BIOACCESSIBILITY OF ORGANOSULPHUR COMPOUNDS FROM *ALLIUM SATIVUM*

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BACKGROUND

Garlic is known for its medicinal uses which have been attributed to the organosulphur compounds. The study investigated two known biologically active organosulphur compounds (Allicin and Ajoene) and assessed the bioaccessibility in an *in vitro* model. Bioavailability is the result of three steps: digestibility and solubility of bioactive compounds in the gastrointestinal tract (bioaccessibility); the absorption and transport to the circulation; and the incorporation to their functional target. The location of release can determine the amount of compound present and the effect that it has on a system.

AIMS

To assess the effect of encapsulation on the bioaccessibility of two biologically active sulphur compounds derived from garlic within an established *in vitro* model.

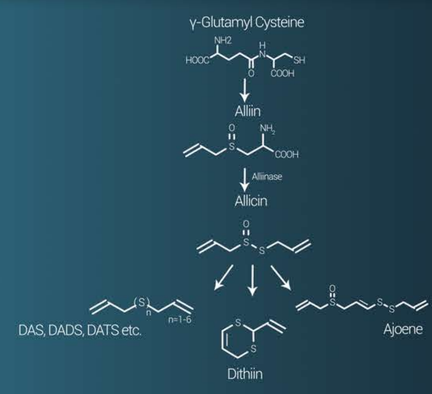
METHODS

The human gastrointestinal tract was simulated by a Dynamic Gastrointestinal Digester (DGD) simulating saliva secretions (α-amylase), gastric secretions (pepsin and lipase) at acid pH, and intestinal secretions (biliary and pancreatic secretion) at neutral pH. The total digestion was performed over 360min (120min stomach, 360min small intestine). Two organosulphur compounds, Allicin and Ajoene were monitored by HPLC throughout the model.

RESULTS 1

Image of In vitro Dynamic Gastrointestinal Digester (DGD) developed at AINIA Technologic Centre.

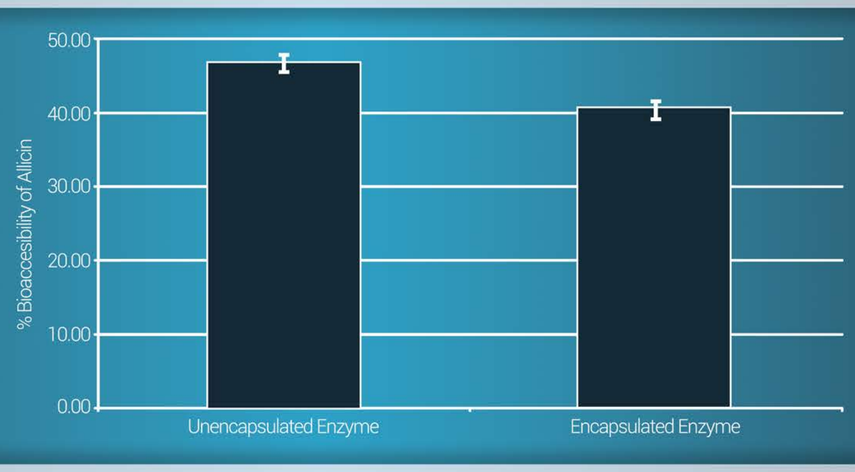
Allicin is produced from the reaction of alliin and the enzyme alliinase on lysis of the cell wall as a defence mechanism, therefore is not present in the garlic. Combination of alliinase and alliin without water allows for the delivery of Allicin to the point of solvation. Thiosulphinates are not formed below pH 3.6, which is the usual pH range in the stomach[2]. Furthermore, thiosulphinates are no generated through the neutralization of a mixture previously incubated below pH 3. Thus, alliinase is completely and irreversibly inhibited under the acidic conditions found in the stomach.



Biological pathway for the synthesis of organosulphur compounds[1]

RESULTS 2

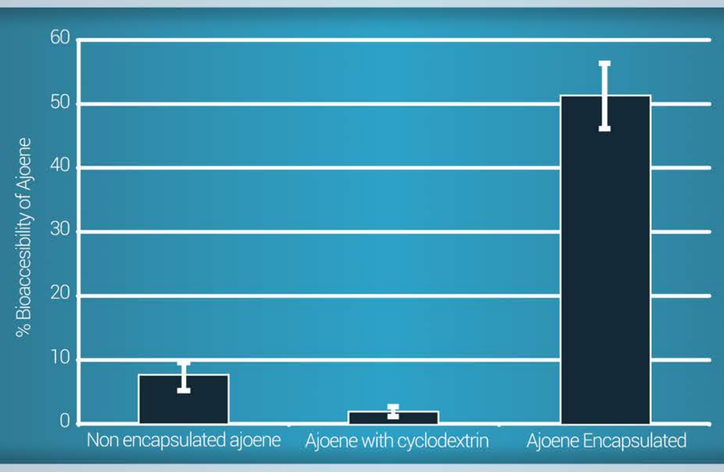
Encapsulation of the enzyme/precursor tablet with an enteric coating allow for the delivery to the later stage of the DGD. The results (Figure 1) show that in fact there is a lower concentration of Allicin produced by the encapsulated material, this may be due to the density of the tablet and penetration of the digestive fluid.



Bioaccessibility (%) of allicin in relation to the total amount available before digestion.

RESULTS 3

Bioaccessibility (%) of ajoene in relation to the total amount available before digestion.



Ajoene is a degradation product of allicin, it is most commonly found in fried garlic products and oils.

The bioaccessibility of ajoene in the Unencapsulated ajoene and ajoene with cyclodextrin is 7.43% and 1.51% respectively, indicating breakdown of ajoene by gastrointestinal. The use of an enterically coated capsule to contain the ajoene allows for transit through the system and released after 2 hours. Ajoene (51%) remained bioaccessible.

CONCLUSIONS

- The use of in vitro gastric simulation enables the prediction of organosulphur compound bioaccessibility in the human gut thus allowing for better understanding of in situ concentrations.

- The presence of allicin after *in vitro* digestion suggests that the process of ingestion and digestion would reduce the concentration by approximately 55%, this result is not in line with current published data (Lawson et al., 1992; Amagase et al., 2001). A model that simulates gut content may give results that are closer to *in vivo* results.

- Simple encapsulation of ajoene within a suitable capsule increased gastrointestinal stability and bioaccessibility. Without encapsulation there is very little bioaccessible ajoene in the small intestine, during the gastrointestinal digestion of the sample.

REFERENCES: Amagase, H; Petesch, B; Matsuura, H; Kasuga, S; Itakura Y. 2001. Intake of garlic and its bioactive components. J Nutr. 131:955S–62S.
Lawson, LD; Hughes, BG. 1992. Characterization of the formation of allicin and other thiosulfinates from garlic. Planta Med. 58:345–50.