

**BDEE**  
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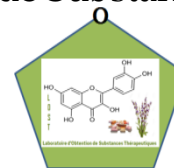
## ***Ceratonia siliqua* L. A promising functional food for chronicle diseases related to gastrointestinal system: diabetes, and lactose intolerance.**

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**Abstract:** The present study contributes to the promotion of a tree widely cultivated in the Mediterranean area, especially in our country Algeria; the carob tree "*Ceratonia siliqua* L."; by a bibliographic mini review which lists the chemical, nutritional, biochemical, biological, and biotechnological properties of carob and its by-products expressed by the evaluation of its activities: antioxidant, anticancer, anti-hyper-lipidemic, anti-diabetic, anti-reflux, anti-diarrheal, antibacterial, anti-inflammatory, antiulcer and enzymatic, noted in the literature for few years.

The presence of the main primary and secondary metabolites: polyphenols, fibers and sugars; give these products very interesting properties and benefits for human health by making it dietetic product and a raw material of choice in food, pharmaceutical and biotechnology industries, in this perspective we developed in our laboratory a *Ceratonia siliqua* L. fruit aqueous extract based vegetal milk as a functional food for chronicle diseases related to digestive disorder: diabetes, and lactose intolerance.

**Keywords:** Mediterranean local products, *Ceratonia siliqua* L., Carob, functional food, nutraceuticals.

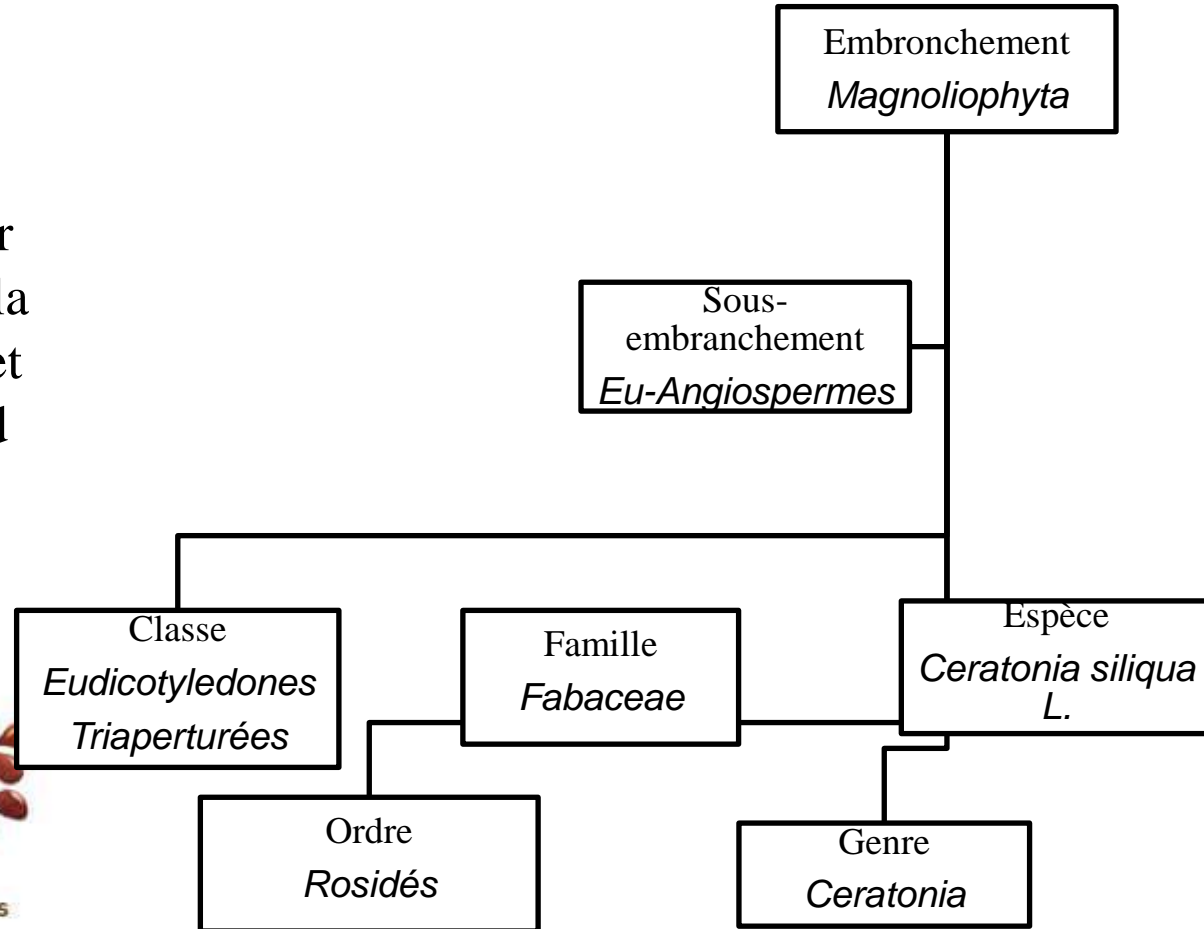
# *Ceratonia Siliqua* .L calssification

Origine :

Les opinions divergeaient sur l'origine de la caroube entre la région Est méditerranéenne et les pays montagneux du Sud d'Arabie (Yémen).

De Candolle (1983) et Vavilov (1951) , Schweinfurth (1894)

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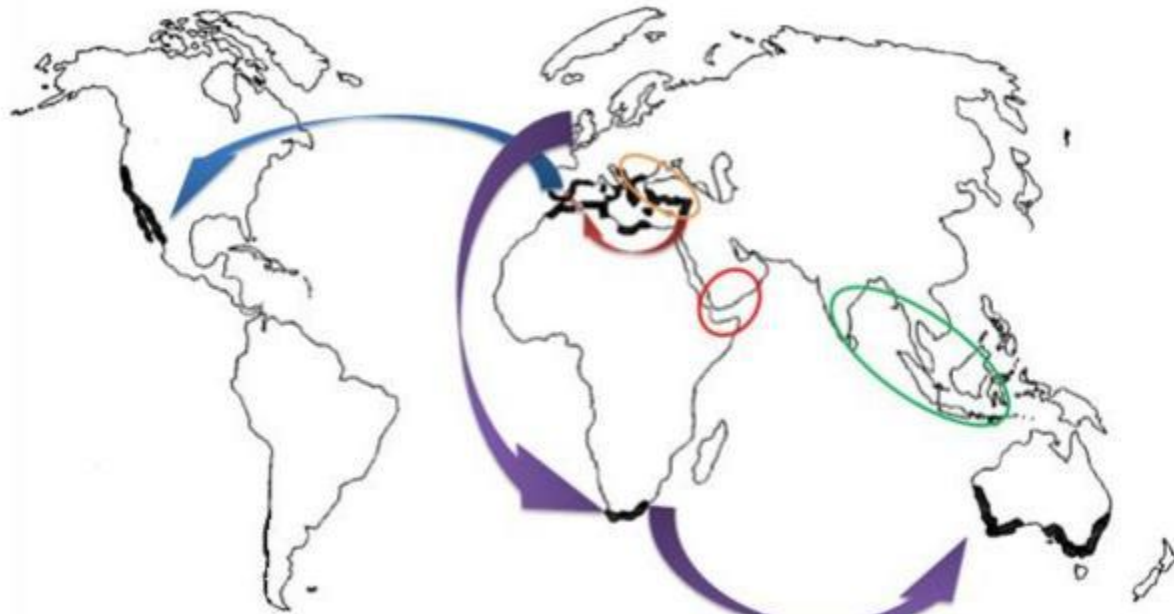
(APGII, 2003)

# Distribution

Cultivar :

Ecology:

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-leur a  
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graines  
leur rés  
**(Bat**



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sols

*Carte élaborée par MAHDAD. M.Y*

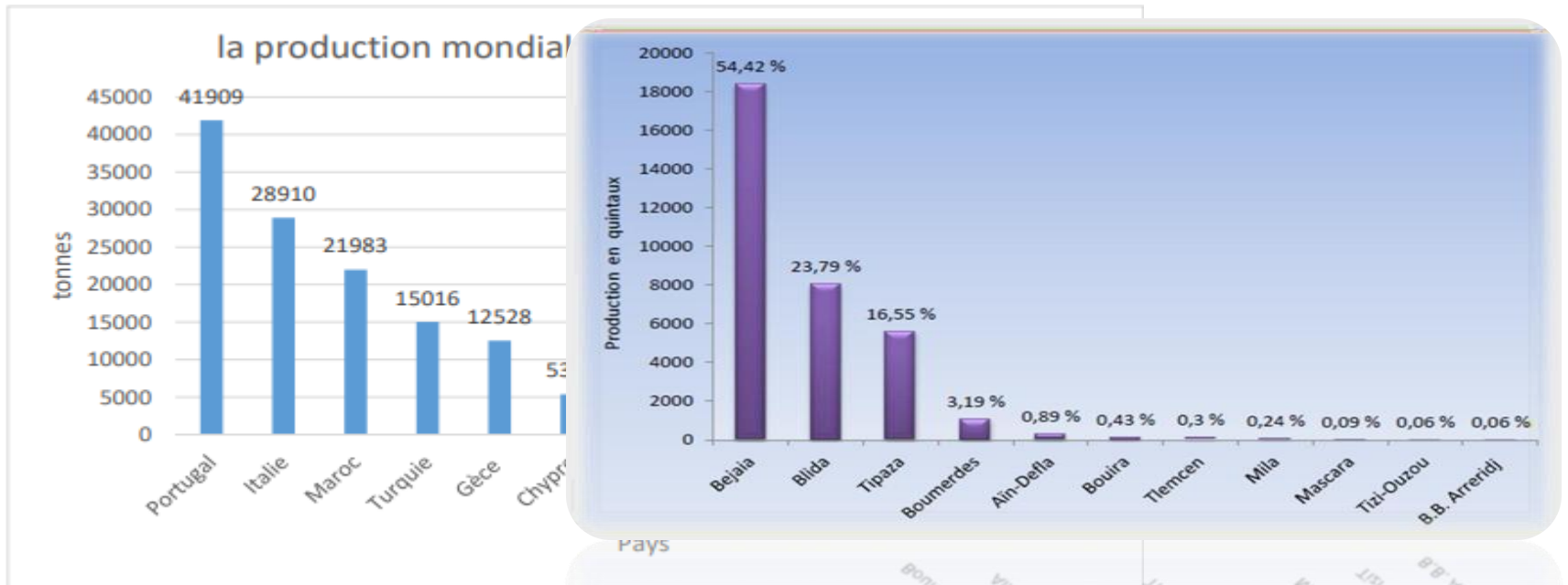
Centre d'origine et distribution du caroubier dans le monde  
(espace . univ-telmcen . dz )  
- contre la dégradation  
- contre la désertification

(Baum, 1989 ; Sbay et Abrouch, 2006 ; Zouhair, 1996, BAUM, 1989).



Production :

La production mondiale annuelle de caroube est essentiellement méditerranéenne ;( Afrique du nord et le sud de l'Europe )



Production de la caroube en Algérie, (DSA de Tlemcen, Production mondiale de la caroube en 2017 (FAOSTAT 2019)

# USES

## Traditionnel

L'utilisation des différents parties du caroubier en médecine traditionnelle est indiquée surtout pour les maladies du système gastro-intestinal (Diarée, gazes intestinaux, Anémie, favorise l'appétit...etc)

**(Ouelbani Rayene; Bensari Souheir; Mouas Toma Nardjes; Khelifi Douadi. (2016).)**

## Actuelle

- **Animale:** La gousse et les feuilles sont utilisées dans l'alimentation des ruminants et des non ruminants. (**Louca et Papas, 1973**)
- **Humaine :** La farine de la caroube est employée surtout en agro-alimentaire, sous de nombreuses formes :

la gousse et la gomme de caroube sont utilisées comme :

- 1/ ingrédient potentiel dans les aliments dérivés des céréales pour les personnes cœliaques ( farine sans gluten )
- ; 2/ coup de faim pour les régimes alimentaires
- 3/ préparation du chocolat, remplaçant: farine, sucres, cacao



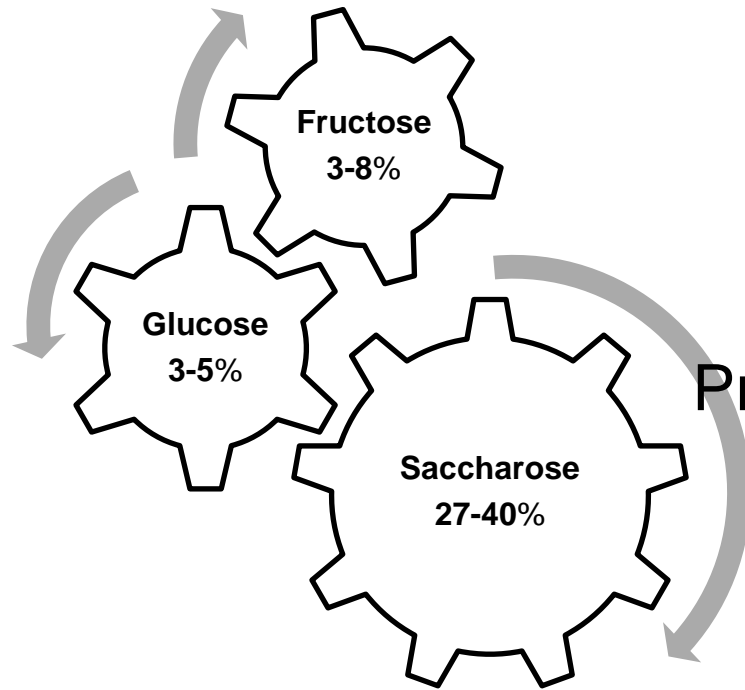
# Composition



Sugar : (la pulpe 40-60 %)

Lipids: (0,4 et 1,3 %)

le caroubier peut être considéré comme une source alimentaire plus saine et peut être un ingrédient idéal pour la production de produits à faible



Protéine : (Graines / AA essentiel) g / 100g

Méth : 1.40

Trp : 0.95

Leu : 9.30

His : 2.80

Val : 9.05

Phén: 3.10

Thr : 5.10

Ile : 3.80

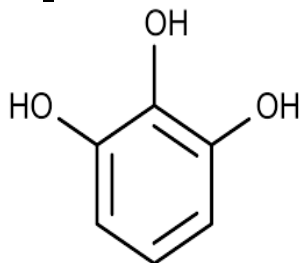
Lys : 4.20



Avallone R, Plessi M, Baraldi M, Monzani A (1997)

Ayaz FA, Torun H, Ayaz S, Correia PJ, Alaiz M, Sanz C, GrÚZ J, Strnad M (2007)

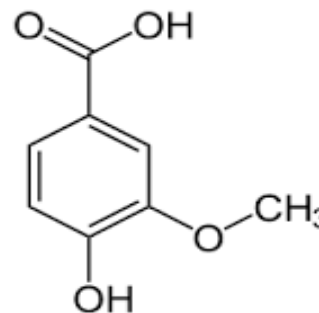
# Pyrogallo



4970,18 ppm

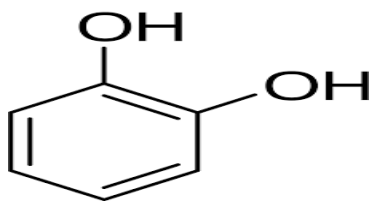
- Poly phénol
- (16 -20 %)

# Vanillique



13,92 ppm

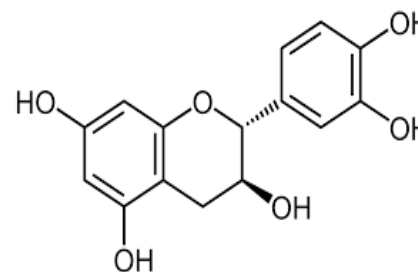
# Catéchol



164,67 ppm

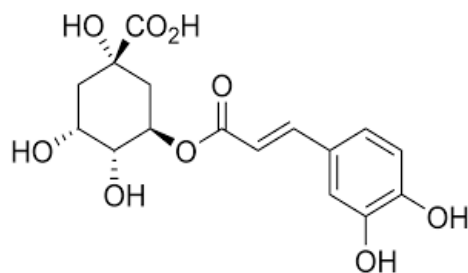


# Catéchine



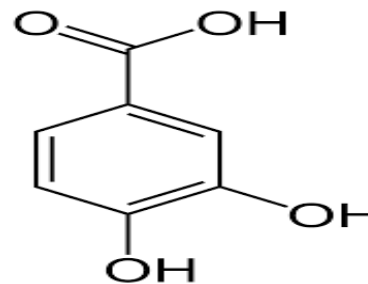
27,97 ppm

# Chlorogénique



101,09 ppm

# Protocatéchine



79,47 ppm

8



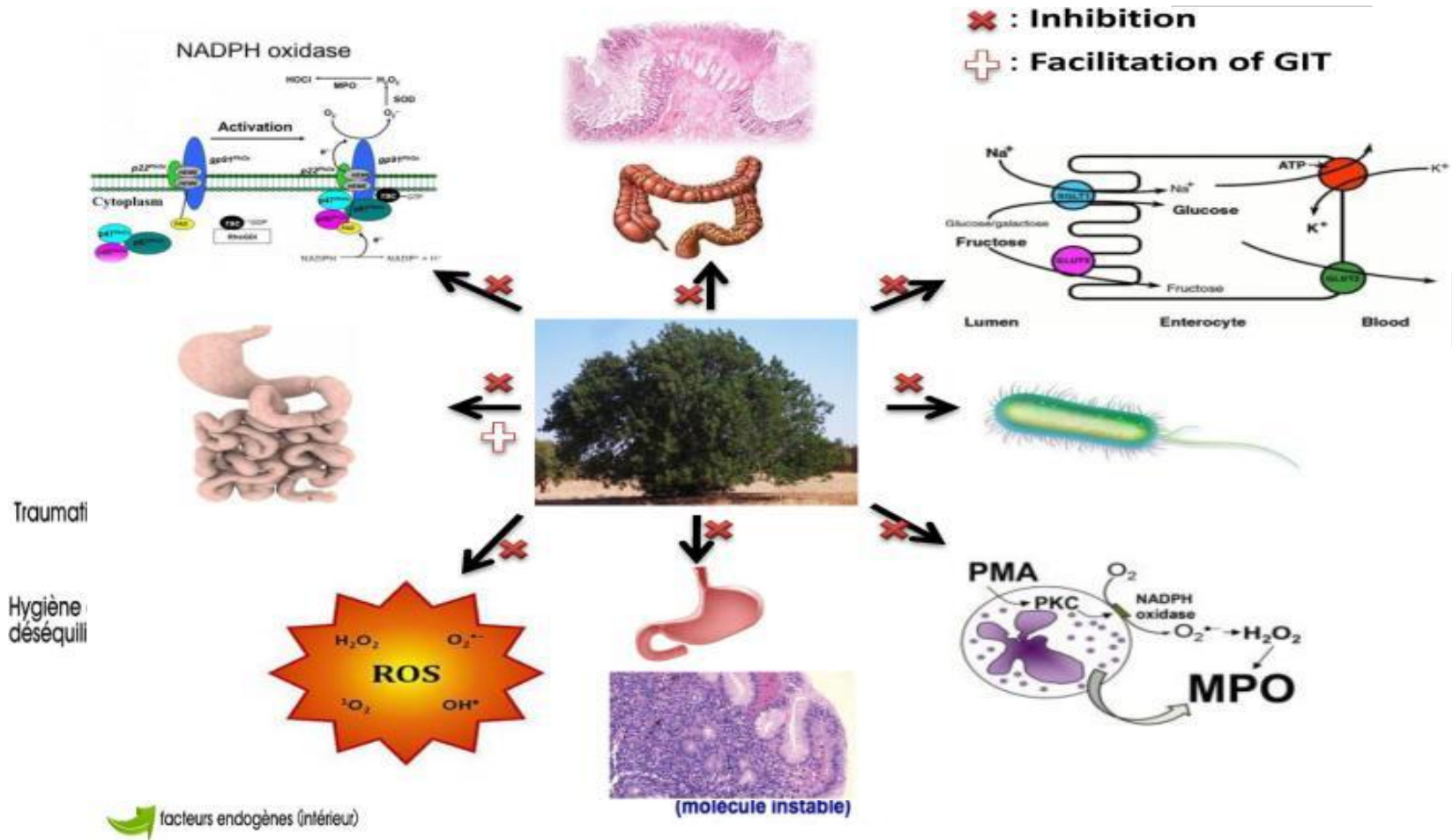
# Carob pulp as substitut of cacao



Component	composition des graines de cacao (%)	composition de pulpe de caroube (%)
Protéines	10.0–16.0	2.0–7.6
Graisses	36.8–57.0	0.4–1.3
Fibre	2.1–15.0	7.6–38.0
Sucres	0.4–3.5	40.7–54.7
Cendre	2.6–8.7	2.0–3.4
Caféine	0.1–1.0	Montant de la trace
Total poly phénols	4–18a	1.2–7.0a

*Composition of cocoa beans and carob pulp ( Loullis Andreas 2018)*

# Antioxidant activity



- lipidic peroxydation inhibition

Protège les cellules (**Rtibi et al,2015**)

- ↘ Cytotoxicité (**Lobo et al. 2010**)

- SOD et CAT  $\longrightarrow$  Elimination des ROS (**Rtibi et al. 2015**)

- Inhibition de MPO  $\longrightarrow$   $\text{Cl}^- + \text{H}_2\text{O}_2 + \text{H}^+ \longrightarrow \text{HOCl} + \text{H}_2\text{O}$   
(**Rtibi et al. 2015**)

- Inhibition de la phosphorylation du p-47phox-ser-328 (**Rtibi et al. 2015**)

# Anti cancer activity



Fibers + poly phénols



Prolifération de l'adénome et  
les cellules adénocarcinome  
**(Corsi et al, 2002).**

Extrait de fibre de caroube  
**(Johns et Houlston, 2001)**



# Anti-hyper-lipidimic activity

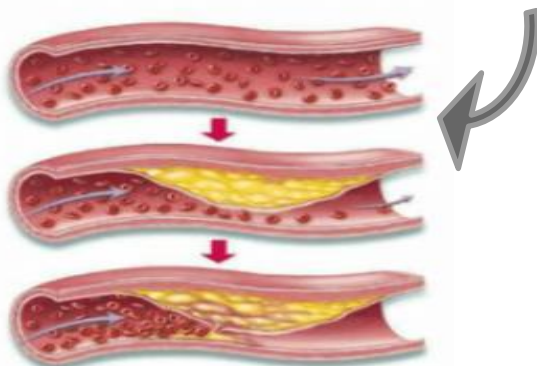


Fibre

- Digestion des graisses
  - Contrôle le cholestérol total
  - ↘ le taux de LDL et Triglycéride
- (Macho-Gongàlaz et al, 2018)**

Fibre soluble

Fibre insoluble



↘ Cholestérol plasmatique  
**(Evan et al, 1992)**

↘ Athérosclérose **(Valero-munoz et al,2017)**

# Antidiabétique activity



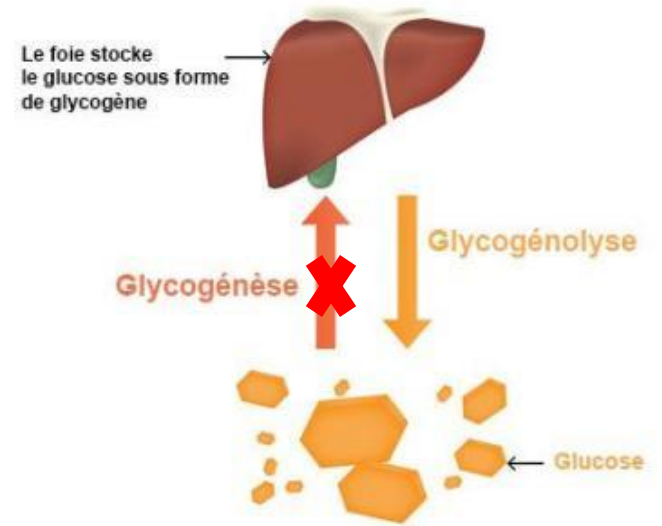
Extrait de gomme de caroube joue un rôle dans la régulation du glucose de sang.

~~G~~lucose (Forestieri et al, 2010)

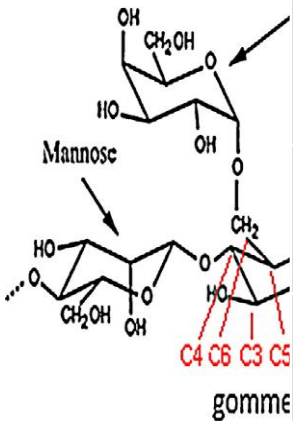
~~G~~lycogénèse

~~G~~lycogène

## Glycogénèse /Glycogénolyse



# Anti-reflux activity



gomme de tara (3:1)

Formule épaissies de gomme	Indice de reflux
A: 0,33g/100ml	Plus efficace
B: 0,45g/100ml	
C: 0,45g/100ml	

risson

régurgitation  
(Miyazawa R, et al 2004)

Femme enceinte

- Améliore les symptômes du reflux gastro-œsophagien, tels que les pleurs et les troubles du sommeil (Orenstein SR, et al 1987)

# Anti diarrhéic and antibacterial activity

Extrait aqueux		
Bactéries	Extrait de feuille	Action
Escherichia coli ATCC 25922	N-hexane	Inhibition de la croissance (Kivçak et Coll, 2002)
Escherichia coli ATCC 11230	Tous les extraits	
Escherichia coli ATCC 29998	Méthanol	
Staphylococcus aureus ATCC 29213	Ethanol Méthanol	
Staphylococcus epidermidis ATCC 12228	Extrait aqueux	



# Anti inflammatory and anti ulcer activity

## Extraits aqueux



- Les tissus enflammés et le plasma du colon (**Rtibi et al, 2016**)
- Prévenir les lésions macro et microscopique de muqueuse
- Poly phénols (Flavonoïde) (**Rtibi et al, 2015**)

**Conclusions** The present bibliographic mini review on carob tree and its organic derivatives (pods, pulp, seeds, flowers, leaves), exhibits its richness in several primary (fibers, hydrocarbs) and secondary metabolites (phenols, Gallic acids, catechins, quercetin, tannins...) which content and profile depend on plant studied part, soil, climate, cultivar, extraction and characterization methods. Besides, an important antioxidant activity, a high nutritional value and dietary profile make its plant parts derivatives very interesting functional foods, dietary supplements, adjuvant in pharmaceuticals, nutraceutical, to treat several chronically diseases related to nutrition such as cancer, diabetes, ulcer, gluten intolerance...

In this regard, a range of dietary products was developed in our laboratory: free gluten flour, molasses, vegetable milk, tires, to promote local organic products for a sustainable eco-responsible economy.

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