

EFFECT OF CHITIN ON CHITINASE SECRETION BY RODENTS

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Several Mammals (Bats, Hedgehog, Mouse) are known to be able to digest chitin, thanks to a gastric chitinase, the action of which is sometimes completed by a chitinase of pancreatic origin (Pig, Mole), as it occurs in Reptiles and Amphibia (1, 2, 3). It has been pointed out that Mammals able to synthesize chitinases are "chitin-eaters", at least occasionally, in the sense that they exhibit insectivorous or fungivorous habits. This correlation between the dietary habits and the secretion of chitinase has been interpreted (3) as being the result of the loss of the chitinase biosynthesis systems by those species adapted to a specialized diet, insectivorous habits being considered as a primitive condition in Mammals.

Two hypotheses may be proposed to explain the origin of these correlations between diet and digestive enzymatic equipment. We could be dealing with a) a metabolic adaptation in the sense given by Knox *et al.* (4), that is to say an individual reaction to a change in the diet, or b) a genetic adaptation, which had occurred by means of mutations and selection during the evolutionary processes. This paper deals with the repercussion of the presence or the absence of chitin in the diet on the biosynthesis of chitinase by several species of Rodents, normally equipped or not with a gastric chitinase (5).

The experiments have been carried out on four different species of Rodents. Each experiment has been conducted on two batches of animals, the individuals being chosen as similar as possible (same strain, age, sex and weight). The animals of the first batch received, during 1 to 3 months, an alimentation entirely devoid of chitin ("Basic Food"), while those of the second batch were fed with the same food, enriched with purified chitin

(5 to 30 g chitin per 100 g basic food). The chitin has been prepared from shrimp shells, after decalcification, removal of the proteins by hot NaOH 0.5 N, repeated washings and grinding. The animals were killed 24 hours after the last meal. Gastric mucosa and pancreas were washed with Ringer, and ground in mortar with sand and water; the homogenised suspension (1 g fresh tissue in 10 ml) was allowed to stand overnight at 0°C and centrifuged. The supernatant has been used for chitinase measurement, by a method given in detail elsewhere (2, 3). The results are given in table I.

In the case of the Mouse (Mus musculus), the chitinase concentration of gastric mucosa seems to be lower when animals are fed with chitin. In the Rat (Rattus norvegicus) and in the Hamster (Cricetus frumentarius), the variations observed are not statistically significant. No variation is observed with the Guinea-pig (Cavia porcellus). From these results, it can be concluded that, whatever the duration of the experiment or the species studied, the secretion of gastric chitinase by Rodents is neither enhanced nor induced by the presence of chitin in the diet. As far as the pancreas is concerned, the addition of chitin to the diet does not induce any chitinase secretion. This fact is particularly significant if we bear in mind that chitinase is actually secreted by the pancreas of other Mammals, such as the Pig, and by most of the Reptiles and Amphibians.

To conclude, the ability of mammalian glandular tissues to synthesize chitinase, and even the amount of synthesized chitinase, does not directly depend on the presence of chitin in the diet of the individual. Chitinase secretion in Mammals thus cannot be considered as being subject to a metabolic adaptation. The same conclusion has been drawn as far as mammalian lactase (6, 7) is concerned. Chitinase and lactase of Mammals seem therefore to contrast with the pancreatic and salivary amylases, the biosynthesis of which appear to be diet-dependent (8, 9, 10).

Effect of
secretion

Species	number of animals
Mus musculus L. (albinos)	3
Rattus norvegicus Erxl. (albinos)	6
Cricetus frumentarius Pallas	9
Cavia porcellus L.	2
	3
	1
	1

(1) chitinolytic activity
chitin/h/g fresh
individual values,(2) BF : basic food
starch and

* not significant

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Table I
 Effect of chitin in the diet on chitinase
 secretion by four species of Rodents

Species	number of animals	duration of experiment (months)	Diet ⁽²⁾	chitinolytic activity ⁽¹⁾	
				Gastric mucosa	Pancreas
Mus musculus L. (albinos)	3	3	BF	1980 ± 118	0
Mus musculus L. (albinos)	3	3	BF +30%chitin	1040 ± 212	0
Rattus norvegicus Erxl. (albinos)	6	2	BF	2364 ± 447	0
Rattus norvegicus Erxl. (albinos)	9	2	BF +5%chitin	2304 ± 699	0
Cricetus frumentarius Pallas	2	1	Grains	105	0
Cricetus frumentarius Pallas	3	1	Grains +10%chitin	234	0
Cavia porcellus L.	1	1	BF	27*	10*
Cavia porcellus L.	1	1	BF +10%chitin	24*	0

(1) chitinolytic activity of tissue extracts, in µg hydrolysed chitin/h/g fresh tissue; each figure is an average of individual values, followed by the standard error.

(2) BF : basic food for rodents (agglomerated cereals flours, starch and meat flours; entirely free of chitin).

* not significant result.

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