Chitin-containing organisms can be alternative whole edible diets for poultry

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Outline

Chitin, a polymer of *N*-acetyl-D-glucosamine (GlcNAc), functions as a major structural component in crustaceans, insects and fungi and is the second most abundant polysaccharide in the nature. Although these chitin-containing organisms have been suggested as novel animal feed resources, chitin has long been considered as indigestible fibers in the animal body. Here, we report that Chia can function as a digestive enzyme that breaks down chitin-containing organisms in chicken GIT. Chia mRNA is predominantly expressed in the glandular stomach tissue in normal chicken. Chicken Chia has a robust chitinolytic activity at pH 2.0 and is highly resistant to proteolysis by pepsin and trypsin/chymotrypsin under GIT conditions. Chia degraded shells of mealworm larvae in the presence of digestive proteases and produced $(GlcNAc)_2$. Thus, chitin-containing organisms can be used for alternative poultry diets.

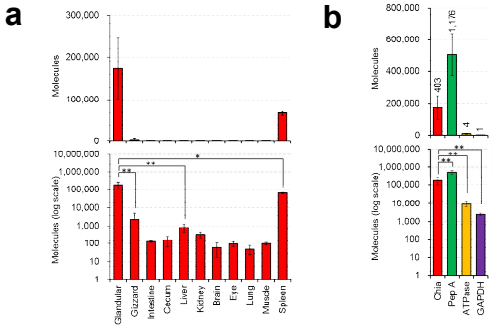

Fig. 1. Chia mRNA is highly expressed in chicken stomach. (a) Chia mRNA levels in chicken major eleven tissues. (b) The mRNA levels of four genes in the glandular stomach.

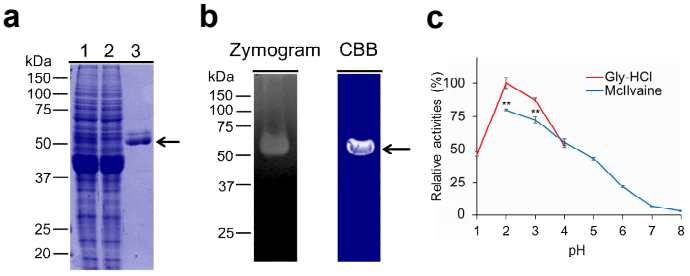

Fig. 2. Purification and characterization of Chia from chicken glandular stomach. (a) SDS-PAGE and CBB staining. (b) Zymogram of chicken Chia. (c) Optimal pH of chicken Chia.

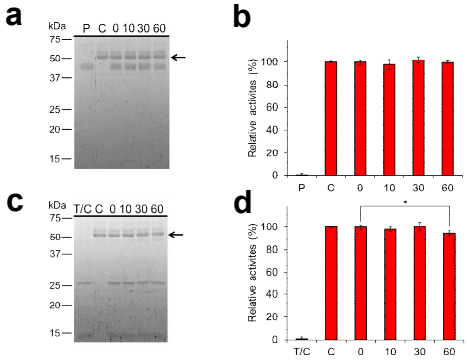

Fig. 3. Functional stability of chicken Chia against gastrointestinal proteases. Chia was incubated under stomach-like (a, b) or intestine-like (c, d) environment in the presence of pepsin or trypsin and chymotrypsin.

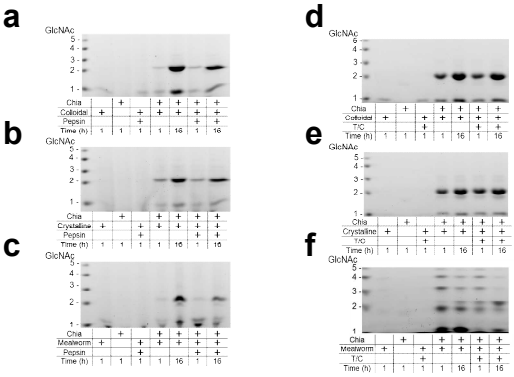

Fig. 4. Chia degrades chitin substrates into $(GlcNAc)_2$ in gastrointestinal condition. (a and d) Colloidal and (b and e) crystalline chitin substrates were degraded by Chia at (a and b) pH 2.0 or (d and e) pH 7.6 for 1 or 16 hours in the presence of pepsin or trypsin and chymotrypsin. Mealworm were also incubated with the enzyme under (c) stomach or (f) intestine condition.

Novelty

Functional similarity of chicken Chia with the mouse enzyme suggests that chitin-containing organisms can be used for alternative poultry diets not only as whole edible resources but also as enhancers of their nutritional value.

Application

Chitin-containing organisms can be used for alternative whole edible diets for poultry.

Related information

● Original paper: Tabata, E., Kashimura, A., Wakita, S., Ohno, M., Sakaguchi, M., Sugahara, Y., Kino, Y., Matoska, V., Bauer, P.O. and Oyama, F. (2017) Gastric and intestinal proteases resistance of chicken acidic chitinase nominates chitin-containing organisms for alternative whole edible diets for poultry. ***Sci. Rep.* 7, 6662.**

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