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POTENTIAL OF DIETARY FIBER AND ANTIOXIDANTS FROM COFFEE SKIN AS A FOOD PRODUCT IN PREVENTING OBESITY: SYSTEMATIC REVIEW

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Abstract

Obesity is a global health problem that continues to increase and is a major concern in efforts to maintain public health. In this context, the role of food in preventing obesity becomes very important. Food components that have an impact on preventing obesity, namely dietary fiber and antioxidants. Coffee skins are often not utilized, even though they contain high amounts of dietary fiber and antioxidants which can help prevent obesity. The purpose of this article is to explain the potential of dietary fiber and coffee skin antioxidants to prevent obesity. The method used to complete this article is by using the literature study method. Coffee skin consists of several parts, namely pulp, parchment, and silverskin. The coffee skin is obtained from processing coffee berries or coffee cherries which go through wet, dry and semi-wet processing stages. Food products made with coffee skins contain high levels of dietary fiber and antioxidants so they can prevent obesity. Food products made using coffee husks include tea, biscuits, granola, syrup, chocolate and kombucha. Utilizing coffee skins as a food ingredient created food product that are not only delicious but also healthy because they can help individuals maintain a balanced body weight. The dietary fiber and antioxidants contained in coffee skin have the potential to prevent obesity so they can be used as food products.

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1. Introduction

The prevalence of obesity in Indonesia has reached unprecedented levels. According to the World Health Organization (WHO), Indonesia ranks first in Southeast Asia for obesity levels. Obesity is a condition of excessive weight and is usually caused by the accumulation of fat in the body. If a person has a BMI ≥ 27,0 kg/m^2, then they are classified as having a nutritional status of obesity. Obesity is a significant problem in Indonesia because the prevalence of obesity among adults (>18 years) is quite high, generally affecting women (29,3 %) and the 40 - 44 age group (29,6 %) (Handari et al., 2023). Obesity can increase the risk of chronic diseases, such as diabetes, high blood pressure, stroke, cancer, and gout. The increase in the incidence of obesity from year to year is accompanied by an increase in the prevalence of people suffering from degenerative diseases, such as diabetes mellitus, heart disease, osteoporosis, and cancer. Fast food outlets also play a role in influencing people's lifestyle, especially in terms of irregular eating habits which can cause obesity (Raharjeng et al., 2023).

Obesity can also occur if daily dietary fiber intake is still low. Dietary fiber plays a very important role, including delaying gastric emptying, reducing hunger, facilitating the digestive process, and reducing the onset of obesity (Nur et al., 2017). Improper dietary choices will also trigger obesity and cause an imbalance of prooxidants and antioxidants. This condition associated with metabolic disorders and heart diseases, such as endothelial dysfunction and atherosclerosis (Yulistianingsih & Firdaus, 2023). Thus, to overcome the incidence of obesity, it is possible to increase the consumption of foods containing high levels of dietary fiber and antioxidants, such as coffee husks.

Coffee consumption in Indonesia throughout the period 2016 - 2021 increased by an average of 8,22 % per year. The increase in coffee consumption is proportional to the increase in coffee by-products namely coffee skins. Coffee skin is the most frequent component that has not been optimally utilized (Nurhayati et al., 2020). Coffee production begins with the harvest of coffee cherries. After dry or wet processing, the product obtained is coffee beans. The processing of coffee berries into coffee beans is quite complex and produces various by-products (Heeger et al., 2017). The by-product of coffee skins amounts to approximately 257.542,8 tonnes/year of coffee bean skins produced throughout Indonesia and is only thrown away or used as manure (Rosidah et al., 2021). Industrial coffee production produces large quantities of by-products such as pulp, parchment and silverskin (Klingel et al., 2020). Coffee skin is a material that can be used to produce caffeine, polyphenols, bioethanol and antioxidants, as well as antimicrobials (Sholichah et al., 2019). By-products in the form of coffee skins represent between 50 and 60 % of the harvest. If the harvest is 1000 kg of freshly ground coffee, then around 400 - 500 kg of coffee beans become coffee beans and the rest is a by-product in the form of coffee skins (Saisa & Syabriana, 2018). Therefore, coffee skins can be used as a potential food product.

The by-product of coffee fruit skins has potential if processed into a food product as it has a fairly high economic value (Wilanda et al., 2021). The pulp is the red or yellow part of the mesocarp or flesh of the coffee fruit. The pulp contains a total dietary fiber of 50,28 % and an antioxidant activity of 51 % (Juwita et al., 2017). The pulp can be made into fruit juice drinks that are mixed with other food ingredients, such as tamarillo (Zuhra et al., 2018). Additionally, dried cascara can be used to prepare cascara kombucha drinks that are brewed like tea drinks with better taste and nutritional value (Muzaifa et al., 2022). Meanwhile, other by-products in the form of parchment have a total dietary fiber content of 19,8 % and antioxidants of 0,76 % (Nalawati & Wardhana, 2022). By-products such as silverskin contain 13,4 % total dietary fiber and 0,35 % antioxidants (Mangku et al., 2022). Some coffee skin by-products are also processed into powder form, which is then made into cakes to create high nutritional content (Suloi, 2019). Therefore, with the high content of dietary fiber and antioxidants from coffee skins, it has the potential to be processed into food products that can overcome obesity. The purpose of writing this article is to explain the potential of dietary fiber and coffee skin antioxidants to prevent obesity.

2. Method

The method used to write this article is the library study method, which is the collection, analysis and conclusion of information from various literary sources relevant to the topic discussed. Literature sources used in writing this article include scientific journals, books, reports, and online articles related to coffee skin, dietary fiber, antioxidants, and obesity. The literature sources used range from 2016 to 2023, using keywords such as “antioxidants”, “coffee skin”, “obesity”, “food products” and “dietary fiber”. The documentary sources used were selected according to criteria of credibility, validity, relevance and timeliness. The documentary sources used are then summarized, classified and synthesized to form the framework of this article.

3. Results and Discussion

3.1. Coffee Skin Parts

Figure 1. Parts of the coffee fruit

Coffee has several important parts in the processing process. First, the skin or flesh of the coffee fruit, often called pulp, protects the coffee beans inside. Coffee beans are the essence of coffee, the part that is processed to produce the coffee drinks we enjoy. The epidermis of coffee beans or silverskin is a thin layer that covers the beans and is usually peeled off during the processing process. Additionally, the horn skin or parchment of the coffee beans becomes a layer that protects the coffee beans during further processing. The slime or sap, known as mucilage, is the sticky substance that coats the coffee beans inside the fruit. Finally, the outer skin or outer rind is the external part of the coffee fruit that protects its internal components.

The coffee processing process involves important steps to separate these components. The process can vary, but generally consists of three main methods: the wet method, the dry method, and the semi-washed method. The wet method involves using water to remove the husk from the coffee beans, while the dry method relies on sunlight to dry the whole coffee cherries before the beans are separated. The semi-wet method is a combination of the two processes.

In coffee processing, coffee beans are used as the main ingredient to prepare coffee drinks. Meanwhile, by-products such as pulp, silverskin and mucilage can be used for various purposes. For example, the pulp can be used as a natural fertilizer or processed into other products, such as beverages or food additives. Silverskin and mucilage can also be used in other industries, for example as raw materials for animal feed or in bioenergy production.

Several coffee by-products have been used to make various food products, as follows (Table 1):

Table 1. Utilization of Coffee Skins as Food Products

Coffee Skin	Origin of Processing	Utilization	Reference
Arabica Pulp	The mesocarp or flesh of the Arabica coffee fruit is red or yellow	Drinks based on fruit juice, syrup, flour, or bioethanol raw materials	(Budiyanto et al., 2019)
Arabica Parchment	The white endocarp or skin of Arabica coffee beans	Bioethanol, biogas, or organic fertilizer	(Febrina et al., 2020)
Arabica Silverskin	The perisperm or thin layer that covers Arabica coffee beans	Flour, chocolate, bread, cakes, or biscuits	(Ateş & Elmacı, 2018)
Robusta Parchment	The white endocarp or skin of Robusta coffee beans	Bread, cakes, biscuits, and drinks	(Littardi et al., 2021)
Robusta Pulp	The mesocarp or flesh of the Robusta coffee fruit is red or yellow	Drinks based on fruit juice, syrup, flour, or bioethanol raw materials	(Anjliany et al., 2022)
Robusta Silverskin	The perisperm or thin layer that covers Robusta coffee beans	Flour, chocolate, bread, cakes, or biscuits	(Cantele et al., 2022)

Table 1 presents the different parts of the coffee skin depending on the type of coffee (Arabica or Robusta) and the origin of processing. Coffee skin is a general term that refers to the layers that protect the coffee beans inside the fruit. The coffee skin is made up of several parts, namely the pulp, the parchment and the silver skin. The pulp is the red or yellow part of the mesocarp or flesh of the coffee fruit. Parchment is the white endocarp or skin of coffee beans. Silverskin is the perisperm or thin layer that covers coffee beans. Apart from this, there is also the hull, which is the green exocarp or outer skin of the coffee fruit. The hull is usually separated from the coffee beans during the picking or drying process. There is also a mixture of parchment and silverskin that is separated from the coffee beans during the grinding or roasting process.

These parts of the coffee skin have various potential uses, both as food and non-food ingredients. As a food ingredient, coffee skins can be processed into beverages, flour, chocolate, bread, cakes, cookies, or other functional food products. As a non-food ingredient, coffee skins can be processed into raw materials for bioethanol, biogas, organic fertilizers, or cosmetics. The use of coffee skins can add value to coffee farmers, reduce agricultural waste, and improve community well-being.

3.2. Dietary Fiber and Antioxidant Content of Coffee Skins as Food Products

Table 2. Nutrient Content of Coffee Skins as Food Products

Coffee Skin	Dietary Fiber	Antioxidant	Other Components	Food Product	Reference
Arabica Pulp	30,8 %	0,5 %	Carbohydrate 39,1 %; Protein 18,9 %;	Coffee skin tea	(Ariva et al., 2020)

			Mineral 10,7 %		
Arabica Parchment	32,4 %	0,6 %	Carbohydrate 38,2 %; Protein 17,8 %; Mineral 11,0 %	Coffee skin biscui, bread	(Sanjaya et al., 2022; Lanywati, et al., 2023; Rizkaprilisa, et al., 2023)
Arabica Silverskin	34,1 %	0,7 %	Carbohydrate 37,3 %; Protein 16,7 %; Mineral 11,2 %	Coffee skin granola	(Li et al., 2023)
Robusta Pulp	32,3 %	0,4 %	Carbohydrate 39,6 %; Protein 19,2 %; Mineral 10,5 %	Coffee skin syrup	(Thamrin et al., 2022)
Robusta Parchment	33,9 %	0,5 %	Carbohydrate 38,7 %; Protein 18,1 %; Mineral 10,8 %	Coffee skin chocolate	(Kusumawardani et al., 2022; Rizkaprilisa, et al., 2023)
Robusta Silverskin	35,6 %	0,6 %	Carbohydrate 36,8 %; Protein 17,0 %; Mineral 11,0 %	Coffee skin kombucha, Bread	(Febriyanto et al., 2021; Rizkaprilisa, et al., 2023)

Table 2 shows the dietary fiber and antioxidant content of coffee skin which differs depending on the type of coffee (Arabica or Robusta). Dietary fiber is a food component that cannot be digested by human digestive enzymes, but has benefits for gut health, weight loss, and chronic disease prevention. Antioxidants are compounds that can protect the body's cells from damage caused by free radicals, which can cause aging, inflammation and degenerative diseases. Coffee skin contains high levels of dietary fiber and antioxidants so it can be used as a nutritious food product.

The dietary fiber and antioxidant content of coffee skin is influenced by the type of coffee, the part of the coffee skin, and the processing process. In general, coffee pulp has the highest dietary fiber and antioxidant content, followed by parchment coffee and silver coffee. The type of coffee also affects the dietary fiber and antioxidant content of coffee skin. Robusta coffee has a higher dietary fiber and antioxidant content than Arabica coffee. Coffee skin processing processes, such as drying, grinding, or roasting, can reduce or increase the dietary fiber and antioxidant content of coffee skin.

Coffee skins can be made into various food products, such as drinks, flour, chocolate, bread, cakes, or biscuits. These food products can provide health benefits to consumers, such as improving bowel function, reducing cholesterol, lowering blood pressure, reducing the risk of diabetes, and reducing oxidative stress. These food products can also add value to coffee producers, reduce agricultural waste, and improve the well-being of communities.

3.3. Dietary Fiber and Antioxidant as Obesity Prevention

Several studies have shown that consuming coffee skins may be beneficial in preventing obesity. For example, giving coffee skin extract to obese mice can reduce body weight, body mass index, visceral fat, and blood sugar (Silva et al., 2021). Additionally, feeding coffee husk flour to obese mice can reduce body weight, body fat, and blood cholesterol levels (Barajas et al., 2020). Giving coffee skin syrup to obese mice can also reduce body weight, body fat, and blood sugar (Cangussu et al., 2021). Next, giving coffee skin vinegar to obese mice can reduce body weight, body fat, and blood sugar (Dehond et al., 2020). These studies show that coffee skin can influence energy metabolism, nutrient absorption and glucose homeostasis, which play a role in controlling obesity.

4. Conclusion

Coffee skins are waste products from the coffee processing process that can be made into various food products, such as flour, syrup, tea and coffee skin vinegar. Food products processed from coffee skins contain high levels of dietary fiber and antioxidants, allowing them to prevent obesity. Some food products made from coffee hulls include tea, cookies, granola, syrup, chocolate, and kombucha. By using coffee skins as a food ingredient, it is possible to create food products that are not only delicious, but also healthy, as they can help individuals maintain a balanced body weight. The dietary fiber and antioxidants contained in coffee skin have the potential to prevent obesity and therefore can be used as food products. Optimal methods of processing coffee skins can increase the availability and quality of dietary fiber and antioxidants contained in coffee skins. Coffee skin has the potential as a raw material to produce functional food products that can prevent obesity.

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