

## CHOCOLATE BAR WITH MORINGA AND DATES AS CALCIUM-RICH FOOD WITH LOW GLYCEMIC INDEX FOR ENDURANCE ATHLETES

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### ABSTRACT

This research aims to provide chocolate for endurance athletes by utilizing the potential of highly nutritious local foods. The ingredients used are chocolate, moringa leaves (*Moringa oleifera*), and dates (*Phoenix dactylifera*). This research method uses a Completely Randomized Design (CRD) with One Way Anova statistical analysis. Samples were analyzed by testing in a food laboratory. In this study, moringa powder was used for its calcium content and dates were used for its carbohydrates content with a low glycemic index. In 100 grams of developed chocolate contains 3.27 g of water, 1.83 g of ash, 30.4 g of fat, 5.32 g of protein, 59.1 g of carbohydrate, 0.38 g of crude fiber, 427.07 mg of calcium.

**Keywords:** *Chocolate; dates; endurance athletes; low GI; moringa.*

### ABSTRAK

Penelitian ini bertujuan untuk menyediakan cokelat bagi atlet *endurance* dengan memanfaatkan potensi pangan lokal yang bernilai gizi tinggi. Bahan-bahan yang digunakan adalah cokelat, daun kelor (*Moringa oleifera*), dan kurma (*Phoenix dactylifera*). Metode penelitian ini menggunakan Rancangan Acak Lengkap (RAL) dengan analisis statistik One Way Anova. Sampel dianalisis dengan pengujian di laboratorium pangan. Dalam penelitian ini, penggunaan moringa powder didasari oleh kandungan kalsiumnya dan kurma oleh kandungan karbohidratnya yang memiliki indeks glikemik rendah dalam 100 g cokelat yang dikembangkan adalah sebagai berikut 3,27 g air, 1,83 g abu, 30,4 g lemak, 5,32 g protein, 59,1 g karbohidrat, 0,38 g serat kasar, 427,07 mg kalsium.

**Kata kunci:** *Atlet endurance; cokelat; GI rendah; kelor; kurma.*

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## INTRODUCTION

In the competition period, the supply of food must meet the quantity and quality of nutrition, namely the amount of energy and balanced nutritional composition. It is recommended that the consumption of carbohydrate-source foods as a reserve of muscle and liver glycogen needed during the match. This aims to prevent the occurrence of hypoglycemia, prevent fatigue and maintain muscle working power. Feeding needs to be arranged so that before the competition begins the process of food digestion is complete. This is important because, during the competition, blood flow is concentrated into the muscles to deliver nutrients and oxygen needed when the muscles contract. Usually, 2-3 hours before the match has given snacks such as bread/crackers (Welis and Syafrizal, 2009). Refill carbohydrate deposits with a pre-event meal or snack for 1-4 hours before the competition around 1-4 g / kg BB (Louise Burke and Greg Cox, 2010).

In this case, the concept of the glycemic index (GI) was developed, which is a level of food according to its effect on blood sugar levels. Consumption of foods with low GI ( $\pm 2$  hours before a competition) can guarantee the release of glucose into the bloodstream constantly during the game. This is because foods with a low GI are digested slowly so that their storage is also slow. Extra glucose will be available until the end of the game because muscle glycogen is stored slowly (Welis and Syafrizal, 2009). Low GI has characteristics that can cause the digestive process in the stomach to run slowly, so the rate of emptying the stomach (gastric emptying rate) also takes place slowly. This results in a suspension of food that has undergone digestion in the stomach (chyme) more slowly reaching the small intestine so that further digestion of carbohydrates and absorption of glucose in the small intestine occurs slowly. Likewise, in low-GI foods, most glucose uptake occurs in the upper small intestine (duodenum) and the middle part (jejunum). In the end, fluctuations in blood glucose levels are relatively small. With these metabolic characteristics, low-GI foods can reduce the glycemic and insulin responses (Hoerudin, 2012). Dates contain high carbohydrates with a low glycemic index so that it

is potentially a food source of energy for endurance athletes. Dates are useful as a substitute for the energy lost when competing because of the natural sugar content. So, it does not make blood sugar pressure soaring sharply. Dates also contain potassium which can strengthen muscle function so that it is not easily injured. 100 g of dates can provide 314 kcal of energy with the main components being monosaccharides (Dayang *et al.*, 2014).

High-intensity exercise causes a decrease in bone mass. Calcium plays an important role in bone health, especially for athletes who prioritize physical contact (Nguyen, 2010). Adequate calcium consumption helps maintain healthy bones and reduces the risk of injury to bones when competing. Athletes are encouraged to consume calcium-fortified foods as an alternative source of calcium to meet calcium needs per day. Calcium helps optimize bone density and prevents osteoporosis in athletes (Amiruddin and Yusni, 2015). One source of calcium is found in Moringa leaves. Moringa leaves are referred to as magic plants based on their use, especially related to medicine and nutrition. In 100 g fresh Moringa leaves contain at least 1077 mg of calcium (Fahey, 2005). The calcium content is increased when the Moringa leaves are dried.

Fortification can also be done on processed cocoa bean products, namely chocolate. Some types of chocolate products such as dark chocolate made from cocoa paste with the addition of a little sugar, milk chocolate made from cocoa paste, cocoa butter, sugar and milk powder, and white chocolate made from cocoa butter, sugar and milk powder. Also, there are couverture chocolates which are premium or high-quality chocolates that are often used by professionals in the industry to make pastries or cakes (Agus, 2012).

Nowadays athletes tend to want food they like and are practical, also consider food in terms of nutrition. The availability of local food-based snacks from chocolate, Moringa, and dates for athletes is still rarely found, especially in Indonesia. Therefore, it needs to be developed as an effort to utilize local food potential.

**METHODOLOGY**

**Materials and Method**

This study used an experimental method with a completely randomized design. Data analysis used One Way ANOVA and continued with the Duncan test. Samples were analyzed in a food laboratory, carbohydrate using the By Difference method, protein using the Kjeldahl method, fat using the Sokhlet method, crude fiber using Gravimetric method, ash using Gravimetric method, moisture using Gravimetric method, and Calcium using AAS method.

The ingredients consist of white chocolate, moringa powder and dates with a comparison of formulations in Table 1. The equipment consists of heat-resistant glass bowls, scales, chocolate molds, pans, spoons, aluminum foil, and refrigerators.

Steps to make chocolate with the addition of moringa flour and dates is chopped chocolate or cut it into small pieces to make it easy to melt, then put it in a heat-resistant glass bowl. Then melt the chocolate using the double boiler technique. By preparing a pan whose top surface fits with a chocolate bowl, then fill about half of the water, cook until it boils. Then place the chocolate bowl on the pan. This aims to keep the water vapor from mixing with chocolate because it will make the chocolate clot quickly and the texture is not good. Stir chocolate until melted. Turn off the heat, stir continuously then add the Moringa flour and dates that have been cut into small pieces. Then pour the chocolate into a mold and put it in the refrigerator until hard. The last, pack with aluminum foil.

Table 1. Comparison Formulations of Chocolate, Moringa, and Dates (g)

<b>Raw Material</b>	<b>F1</b>	<b>F2</b>	<b>F3</b>
Chocolate	40.00	40.00	40.00
Moringa Powder	5.00	10.00	15.00
Dates	15.00	10.00	5.00

**Results and discussion**

The results of ANOVA mean analysis presented in a pie chart. The pie chart explains the

total average of nutritional content of chocolate bars in 100 grams.

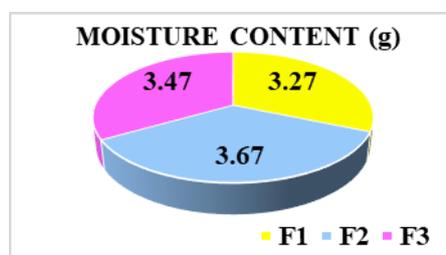


Figure 1. Nutrition-related claims in chocolate bar products (Moisture)

Based on the analysis of nutrients found the highest moisture content is F2 3.67 g. The moisture content contained in the product is affected by the constituent ingredients.

According to Rahmadi (2010), dates are a fairly high contributor to water content. A study by Sinaga *et al.*, (2019) that the addition of Moringa leaf powder can increase ash content.

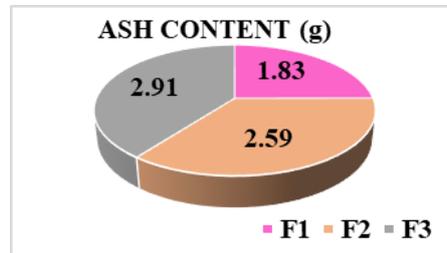


Figure 2. Nutrition-related claims in chocolate bar products (Ash)

Based on the analysis of nutrients found the highest ash content is F3 2.91 g. Because the content of Moringa powder is more than other ingredients. Moringa contains calcium that are high enough so that the more moringa powder,

ash content will increase. About 96% of food consists of organic matter and water. The rest consists of mineral elements known as organic substances or ash content. Ash content indicates the mineral content contained in an ingredient (Fajri *et al.*, 2013).

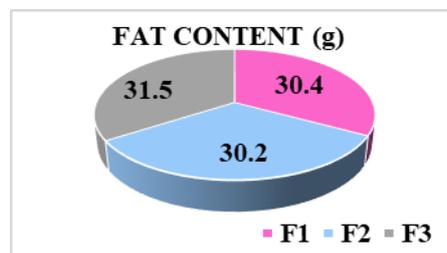


Figure 3. Nutrition-related claims in chocolate bar products (Fat)

Based on the analysis of nutrients found the highest fat content is F3 31.5 g. The fat content of this product is affected by the addition of dates and chocolate. White chocolate contains a high fat compared to other constituent ingredients. Fat in the body acts as an energy source, especially in sports with moderate intensity in a long time, for example endurance sports (Rismayanthi, 2015).

According to Burke *et al.*, (2004) fat is an important source of energy for muscle contraction during endurance sports. High-fat consumption (> 30% of total calories) can reduce carbohydrate intake, so muscle glycogen cannot be maintained. According to Fink and Mikesky (2015), the recommended consumption of fat for athletes per day is 20–35% of total energy, which includes 7–10% SFA, 10% MUFA, 10% PUFA.

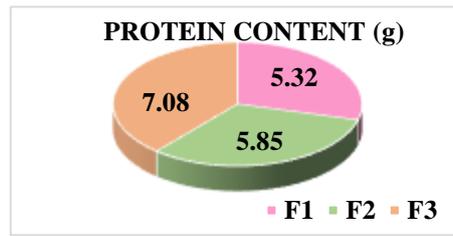


Figure 4. Nutrition-related claims in chocolate bar products (Protein)

Based on the analysis of nutrients found the highest protein content is F3 7.08 g. Because the concentration of Moringa powder is higher than other formulations.

Athlete's protein requirements are in the range of 1.2–1.6 g/ kg body weight per day. Increased protein requirements because athletes are more at risk of damage to muscle tissue, especially when training or strenuous exercise (Irawan, 2007).

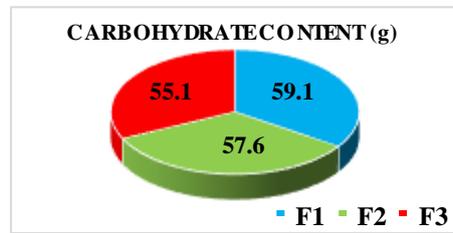


Figure 5. Nutrition-related claims in chocolate bar products (Carbohydrate)

Based on the analysis of nutrients found the highest carbohydrate content is F1 59.1 g. Because of the concentration of dates more than other ingredients. Dates contain high carbohydrates with a low glycemic index so that it is potentially a food source of energy for endurance athletes (Hoerudin, 2012). Research by Hafidha (2018) that the addition of dates can increase carbohydrate levels. Research by Al-Shahib and Marshall (2003) that dates contain a high percentage of carbohydrates (total sugar, 44-88%).

According to Louise Burke and Greg Cox (2010), the carbohydrate requirement of endurance athletes is 1–4 g per kg of body weight. Carbohydrates play a role in maintaining blood glucose levels and the speed of carbohydrate metabolism in the body to reduce the occurrence of fatigue in athletes who have endurance, carbohydrates contained in chocolate will be absorbed by the body slowly so that it can become a continuous source of glucose. Adding dates to this chocolate product can provide energy quickly for endurance athletes (Burke *et al.*, 2004).

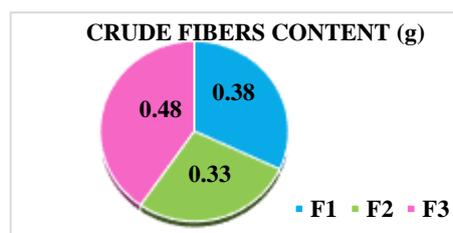


Figure 6. Nutrition-related claims in chocolate bar products (Crude Fibers)

Based on the analysis of nutrients found the highest crude fibers content is F3 0.48 g. Because the concentration of Moringa powder is higher than other formulations. Besides, the addition of dates also contributed to the levels of the fiber of chocolate dates and moringa.

According to Rock (2009) dates contain 2.49–12.31% food fiber. The comparison between the addition of dates and moringa leaf powder affects the levels of crude fibers of chocolate moringa and dates.

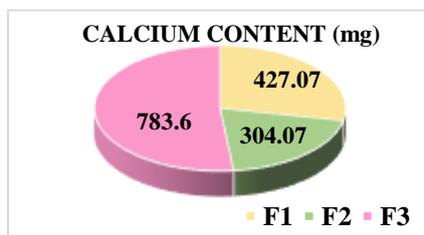


Figure 7. Nutrition-related claims in chocolate bar products (Calcium)

Based on the analysis of nutrients found the highest calcium content is F3 783.6 mg. Because the concentration of Moringa powder is higher than other formulations. According to Mahmood *et al.*, (2011) that Moringa contains good nutrients one of which is calcium. In 100 g of Moringa leaves contain at least 2003 mg of calcium (Fahey, 2005). Athletes who exercise with high intensity require calcium intake to maintain bone health to reduce the risk of injury to the bones during exercise or competition. According to Nguyen (2010) in the NSCA’s Performance Training Journal that the athlete’s calcium adequacy rate is Upper Level (UL) around 2500 mg/day.

kcal, 3.27 g of water, 1.83 g of ash, 30.4 g of fat, 5.32 g of protein, 59.1 g of carbohydrate, 0.38 g of crude fiber, 427.07 mg of calcium. The final product is served as much as 30 grams. So, it contains ± 120 kcal, ± 18 g carbohydrates, ± 9 g fat, ± 1.6 g protein, ± 0.1 g crude fiber, ± 130 mg calcium. Based on the daily value of 2475 calorie diets, 30 grams of this product can meet the daily needs of calcium 10.6%, carbohydrates 5.2%, protein 2.2%, fat 10.9%. It can be concluded that this product can be a snack for endurance athletes with good nutritional content. Health claims may also contribute to the improvement of industrial competitiveness (Fadlillah *et al.*, 2019). Chocolate with calcium content and low glycemic index is a new finding in the food industry, so it needs to be developed.

**CONCLUSION**

Based on this research, F1 is the best formula. In 100 grams of developed chocolate contains 406.16



Figure 8. Chocolate Bar with Moringa and Dates (30 g) and Nutrition Fact

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