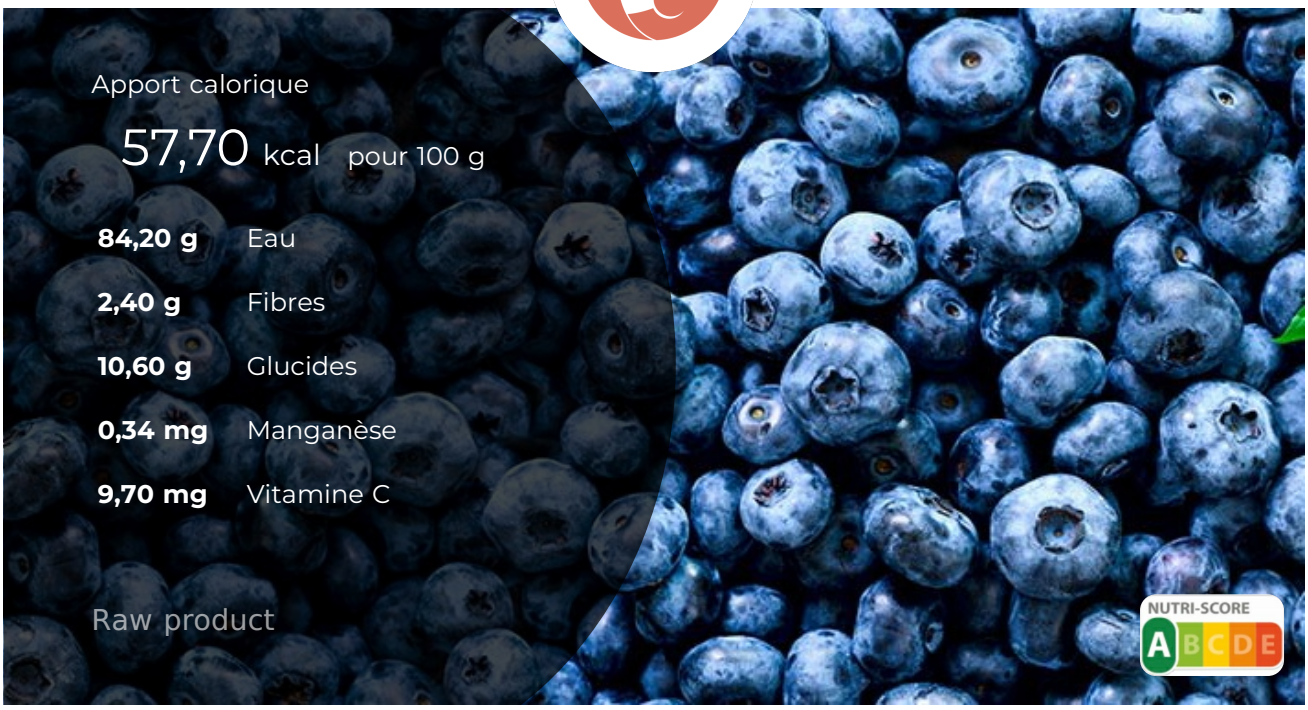
FICHE NUTRITIONNELLE

BLUEBERRY



DESCRIPTION

- The **blueberry bush** (Vaccinium corymbosum) belongs to the **Ericaceae** family.
- It is native to **North America** (Rodriguez-Saona, 2019).

PHYSICAL AND ORGANOLEPTIC CHARACTERISTICS

- The blueberry is a **small round fruit**. Its epidermis is covered with a hydrophobic surface with a matt appearance, composed of the **cuticle** and an **epicuticular wax**. The thicker this hydrophobic surface, the better the fruit retains its physical and nutritional qualities during harvesting and storage (Sapers, 1985).
- The skin (epidermis + hydrophobic surface) is **blue** and the **flesh yellowish white** (Michalska, 2015).
- The blue colour of the skin is due to the presence of **anthocyanins**. At least 14 anthocyanins and 3 acetylated anthocyanins have been quantified, with delphidin 3-galactoside, petunidin 3-galactoside and malvidin 3-galactoside being the most represented (Cho, 2004). **Chlorogenic acid**, also present, is a co-pigment that intensifies the colour of the anthocyanins (Mazza, 1990).
- Conversely, the « absence of colour » of the flesh is characterised by the virtual absence of anthocyanins (Lee, 2006).
- During ripening, the blueberry becomes **less and less acidic**, with a titratable acidity that decreases. Malic acid is the predominant organic acid, responsible for the acidity of the fruit (Castrejón, 2008).
- The content of **proanthocyanidins**, responsible for the bitter taste of unripe fruits, also **decreases** with ripening (Zifkin, 2012).
- Ripe blueberry has a **sweet taste**, the intensity of which varies according to the cultivar (Mennella, 2017). This sweetness is due to the presence of **sucrose**, but also **fructose, galactose and glucose** (Montecchiarini, 2018).
- Concerning the **aroma** of blueberries, more than **120 volatile compounds** have been listed (Sater, 2020). Among them, 1-penten-3-ol, hexanal, (E)-2-hexenal, (E)-2-hexen-1-ol, and linalool are thought to play significant roles. During ripening, the average amount of all volatile compounds increases (Gilbert, 2013).

COMPOSITION CHARACTERISTICS (EXCLUDING MACRONUTRIENTS, VITAMINS AND MINERALS)

- Blueberry contains **polyphenols**: **flavonoids** (proanthocyanidins and flavonols), **phenolic acids** (gallic, syringic, vanillic and hydroxycinnamic acids) and **stilbenes** derivatives The polyphenol content can be up to 304 mg/100 g of fresh fruit, depending on the cultivar and ripeness. They are mainly present in the **outer layers** (the skin and just under the epidermis). Only a small amount is found in the flesh (Michalska, 2015).
- While anthocyanin content increases with ripening, the contents of proanthocyanidins, flavonols and hydroxycinnamic acids, a family of phenolic acids, decrease (Castrejón, 2008; Zifkin, 2012). The ripe fruit therefore contains mostly **anthocyanins** with a content of up to 495 mg/100 g of fruit (Michalska, 2015).
- The **polyphenols** present have antioxidant and protective activity, believed to provide many health benefits. They possess the following activity:
  - Protection against lipid peroxidation and other types of oxidative damage;
  - Protection against DNA mutations, which hinder their transformation into cancer cells;
  - antitumour;
  - anti-inflammatory;
  - immunomodulatory;
  - neuroprotective;
  - prevention of cardiovascular pathologies;

- prevention of obesity and diabetes;
- antimicrobial (Silva, 2018).

- Blueberry also contains a notable amount of **organic acids**, such as malic acid, citric acid and ascorbic acid or vitamin C, which is also known as a powerful **antioxidant** (Castrejón, 2008; Silva, 2018).

COMPOSITION ET ANALYSE NUTRITIONNELLE

RAW

The following values are approximate and depend on variety, season, ripeness, cultivation conditions, etc. The blueberry brings on average **57.70 calories (kcal)** per 100 g, i.e. **244 kJ**. A portion of blueberries weighs on average 140 g, which represents an energy intake of 80.78 kcal.
COMPOSITION TABLES
For each nutrient, the tables provide information on the content, minimum and maximum values, as well as the percentage of the Dietary Reference Values (DRVs) per 100 g net of raw blueberries.

MACRONUTRIMENTS

Valeurs

Constituant (g)	Teneur moyenne	Min-Max pour 100 g	% VNR
Eau	84,20	80,70 - 86,80	-
Fibres	2,40	2,30 - 2,80	-
Glucides	10,60	-	-
dont Sucres	9,96	7,67 - 12,30	-
Lipides	0,33	0,20 - 0,50	-
dont Acides Gras Saturés	0,028	-	-
Protéines	0,87	0,60 - 1,14	-

Sources

Constituant (g)	Quantité	Min-Max	% VNR
Eau	Ciqual 2020	-	-
Fibres	Ciqual 2020	-	-
Glucides	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011

Constituant (g)	Quantité	Min-Max	% VNR
dont Sucres	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Lipides	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
dont Acides Gras Saturés	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Protéines	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011

Zoom on carbohydrates

- The energy of the blueberry comes essentially from its carbohydrates, at 10.60 g per 100 g.
- The main sugars present in blueberries are fructose (4.97 g per 100 g), glucose (4.88 g per 100 g) and sucrose (0.11 g per 100 g).
- The amount of carbohydrates remains lower than the average quantity found in fresh fruit: about 11.31 g per 100 g.

Zoom on fibres

- The amount of fibre is significant (2.40 g per 100 g) but remains lower than the average quantity found in fresh fruits (2.77 g per 100 g).

Zoom on proteins

- The protein content of blueberries (0.87 g per 100 g) is slightly lower than the average amount found in fresh fruit (0.93 g per 100 g).

Zoom on lipids

- The amount of fat in blueberries (0.33 g per 100 g) is lower than the average for fresh fruit (0.56 g per 100 g).

MINÉRAUX ET OLIGO-ÉLÉMENTS

Valeurs

Constituant	Teneur moyenne	Min-Max pour 100 g	% VNR
Calcium (mg)	6	2 - 11	0,75

Constituant	Teneur moyenne	Min-Max pour 100 g	% VNR
Chlorure (mg)	-	-	-
Cuivre (mg)	0,057	0,015 - 0,088	5,70
Fer (mg)	0,28	0,11 - 0,41	2
Iode (µg)	0,50	-	0,33
Magnésium (mg)	6	5 - 7	1,60
Manganèse (mg)	**0,34**	**0,16 - 0,43**	**17**
Phosphore (mg)	12	7 - 16	1,71
Potassium (mg)	77	72 - 83	3,85
Sélénium (µg)	-	-	-
Sodium (mg)	1	1 - NC	-
Zinc (mg)	0,16	0,10 - 0,28	1,60

Sources

Constituant	Quantité	Min-Max	% VNR
Calcium (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Chlorure (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Cuivre (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Fer (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Iode (µg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011

Constituant	Quantité	Min-Max	% VNR
Magnésium (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Manganèse (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Phosphore (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Potassium (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Sélénium (µg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Sodium (mg)	Ciqual 2020	-	-
Zinc (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011

Zoom on minerals and trace elements

- Blueberry is a **source of manganese** as it provides the equivalent of 17% of DRVs, i.e. 0.34 mg per 100 g.
- It also provides the equivalent of 5.70% of DRVs for copper, i.e. 0.057 mg per 100 g.
- The quantity of other minerals and trace elements represents less than 4% of DRVs.

VITAMINES

Valeurs

Constituant	Teneur moyenne	Min-Max pour 100 g	% VNR
Provitamine A Béta-carotène (µg)	32	13 - 89	-
Équivalent Vitamine A (µg)	5,33	2,17 - 14,83	0,67
Vitamine B1 (mg)	0,037	0,022 - 0,069	3,36
Vitamine B2 (mg)	0,041	0,02 - 0,06	2,93

Constituant	Teneur moyenne	Min-Max pour 100 g	% VNR
Vitamine B3 (mg)	0,42	0,22 - 0,87	2,63
Vitamine B5 (mg)	0,12	0,058 - 0,16	2
Vitamine B6 (mg)	0,052	0,024 - 0,08	3,71
Vitamine B9 (µg)	6	3 - 11	3
Vitamine C (mg)	9,70	7,40 - 11,50	12,13
Vitamine E (mg)	0,57	0,40 - 1	4,75
Vitamine K1 (µg)	**19,30**	**15,50 - 29,10**	**25,73**

Sources

Constituant	Quantité	Min-Max	% VNR
Provitamine A Béta-carotène (µg)	Ciqual 2020	-	-
Équivalent Vitamine A (µg)	Calcul à partir de la valeur Provitamine A Béta-carotène*	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine B1 (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine B2 (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine B3 (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine B5 (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine B6 (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011

Constituant	Quantité	Min-Max	% VNR
Vitamine B9 (µg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine C (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine E (mg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011
Vitamine K1 (µg)	Ciqual 2020	-	Règlement (UE) N°1169/2011 du parlement Européen et du conseil du 25 octobre 2011

Zoom on vitamins

- Blueberry is a **source of vitamin K1** as it provides the equivalent of 25.73% of DRVs, i.e. 19.30 µg per 100 g. According to the data of the Ciqual 2020 table, the blueberry is the fruit that contains the most vitamin K1.
- It provides a significant amount of **vitamin C** (9.70 mg per 100 g), equivalent to 12.13% of DRVs.
- The amount of other vitamins represents less than 5% of DRVs.

* Calculation made: Beta-Carotene / 6 + retinol

POLYPHÉNOLS

Valeurs

Constituant (g)	Teneur moyenne	Min-Max pour 100 g
Flavonoïdes (mg)	1,27	1,27 - 1,27
dont Flavonols (mg)	1,27	1,27 - 1,27
Acides Phénoliques (mg)	2,90	2,90 - 2,90
dont Acides Hydroxycinnamiques (mg)	2,90	2,90 - 2,90
Stilbènes (mg)	0,67	0,67 - 0,67
Polyphénols totaux	**4,84**	**4,84 - 4,84**

Sources

Constituant (g)	Quantité	Min-Max
Flavonoïdes	Phénol-Explorer version 3.6- Méthode utilisée : chromatographie	-
dont Flavonols	Phénol-Explorer version 3.6- Méthode utilisée : chromatographie	-
Acides Phénoliques	Phénol-Explorer version 3.6- Méthode utilisée : chromatographie	-
dont Acides Hydroxycinnamiques	Phénol-Explorer version 3.6- Méthode utilisée : chromatographie	-
Stilbènes	Phénol-Explorer version 3.6- Méthode utilisée : chromatographie	-
Polyphénols totaux	**Phénol-Explorer version 3.6- Méthode utilisée : chromatographie**	**-**

Zoom on polyphenols

- Polyphenols are substances with an antioxidant effect.
- **Hydroxycinnamic acids**, which are part of the phenolic acids, are mainly present in blueberry composites, representing 59.92% of the total polyphenols identified.
- Next come **flavonols** (26.24% of total polyphenols).
- **Resveratrol**, belonging to the stilbene family, represents 13.84% of the total polyphenols in blueberry.

ALLÉGATIONS NUTRITIONNELLES ET DE SANTÉ

ALLÉGATIONS NUTRITIONNELLES ET DE SANTÉ RAW

According to the definitions of nutrition claims as presented in Regulation (EC) No 1924/2006 on nutrition and health claims, and in view of the composition of blueberry, the following claims may be used:

NUTRITION CLAIMS OF BLUEBERRIES

- **Source of vitamin K1** (100 g of blueberries provide more than 15% of DRVs)
- **Source of manganese** (100 g of blueberries provide more than 15% of DRVs)
- **Low in fat** (100 g of blueberries contain less than 3 g of fat).

HEALTH CLAIMS (FOR A CONSUMPTION OF 100 G OF BLUEBERRIES)

Vitamin K1

- Vitamin K1 contributes to:

- maintenance of normal bones,
- normal blood clotting.

Manganese

- Manganese contributes to:
  - normal energy-yielding metabolism,
  - maintenance of normal bones,
  - normal formation of connective tissues,
  - protection of cells from oxidative stress.

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