

## Literature Review: The Effectiveness of Blueberries as a Diet Menu for Adolescents

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**Keywords :** Nutrition, Blueberries, Healthy Diet.

**Abstract :** Blueberries are a powerful source of fiber that fills you up without consuming excess calories. Although blueberries are a good source of fiber and can help provide a feeling of fullness, it is still important to maintain a balance in food consumption and overall nutrition. A healthy and balanced diet will include a variety of foods and nutrients, not just relying on one type of food. This study is to deepen researchers' knowledge regarding blueberry fruit nutrition for a healthy diet menu in adolescents and review the results of previous research that is related to the research that we will conduct. In writing this article using the narrative method in reviewing and analyzing the results of previous studies. The articles used in this study only come from one database, namely Google Scholar with the criteria for a 5-year publication range, namely from 2018 to 2022 with the type of review article and in full text form. The results of the study show that people show an interest in consuming blueberries because of their antioxidant polyphenol content which plays a role in controlling the process of obesity and inflammation. Intake of blueberries in the diet can reduce body weight, glucose, cholesterol, triglyceride, and adenosine levels in obese male subjects. Even in women, blueberries only lower adenosine levels without affecting weight, glucose and triglyceride levels. Research has also shown that adding blueberries to the diet of healthy, older adults can improve cognitive function, especially in challenging cognitive tests. In addition, blueberries have also been shown to increase factors related to bone formation. Blueberries have a variety of health benefits, including controlling obesity, improving cognition, reducing the risk of gestational diabetes, and protecting the bones and heart from oxidative damage. Consuming blueberries can be a great addition to a healthy and colorful diet.

### INTRODUCTION

Cases of overweight and obesity have become a problem that worries the whole world in recent years. Obesity is a non-communicable disease and can actually be avoided. Obesity occurs due to excessive or abnormal fat accumulation, which has various negative effects on the body and can interfere with health (Mutia et al., 2022). In dealing with the endemic problem of obesity, efforts are needed to identify new strategies that are effective in preventing the diseases associated with this condition. Various studies have revealed that consumption of certain classes of polyphenols is associated with

reduced risk of type 2 diabetes, cardiovascular disease events, and overall mortality. Therefore, it is necessary to consume foods rich in polyphenols, as an effort to prevent metabolic disorders associated with obesity. Fruits, especially berries, have an important role as a source of polyphenols in the diet. One of them is blueberries, where many studies have examined the protective effect of blueberries on obesity-related disorders, such as insulin resistance and low-grade inflammation (Morissette et al., nd).

Berries are a source of disease-fighting vitamins, minerals and nutrients (Vahapoglu et al., 2021). Berries can be a delicious and healthy part of a balanced diet. Berries come in different

varieties and colors, such as black, purple, red, blue, or yellow. One of the blue berries is blueberries. Blueberry or *Vaccinium corymbosum* is a type of berry that belongs to the genus *Vaccinium* and the family *Ericaceae*. Blueberries are known for their sweet and fresh taste, as well as their high nutritional content. In addition, blueberries contain many bioactive substances and polyphenols. Consumption of blueberries in combination with calorie restriction may provide different health benefits in obese men and women. The potential positive effects of blueberries on regulating several obesity-related health parameters and demonstrates the importance of considering gender differences in the effect of dietary patterns on certain health conditions. Although BMI did not change significantly, weight loss and improvement in other parameters could be a positive step in preventing obesity-related metabolic disorders in a larger population.

Judging from the current developments, not a few teenagers who want to go on a diet to achieve an ideal body. When you are a teenager, appearance is something that is very concerned. For them to have an ideal body is a dream that must be achieved. That's why many of today's teenagers want to go on a strict diet, namely a diet that does not pay attention to the intake of nutrients received by their bodies. However, a strict diet is not very good for teenagers, because teenagers must get nutrition and vitamins for brain development which aims to facilitate learning activities so they are not malnourished. Therefore, teenagers who want to go on a diet must pay attention to their nutritional intake. For example, replacing staple foods (rice) with foods that contain fiber. Dietary fiber has been shown to reduce appetite and energy intake, thereby facilitating weight loss, delaying gastric emptying, slowing glucose absorption, and exerting beneficial effects on glucose homeostasis. A healthy diet menu for teenagers is a diet menu that contains essential nutrients and minerals even though the portion of food consumed is reduced. Blueberries are one of the healthy diet menus that can be consumed by teenagers. This is because of the Ppolyphenol

content found in it. Blueberries are efficacious for reducing excess fat around the stomach and reducing metabolic problems in the body. In addition, low in calorie content, this fruit is good for consumption for teenagers who are on a diet program. delays gastric emptying, slows glucose absorption, and exerts a beneficial effect on glucose homeostasis. A healthy diet menu for teenagers is a diet menu that contains essential nutrients and minerals even though the portion of food consumed is reduced. Blueberries are one of the healthy diet menus that can be consumed by teenagers. This is because of the Ppolyphenol content found in it. Blueberries are efficacious for reducing excess fat around the stomach and reducing metabolic problems in the body. In addition, low in calorie content, this fruit is good for consumption for teenagers who are on a diet program. delays gastric emptying, slows glucose absorption, and exerts a beneficial effect on glucose homeostasis. A healthy diet menu for teenagers is a diet menu that contains essential nutrients and minerals even though the portion of food consumed is reduced. Blueberries are one of the healthy diet menus that can be consumed by teenagers. This is because of the Ppolyphenol content found in it. Blueberries are efficacious for reducing excess fat around the stomach and reducing metabolic problems in the body. In addition, low in calorie content, this fruit is good for consumption for teenagers who are on a diet program. A healthy diet menu for teenagers is a diet menu that contains essential nutrients and minerals even though the portion of food consumed is reduced. Blueberries are one of the healthy diet menus that can be consumed by teenagers. This is because of the Ppolyphenol content found in it. Blueberries are efficacious for reducing excess fat around the stomach and reducing metabolic problems in the body. In addition, low in calorie content, this fruit is good for consumption for teenagers who are on a diet program. A healthy diet menu for teenagers is a diet menu that contains essential nutrients and minerals even though the portion of food consumed is reduced. Blueberries are one of the healthy diet menus that can be consumed by teenagers. This is because of the Ppolyphenol

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**METHOD**

Writing this article is in accordance with the literature review (literature review) using the narrative method in reviewing and analyzing the results of previous studies. The articles used in this study only come from one database, namely Google Scholar with inclusion criteria (1) a 5-year publication range, namely from 2018 to 2022. (2) type is a review article. (3) in the form of full text. A literature search is used using keywords such as "blueberries" "diet" and "nutrition". With the filtering that was done, the writer got the final result by taking 6 journals.

Based on search results using keywords in the first stage, identifying through Google Scholar, 58,500 journals and articles were found. Then journals and articles were filtered based on publications in the last 5 years, namely from 2018 to 2022 and produced 16,900 journals and articles. Next is filtering articles and journals according to the type of article, namely review articles and getting as many as 5,830 articles and journals. After that, the title was eliminated and 6 journals with the appropriate manuscripts were obtained.

**RESULTS**

The results of the literature review show that blueberries are a fruit that is closely related

to health. Blueberries contain antioxidant polyphenols which play a role in controlling the process of obesity and inflammation. Dietary interventions with polyphenol-rich foods, such as blueberries, present a potentially useful strategy for combating some of the deleterious effects of age-related neurodegeneration. Blueberries stand out as a rich source of polyphenolic flavonoids, phenolic acids, several micronutrients, and fiber, they are also low in total calories. A colorful diet, rich in fruits and vegetables is an added value that is very effective in promoting health status.

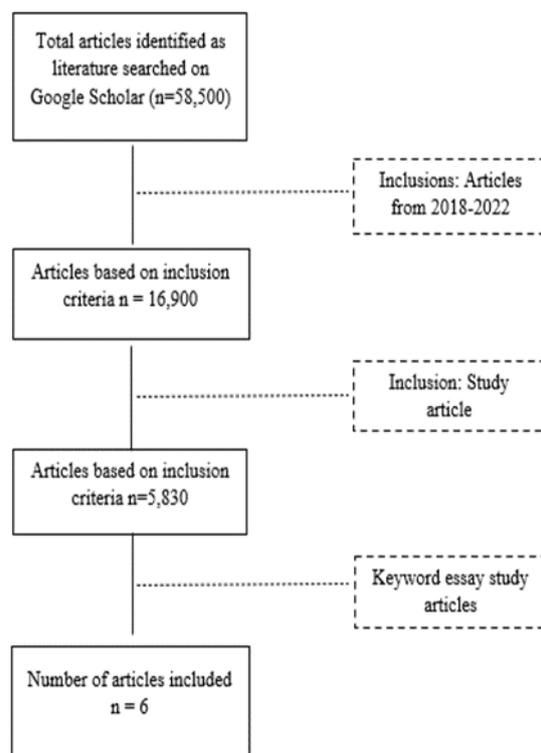


Figure 1:

Table 1:

No.	Author : Year of Publication	Title	Research methods	Results
1.	Maria Fernanda Higuera Hernandez, Elena Reyes Cuapio, Marissa	Blueberry intake included in hypocaloric diet decreases weight, glucose, cholesterol,	This research method uses experimental research methods conducted in a group selected randomly	Blueberries are one of the fruits that are included in foods related to health benefits. Blueberries contain antioxidant polyphenols which play a role in controlling the process of obesity and

	Gutierrez Mendoza, etc : 2019	triglycerides, and adenosine levels in obese subjects	which aims to measure research subject data carried out before and after being given an intervention.	inflammation. Obesity is a disease characterized by excessive fat accumulation and is associated with an increase in endogenous molecules associated with inflammation, such as adenosine. Diet plans that replace high-calorie foods have become a clinical approach to treating obesity. Blueberries are known as a fruit that causes anti-obesity effects. Based on this study, data was obtained which proved that blueberry intake could reduce several parameters related to obesity in female and male subjects. This study proves that consumption of blueberries in obese male subjects can reduce body weight, glucose, cholesterol, triglyceride levels, and AD levels. While in female subjects there was no decrease in body weight, glucose levels, triglycerides but decreased AD content.
2.	Marshall G. Miller, Derek A. Hamilton, James A. Joseph, Barbara Shukitt-Hale : 2018	Dietary blueberry improves cognition among older adults in a randomized, double-blind, placebo-controlled trial	This study used a randomized, double-blind, placebo-controlled approach to determine the feel of the 3-month intervention with the blueberry diet.	In this study, the addition of blueberries to the diets of healthy older adults improved several aspects of executive function, and these improvements were evident in the most challenging cognitive tests. Dietary interventions with polyphenol-rich foods, such as blueberries, present a potentially useful strategy for combating some of the deleterious effects of age-related neurodegeneration. Blueberries are one of the fruits that have been widely consumed because they contain various antioxidant and anti-inflammatory polyphenols. Adding blueberry juice to an adult's regular diet improves CVLT-II performance. Additionally in older adults with mild memory it was found that word list memory was improved by blueberries.
3.	Arpita Basu, Du Feng, Petar Planinic, Jeffrey L Ebersole, Timothy J Lyons, and James M Alexander : 2020	Dietary Blueberry and Soluble Fiber Supplementation Reduces Risk of Gestational Diabetes in Women with Obesity in a Randomized Controlled Trial	This research method uses experimental research methods conducted in a group selected randomly which aims to measure research subject data carried out before and after being given an intervention.	Among fruits and vegetables worthy of investigation in the prevention of diabetes and GDM, blueberries stand out as a rich source of polyphenolic flavonoids, phenolic acids, several micronutrients, and fiber, they are also low in total calories. Blueberries have been associated with constituent antioxidant and anti-inflammatory effects, effects on glucose and lipid metabolism including inhibition of enzymes such as $\alpha$ -glucosidase and maltase, and effects on glucose transporters, all contributing to improved glycemic control. Berries and their anthocyanins have also been shown to increase the expression of adenosine

				<p>monophosphate-activated protein kinase which reduces insulin resistance and cholesterol synthesis in the liver. Another important mechanism underlying the anti-obesity effect of blueberry polyphenols is their role as a prebiotic in enhancing the growth of certain beneficial bacteria, such as Bifidobacterium and Muribaculaceae species as reported in obese rats induced by a high-fat diet. Similar gut microbiome modulating effects have also been observed with soluble fiber supplements in reducing weight gain in obese mice. In addition, dietary fiber has also been shown to reduce appetite and energy intake and thereby facilitate weight loss, delay gastric emptying, slow glucose absorption, and exert beneficial effects on glucose homeostasis. Similar gut microbiome modulating effects have also been observed with soluble fiber supplements in reducing weight gain in obese mice. In addition, dietary fiber has also been shown to reduce appetite and energy intake and thereby facilitate weight loss, delay gastric emptying, slow glucose absorption, and exert beneficial effects on glucose homeostasis. Similar gut microbiome modulating effects have also been observed with soluble fiber supplements in reducing weight gain in obese mice. In addition, dietary fiber has also been shown to reduce appetite and energy intake and thereby facilitate weight loss, delay gastric emptying, slow glucose absorption, and exert beneficial effects on glucose homeostasis.</p>
4.	Vladana Domazetovic, , Gemma Marcucci, Irene Falsetti, Anna Rita Bilia : 2020	Blueberry Juice Antioxidants Protect Osteogenic Activity against Oxidative Stress and Improve Long-Term Activation of the Mineralization Process in Human Osteoblast-Like SaOS-2 Cells: Involvement of SIRT1	This research uses quantitative research methods that are experimental in nature.	Based on the results of the study showed that the polyphenol content of blueberry juice was characterized and it was shown that blueberry juice performs important anti-oxidant action and protects against damage caused by oxidative stress. In addition, blueberry juice also increases factors such as ALP and RUNX-2, which are related to differentiation and mineralization processes under normal intracellular redox conditions. This study shows that total soluble polyphenol (TSP) with other phytochemicals contained in blueberry juice is known to be able to prevent inhibition of osteogenic differentiation and mineralization processes which are induced by early

				<p>oxidative stress. This can occur in vivo due to estrogen deficiency, and in diseases of aging and inflammation where loss of antioxidants results in accelerated bone loss and thus osteoporosis. In addition it was found that the effect of blueberry juice is due not only to its protective antioxidant activity, but also to its ability to modulate signals that regulate the expression and activity of osteogenic factors associated with bone formation. Blueberry juice soluble polyphenols indicate the prevalence and high presence of anthocyanins. In fact, polyphenols activate osteoblast function and inhibit osteoclast differentiation so that they can promote bone growth. but also because of the ability to modulate signals that regulate the expression and activity of osteogenic factors associated with bone formation. Blueberry juice soluble polyphenols indicate the prevalence and high presence of anthocyanins. In fact, polyphenols activate osteoblast function and inhibit osteoclast differentiation so that they can promote bone growth. but also because of the ability to modulate signals that regulate the expression and activity of osteogenic factors associated with bone formation. Blueberry juice soluble polyphenols indicate the prevalence and high presence of anthocyanins. In fact, polyphenols activate osteoblast function and inhibit osteoclast differentiation so that they can promote bone growth.</p>
5.	Ana C. Gonçalves, Ana R. Nunes Sara Meirinho	Exploring the Antioxidant, Antidiabetic, and Antimicrobial Capacity of Phenolics from Blueberries and Sweet Cherries	This research uses quantitative research methods that are experimental in nature.	<p>A colorful diet, rich in fruits and vegetables is an added value that is very effective in promoting health status. Based on this study showed a more complex phenolic compound profile is blueberries than sweet cherries, mainly dominated by anthocyanins. These compositions bind to free radicals and antidiabetic activity is observed. Among the results obtained, blueberry and sweet cherry extracts were several times more active in reducing NO and inhibiting the glucosidase enzyme than the positive controls of ascorbaric acid and acarbose. These results reinforce the notion that consuming berries is an excellent choice for maintenance of basic health, reducing the incidence of chronic diseases, such as diabetes. In addition, blueberry extract exhibits activity against pathogenic bacteria. This</p>

				research also proves that phenolics from red and purple fruits, including blueberries and sweet cherries. Blueberries have high potential for incorporation into pharmaceuticals, dietary supplements, and nutraceuticals.
6.	Wilhelmina Kalt, Aedin Cassidy, Lukas R Howard, Robert Krikorian, April J Stull, François Tremblay, and Raul Zamora-Ros : 2020	Recent Research on the Health Benefits of Blueberries and Their Anthocyanins	This research uses quantitative research methods that are experimental in nature.	The anti-inflammatory, antioxidant and vasoprotective effects of blueberry components together contribute to well-regulated glucose delivery to insulin-sensitive tissues and good metabolic function. Each of these aspects has implications for multiple areas of healthy aging. Notably, biomarkers of cardiometabolic dysfunction associated with vascular risk and dementia of the Alzheimer's type late in life may be related to mitigation of neuroinflammation. The anti-inflammatory and immune benefits of blueberries may involve mucin-related and other colonic microbiota which is a new domain for berry health research. Blueberries can be processed into shelf-stable products (e.g., canned fruit, juice, and preserves). However, processing can lead to changes in the phytochemical profile. During juice and pulp processing, heat, oxygen, and enzymes can degrade blueberry phytochemicals, with the greatest losses in vitamin C and anthocyanins. Blueberries are low in ascorbic acid and high in anthocyanins, and especially anthocyanins are easily degraded by ascorbic acid. Fresh blueberries are delicate and are often processed immediately after harvest to preserve them. Individual rapid freezing is a widely used way to preserve blueberries, to preserve their vitamin C, total phenolic, anthocyanin, and antioxidant capacity.

## DISCUSSION

Blueberries are a flowering plant that belongs to the genus *Vaccinium*, part *Cyanococcus*. Blueberries are shrubs with various sizes, ranging from 10 cm – 4 m. The smallest species of blueberries are known as low bush blueberries, while the largest species are known as tall bush blueberries (Kurniawaty & Yusnita, 2017). Blueberries have green leaves with white, red, and pale pink bell-shaped flowers. Blueberries grow a lot in North America

(Kurniawaty & Yusnita, 2017; Sarjan et al., 2021).

The nutritional and physiological composition of blueberries is very good for body health. Blueberries have high fiber content, antioxidants, and the ability to lower bad cholesterol levels (Kurniawaty & Yusnita, 2017). The purple pigment found in blueberries is useful as an antioxidant because it can absorb toxins, improve blood flow, and is a natural anti-inflammatory (Widya Arum Nurbaeti; Dr. Bedjo Santoso, 2017).

Blueberries contain phenolic compounds which are often called anthocyanins. Anthocyanins in a plant pigment have been shown to be antioxidants, so they can help reduce bad cholesterol (LDL) levels in the body, as well as prevent high blood pressure and maintain heart health. In 100 grams of blueberries there are 487 mg of anthocyanins. This proves that the anthocyanon content of blueberries is higher than that of grapes (120 mg) and blackberries (245 mg) (Isnaini et al., 2022; Kurniawaty & Yusnita, 2017).

The anthocyanin content in blueberries has been clinically tested to provide a protective action on the human cardiovascular system. Blueberries have an impact on reducing LDL oxidation by preventing the process of producing atherosclerotic plaques that can clog blood vessels. Thus, blueberries can lower blood cholesterol levels thereby preventing heart disease, such as coronary heart disease. According to research, increased intake of blueberries can reduce the risk of coronary heart disease. Consuming three servings of blueberries a week can reduce atherosclerotic plaque levels. This is proven by a study conducted on women aged 20-40 years (Kurniawaty & Yusnita, 2017).

Obesity is a global health problem that contributes to other chronic diseases, such as diabetes. Obesity is usually characterized by excess fat accumulation in the body. Blueberries contain antioxidant polyphenols that can control the process of obesity and inflammation. Consuming blueberries can be done as a hypocaloric diet. Research proves that consumption of blueberries can reduce body weight, glucose levels, cholesterol levels, triglycerides, and adenosine in obese male subjects. Whereas in obese female subjects, no significant changes were found in body weight, glucose levels, and triglyceride levels, but showed a decrease in adenosine levels. Thus, blueberries can be used as part of an obesity diet program (Higuera-Hernández et al., 2019).

Blueberries rich of nutrients and minerals. In 100 grams of blueberries, there is a vitamin C content of 7.2 mg, vitamin A (54 IU), and vitamin E of 0.57 mg (Isnaini et al., 2022).

Blueberries also contain potassium which is very useful for controlling blood pressure, preventing the development of kidney vascular, glomerular and tubular damage, reducing the risk of stroke, reducing urinary calcium excretion, and reducing bone demineralization (Sarjan et al., 2021). Blueberries are also rich in polyphenols, so they can be used as a dietary strategy to combat some of the adverse effects of age-related neurodegeneration (Miller et al., 2018). Adding blueberries to the light memory diet menu for adults to the elderly (Miller et al., 2018). In addition, blueberries contain high fiber so that they can reduce appetite and energy intake. Thus, blueberries can facilitate weight loss, delay gastric emptying, slow glucose absorption, and exert beneficial effects on glucose homeostasis (Basu et al., 2021). With lots of nutritional content in blueberries, this fruit is suitable as a food to support a low-calorie diet, especially for teenagers.

## CONCLUSION

Blueberries contains many nutrients that are beneficial to health. The content in blueberries can control obesity, improve cognition, reduce the risk of gestational diabetes, and protect bones and heart from oxidative damage. Consumption of blueberries can be a good addition to a healthy and colorful diet, so it can be a low-calorie diet intervention, especially in adolescents.

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