

HONEY

HONEY

- Is made by bees from nectar from flowers (Floral) and from tree saps (Honey dew).
- Man is indebted to the honeybee for searching earths fields and forests for their treasured sweetness
- Prepared by the bee from natural solutions, changed from an easily spoiled thin sweet liquid to a stable high density energy food

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- Definition: Honey is twice stolen sweet. Stolen sweets are said to be the best. Prov 9 :17
- Stolen once by the bees from flowers (owners of the flowers on which the plot stands)
- Twice, stolen from the bees by the beehive keepers

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Composition

- Honey composition depends on i) Composition of the nectars where it originates and ii) external factors.

Carbohydrates

- Carbohydrates makes the largest portion of the dry matter of honey. It is responsible for the honey character, viscosity, hygroscopicity, granulation and energy values

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- Monosaccharides and Disaccharides. Of this fructose predominates but source of the nectar is important
- These account for 85- 95% of honey CHO
- Over time, changes in CHO occurs by enzymatic or acid reversions
- After 2 yrs storage at room temperature Maltose increases at the expense of dextrose and leavulose

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- Honey has triglucosylases which synthesizes these sugars after splitting of sucrose
- Low water content in honey favors accumulation of disaccharides but these are broken to monosaccharide by invertase
- Monosaccharides like glucose and fructose remain in solution in presence of acids

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Acids

- Acids in honey are responsible for its flavor
- The level of acids adds to its stability towards microorganisms
- Formic acid was the first to be recognized but others like acetic, butyric, citirc, formic glucoronic, lactic, maleic, malic are found
- Glucoronic acid is found in amounts that exceed other acids.

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- Most of the acids listed above are intermediates of the Krebs's cycle. This indicates biological oxidation usually found in nectar
- Honey pH ranges between 3.2- 4.5 with a mean of 3.9. This is determined by amount of acid present but also amount of mineral content Ca^{++} , Na^+ and K^+
- Honey with a high ash content as a high pH

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Minerals

- Average ash content is 0.17%
- Proteins (Amino Acids)
- Honey contains proteins and their presence is used to determine adulteration. Protein constitutes 0.041%

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Enzymes

- Enzymes present include lipases, lactase, protease, catalase, diastase and invertase

Diastase

- Starch digesting enzyme diastase is used to determine honey quality
- Diastase is sensitive to heat. Heating reduces the half life of diastase and invertase

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Invertase

- Is responsible for changes occurring during storage of honey
- Bees have been shown to be responsible for adding invertase to honey. Substrate for invertase is sucrose which is hydrolyzed to fructose (Fructoinvertase) and glucose (glucoinvertase)

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Honey color

- The precursors are unknown. Color of honey is described as being polyphenolic and ferric chloride. Oxidation of these compounds forms colored compounds
- Color is attributed to: i) combination of tannates and other polyphenols with iron

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- ii) Reaction of reducing sugars with substances containing amino acids – browning reaction
- lli). Instability of fructose in acid solutions (caramelization)
- Aroma/Flavor
- Its mainly from sugars, glucuronic acid and proline content. Sugars, AA, acids all contribute to flavor leading to aroma/flavor characteristic varying

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- A compound 5 hydroxymethylfurfuraldehyde shows as the principle peak in GLC as the one responsible for satisfactory organoleptically acceptable honey

Vitamins

- Vitamins are found in negligible amounts

HMF

- Is formed by decomposition of fructose in the presence of acids

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Biological properties of honey

- These vary depending on their plant origin.

Antibacterial

- Bacteria die in honey. Diluted honey is more effective. This is attributed to presence of inhibins. These are sensitive to light and heat. Honey dew has more antibacterial properties than floral honey

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- One of the inhibines is H_2O_2 produced by natural glucose oxidase system in honey
- Thermolability is seen at $80^\circ C$ for these inhibines

Pharmacological

- Honey has been used in medicine throughout time.
- Used as topical application to burns and wounds. Due to its viscosity it forms a thick barrier to entry of microbes

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- It is used to sober drunken patients. Due to its high fructose content, it speeds up alcohol metabolism due to catalase

Nutritive Value

- One may survive on honey and milk for 3 months when one starts to show Vit C deficiency
- Used by invalids and infants because its more palatable

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- One requires only 100g/day
- John survived in the desert eating wild honey and locusts

Quality Control of Honey

- Moisture- sugars are responsible for sweetness sugar content suppresses fermentation as moisture decreases

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- Moisture content varies between 17.2 – 18% with an upper limit of 21%. Viscosity of honey is due its low moisture content.
- This can be measured using a refractometer.

Flavor

- Measured using trained panelists. No instrumentation. Honey should be free from foreign flavors, aromas associated with fermentation

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Sugar Composition

- Sugar spectrum is as a result of physical properties of honey. Glucose and fructose make up to 75% while lower acceptable limit is 65% for floral and 60% for honeydew.
- Dissacharides (sucrose) upper limit is 5%. Non reducing do not react with copper reduction methods

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Ageing/heating/adulteration with invert sugar

- High temperatures (storage above 27 or heating at 70°C) affect constituents that are important for flavor and color
- Excessive temperature increases the production 5HMF from the breakdown of sugar solution especially those containing glucose and fructose

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- Addition of commercial sugar increases 5HMF which is usually at 10mg/kg. Heating hydrolysis sugars and 5HMF increases to 30 - 40mg/kg
- If 5HMF reaches 150mg/kg the honey has been adulterated with invert sugars (sucrose)
- Enzyme diastase and invertase are sensitive to heat. Diastase has a higher tolerance to temperature and is used to identify honey that has been overheated. Normal honey has a diastase number 8.

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- Diastase is measured as amount in mls of 1% starch solution hydrolyzed by enzyme in 1g honey at 40°C in 1h
- Acids
- Determined by titrable acidity and this gives history of honey. High acid figure, honey has been fermented resulting in alcohol which is converted to acetic acid by bacteria