food selection according to needs, so that behavior changes occur, especially related to eating patterns. However, in order to get effective intervention in changing behavior, it is necessary to identify the desired behavior, guide the recommended amount and include activities that are appropriate to the target population (Murimi et al., 2019).

Nutrition for athletes is the application of nutritional knowledge to the athlete's diet plan that can provide energy for exercise, carry out the body's metabolism, improve performance in competition, and provide health. Unhealthy eating behavior not only affects the performance of athletes, but also negatively affects their general health (Furber et al., 2017). Therefore, nutrition education interventions carried out during a pandemic must also be changed to adapt the current situation. Alternatively, nutrition education that is usually done using the offline method can also be modified using the online method, even though offline nutrition education has proven to be successful on its ability in educating participants (Tam et al., 2019).

Despite the pragmatic education method however the online nutrition education also has its own challenges. Although educational materials through online media are easy to use and interesting, athletes who receive education will find it more difficult to directly clarify concepts that are not understood (Hughes et al., 2019). Previous studies have discussed a lot about nutrition education and BMI, but studies which compare the online and offline nutrition education to BMI on the athletes are still scarce. Anthropometric research in athletes should be carried out to find out the significant changes during this pandemic condition, because this can affect the athlete's performance. Therefore, the aim of this study was to compare the body mass index of Rugby athletes in offline and online nutrition education.

Material & methods

Participants

The sample consisted of 30 DKI Jakarta regional rugby athletes. The sample selection was carried out by purposive random sampling. The inclusion criteria in the study were: 20-25 years old at the date of collection; healthy; participating in offline and online nutrition education in March 2019 and December 2020; taking anthropometrics data (BMI) in every education. A total of 23 athletes were selected based of the inclusion criteria, consisted of 12 male (52%) and 11 female (47,8%) athletes.

The subjects in this study were Jakarta rugby athletes who are training at the Jakarta Training Center. The Jakarta Training Center athlete is intended to prepare athletes for the national sport event named XX PON in Papua.

Procedure

This study used an experimental study design. The study design is used because it studies causal phenomena (Rachmat, 2016). The place used in this research is KONI Jakarta (Jakarta Sports Committee), considering that KONI Jakarta is a training centre for Jakarta athletes. Research and data collection were carried out in March 2019, and December 2020.The type of data used in this research is primary data includes individual characteristics and anthropometric data. The data on individual characteristics collected were age and gender. Anthropometric measurements are in the form of measurements of the athlete's height and weight.

Table 1. Materials and Research Methods

Variable	Data Types	Data	Collection Method
Individual Characteristics	Primary	• Age • Gender	• Interview
Anthropometrics measurement	Primary	• Weight • Height	• Measurement with BIA (Bio-electrical Impedance Analysis) Omron HBF-375 • Measurement with stature meter

Athletes undergone anthropometric measurements after receiving nutrition education, both offline and online. Anthropometric measurements were carried out to obtain weight and height data from previous nutritional education interventions. Measurement of body weight using Bio-electrical Impedance Analysis (BIA) using Omron HBF-375 with an accuracy of 0.1 kg. Height measurement was done using a stature meter with an accuracy of 0.1 cm.

Data collection and analysis

The data obtained recapitulated and processed with Microsoft Excel 2016 and SPSS version 26 for windows. Data processing begun with several stages, which were coding (coding), entry (data entry), cleaning (re-checking data), and data analysis. The coding was done by providing certain codes as a guide for the next stage. Then, the data were entered into Microsoft Excel and presented in tabular form. Re-checking was carried out after all data has been entered. The final stage was the data analysis .

Individual characteristics data were age and gender. Anthropometric data in the form of height and weight calculated to determine Body Mass Index (BMI). The BMI category is according to WHO (1998) with the following categories; underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), obese I (30-34.9 kg/m^2), obese II (35-39.9 kg/m^2), and obese III (≥ 40 kg/m^2). Shapiro-Wilk test was conducted to see the data distribution. The BMI for Rugby athletes was spread normally. The correlation test was used to determine the relationship between nutritional education interventions and athlete's BMI.

The comparative test conducted was the General Linear Model (GLM) Repeated Measures. Modelling in GLM is generally a function of value decomposition of the dependent variant in which the explanatory variable (independent variable) wants to explain. GLM is an extension of the linear regression model with the assumption that the predictor has a linear effect, but does not assume a specific distribution of the response variable and used when the response variable is a member of the exponential family. The requirement for this test is quantitative data (interval or ratio) that is normally distributed.

H0: There is no difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes

H1: There is a difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes

The significance value used in this study is <0.05. This provides an explanation that H0 is rejected and H1 is accepted when the p value is <0.05, which means that there is a difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes. H0 is accepted and H1 is rejected when the p value is> 0.05, which means that there is no difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes.

Results

BMI is a measure to show nutritional status in adults. BMI is defined as a person's weight in kilogram, divided by the square of the person's height in meters (kg/m^2). BMI is widely used to measure levels of overweight and obesity in a population (Jameel et al., 2019). BMI which were obtained from the subjects' intervention result is presented in table 2.

Table 2. Data on Athletes after offline and online nutrition education

Category	Offline Education		Online Education	
	Mean	Std. Deviation	Mean	Std. Deviation
Age (Years)	22.21	1.38	23.21	1.38
Height (cm)	165.90	8.25	166.00	8.28
Weight (kg)	68.90	13.36	71.42	11.82
BMI (kg/m^2)	24.78	2.78	25.73	2.24

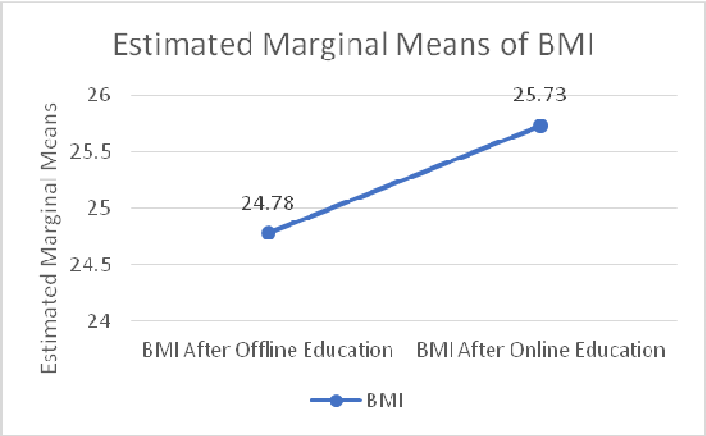

Figure 1. Estimated Marginal Means of BMI

Anthropometric measurements (body weight and height) were performed to calculate BMI in Rugby athletes. The results in table 1 show that after offline nutrition education was carried out in 2019 and online nutrition education in 2020, there was an increase in the BMI of Rugby athletes. The average BMI of the Rugby athletes increased from 24.78 ± 2.78 to 25.73 ± 2.24 (figure 1). The GLM Repeated Measures statistical test showed the p value of 0.033 (p <0.05). This explains that there is a difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes. Pairwise Comparisons test results showed an increase in the average BMI of 0.952 kg/m^2 from offline nutrition education to online nutrition education.

Discussion

A total of 23 athletes from 30 Rugby athletes have participated in offline nutrition education and online nutrition education. Rugby is a team sports that is characterized by high frequency of physical contact. The sport requires endurance, power, and speed. Rugby athletes who take part in nutrition education are DKI Jakarta regional athletes. The Rugby athletes who participated in the education consisted of 12 (52.2%) male and 11 (47.8%) female. The age of the athletes who were sampled in this study were 20-25 years old with the mean age in 2019 being 22.21 ± 1.38 years and 2020 being 23.21 ± 1.38 years.

There are previous studies on the relationship between nutrition education and BMI. Nutrition education has been proven to increase knowledge and improve body mass index in athletes. As far as the author's concern, no study has examined the body mass index of athletes with offline nutrition education, and compared when done online. This study aims to determine whether there is a significant differences between the two nutritional interventions given (offline nutrition education and online nutrition education) on the BMI of Rugby athletes. Anthropometric measurements in athletes were carried out after offline nutrition education and online nutrition education. Body weight and height were measured to then determine BMI in athletes. The results showed that there was a significant difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes.

According to WHO (1998), the normal range of BMI is between 18.5-25 kg/m^2. In this study, the average BMI of athletes after receiving offline nutrition education was 24.78 ± 2.78 kg/m^2, while the BMI of athletes after online nutrition education was 25.73 ± 2.24 kg/m^2. There was an increase in the average BMI of Rugby athletes by 0.925 kg/m^2 from offline nutrition education to online nutrition education.

The increase of BMI in Rugby athletes during a pandemic can occur due to several factors. Factors during the pandemic are mostly a decrease in physical activity, especially exercise and uncontrolled food intake. The decrease in physical activity during the pandemic is a consequence of the health authority policy. Social isolation at home has led to a decrease in non-exercise physical activity during the pandemic. Furtheremore, the training program that is performed during the pandemic was less than during face-to-face training. da Silva Santos et al., (2021) found that there was an increase in sedentary time and a decrease in total physical activity per day in badminton athletes during the Covid-19 pandemic compared to before the Covid-19 pandemic. In a survey involving 35 research institutions, it was reported that respondents had an unhealthy diet and consumed more snacks during the COVID-19 lockdown (Ammar et al., 2020).

Reduced exercise intensity and increased sedentary time during a pandemic can reduce athlete's performance. Paoli & Musumeci (2020) showed that stopping exercise in the long term, such as during the Covid-19 pandemic, causes a decrease in maximal oxygen consumption (VO_2max), reduced endurance capacity, strength, and muscle mass. A decrease in skeletal muscle activity can significantly increase the risk of injury in both non-contact and contact sports such as football. In addition to performance and injury, increased BMI could be a risk factor of decreased immunity and health in athletes. High BMI also risk factor for metabolic syndrome. Continuous increase in weight will lead to obesity and can also lead to an increased risk of degenerative disease (Walsh et al., 2018). Cohort Study by Bhaskaran et al., (2018) showed that the BMI range is analogous to a J-shaped curve with the lowest risk occurring in the range of 21-25 kg/m². Individuals with obese and underweight categories have a shorter life expectancy than individuals with a normal BMI.

Uncontrolled eating patterns or excessive food intake can increase BMI in athletes. This increase in BMI is related to weight gain due to daily energy surpluses. In fact, an increase in BMI can occur when the athlete's diet is the same as before the pandemic, but with a lower intensity of exercise. This is due to the imbalance of energy consumed which is greater than the energy expended. Reduction in activity may result reduced energy expenditure, which consequently may cause unwanted body fat gain (Jukic et al., 2020).

BMI in athletes is important because it can affect athlete's performance, nutrition regulation, and risk of injury. Estimating BMI in athletes helps to improve performance and to evaluate the results of the training performance. BMI and injury are related to each other in athletes. BMI can be used to adjust training sessions, diet, and others according to the athlete's fitness level (Jameel et al., 2019). Amoako et al., (2017) found that there is a correlation between higher BMI and increased risk for lower leg injuries. Ankle sprain were associated with higher BMI related to a person's inability to effectively and rapidly change momentum. Similarly, knee injuries may be more likely to occur in high BMI athletes.

During the pandemic, there has been a change in activities from offline to online, including providing nutrition education to athletes. Changes in patterns caused by COVID-19 have physical, nutritional, and psychological consequences that may affect athletes.

Nutrition education interventions in professional sports can help targets to modify eating habits and food choices of athletes, and increase nutritional knowledge (Jenner et al., 2020). Nutritional knowledge that brings changes to a better eating habits can improve the performance of a team sports athletes. Therefore, nutrition education interventions appeared to be a key strategy in optimizing the performance of team sports athletes (Sánchez-Díaz et al., 2020). Although nutrition knowledge was not a strong-predictors for athlete's performance, Debnath et al., (2019) found that there is a direct proportional relationship of nutrition knowledge and nutrition practice with VO_2 max.

Mohd Elias et al., (2018) found that sports nutrition education interventions increase sports nutrition knowledge, attitudes, and practice (KAP) scores, increasing total energy intake and athletes' macronutrients. The main results of the meta-analysis conducted by Sánchez-Díaz et al., (2020) found that the implementation of nutrition education interventions consistently leads to positive changes in eating habits and nutritional knowledge, as well as maintaining or improving body composition. Nutrition education has been proven in various studies to have a positive impact on nutritional knowledge in athletes.

Providing nutrition education to increase knowledge is only one of the factors that influence what we eat. Other factors, such as psychological, social, economic, lifestyle, and beliefs, will also have an effect. Thus, simply increasing knowledge does not always change into certain behaviors, if the intention to carry out these behaviors is lacking (Heikkilä et al., 2019).

The results of this study indicate an increase in BMI in rugby athletes after being given nutritional intervention. The increase in BMI from offline education to online education shows that there are other factors that influence nutrition interventions and have been discussed previously. If it is related to the nutritional education intervention method, which is given the provision of offline nutrition education, it is considered to be better than the provision of nutrition education online. Offline nutrition education that teaches skill-based nutritional knowledge has shown success in its ability to educate participants about healthy dietary choices in non-athletic populations (Tam et al., 2019). The offline education method has the advantage of having face-to-face interactions so that subjects can interact more and also show enthusiastic participation in learning (Chand et al., 2021). Education through online media can be a time and distance saver alternative. However, online nutrition education also has its own challenges. Although educational materials through online media are easy to use and interesting, athletes who receive education will find it more difficult to directly clarify concepts that are not understood (Hughes et al., 2019). In addition, poor internet connection conditions and other technical obstacles can also be a drawback in educational activities using online media.

The limitations of this study were that the scores of knowledges, attitudes and practices (KAP) of athletes were not studied after being given education both online and offline. In addition, the training patterns and consumption patterns of athletes have not been studied before and during the pandemic. The same or higher food intake during a pandemic with a less intense exercise pattern can lead to a positive energy balance. Although no studies have yet shown the long-term implications of large-scale lockdowns during a pandemic on body composition, athletes should reduce their total daily energy intake to reflect the reduction of physical inactivity (Narici et al., 2021)

Another factor contributing to our results is the ineffectiveness of online methods. This is in line with the research conducted by Chan et al., (2021) related to the effectiveness of online teaching methods in physical education, the results show that online method has low effectiveness, so it is necessary to develop more creative and interactive online methods. There is another study with similar online education methods using social media in the delivery of nutrition education. This study showed a significant decrease in the percentage of total calories from dietary fat and a significant decrease in BMI values from the pre-test and post-test results. This shows that online education can have a good impact on respondents. In addition, this research shows that more alternatives can be developed to provide online education (Coccia et al., 2020).

Previous in-line studies only showed the results of nutrition education interventions using one method (online or offline). It was not clear how the two methods were compared and the effectiveness comparison of those methods. This study shows us that the comparison is to know the effectiveness in giving nutritional interventions on educating athletes. Recommendations for further research are to increase the number of samples and to conduct a research on samples of other sports or in various sports. In addition, level of knowledge, training patterns, and nutritional intake of athletes before and during the pandemic are need to be added as additional data.

Conclusions

Our findings indicate that there is a difference between BMI after offline nutrition education and BMI after online nutrition education for Rugby athletes. After offline nutrition education was carried out in 2019 and online nutrition education in 2020, there was an increase in the BMI of Rugby athletes. In conclusion, nutrition education methods are important to control the BMI of athletes. It implies that sport nutrition team may prioritize to give athletes nutrition educations with offline methods. However, further research needs to be carried out to examine athlete's level of knowledge, training patterns, and nutrition intake of athletes before and during the pandemic.

Conflicts of interest: The authors declare no conflict of interest.

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