Tracking Residual-Yolk Energy in Dormant Hatchling Turtles

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SYNOPSIS

Hatchling painted turtles become dormant in their first winter and must rely on maternally derived energy in the form of residual yolk. Here we take a closer look at the use and movement of residual-yolk energy during the first 33 weeks.

Method

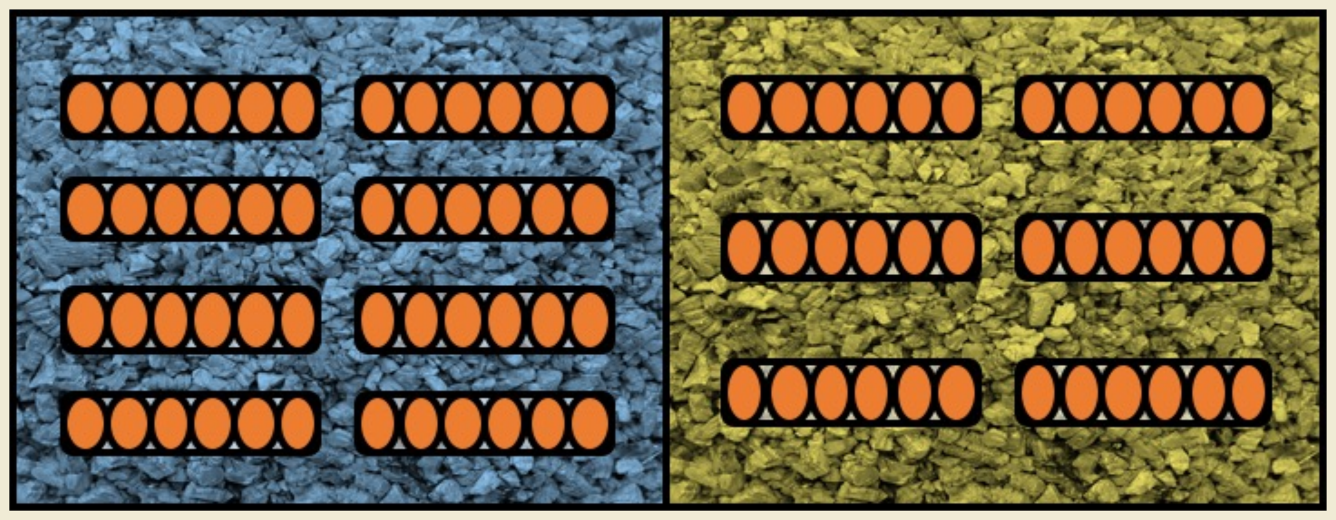


Fig 1. Left: eight clutches (n=8x6) were incubated in relatively wet conditions (1-g dry vermiculite: 1-g water). Right: six clutches (n=6x6) were incubated in relatively dry conditions (1-g dry vermiculite: 0.3-g water).

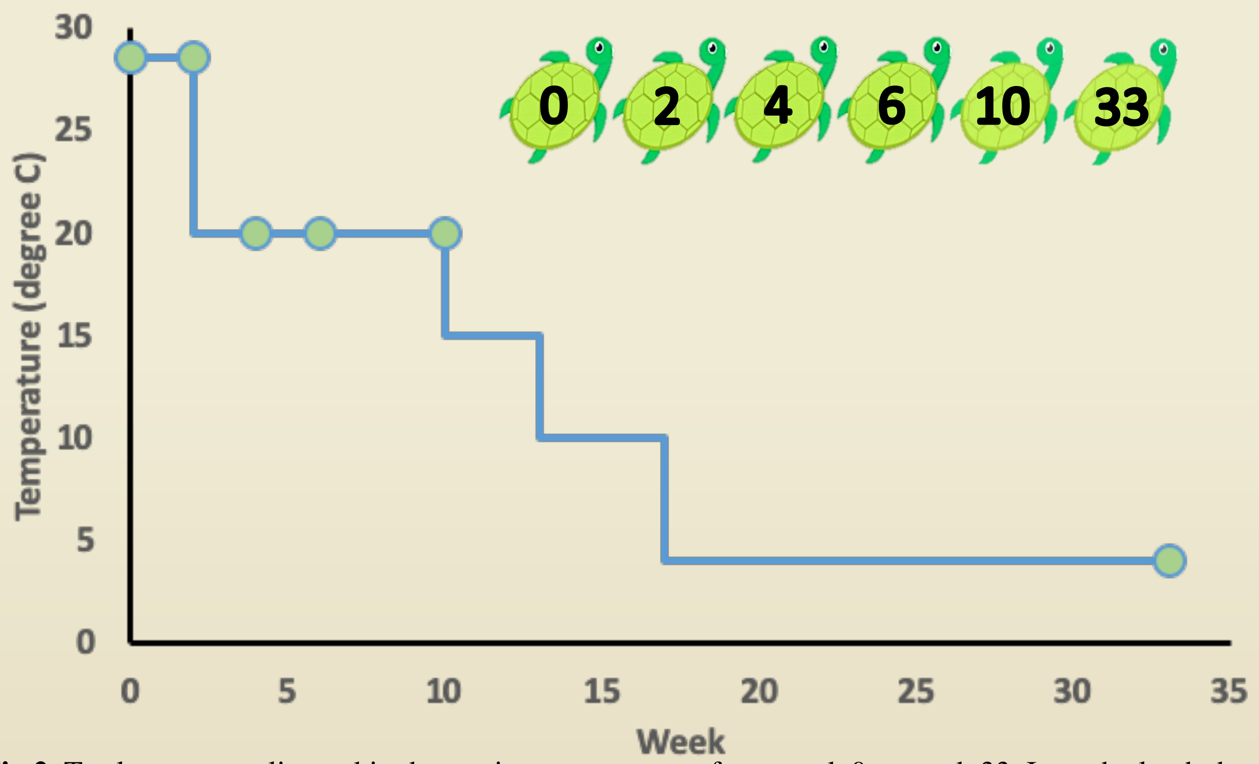
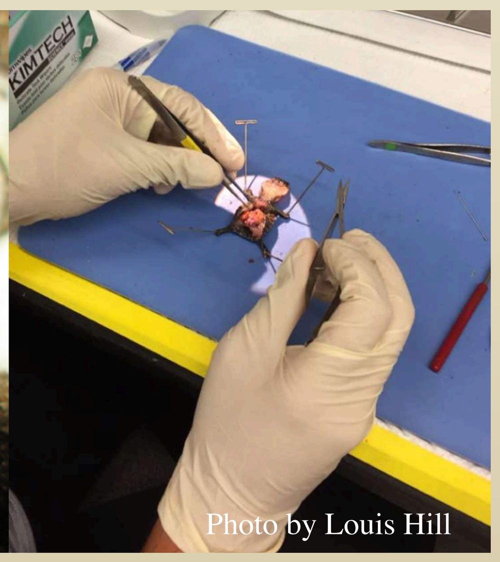


Fig 2. Turtles were acclimated in decreasing temperatures from week 0 to week 33. In each clutch the hatchlings were dissected at week 0, 2, 4, 6, 10, and 33.



1. Effect of incubation condition on mass

There is no significant difference in organ masses among clutches with different incubation conditions.

2. Organ masses over time

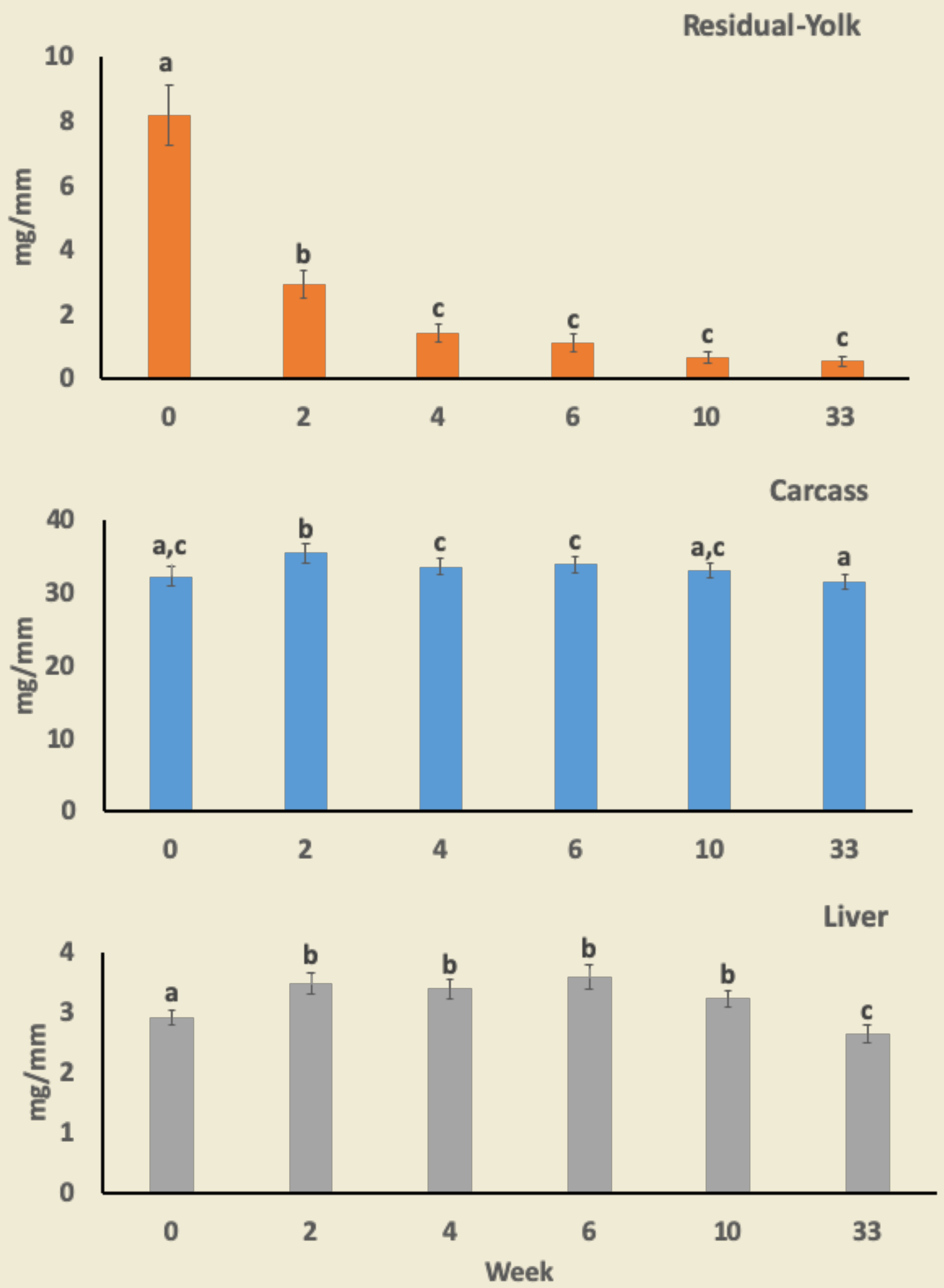


Fig 3. Mean (±SEM, n=14x6) mass per carapace length over time of painted turtles' (*Chrysemys picta*) residual-yolks, carcasses, and livers.

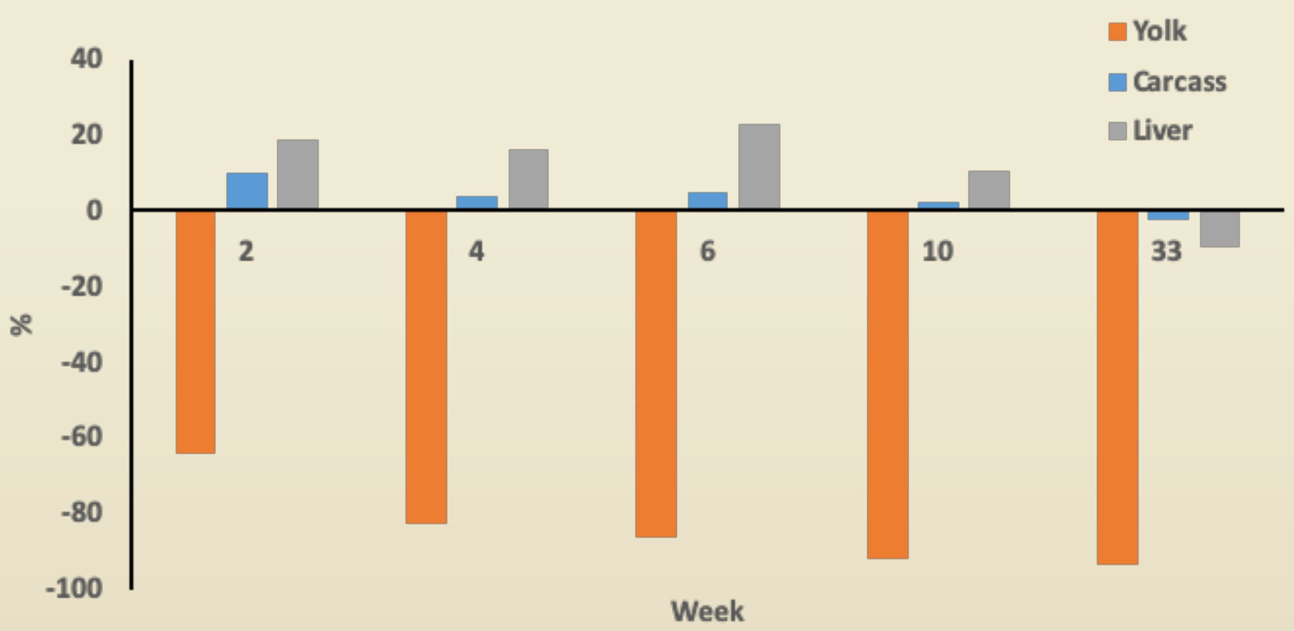


Fig 4. Mean (n=14x6) percentage change compared to week 0 in mass per carapace length of residual-yolks, carcasses, and livers.

Our data showed a significant decrease in yolk mass by 64% and significant increases in carcass & liver masses of 9% & 16%, respectively, during the first 2 weeks after hatching. Yolk mass was further depleted to 17% at week 4 and did not significantly decrease further for the remaining 29 weeks. These results suggest that energy is transferred from residual yolk to somatic storage soon after hatching, and well before hibernation begins.

We theorize that a low-temperature-induced downregulation of gut function that renders residual-yolk energy inaccessible during hibernation necessitates digestion and storage of residual-yolk energy soon after hatching when temperatures inside the nest are still high. That strategy may be used despite the net energy cost of digesting, storing, and later mobilizing that residual-yolk-derived energy.

CONCLUSION

Our results suggest that hydric conditions during incubation had no effect on hatchling organ masses. That residual yolk masses decreased rapidly while liver & carcass masses increased suggests that energy is transferred from residual yolk to somatic storage soon after hatching, and well before hibernation begins.

3. Total triglyceride over time

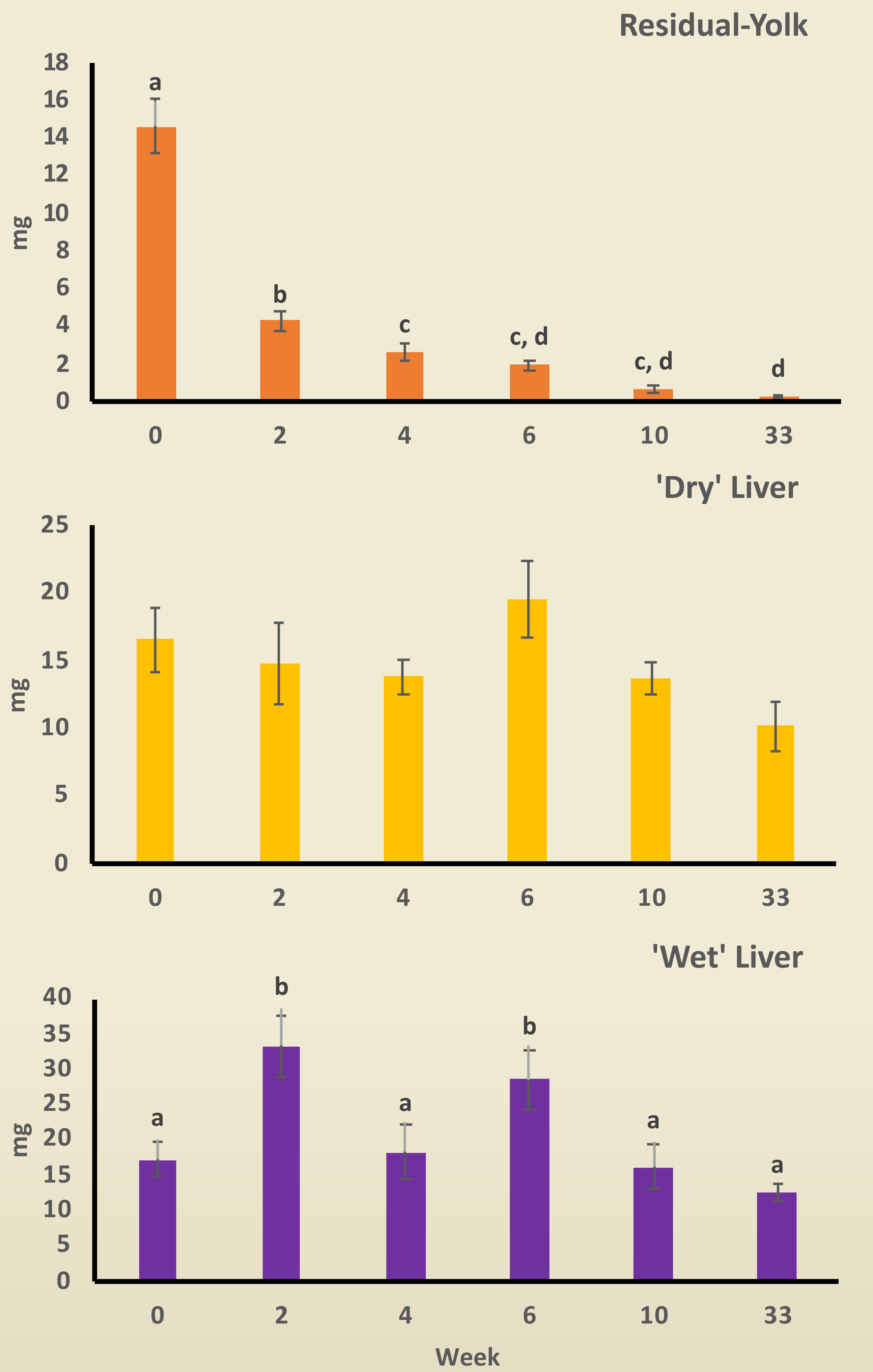


Fig 5. Mean (±SEM, n=14x6 for yolk; 6x6 for 'dry' liver; 8x6 for 'wet' liver) total triglyceride content in residual-yolks and livers of turtles incubated in dry/wet conditions.

Our data showed significant decrease in residual-yolk total triglyceride in the first 4 weeks. Along with a similar trend in Fig 3. (Yolk), we suggest that triglyceride is an important type of energy storage. Our data also shows a significant increase in wet-incubated liver total triglyceride during week 2 & 6, but no significant differences in dry-incubated liver total triglyceride. We are in the process of investigating the underlying cause for this trend.

4. Looking forward

We are currently measuring triglyceride & protein contents of the aforementioned body parts to better track the use and movement of energy in the hatchlings.