

Underrated fruit: round green avocado's hidden nutrients against obesity and comorbidities

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ABSTRAK

Latar belakang: Alpukat merupakan tanaman buah bernilai gizi tinggi yang banyak tersedia, terjangkau, dan melimpah, khususnya di Jawa Tengah. Ijo bulat merupakan varietas alpukat unggulan di Indonesia. Sebagai sumber makanan alami, alpukat kurang dihargai dan kurang populer dibandingkan buah-buahan lainnya, sedangkan kandungan zat gizi kompleks yang tersembunyi kurang dipelajari. Penelitian ini dilakukan karena banyaknya kandungan zat gizi alpukat dan kecenderungannya untuk obesitas.

Tujuan: Tujuan dari penelitian ini adalah untuk mengetahui kandungan zat gizi yang tersembunyi pada alpukat hijau bulat dan kemampuannya dalam melawan obesitas dan komorbidnya.

Metode: Penelitian ini adalah deskriptif obeservasional. Alpukat dipilih varietas ijo bulat. Analisis proksimat dilakukan mengikuti AOAC, dan kandungan asam lemak diukur menggunakan kromatografi gas dengan flame ionization detector (GC-FID).

Hasil: Hasil penelitian menunjukkan bahwa analisis proksimat alpukat hijau bulat adalah kadar air (87,66-87,71%), abu (0,65-0,71%), lemak (5,88%), protein (1,62-1,73%), karbohidrat (4,03-4,13%). %, total serat makanan (5,47-5,63%), lemak jenuh dan tak jenuh masing-masing (3,02 dan 96,98%) /100 g. Kandungan zat gizi tersembunyi primer alpukat hijau bulat adalah serat makanan yang tidak larut dan asam lemak tak jenuh, utamanya α -linolenat. Menurut literatur, keduanya berpotensi melawan obesitas dan penyakit penyertanya.

Kesimpulan: Penelitian kami menunjukkan bahwa komponen zat gizi tersembunyi terpenting dari alpukat hijau bulat adalah serat pangan dan lemak tak jenuh. Keduanya memiliki kemampuan untuk mengurangi obesitas sekaligus menghindari dan memperbaiki komorbiditasnya.

KATA KUNCI : alpukat; asam lemak tak jenuh; obesitas; serat pangan

ABSTRACT

Background: Avocado is a valuable fruit plant with a high nutrient content that is widely available, affordable, and abundant, particularly in Central Java. Round green is the greatest avocado variety in Indonesia. As a natural food source, avocado is underappreciated and less popular than other fruits, while the hidden complex nutrient content is less studied. This study was carried out due to the quantity of avocado nutrient content and its propensity for obesity.

Objectives: The purpose of this study was to investigate the hidden nutrient content of round green avocado and their ability to against obesity and its comorbidities.

Methods: This is a descriptive observational study. The avocado variety chosen is round green. Proximate analysis was performed following AOAC, and fatty acid content was measured using gas chromatography with a flame ionization detector (GC-FID).

Results: The results showed that proximate analysis round green avocado was water content (87.66-87.71%), ash (0.65-0.71%), fat (5.88%), protein (1.62-1.73%), carbohydrates (4.03 -4.13%), total dietary fiber (5.47-5.63%), saturated and unsaturated fats, respectively (3.02 and 96.98%) /100 g. The primary hidden nutrients of round green avocados are insoluble dietary fiber and unsaturated fatty acid, mainly α -linolenic. According to the literature, both have the potential to go against obesity and its comorbidities.

Conclusions: Our study shows round green avocados' most important hidden nutrient components are dietary fiber and unsaturated fat. Both have the ability to reduce obesity as well as to avoid and improve its comorbidities.

KEYWORDS: avocado; fiber; obesity; fatty acid

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INTRODUCTION

Avocado (*Persea Americana Mill*) is a fruit that has a shape resembling a pear, round or ovoid, has one large seed in the middle surrounded by soft, smooth-textured fruit flesh, edible and covered by a thick rough skin which turns purple-black when ripe (1). Avocado is a tropical fruit native to Mexico and Central America that belongs to the Lauraceae family (2). Avocados have a rich history, dating back thousands of years (2). According to the literature, it is ingested by people from Mesoamerica, namely the Aztec, Olmec, and Maya cultures (3). Avocado is a favored meal, particularly in this culture, sometimes referred to as a "gift of the god" or the fruit of the god's offerings(3).

Avocado's popularity in foreign markets has skyrocketed in recent years (4). Every year, around 8.06 million tonnes of avocados are produced worldwide (5). Indonesia is the world's fourth biggest avocado producer, after only Mexico, the Dominican Republic, and Peru (3,4). According to the statistics, the island of Java produces the most various

varieties of avocados in Indonesia, ranking top in East, West, and Central Java (6). More than 500 avocado types have been discovered. However, the majority are not commercially cultivated(2).

The study showed that avocados are categorized botanically into three groups, including West Indian (*Persea americana* var. *americana*), Mexican (*Persea americana* var. *drymifolia*), and Guatemalan (*Persea nubigena* var. *guatemalensis*)(2). Hass is the most extensively produced cultivar (7,8) because of its high-fat content in the pulp and great yields (8). In Indonesia, superior avocado varieties specified by the Minister of Agriculture of the Republic of Indonesia, including ijo panjang (long green) and ijo bundar (round green) avocados, are grown (9). The advantages of the two varieties are more fruit flesh with a smaller proportion of seeds (9). Additionally, in terms of the dual opening flower cycle behavior, they have an "A" flower type (10). The government has authorized these cultivars due to their high

output, year-round availability, thicker fruit pulp, better yield, and resilience to pests and illnesses(10).

Avocados comprise pulp, seeds, and skin with an average weight of 150 to 400g, with 73% pulp, 16% seeds, and 11% skin(11). Avocado pulp accounts for 52.9 to 81.3% of fruit mass (11) and is abundant in bio compounds (2). Avocados are often consumed as a whole natural fruit, processed into juice (12), extracted to acquire the oil among the larger society (13), and utilization a by-product (12). Avocados are rich in nutrients and phytochemicals(14). According to the United States Department of Agriculture (USDA), previous studies have investigated avocado's amazing nutrient content in general, which is related to health advantages (15). It makes it a fruit with millions of properties(14).

Avocados are recommended in the daily diet because of their health-promoting, therapeutic characteristics and as a nutraceutical(16). Hass avocado for example, studies have explored the benefits of the nutrient content of hass avocado in reducing obesity and adiposity(17), cardiovascular risk (18) and, cardiometabolic and cholesterol levels (19), and gastrointestinal and gut health (17,20). Unsaturated fats and dietary fiber are believed to be essential for increasing health (21). Avocados are known as a source of unsaturated fats, including polyunsaturated fatty acid (PUFA)(22), monounsaturated fatty acid (MUFA)(20), and a source of dietary fiber (23). One serving (50g) avocado contains 80 kcal of energy, 3.4g dietary fiber, 1g PUFA, and 5g MUFA(1). Several studies have examined the round

green avocado. However, their focus has been on avocado oil's physicochemical, lipid properties, and tocopherol content (10). However, a lack of studies focused on the round green avocado's hidden nutrient content linked to its anti-obesity and comorbid potential. Therefore, we conducted a study that aimed to explore the hidden nutrient content of the round green avocado and its potential as anti-obesity and prevention and improvement related to comorbidities.

MATERIALS AND METHODS

Design and materials

This study was a descriptive, observational study. The study focuses on the nutrient composition of round green avocado variety and their ability to against obesity and their comorbidities. The study was conducted in the Pusat Studi Pangan dan Gizi, Gajah Mada University, Yogyakarta. Avocados are acquired from the traditional Giwangan market, Yogyakarta, which wholesalers provide from the harvest of avocado farmer plantations from Klaten.

Sample preparation

The selected sample is the round green avocado variety. It is because this type is a superior variety of Indonesian avocados as established by standard. Avocado ripeness and quality selection are based on previous studies (9,24). The avocado is harvested when it is still ripe (ripe. Physiological), and it is collected when they are ripe and stored at room temperature for a maximum of 7 days. Avocados selected five days after ripening are picked from the tree. The avocado was cleaned first, and the total and peeled avocado weights were recorded for edible

percentage assessment.

Proximate determination

Proximate analyses were carried out following the AOAC, following previous similar studies. Weighing 5 g of wet pulp dried in a forced air oven at 105°C for 24 hours yielded the moisture content. The difference in weight was used to calculate ash content, which included incinerating out moisture and all organic components in a muffle furnace at 550 °C. Ash and water were analyzed by the *gravimetric method*, and fat by the Soxhlet method(25). Initially, the material is dried, pulverized into fine particles, and put in a porous thimble. It is divided into three sections: flask, extraction chamber, and condenser(25). The crude protein content was determined using the Kjeldahl method, and dietary fiber using an enzymatic-gravimetric approach using AOAC 2009.01. Total accessible carbohydrate content was estimated as the difference between 100% and the sum of the percentages of moisture, ash, lipids, protein, and total dietary fiber ' (26).

Fatty acid determination

The fatty acid content was determined following the previous study using gas chromatography with a flame ionization detector (GC-FID) Agilent (27). Avocado was transformed into fatty acid methyl ester (FAME), then employed in the GC with FID to determine the retention duration of various fatty acids found in the avocado(27).

RESULTS AND DISCUSSIONS

Characteristic of material

The avocado used in this study is an excellent fruit derived from the round green,

as illustrated in **Figure 1**. The avocado used in this study is the best fruit derived from the round green. The avocados chosen are fresh avocados of great quality and proper ripeness. We apply avocado standards by conducting a study in order to maintain quality (9,24). We measure avocados to determine the characteristic of the material. One avocado weighs 255 g or four in one kilogram. The pulp weighs 181 g (71%), the seeds 51.1 g (20%), and the skin 22.9 g (9%). The avocado is 27.8 cm in circumference, 8.85 cm in diameter, and 9,7 cm in length. Organoleptically, avocado skin color is dark green with a rough wavy surface. The color of the pulp is a butter yellow little bit green, the part that sticks to the skin. Soft pulp because the fruit has reached the ripe phase.



Figure 1. Results of fatty acid analysis

This study consists of an earlier study that found the average weight of a round green Indonesian avocado to be between 300 and 400 g (9), with the proportion of pulp, seed, and skin respectively around 73, 16, and 11% (11). In contrast to our findings, Ramos-Aguilar and colleagues(28) found a lower percentage of pulp (76.43%) and a more significant amount of skin (13.34%) and seeds (12.5%). The round green avocado is more extensive in fruit size than other superb

varieties, such as the Hass avocado. One Hass avocado weighs just approximately 136 g (29). When compared to avocados in general, the fruit size of an avocado the length is between 6 to 12 cm, and the weight is between 130–385g (30), that showed the round green avocado is standard size and is within the range of market value.

Analysis of hidden nutrient content

The results of the composition of the proximate analysis are summarized in **Table 1**. The proximate analysis showed that protein, fat, and carbohydrate percentages fluctuated around 1%, 5%, and 4%, respectively. This study's two most significant findings were percent dietary fat and fiber. The percentage of dietary fiber is higher in

insoluble dietary fiber by 5-5.2% and little soluble fiber under 0,5%. This finding is in line with previous results reported by Araújo and colleagues, which explained that the highest fiber content was insoluble fiber (2). Avocado is rich in fiber sources and contains 65-80% of its carbohydrates as dietary fiber (31), including 70% insoluble and 30% soluble fiber (29). The amount of fiber in avocados is believed to be proportional to their ripeness. Similar studies reveal that the more ripe the fruit, the lower the fiber content, implying that the fiber content will be high if the fruit is still unripe or near ripe (32). The avocado was five days after harvesting, and the ripeness was still a touch thick. It is according to the standard that the right level of ripeness is less than seven days (24).

Table 1. Avocado nutrients content

Nutrients content	Result analysis	
	Relative concentration (%)	Concentration (ng/μl)
Water	87.71	-
	87.66	
Ash	0.65	-
	0.71	
Fat	5.88	-
	5.88	
Protein	1.73	-
	1.62	
Carbohydrates	4.03	-
	4.13	
Dietary fiber	0.4062	-
Soluble fiber	0.3816	-
Insoluble fiber	5.225	-
	5.067	
Total dietary fiber	5.6318	-
	5.479	
Saturated fatty acid	3.02	1.6483
Unsaturated fatty acid	96.98	48.9573
Omega-3	38.8	21.7046

Fatty acid		
Palmitoleic (C16:1)	20.93	8.5756
Linolelaidic (C18:2n6t)	29.13	13.6265
α -Linolenic (C18:3n3)	38.8	21.7046
Arachidic (C20:0)	3.02	1.6483
<i>cis</i> -5, 8, 11, 14, 17- Eicosapentaenoic (C20:5n3)	8.12	5.0506

This study surprised us that the most significant percentage of fat, which accounts for 96.9% of the fat content, was unsaturated fat. It's enormous content. The composition of unsaturated fats that we found includes n-3 and n-6 fatty acids. The highest proportion (38,8%) is α -Linolenic (C18:3n3), an omega-3 essential fatty acid. This result is in line with the James-Martin study, which showed that most of the avocado pulp fat is unsaturated (33). Other studies have shown that avocados contain up to 80% unsaturated fat (29).

However, this opposes the previous study that claims avocados have a low α -Linolenic (ALA) content (15). Our findings are high α -Linolenic acid. It may be influenced by the type of variety, climate, temperature, and post-harvest treatment. One previous study (34) has succeeded in identifying factors that affect avocado's fatty acid content, including weather, nutrition, and temperature. Aside from this, preharvest variables influence the content of fatty acids, mainly oleic (34).

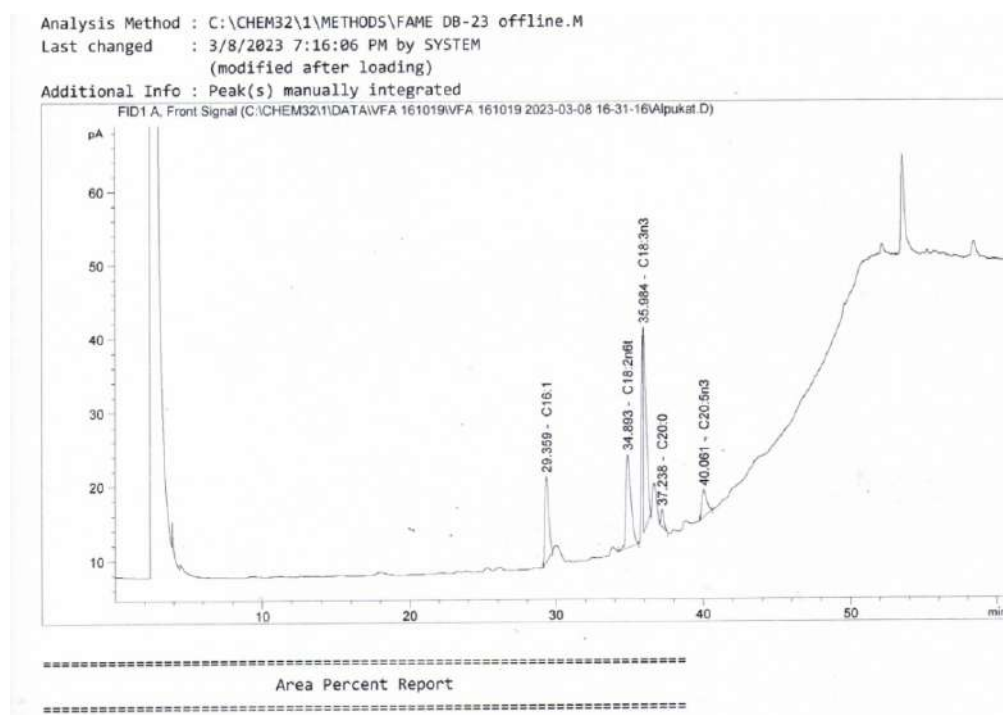


Figure 2. Results of fatty acid analysis

The results of the analysis using GC-FID, we found several fatty acids contained in round green avocados, including saturated fatty acids: Arachidic and unsaturated fatty acids: MUFA (Palmitoleic) and PUFA (Linoleic, α -Linolenic, and cis-5, 8, 11, 14, 17-Eicosapentaenoic/EPA). We highlighted in this analysis that we didn't uncover much information regarding linoelaidic acid, but our search in the [Human Metabolome Database \(HMDB\)](#) yielded exciting findings. An isomer of linoleic acid, often known as conjugated linoleic acid (CLA), is a linoleic fatty acid derivative. **Figure 2** above depicts the findings of a GC-FID investigation of the fatty acids found in the round green avocado. The results of GC/FID analysis based on the peak chromatogram showed that a retention time of 29.359 minutes was obtained for palmitoleic acid (C16:1), linoelaidic acid (C18:2n6t) at 34.893 minutes, α -Linolenic acid (C18:3n3) at 35.984 minutes, arachidic acid (C20:0) at 37.238 minutes, and cis-5, 8, 11, 14, 17-Eicosapentaenoic acid (C20:5n3) at 40.061 minutes.

The potential of round green avocado as anti-obesity and its comorbidities

Our main findings in this study showed that the hidden nutrient content of the pulp of round green avocado is an insoluble dietary fiber, PUFA, and MUFA. They are known to have potential as anti-obesity and prevention and improvement related to comorbidities. Dietary fiber has been widely recognized as an anti-obesity agent (3540) and metabolic disease (41). It acts via several pathways. The study reported insoluble dietary fiber decreases body weight, liver lipids and fat

droplets, fat index, total cholesterol, triglycerides, and low-density lipoprotein (LDL) while raising High Density Lipoprotein (HDL) levels and preventing high-fat diet-induced obesity (42). Insoluble dietary fiber can protect as well as against obesity and comorbidities through various mechanisms, including reduced appetite and promotion of modulation of gut microbiota (43), decreased absorption of macronutrients (44), and food transit time (45). Existing research states that soluble fiber contributes to fat absorption inhibition, but there has recently been a resurgence of evidence showing insoluble fiber also helps. It shortens gastrointestinal transit time (45), making macronutrients less accessible for digestion and absorption and, as a result, lowering calorie intake may contribute to the reported favorable benefits on metabolic health(44).

Avocado's unsaturated fatty acid composition is responsible for most health advantages(28). Unsaturated fats are known to provide benefits in metabolic (46,48) and cardiovascular diseases (49,50). Round green avocado is contained MUFA-type CLA. CLA has anti-obesogenic and anti-aterosklerotic properties (51). CLA's anti-obesity actions are mediated through increased energy expenditure, absorption of energy intake, and metabolic regulation in lipids, adipocytes, and skeletal muscle (52). Other studies report CLA alters body composition by causing metabolic changes that promote lower lipogenesis and lipolysis, as well as skeletal muscle fatty acid oxidation (53). Similar mechanism act of PUFA, ALA, and EPA, both is n-3. ALA has been studied to play an essential part in the molecular

mechanism of anti-lipolytic activity (54) and fatty acid oxidation (55), suggesting that it may have therapeutic significance in obesity-related metabolic diseases. ALA improves glucose tolerance, lowers insulin resistance, and changes a high-fat diet-induced concentration of standard liver fat (56).

Limitation

Despite the fact that the data is given in an organized manner, this study has limitations. This study only focuses on the macronutrient content of the round green avocado and ignores the micronutrient content.

CONCLUSION AND RECOMMENDATIONS

This study found that round green avocados' most important hidden nutrient component is dietary fiber and unsaturated fat. Dietary fiber and unsaturated fat have potential benefits in reducing obesity and preventing and improving comorbid diseases. Future directions are expected to carry out further research to explore the effect of the hidden nutrient content of the avocado on obesity and comorbidities separately, in particular, to explore other potential micronutrients.

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