FIELD CYCLING RELAXOMETRY OF HEN EGG ALBUMEN

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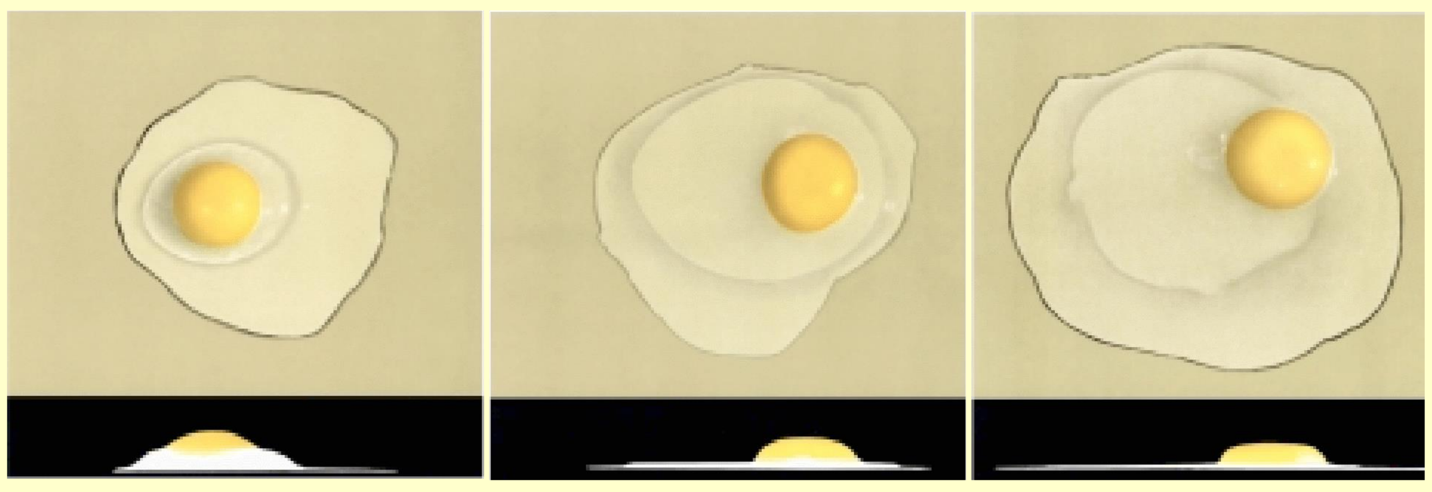
INTRODUCTION

Eggs quality is assessed by a number of well established methods, each exploiting some naturally occurring phenomena in eggs after laying. The quality of the egg albumen is usually determined through the measure of the so-called Haugh Index (HI), which is related to the firmness of the albumen and also gives and indication of the egg's age.

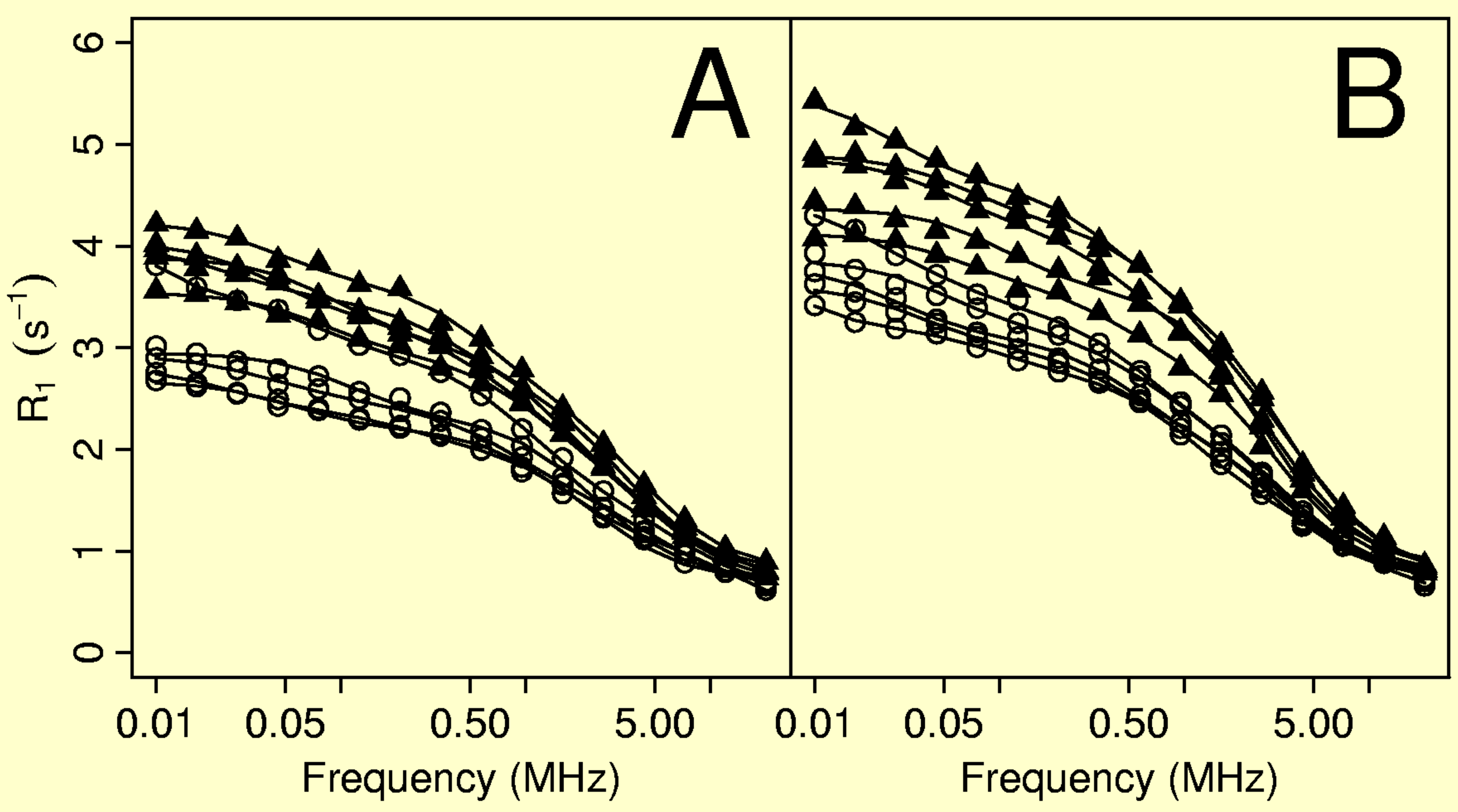


Fresh egg | Aged egg | More aged egg

The mechanism by which albumen undergoes thinning is even today not completely understood. It is agreed that the high molecular weight glycoprotein ovomucin is responsible for the semi-solid appearance of the thick white through chain entaglement and/or electrostatic interactions with lysozyme and metal cations (Robinson, 1987). One of the suggested explanations of albumen thinning implies an ehancement of the complexation between ovomucin and lysozyme as pH increases during ageing. The complex would then precipitate causing ovomucin depletion (Robinson and Monsey, 1972b; Miller at al., 1982).

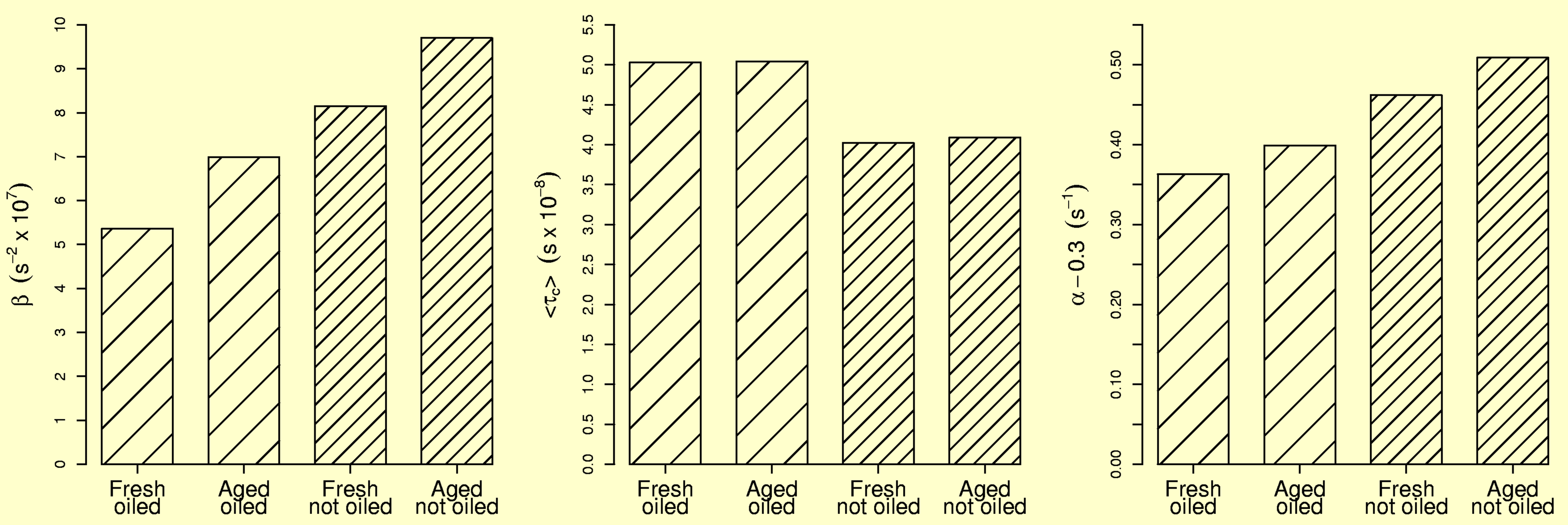
NMRD OF THICK ALBUMEN FROM FRESH AND ONE-WEEK AGED EGGS

Thirty eggs from Isa Brown Warren hens of 20 weeks of age were collected by hand from a local farm while they were still warm. As it is well known (Romanoff and Romanoff, 1949) that thinning is greatly reduced if egg's pH is kept at the value it has at laying (about 7.6), half of the eggs were immediately oiled by dipping them in paraffin oil. Each oiled egg was further wrapped in polyethylene film to avoid CO_2 loss from the shell. Five oiled and 5 not oiled egg were taken to the laboratory and analyzed by NMRD approximately 6 hours after laying. The remaining eggs were stored at 20 degrees and analyzed one week later. The NMRD curves were analyzed according to the model-free approach by Halle et al. (1998).



NMRD of albumen samples from (A) oiled eggs and (B) not-oiled eggs. Circles: fresh albumen samples; triangles: aged albumen samples.

RESULTS AND DISCUSSION



Average parameters obtained by model-free analysis of the NMRD curves.

From the above figure it appears that $<\tau_c>$ decreases significantly ($p<0.05$) on passing from oiled to not oiled eggs, but does not change with eggs age. The β value increases in one week by 30% in oiled eggs and by 20% in not oiled eggs; interestingly, if we take the β measured for fresh oiled eggs as the value one should obtain for thick albumen at laying, it turns out to have increased by more than 50% in 6 hours (*i.e.* pending analysis) for not oiled eggs. As expected (Capozzi et al., 2000), the α values tend to increase with the albumen age (about 10% per week) and, similarly to what happens for β (and under the same assumptions), α increases more (about 30%) during the first 6 hours than during the week afterwards.

	Oiled (fresh)	Oiled (aged)	Not-Oiled (fresh)	Not-Oiled (aged)
pH	7.77^a	7.79^a	8.50^b	9.10^c
HI	77.7^d	83.8^d	68.5^e	56.7^f

Table 1 (different letters indicate significant differences with $p<0.05$)

It is tempting to speculate that the sudden increase of α and β in not oiled eggs is due to the structural modifications that take place within the albumen in the first hours after laying because of the pH increase (Table 1). The hypothesis of an increased interaction between ovomucin and lysozyme (Robinson and Monsey, 1972b; Miller at al., 1982) would fit only in part within the present results, as in this case the hydrodynamic radius of the new aggregate should become greater and not lower (a higher $<\tau_c>$ should be detected); however a higher β in not oiled eggs might indicate the presence of water molecules trapped between the interacting macromolecules. This view still does not explain why α and β increase with the age of the eggs; it is likely that a second unrelated process is active in which the albumen macromolecules undergo purely structural modifications during the time after laying.

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