



Antioxidant properties of honey and other bee products, from different botanical origins, of interest to the food industry

Propiedades antioxidantes de la miel y otros productos apícolas, de diferente origen botánico, de interés para la industria alimentaria



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Definición productos de la colmena



- Miel
- Polen
- Jalea real
- Propóleos



1. Son productos vegetales de origen animal
2. Distinto origen botánico
3. Distinto origen geográfico



MIEL

Según la norma de calidad vigente en España (RD 1049/2003) de la miel destinada al mercado interior:

La miel es la sustancia natural dulce producida por la abeja *Apis mellifera* a partir del:

- néctar de plantas
- de secreciones de partes vivas de plantas
- de excreciones de insectos chupadores presentes en las partes vivas de plantas, que las abejas

Recolectan



Transforman,
combinándolas
con sustancias
específicas

Depositan
en
celdillas



Deshidratatan

Almacenan
en colmenas
para que
madure".



Tipos de miel

- Tipos de miel según su origen:
 - Miel de flores: origen en el néctar
 - Mielato: origen en la mielada
- Tipos de miel según exista o no dominancia de un tipo de néctar:
 - Monofloral
 - Multifloral



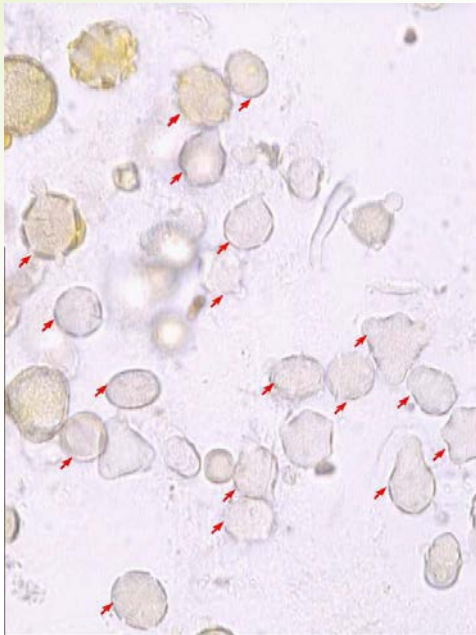
Miel

- Mezcla de néctares de distintas plantas del entorno de la colmena
- Factores que influyen en su naturaleza:
 - Preferencias sobre las especies de planta
 - Densidad de esa especie
 - Periodo de floración
 - Amplitud del periodo de floración
 - Condiciones climatológicas



Tipo de monofloralidad

- Según carga mayoritaria de un tipo de néctares o de otros
- Valoración en función de % pólenes correspondientes a las diferentes plantas

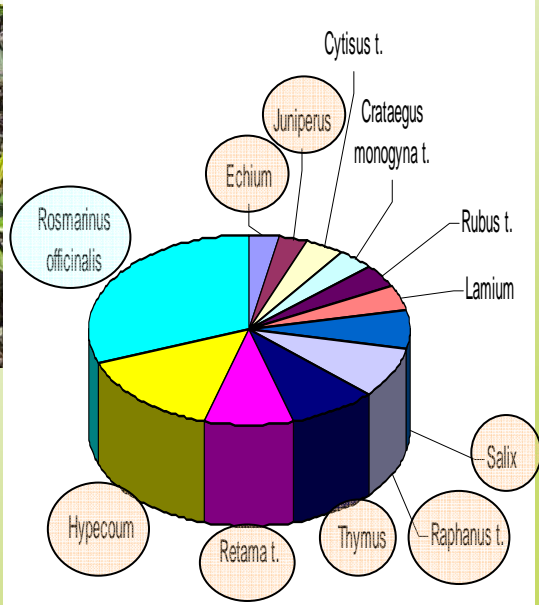
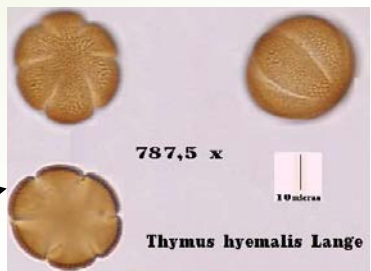


Polen=DNI
de la planta
pecoreada





N=nectarífera P=polínifera M=mielada	ROMERO D.O.P.
Carácter	TAXONES
N	Rosmarinus officinalis
N	Lavandula stoechas
N	Helianthus
N	Thymus
N	Crataegus t.
N	Leguminosae
N P	Ericaceae
N P	Hypecoum
N M P	Salix
P	Cistus ladanifer
P	Cistaceae
P	Quercus ilex t.
P	Quercus suber t.



Ejemplos de monoflorales



Castaño tomillo

eucalipto

romero

romero

azahar

acacia

Mielato multifloral

zarza

colza

colza

trébol

brezo

girasol

¿Cómo considerar monofloral?

¡Producción polínica de las plantas es diferente!

1. Influye en su representación en la miel
2. Plantas poco productoras de polen:
 - Labiadas: espliego > 12-15% en la miel
 - Aguacate: >4%
 - Azahar: 5-10%

Infrarrepresentación en el sedimento de la miel

3. Plantas muy productoras de polen:
 - eucalipto, castaño: >70-80%

Suprarrepresentación en la miel

4. Otras muchas como brezo: >45%

Tipificación de la miel

- Análisis de polen del sedimento
- Análisis organoléptico
- Parámetros físico-químicos para afianzar el origen:
 - Conductividad eléctrica
 - CIELAB
 - En ocasiones: acidez y pH

LABORATORIO DE MIEL
Centro Agrario de Marchamalo

ANÁLISIS SENSORIAL - HOJA DE VALORACIÓN Y REGISTRO

Operador	Tipo ensayo	Nº Orden	Fecha Datos	Base Datos
D.O.				
No D.O.				
Nº Muestra		Fecha Análisis		
Tipo de miel según análisis:				
Valores: 1-Suave, 2-Normal, 3-Fuerte				
VISUAL				
Color		Tono		
Anbar Oscuro		Negro		
Anbar		Marrón		
Anbar Claro		Rojizo		
Anbar Extra-claro		Naranja		
Bianco		Yema		
Extrablanco		Amarillo		
Bianco Agua		Cream		
Brillo Espejo		Blanco		
OLFATIVO				
Persistencia		Intensidad		
Floral		Vegetal		
Sutil		Fresco		
Floral		Seco		
Pesado		Nervio		
Aromático		Afrutado		
Salumbrico		Almendra amarga		
Encantado		Abaronado		
Especiado		Citrino		
Madera		Fresco		
Resinoso		Fruta Desechada		
Animal		Químico		
Estallo		Antiséptico		
Profetico		Petroquímico		
Transpiración		Punzante		
Cálido		Degradado		
Ahumado/ Holín		Acido		
Caramelo		Almonacal		
Láctico		Azufrado		
Óxido		Humido		
Stall		Pútrido		
Tostado		Rancio		
GUSTATIVO				
Persistencia		Intensidad		
Sabor		Gusto		
Acido		Afrutado-Fruta Seca		
Amargo		Almendra amarga		
Dulce		Antiséptico		
Salado		Aromático		
Retrogusto		Balsámico		
Astringente		Encurtido		
Empalagoso		Especiado		
Fresco		Floral		
Picante		Citrino		
Seco		Madera		
Tostado		Óxido		
Caramelo		Rosquilla		
Rancio		Verdura		
TEXTURA				
Cristalizado		DEFECTOS		
Líquido		Acidosa		
Pastoso		Calentada		
Útilioso		Cristal Heterogéneo		
Granuloso		Espuma		
		Fases		
		Fermentación		
		Impurezas		
OBSERVACIONES				
Agradable	SI		Cumple D.O.	SI
	NO			NO
Vº Bº El Director Técnico			El Analista	

Polen



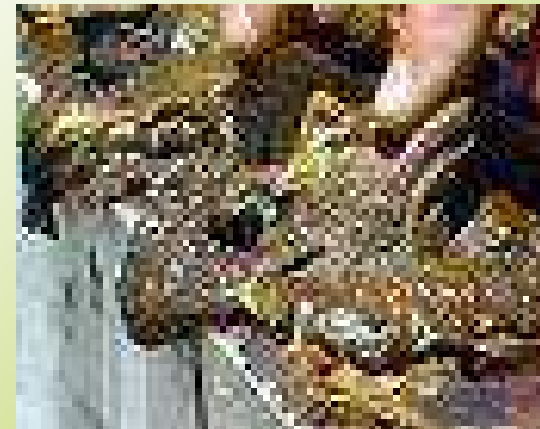
Proyecto FP7:
APIFRESH:

Monofloral si uno $>70\%$
y el siguiente $<25\%$

Propóleos

Distinto origen botánico pero
restringido a árboles y arbustos

Condicionado a los existentes
en una zona



Composición química de la MIEL

- En torno a 70% azúcares
 - según origen botánico distinto balance
 - Fructosa/glucosa
 - Fructosa+glucosa
 - Contenido en otros azúcares
- Otros componentes minoritarios o trazas:

Composición química del POLEN

- 13-30% proteína
- 18-20% azúcares
- Resto de componentes igual que en miel

- Minerales (K, Na, Ca, etc.)
- Lípidos
- Proteínas
- Aminoácidos libres
- Ácidos orgánicos (ácido glucónico)
- Enzimas
- Compuestos aromáticos
- Flavonoides
- Vitaminas hidrosolubles



LA MIEL COMO ANTIOXIDANTE

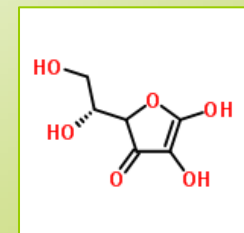
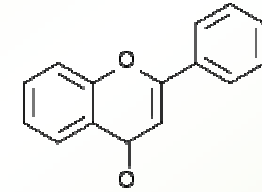
En la bibliografía científica se ha demostrado que la miel es una fuente natural de antioxidantes, muy efectiva:



- Reducir riesgos en enfermedades de **corazón, cáncer, sistemas inmunosuprimidos, cataratas y procesos inflamatorios** [*The National Honey Board,2003*]
- Prevenir** reacciones de **oxidación** en **frutas y hortalizas** [*Chan et al,2000*] y oxidación lipídica en **carne** [*Suzuki et al, 2006*]
- **Inhibir** el crecimiento de **organismos patógenos** de alimentos [*Mundo et al, 2004*]

¿QUE ANTIOXIDANTES CONTIENE LA MIEL?

- Ácidos fenólicos y flavonoides
- Algunas enzimas (glucosa oxidasa, catalasa, etc.)
 - Ácido ascórbico
 - Carotenoides
 - Ácidos orgánicos
- Productos de degradación de Maillard
 - Aminoácidos



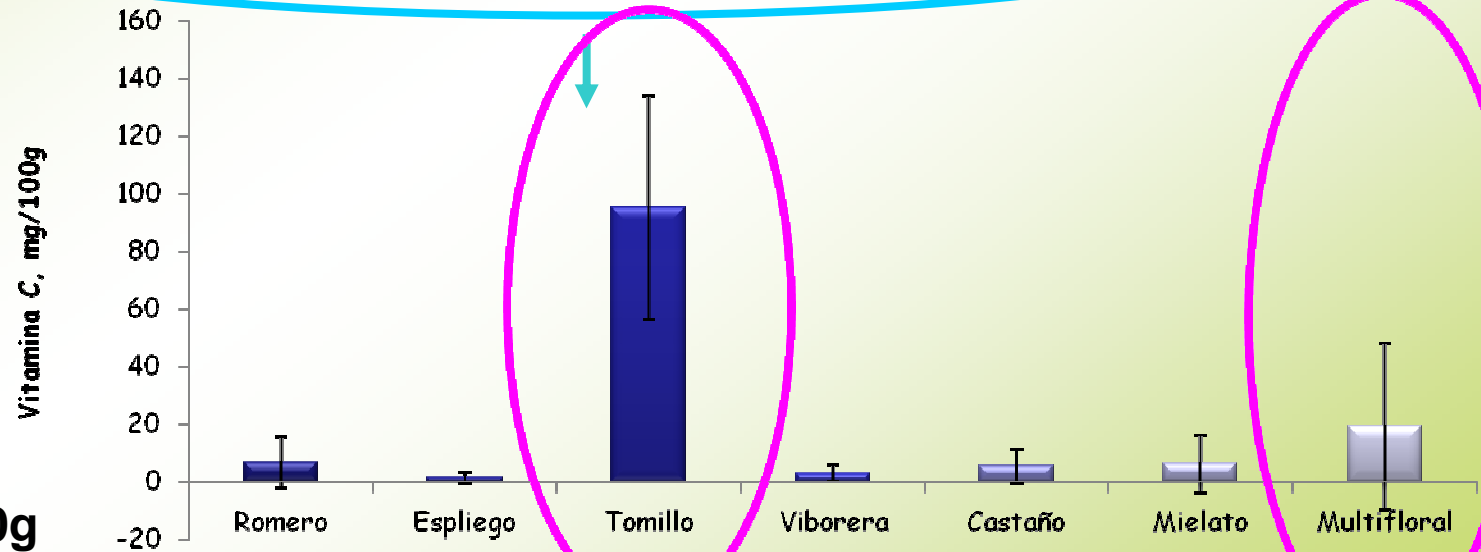
Componentes antioxidantes

- Diferentes % de polifenoles y vitaminas determinan distintas actividades o capacidades antioxidantes
- Variaciones dependen de:
 - origen botánico
 - Condiciones del néctar de la planta
 - Grado de madurez
 - Humedad
 - Ciclo de la planta
 - Efectos secundarios de la climatología: stres = contenido en azúcares

Vitamina C en MIEL

- Alto potencial antioxidante presente en muchos alimentos.
- Bibliografía - disparidad de resultados de su contenido en mieles :

0.0 mg/100g hasta 311.1 mg/100g

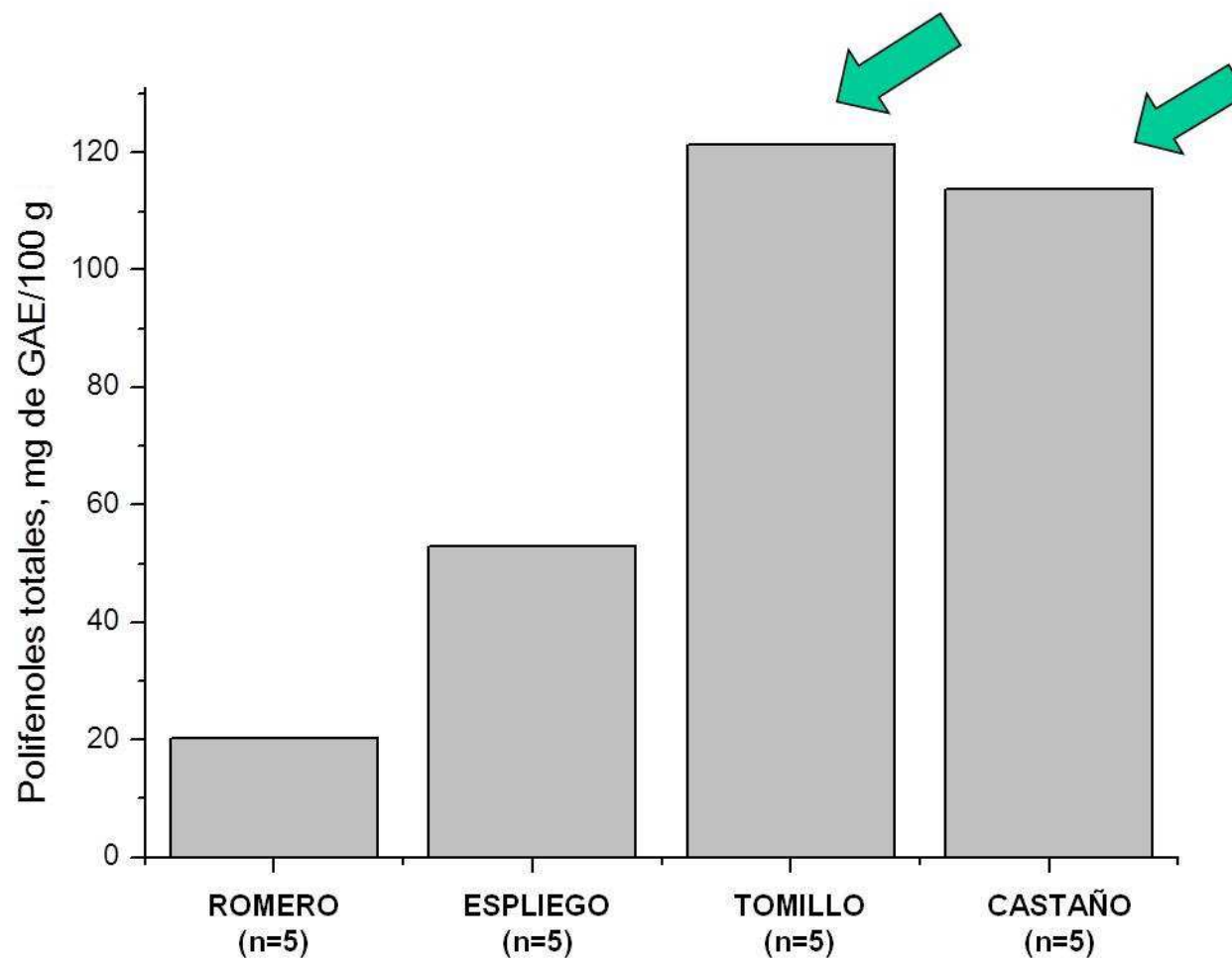


Kiwi 59 mg/100g

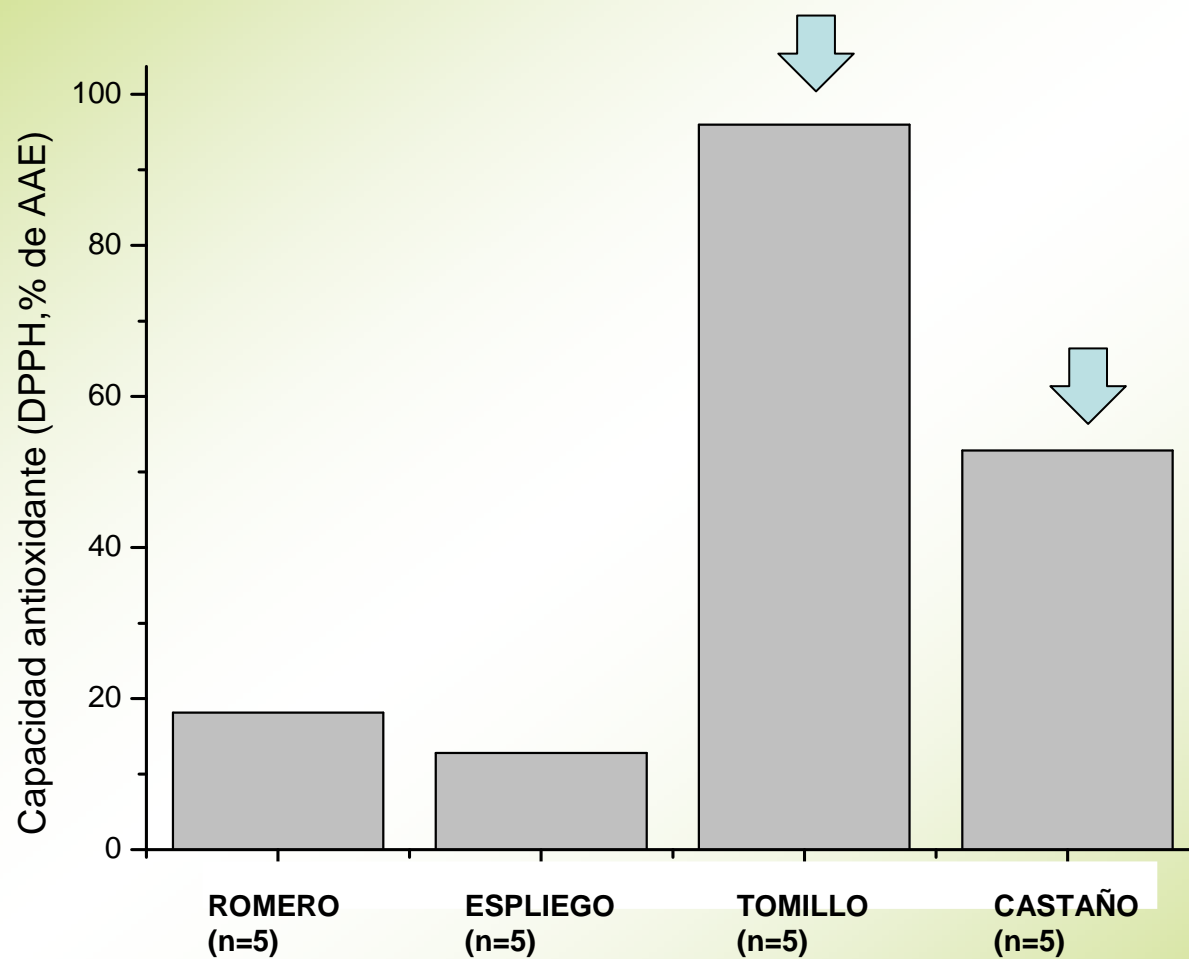
Perejil 190 mg/100g

IMPORTANCIA DEL ORIGEN BOTÁNICO

COMPONENTES ANTIOXIDANTES

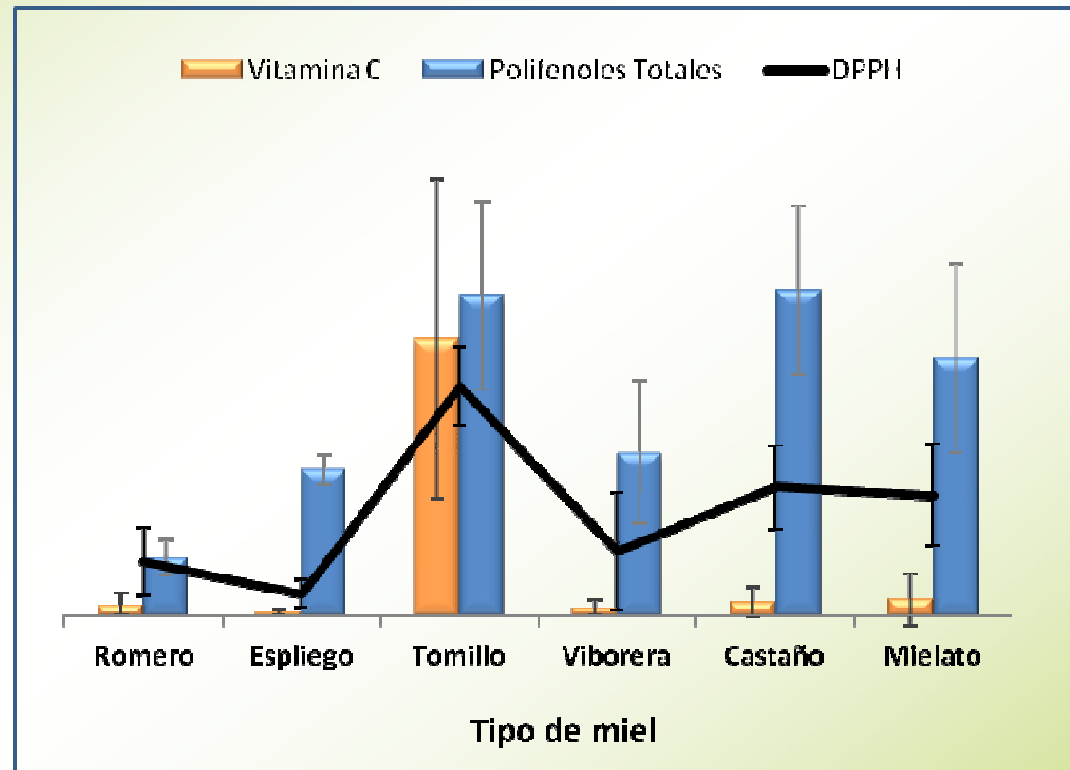


COMPONENTES ANTIOXIDANTES



ACTIVIDAD ANTIOXIDANTE

Mayor contenido de **polifenoles totales** (PT) en las mieles oscuras -excepción de las mieles de tomillo, de color ámbar claro, con niveles de PT similares a castaño y superiores a mielato.



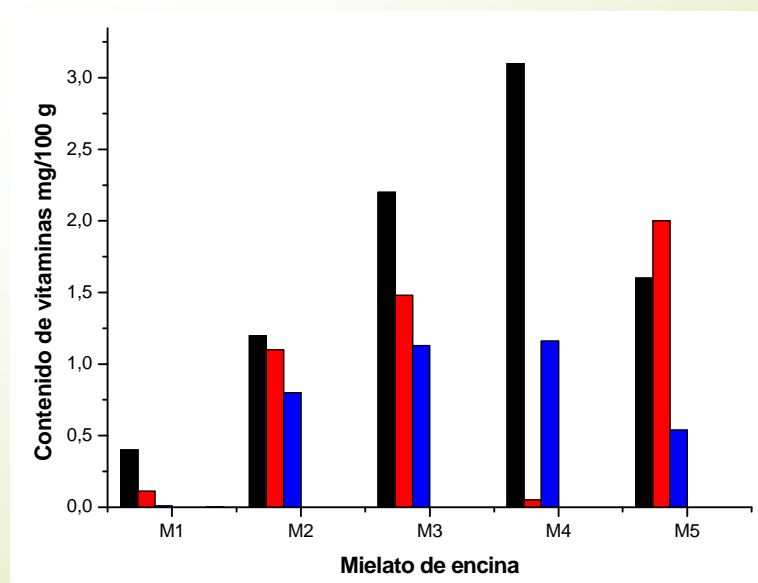
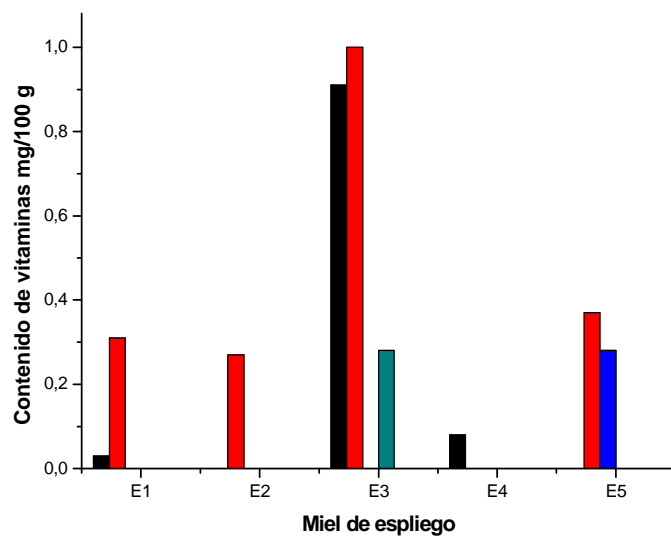
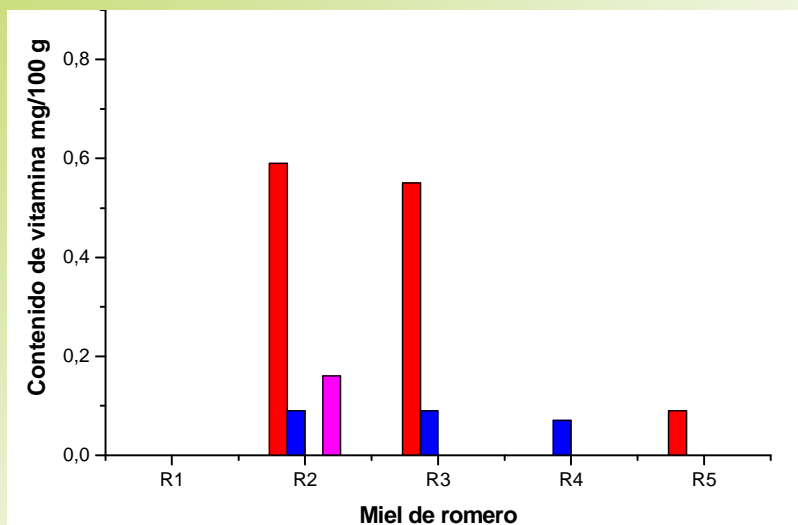
Capacidad antioxidante (DPPH) mayor en:

- las mieles de tomillo
- las de castaño y mielato.

Menor actividad: espliego y romero.

Vitamina C contribuye mucho a la capacidad antioxidante (miel de tomillo, sobre todo).

VITAMINAS HIDROSOLUBLES DEL GRUPO B



FUENTE:

a) V. León-Ruiz, S. Vera, A. V. González-Porto y M. P. San Andrés. *Food Analytical Methods*, 6, 2013, 488–496

b) V. León-Ruiz, Tesis Doctoral (2013). Depositada y a disposición del personal investigador en el Departamento de Química Analítica, Química Física e Ingeniería Química, UAH.

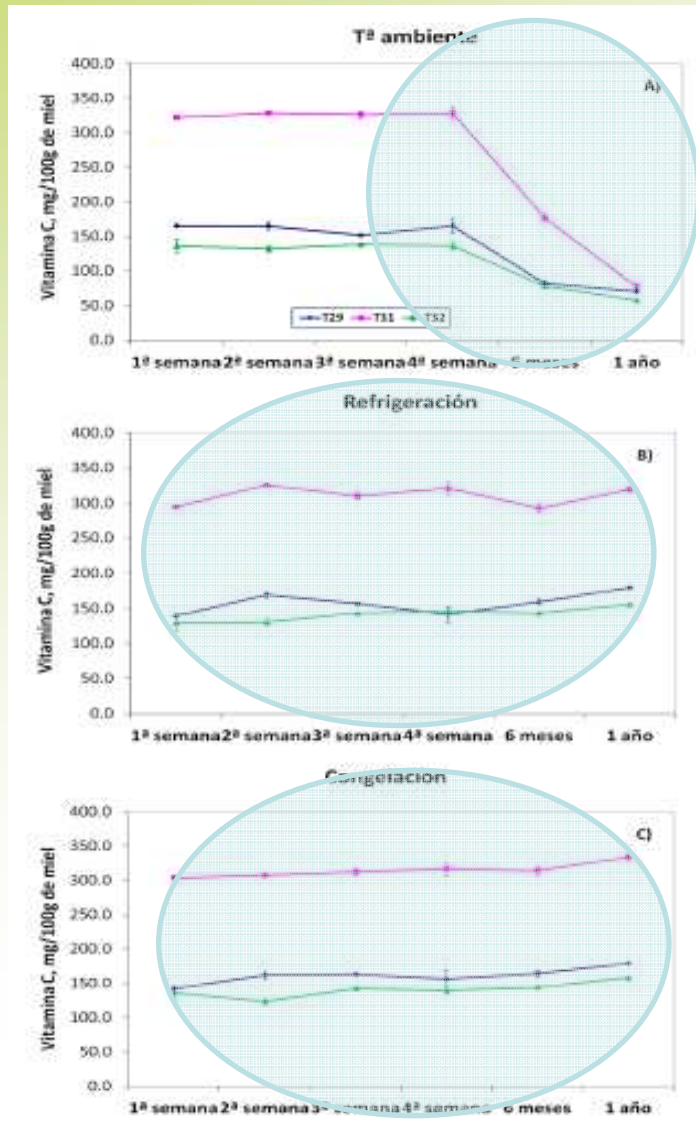
Variación en la CALIDAD DE LA MIEL

- Alimento natural, de fácil conservación que no necesita de ningún tipo de tratamiento o manipulación para su consumo

Conservantes naturales: alta osmolaridad y carácter ácido.

- Mala conservación (mieles sucias, con alto contenido de agua, calentada) o envejecimiento natural puede:
 - CRISTALIZAR
 - FERMENTAR
 - AUMENTAR EL HMF

ESTABILIDAD de vitamina C en mieles de tomillo



- ✓ Durante el almacenaje de la miel, aún en óptimas condiciones, algunos componentes pueden sufrir alteraciones → enzimas, azúcares y **vitamina C**.
- ✓ Estudio de 3 mieles de tomillo con [vit.C] > 100 mg/100g. Cada una se divide en 3 partes, que se guardan a 3 temperaturas diferentes (-18°C, 4°C, 25°C) durante 1 año.
- ✓ RESULTADOS: **disminución** de [vit. C] en un 72% en la miel almacenada a **Tª ambiente** (25°C). En refrigeración (4°C) y en congelación (-18°C) la [vit. C] permanece invariable.

Vitamin C and Sugar Levels as Simple Markers for Discriminating Spanish Honey Sources.

V. León-Ruiz, S. Vera, A.V. González-Porto y M. P. San Andrés

Journal of Food Science, 76, 2011, C356-C361



Antioxidant, antibacterial and ACE-inhibitory activity of four monofloral honeys in relation to their chemical composition

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Food & Function, 4, 2013, 1617-1624

Food & Function

Antioxidant, antibacterial and ACE-inhibitory activity of four monofloral honeys in relation to their chemical composition

Virginia León-Ruiz¹, Amelia V. González-Porto¹, Nasser Al-Habsi¹, Soledad Vera¹, María Paz San Andrés¹ and Paula Jauregi²*

Abstract An isocratic RP-HPLC method has been developed for the identification and quantification of water-soluble vitamins in honey. The mobile phase used was an aqueous solution of sodium acetate and the detection was carried out simultaneously by UV and fluorescence. The separation of vitamins C (ascorbic acid), B1 (thiamine), B2 (riboflavin), B6 (pyridoxine) and B12 (cyanocobalamin) was achieved in 15 min. The addition to the mobile phase of methanol 2% v/v reduced significantly the analysis time as the separation of these vitamins up to 10 min. Moreover, in presence of a cationic surfactant (hexadecyltrimethylammonium bromide (CTAB)) in the phase, the separation of vitamins C, B1, B2 (obvious) and B6 is possible in a 6 min combination of both mobile phases, ethanol and H₂O/NaOH/ethanol/CTAB, has led to the analysis, in isocratic mode, of monofloral honeys (rosemary, thyme, clover, orange) and a honey adulterated with fructose syrup.

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www.rsc.org/foodfunction

Introduction

Honey is a natural bee product. Its composition depends primarily on the botanical origin and secondarily on the geographical origin, processing and climatic conditions. It has been demonstrated that honey has a great potential to serve as a natural food antioxidant because its antioxidant content is similar to that of many fruits and vegetables. The principal antioxidant compounds found in honey are flavonoids, phenolic acids, some enzymes (glucose oxidase, catalase, ascorbic acid, carotenoid-like substances, organic acids). Most lipid reaction products, amino acids and proteins. However, the antioxidant activity varies greatly depending on the O origin source. In one study have reported the fact that honey is bioavailable and very noticeable oxidative stress in the gastrointestinal tract, low, pancreas, kidney and plasma. In this sense, substitution of traditional components by honey in some foods could result in enhanced antioxidant activity in healthy adults.

Honey has also been used as medicine since ancient times and has lately been rediscovered as a treatment for infected ulcers, bad sore, burns, wounds and bacterial gastroenteritis in.

Introduction The antioxidant activity of honey has been attributed to physical (enzymes and acidity) and chemical properties. The principal component of honey responsible for this activity is hydrogen peroxide which is formed from the oxidation of glucose by the enzyme glucose oxidase (GluOx) together with other polymeric substances acquired from flower nectar and the enzyme originates from the glands of bees. Glucose oxidase reaction mixture used honey is obtained as the high sugar concentration provide the enzyme from functioning. Typically, when extracted combes is added to a honey solution to destroy the hydrogen peroxide the antibacterial activity is not completely eliminated. It has been suggested that other molecules besides hydrogen peroxide could be contributing to this activity and these are referred to as "non-peroxide" components. These substances have been associated with antioxidant and prebiotic compounds such as flavonoids. In addition to antioxidant and antibacterial activity, other therapeutic and medicinal effects such as antitumor, anti-proliferative, anti-atherosclerotic, hepatoprotective and hypotensive and hypoglycemic have been reported to honey in recent.

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The vitamin C content in honey is a very water soluble due to its aqueous nature containing a high quantity of sugars and a low percentage of lipids. Vitamin C has been specially decreased in honey because of its antioxidant effect (Cano et al. 2001; Obialor et al. 2002; Hayakawa et al. 2006; León-Ruiz et al. 2011) and it is often found in almost all honeys. Only Canada and Cuba (2011) in one country honey samples, Alvarez-Suarez et al. (2010), in its honey samples and Castro et al. (2002), in spite of a high number of honey studies, did not detect the presence of ascorbic acid in any sample. Vitamin C analysis in honey is more often used to detect the adulteration of honey, if it is very difficult to identify and quantify oxidation products of honey by factors such as light, oxygen or heat. In the last 10 years, very few references appear on the

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Analysis of Water-Soluble Vitamins in Honey by Isocratic RP-HPLC

Virginia León-Ruiz¹, Soledad Vera¹, Amelia V. González-Porto¹, Nasser Al-Habsi¹ and Paula Jauregi²*

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*Gracias a todos
por su atención*

