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### A SCIENTIFIC REVIEW ON: ACAI BERRY FRUIT (EUTERPE OLERACEA) A POTENTIAL SUPER FRUIT OF WORLD

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#### ABSTRACT

An evidence-based systematic review of acai (*Euterpe oleracea*) the acai (ah-sigh-EE) berry is a grape like fruit harvested from acai palm trees, which are native to the Amazon rain forests of South America. Like other berries, acai berries contain antioxidants and fiber. Acai berries are widely touted as a so-called super food, with proponents claiming that they are helpful for a variety of health concerns, including arthritis, weight loss, high cholesterol, erectile dysfunction, skin appearance, detoxification and general health. The acai extracts have a range of poly phenolic components with antioxidant properties, some of those present in greater quantity are orientin, isoorientin and vanillic acid, as well as anthocyanins cyanidin-3-glucoside and cyanidin-3-rutinoside. The presence of these substances is linked mainly to the antioxidant, anti-inflammatory, anti-proliferative and cardio protective activities. However, research on acai berries is limited, and the claims about their health benefits haven't been proved. Acai is usually safe to consume. This article includes written of historical background, active chemical constituents, nutritional values, health benefits plus a compilation of expert opinion, folkloric precedent, side effects, marketed products and dosing.

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## INTRODUCTION

A health crisis or public health crisis is a difficult situation or complex health system that affects humans in one or more geographic areas (mainly occurred in natural hazards), from a particular locality to encompass the entire planet. Health crises generally have significant impacts on community health, loss of life, and on the economy. They may result from disease, industrial processes or poor policy. Its severity is often measured by the number of people affected by its geographical extent, or the disease or death of the pathogenic process which it originates<sup>1</sup>.

Oxidative stress is a phenomenon caused by an imbalance between production and accumulation of oxygen reactive species (ROS) in cells and tissues and the ability of a biological system to detoxify these reactive products. ROS can play, and in fact they do it, several physiological roles (i.e., cell signaling), and they are normally generated as by-products of oxygen metabolism; despite this, environmental stressors (i.e., UV, ionizing radiations, pollutants, and heavy metals) and xenobiotics (i.e., antiproliferative drugs) contribute to greatly increase ROS production, therefore causing the imbalance that leads to cell and tissue damage (oxidative stress). Several antioxidants have been exploited in recent years for their actual or supposed beneficial effect against oxidative stress, such as vitamin E, Flavonoids, and polyphenols. Oxidative stress plays a major part in the development of chronic and degenerative diseases such as cancer, arthritis, aging, autoimmune disorders, cardiovascular and neurodegenerative diseases. Free radicals are generated from immune cell activation, inflammation, mental stress, excessive exercise, ischemia, infection, cancer and aging. They also result from air and water pollution, cigarette smoking, alcohol, heavy metals, certain drugs, industrial solvents, cooking and radiation. Specifically measures the antioxidant capability of the product against the damage induced by free radicals<sup>2</sup>

Ayurveda places great emphasis on prevention and encourages the maintenance of health through close attention to balance in one's life, right thinking, diet, lifestyle and the use of herbs. Knowledge of Ayurveda enables one to understand how to create this balance of body, mind and consciousness according to one's own individual constitution and how to make lifestyle changes to bring about and maintain this balance. Ayurveda means "The Science of Life." Ayurvedic knowledge originated in India more than 5,000 years ago and is often called the "Mother of All Healing." It stems from the ancient Vedic culture and was taught for many thousands of years in an oral tradition from accomplished masters to their disciples. Ayurvedic medicine originated in India and first found in the Rig-Veda and the Atharveda<sup>3</sup>.

The main aim and objective of this scientific review is to explore the importance of acai berry fruit as a super fruit of word as well as to describe the marketed product of acai berry fruit as main ingredients.

### What Are Acai Berries?

Ac,á (acai) is a berry grown on the acai palm tree (*Euterpe oleracea*), which is native to tropical Central and South America and grows mainly in floodplains and swamps. It produces small flowers that are brown to purple in color. The ac,á fruit is round, reddish-purple, and 1–2 cm in diameter, with the seeds constituting about 80% of the fruit. There are many healthy fruits you can add to your diet, but the acai (pronounced ah-sigh-ee) berry is one of the healthiest berries you will find. These reddish-purple round fruits are found in the rainforests of South America.

### Historical or theoretical uses that lack sufficient evidence

The word "ac,á" is borrowed from the indigenous peoples of South America and means "fruit that cries." Ac,á has been a traditional food of the natives of the Amazon for hundreds of years. Ac,á beverages are prepared by extracting juice from the fruit pulp and skin. In the Brazilian Amazon, the Indian tribes of the forest cut down the tree and eat the palm heart, turn the fruit into a juice drink, and use the mature palm fronds for the roof of their houses. They then urinate on the rest of the tree to attract a species of palm beetle to lay its eggs inside the tree. Several weeks later, they return to harvest 3–4 pounds of beetle grub larvae, which are an important source of protein (62 %) and fat (4.5 %) in their diet. Acai berries have been around for thousands of years but have only been introduced to the Western world around the 1990s. These berries were first known to be used by the Amazonian tribes to cure several ailments. According to secondary sources, due to what has been called the "ac,á craze" in the United States, one proposed project in Brazil has called for the planting of five billion ac,á trees in the next 10 years because they have virtual medicinal and nutritional values of fruits. Acne, Aging, Alcohol abuse, Anemia, Antibacterial, Anti-inflammatory, Antimutagenic, Antiparasitic, Antiviral (human rotavirus activity, hepatitis), Astringent, Atherosclerosis, Blood cleanser, Cancer, Contraceptive (birth control), Diabetes, Diagnostic (contrast agent), Diarrhea, Digestive aid, Energy enhancer, Fever, Food uses, Hair loss, Hemorrhage, Hypercholesterolemia, Hypertension, Immune stimulant, Jaundice, Kidney problems, Liver disease, Malaria, Menstrual pain, Pain (muscle and joint), Sexual dysfunction, Skin care, Sun protection, Weight loss, and Wrinkle prevention<sup>4</sup>.

### Synonyms/Common Names/Related Substances

Ac,á, ac,á floor, ac,á palm, ac,á preto (Portuguese), ac,á-do-Par,á (Portuguese), ac, aizeiro (Portuguese), Amazonian palm, Amazonian palm berry, anthocyanins, antioxidant, asai, ashá, assá, beta-sitosterol, cabbage palm.



Figure 1. Acai berry palm plant with acai berry fruits.

### Chemical constituents

Chemical studies demonstrated that acai exhibits a diverse composition of p-hydroxy benzoic acids, antioxidant polyphenolics, flavan-3-ols, and anthocyanins. Cyanidin 3-rutside, cyanidin 3-diglycoside, and cyanidin 3-glucoside are the major anthocyanins found in acai. The antioxidant activity of acai polyphenols may also be attributed to the conjugate forms: glucuronate, sulfonate, aglycone, and methylate. Proanthocyanidins have also been isolated from acai extracts. Flavonoid like compounds, including homoorientin, orientin, taxifolin deoxyhexose, isovitexin, and scoparin, have been identified. Protocatechuic acid (a phenolic acid) and epicatechin (a polyphenols) have been identified as minor compounds. Other compounds found include gallic acid, ellagic acid, (+)-catechin, protocatechuic acid, ellagic acid, p-coumaric acid, ferulic acid, vanillic acid, cyanidin, and pelargonidin 3-glucoside, Ellagi tannins, oleic acid (approximately 60 % of total fats), linoleic acid (12 % of total fats), palmitic acid (24.1 % of total fats), and phytosterols, including beta-sitosterol (78 %–91 % of total sterols). The pulp contains 6.42 g of fatty acids per 100 g: 61.4 % octadecanoic acids (18:1 oleic acid), 20.8% hexadecanoic acids (16:0 palmitic), and 11.2 % octadecadienoic acids (18:2 linoleic acid). The pulp also contains 3.5 mg/ml of total phenolics (gallic acid) and 0.77 mg/ml of total anthocyanins (cyanidin 3-glucoside). It has 71.8 calories, 5.8 g of total carbohydrates (<0.25 g of sugars), 4.9 g of total fats (1.1 g of saturated fat), 5.33 g of fiber, and 1 g of protein. Acai berries also contain some other trace minerals, including chromium, zinc, iron, copper, manganese, magnesium, potassium and phosphorus<sup>5</sup>.

### What is the Nutritional Value of Acai Berries?

Acai berries can be a nutritious addition to your diet since they contain an array of important minerals and vital nutrients. Below is the nutrition profile of these berries. The antioxidant content of foods is typically measured by an Oxygen Radical Absorbance Capacity (ORAC) score. In the case of acai, 100 grams of frozen pulp has an ORAC of 15,405, whereas the same amount of blueberries has a score of 4, 6696.

Table 1. Nutrients and nutritional values of 100 grams of fresh acai berry fruit.

Sl. No	Nutrient	Nutritional value
1	Ener.gy	60 k.cals
2	Protein	2 grams
3	Fat	5 grams
4	Carbohydrate	6 grams
5	Fiber	3 grams
6	Sugar	2 grams
7	Calcium	40 mg
8	Iron	1.51 mg
9	Sodium	7 mg
10	Vitamin C	13.4 mg
11	Vitamin A	1400 IU (15% DV)
12	Manganese	130% DV
13	Copper	8% DV
14	Cholesterol	0

### What are the health benefits of Acai Berries?

The berries possess several properties that have been known to improve our overall health. Hence, it is safe to say that acai berries are very healthy if consumed regularly. Some of health benefits of acai berry fruit.

#### Very High in Antioxidants

The food we eat and the air we breathe – everything contains toxins that can harm our body. These toxins are mostly in the form of free radicals. One of the reasons acai berry is so popularly used in the health industry is that it has unusually high levels of antioxidants as compared to other plant foods. Cyanidin 3-rutinoside, cyanidin 3-diglycoside, and cyanidin 3-glucoside are the major anthocyanins found in acai. The antioxidant activity of acai polyphenols may also be attributed to its conjugate forms: glucuronate, sulfonate, aglycone, and methylate. In freshly purified human neutrophils, pretreatment with the freeze-dried acai extracts (OptiAcai) before hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>)-induced oxidative stress reduced the formation of reactive oxygen species (ROS), even at low doses (0.1 parts per trillion). This formulation also scavenged peroxyl radicals, with a reported total oxygen radical-abstracting capacity (ORAC) value of 1,026.9 mcM of TE/g, which the researchers noted as being higher than other fruits and vegetables. *In vivo*, the acai juice blend was found to inhibit lipid peroxidation within 2 hours of consumption. Not only that, these antioxidants inhibit the growth of harmful organisms and help detoxify our body of all contaminants that can cause cardiovascular diseases and cancer<sup>7</sup>.

#### Protect against Heart Disease and Diabetes

Research shows that acai berries are extremely high in anthocyanins, antioxidants that promote overall heart health. A 2014 study done on rats subjected to myocardial infarction (heart attack) concluded that acai berry significantly helps in the treatment of heart-related diseases like cardiac hypertrophy, fibrosis, and cardiac dysfunction<sup>8</sup>.

In humans, frozen acai pulp twice daily for 1 month reduced fasting glucose by 5.3 %, compared with baseline measurements. Plasma insulin levels were also found to be reduced. The researchers suggested that the antidiabetic effects of acai may be attributed to the anthocyanin compounds. Another study was done in California on 10 overweight individuals who were given acai berry fruit pulp for 30 days. There was a reduction in blood sugar, insulin, and cholesterol levels in the body<sup>9</sup>.

#### Boost Weight Loss

A lot of brands market their acai berry supplements as a standalone solution for weight loss. But the fact remains that while acai berries may be extremely healthy and contain a wide range of nutrients, to boost weight loss. Research shows that the fiber and fatty acid content in acai berries help increase metabolism, boost fat burn, and decrease cravings. In human study, frozen acai pulp twice daily for 1 month reduced total and LDL cholesterol, as well as the ratio of total cholesterol to HDL cholesterol. HDL cholesterol, VLDL cholesterol, and triglycerides were not affected in a statistically significant manner. These berries contain a significant amount of fats, but most of it is in the form of healthy fats. They help reduce bad cholesterol and increase good cholesterol in the body and also aid weight loss<sup>10</sup>.

#### Promote Digestion

The high amount of fiber present in acai berries helps improve digestion and assimilation of nutrients and prevents constipation. Traditionally, acai berry juice was used as a natural treatment for diarrhea. It was believed to cleanse the system of toxins and strengthen the digestive system.

#### Help Fight Cancer Cells

Several studies have proved that consuming acai berries regularly could help prevent several types of cancers, particularly those of the colon and the breast. In human promyelocytic leukemia (HL-60) cells, polyphenolic fractions (at 0.17–10.7 mcM) of frozen acai pulp (donated by Amazon Energy, LLC) suppressed proliferation, in a dose- and time-dependent manner, through a caspase-3-mediated mechanism (a mechanism of apoptosis). In rats treated with N-nitroso methyl benzylamine (NMBA; a carcinogen), a 5 % acai diet administered after carcinogen administration reduced esophageal tumorigenesis. The chemo preventive effects were attributed to the ellagic tannins in the berries. It was also noted that tumorigenesis was inhibited through the regulation of cytokines. Serum IL-5 and GRO/KC levels were reduced, which correlated to an increase in antioxidant capacity<sup>11,12</sup>.

#### Enhance Cognitive Functioning

One of the many good things about acai berries is that they significantly help maintain your overall brain health. A 2012 study conducted on mice suggested that acai berry pulp has protective properties towards brain cells, which indicates better cognitive and motor functions<sup>13</sup>. Another study performed on rats in 2014 concluded that the compounds present in acai berries could protect your brain from damage as you age<sup>14</sup>.

#### Improve Cellular Health

The antioxidant properties of acai berries increase the efficiency of the cells in absorbing nutrients and reduce the chances of cellular death<sup>15</sup>.

### **Boost T cells**

One of the greatest benefits of acai berries is their ability to boost and strengthen the immune system. The antioxidant-rich fruits fight the free radicals and protect your body from several diseases and infections. A 2011 study showed that the immune responses of acai berry have the potential to treat asthma and infectious diseases. However, the effect was not produced in a dose-dependent manner, and low concentrations of the formulation appeared to exert higher immune stimulatory action than higher concentrations. The freeze-dried acai (at 250–2,500 mcg/ml) also inhibited LPS-induced production of nitric oxide in a dose-dependent manner. In human peripheral blood mononuclear cells (PBMCs), the polysaccharide fraction of acai was found to exert immune modulatory activity and stimulate gamma-delta T cells and myeloid cells. In mouse lung, these polysaccharides induced IL-12 production by promoting Th1 (interferon [IFN]-gamma-producing) response<sup>16</sup>.

### **Increase Energy Levels**

Acai berries are rich in carbohydrates, proteins, and good fats that help to keep our stamina and energy levels high. This fruit is commonly termed “Amazon rainforest viagra” since it increases libido and enhances sex drive. Acai berries are also known to improve blood circulation. There is no research yet to back this claim, but it has received positive testimonials from many people.

### **Help Heal Wounds**

Acai berries have significant wound-healing properties, owing to their anti-inflammatory nature. A 2017 study showed that a scratch wound healed faster after 24 hours of using acai berry water extracts<sup>17</sup>. Anti-inflammatory effects: In *in vitro* research, freeze-dried acai fruit pulp and skin powder (OptiAcai, found in MonaVie products) displayed selective inhibitory activity against COX-1 and COX-2 enzymes<sup>18</sup>. The Review of Acai 139 freeze-dried acai product (at 250–2,500 mcg/ml) inhibited lipo polysaccharide (LPS)-induced production of nitric oxide in a dose-dependent manner<sup>19</sup>. In LPS-induced inflammatory stress in HUVEC, acai was found to inhibit vascular endothelial adhesion molecules-1 (VCAM-1) through nuclear factor-kappa B (NF-kappa B) inhibition. In glucose-induced stress and inflammation in HUVEC, acai down regulated the inflammatory markers IL-6 and IL-8, which correlated to down regulation of microRNA-126<sup>20</sup>.

### **Promote Sound Sleep**

Acai berries are known not only to increase energy levels and stamina but also to promote better sleep at night. A ¼ cup serving of acai berry juice before going to bed each night may help with improving the quality of sleep<sup>21</sup>.

### **There any Skin Benefits of Acai Berry?**

Acai berries contain many vitamins and minerals that enhance skin health. They not only help to slow the signs of aging but also lighten scars and prevent acne and breakouts. The benefits are discussed in detail below.

#### **Control Pigmentation**

Acai berry was found to be one of the most beneficial ingredients to treat hyperpigmentation.

#### **Lighten Scars**

With acne scars, acai berries can help to lighten them. Try crushing some acai berries with a ripe avocado and apply the mask on your face. Leave it on for about 10-15 minutes and then wash it off. This treatment will leave your skin feeling smooth and blemish-free<sup>22</sup>.

#### **Hydrate Your Skin**

Your facial skin is prone to wear and tear due to excessive exposure to the sun, chemicals, and pollutants. The antioxidants present in acai berry help to repair the damage and replenish the lost moisture<sup>22</sup>.

#### **Make Your Lips Soft**

Regular application of acai berry juice is known to keep the lips hydrated, soft, and luscious due to its excellent moisturizing properties<sup>22</sup>.

#### **Have an Anti-Aging Properties**

Acai berries are a powerhouse of important nutrients. They also have antioxidant properties, which help them, fight the free radicals and delay the signs of aging. These properties make them a perfect ingredient for anti-aging face and body creams. Using them every day keeps the skin glowing and healthy<sup>23</sup>.

#### **Control Acne**

Owing to their anti-inflammatory properties, acai berries are excellent at controlling acne and breakouts<sup>24</sup>.

#### **What about Hair Benefits of Acai Berry?**

Acai berries contain vital nutrients that make your hair stronger, softer, and shinier. These nutrients not only promote scalp health but also prevent hair loss. Scroll down to find out more<sup>25</sup>.

**Strengthen Hair**

Acai berries, being a powerhouse of essential nutrients, help to maintain a healthy scalp and strengthen your hair from the roots. This helps to prevent hair from shedding<sup>26</sup>.

**Aid Hair Growth**

Acai berries are rich in proteins, healthy fats (omega 3, 6, and 9), and a wide range of vitamins such as A, B complex, C, and E. All these nutrients work together to aid hair growth<sup>26</sup>.

**Promote Scalp Health**

Acai berries contain a significant amount of zinc and folic acid. Zinc is known to greatly benefit scalp health and prevent hair loss by making the hair roots stronger. Folic acid improves blood circulation in the scalp, aids the regeneration of the cells that contribute to hair growth, and prevents graying of hair<sup>27</sup>.

**MRI oral contrast agent effects**

Acai fruit pulp has been used as an experimental, clinical oral contrast agent for MRI of the gastrointestinal tract *in vivo*. Acai pulp presented an increase in T(1)-weighted MRI signal, equivalent to that of gadolinium-diethyltriamin pentaacetic acid, and a decrease in T(2)-weighted images. Paramagnetic Fe, Mn, and Cu ions in acai may contribute to the T(1) signal enhancement and T(2) opacification<sup>28, 29</sup>.

**How to Select and Store Acai Berries**

Acai berry supplements of various brands are easily available in pharmacies. Simply refrigerate them and consume within a week. Supplements have a shelf life of about 1 year, so they can be stored in a cool and dry place. Acai berry juice, however, should be consumed almost immediately after juicing the berries. How do you incorporate these yummy berries into your diet? Here's one of our favorite recipes.

**Where to Buy Acai Berries?**

It is very difficult to obtain fresh acai berries unless you live in Brazil or its neighboring countries. You can buy acai berries in the powder or capsule form from most health stores. You can also purchase them online. Some of nutraceuticals marketed products consist of acai berry fruit as main ingredient.

**i – Pulse:**

I-pulse contains a wide variety of antioxidants (cyanidins, quercetin, anthocyanins, gallic acid, ellagitannins, stilbenes, and ellagic acid) with gluconutrients, trace minerals (iron, calcium, manganese, magnesium), energizing compounds and micronutrients (silica) and it has is another blend of 15 super fruits like Acai berry, cranberry, blueberry, mulberry, strawberry, blackberry, orange, pomegranate, banana, cherry, pear, apple, kiwi, white grape, concord grape, and pineapple in the form of juice. The main ingredient of this juice is the Acai berry of Amazon which is very rich in antioxidants. According to research Acai berry is the most powerful immune booster for our body.

I-pulse can be consumed by all of the age groups. It is completely safe and side effects free and can be consumed for a longer period of time even with other regular medicines also. Women during pregnancy and lactation periods can also consume I-pulse. It comes in a bottle of 1 L and must be stored in cool and dry place, Refrigerate before and after opening the seal. Shake well before use. The recommended dosage of I pulse is 30ml of i-pulse before 30 min of breakfast and 30ml of i-pulse 30 min before dinner. The Ministry of AYUSH (AYURVEDA, YOGA, UNANI, SIDHA AND HOMEOPATHY) department India has awarded I-pulse a Premium certification due to its various Health Benefits in India. It clearly signifies that I-pulse is a premium and high-quality product. The formulation of i-pulse is done by the Indus Viva Health Sciences Pvt Ltd, Bangalore, Karnataka, india<sup>30</sup>.



Figure 2. Marketed i- pulse product consists of acai berry fruit as a major ingredient

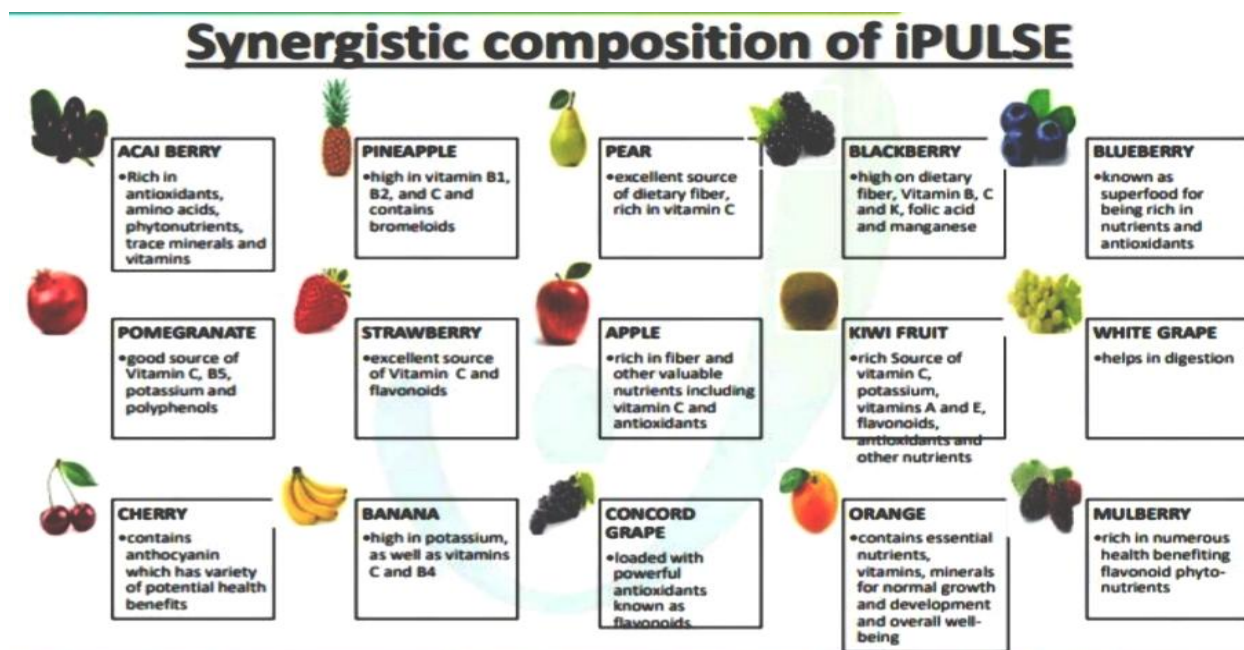


Figure 3. Synergistic composition of i- pulse including 14 % of Acai berry fruit

**AS 10 Space drink:**

AS10 was developed as a nutritional supplement for astronauts to protect them from the damaging effects of high levels of radiation outside the Earth’s atmosphere. The drink contains a blend of fruits including cupuacu (a Brazilian fruit from the cacao plant family), acai, acerola, prickly pear and yumberry, which all provide vitamins and phytochemical – compounds known to block the harmful effects of radiation. Other ingredients are grape, green tea, pomegranate and vegetables. The Acai berry is the main ingredient in the space drink developed by NASA AS-10<sup>31</sup>.



**Figure 4. Marketed AS10 product consist of acai berry fruit.**

#### **Are there any side effects i need to be aware of?**

Overconsumption of acai berries may cause diarrhea, irritation in the intestinal tract, headaches, and reduced vision. Overcome this problem, it should be diluted with equal volume of water and consume. As long as you consume these berries in limited quantities, your body will receive all the goodness from them<sup>32</sup>.

#### **CONCLUSION**

Nowadays people are getting more conscious about their health. Due to the hectic schedule, we are not able to take proper care of our bodies, resulting in many types of diseases. It all starts with a improper diet. But the main problem is that the common and mostly middle-class people like us don't believe in the fruitarian diet. Fruitarian diet consists of major proportion of diet in the form of fruits. It is a big question how to complete that the amount of nutrients and antioxidants that we need in our diet. It is clear that one cannot eat 3.5 kgs of fruits and vegetables in his daily diet due to a tightly packed schedule, financial issue and our bad craving for fast food. There are lots of medicines in the market which provide us different kinds of minerals, vitamins, and nutrients which are necessary for our day to day life, but in the end, they are artificial and put some harmful impact on our health in long term use. Acai berries are extremely healthy due to the lot of antioxidants, vitamins, minerals, fiber, protein, and good fats. Acai berry benefits the body in several ways like treat Acne, anti-aging, Alcohol abuse, Anemia, Antibacterial, Anti-inflammatory, Antimutagenic, Antiparasitic, Antiviral (human rotavirus activity, hepatitis), Astringent, Atherosclerosis, Blood cleanser, Cancer, Contraceptive (birth control), Diabetes, Diagnostic procedure (contrast agent), Diarrhea, Digestive aid, Energy enhancer, Fever, Food uses, Hair loss, Hemorrhage, Hypercholesterolemia, Hypertension, Immune stimulant, Jaundice, Kidney problems, Liver disease, Malaria, Menstrual pain, Pain (muscle and joint), Sexual dysfunction, Skin care, Sun protection, Weight loss, and Wrinkle prevention.

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