The University Of Sheffield.

The Medical School.

The travel grants committee
Society of Reproduction and Fertility

Professor William Holt
Academic Unit of Reproductive and Developmental
Medicine
Department of Human Metabolism
Level 4, The Jessop Wing, Tree Root Walk
Sheffield S10 2SF
United Kingdom

Telephone: +44 114 2268345
Fax: +44 114 2261074
Email: bill.holt@sheffield.ac.uk
fazelilab.group.shef.ac.uk

15th March 2015

Dear Sir/Madam

Report from the International Embryo Transfer Society (IETS) meeting, Paris 2015.

I am most grateful to the SRF committee for supporting my attendance at this year's IETS meeting.

I had two main reasons for attending: the first was to present a poster about research on reproduction in seahorses, in which, together with colleagues from the University of Las Palmas, Gran Canaria, we demonstrated that manipulation of the periconception environment, independently in both males and females, produced major impacts on the growth and survival of embryos and newborns. In essence, because pregnancy occurs in the male, and embryos are supported by a type of placenta known as the male's brood pouch, the seahorse model allows male and female-dependent effects to be appreciated separately. The experimental treatments involved feeding two types of diet to male and female couples prior to mating. Feeding a commercially available aquarium diet was compared with the provision of wild caught diet from around the Canary Islands. The main result was that if males fed with commercial diet were mated with females fed with wild diet, the resultant newborns were unusually large but showed significantly poorer 15 day survival than the control treatment (i.e. both male and female parents fed with wild diet).

The second reason for attending the conference was that I participated in a special session devoted to companion, non-domestic and exotic animals (CANDES). I was invited to present an overview of a recent book that I had co-edited (entitled: Reproductive sciences in Animal Conservation; Springer, 2014). Two of the chapter authors (Dr Nucharin Songsasen and Professor Pasqualino Loi) presented more detailed information about their own review chapters (i.e. reproduction in carnivores and the application of cloning technologies in conservation, respectively). The CANDES session was attended by just over 50 delegates, who generated such a lively discussion that the session overran its allocated time by about 45 minutes. Fortunately this was at the end of the day so did not interfere with the programme.

Yours faithfully

William V. Holt

Sex-specific effects of parental diet during pregnancy on embryo development in the long snout seahorse (*Hippocampus reidi*)

Francisco Otero-Ferrer[1], Marisol Izquierdo[1], Alireza Fazeli[2] & William V. Holt[2]

[1] Universidad de Las Palmas, Gran Canaria, Grupo de Investigación en Acuicultura, Spain

[2] University of Sheffield, Academic Unit of Reproductive and Developmental Medicine, Jessop Wing, Sheffield, UK (bill.holt@sheffield.ac.uk)

Environmental influences (including diet and feeding conditions) experienced during early development are increasingly thought to modify mammalian phenotype, possibly in ways that are predictive of future conditions during adulthood. Research in humans and experimental mammalian species has linked the prenatal and postnatal effects within a theoretical framework known as the "Developmental Origins of Human Adult Disease" (DoHAD) or Barker's hypothesis. Here we have investigated the radically different, but analogous, reproductive system of the seahorse to see whether any parallels are discernible.

The aims of this work were;

1. To investigate the hypothesis that parental nutrition in adult seahorses (*Hippocampus reidi*) affects growth and development of offspring, much as in the mammalian system.
2. To validate the proposal that seahorses may be a valuable and effective model species for studying the periconception environment.

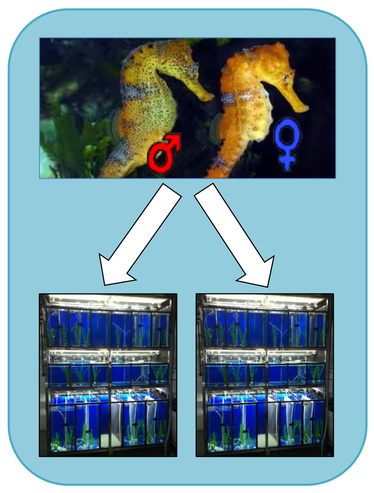
Experimental design

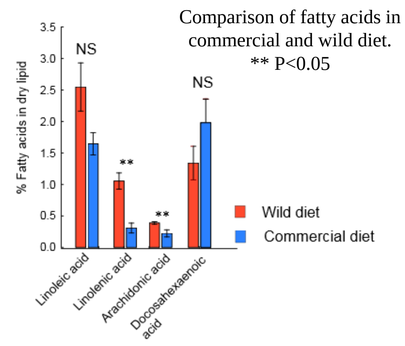
Two types of diets: Wild caught (W) and Commercial (C); 4 treatments x 4 replicate couples each.

Males and females received separate diets (Wild caught mysids (shrimp) or Commercial feed) for 1 month before conception and during pregnancy (15 days)

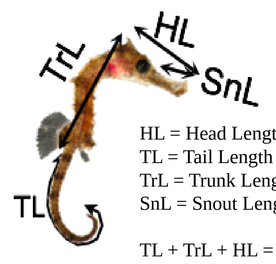
- (Treatment 1) Male $_{(Wild)}$ x Female $_{(Wild)}$
- (Treatment 2) Male $_{(Commercial)}$ x Female $_{(Wild)}$
- (Treatment 3) Male $_{(Wild)}$ x Female) $_{(Commercial}$
- (Treatment 4) Male $_{(Commercial)}$ x Female $_{(Commercial)}$

Couples were allowed to breed freely for 5 months. Newborns were collected for physical and biochemical measurements. 15 day survival was estimated from groups of >200 newborns/treatment.





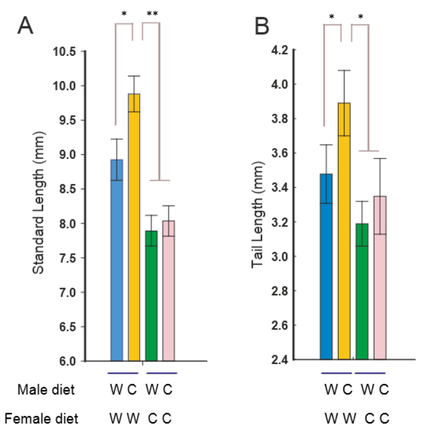
No difference in protein or carbohydrate content between diets



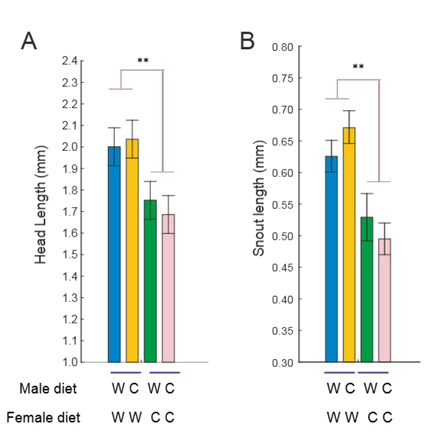
HL = Head Length
TL = Tail Length
TrL = Trunk Length
SnL = Snout Length

TL + TrL + HL = Standard Length

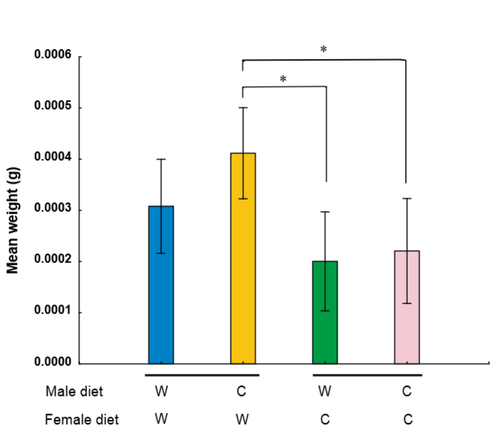
Results



Standard Length (SL) and tail length (TL) of newborn seahorses from the first brood. Values are mean ± s.e.m: * and ** denote $P<0.05$ and $P<0.01$. In the key, W and C represent "wild" and "commercial" diet respectively.



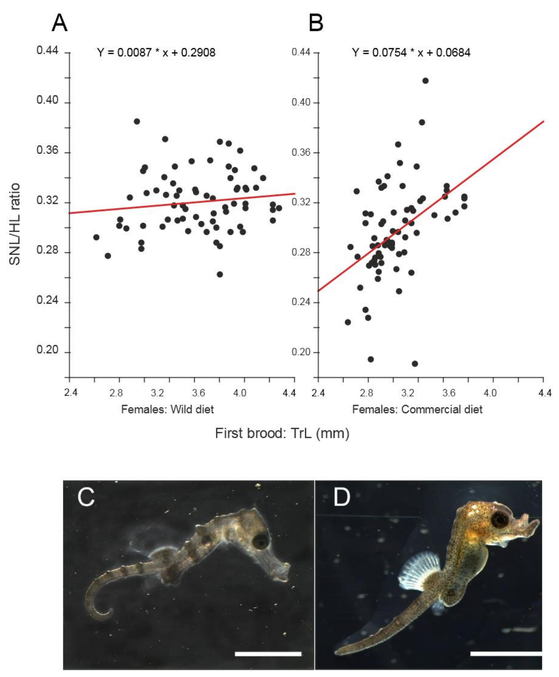
Treatment effects on Head length (HL) and Snout length (SnL) in the first brood. Values are mean ± s.e.m: ** denotes $P<0.01$. In the key, W and C represent "wild" and "commercial" diet respectively.



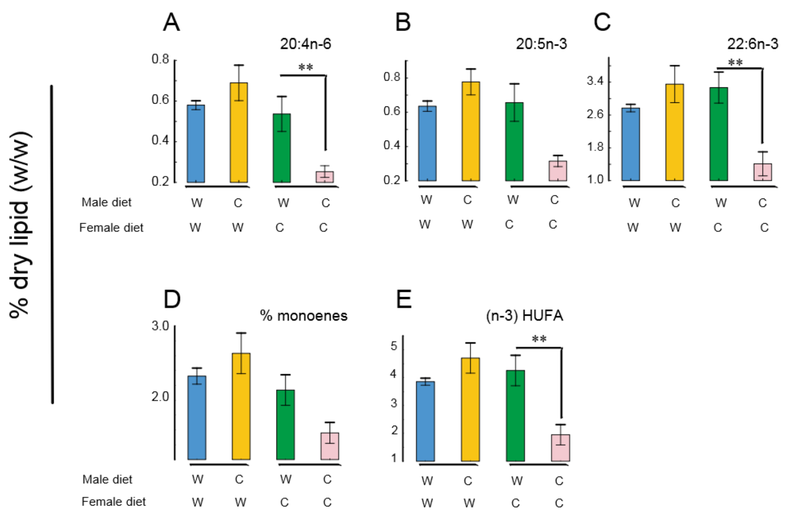
Treatment effects on newborn seahorse weights in the first brood. Values are mean ± s.e.m: *denotes $P<0.05$. In the key, W and C represent "wild" and "commercial" diet respectively.

15 day offspring survival

- Survival of offspring produced by Wild-fed males x Wild-fed females was 181/465 = 39%
- Survival of offspring from Commercial-fed males x Wild-fed females was 43/290 = 12.9%
- These proportions were significantly different ($\chi 2 = 39.19$: 1 DF: $P< 0.001$).
- 15 day survival of offspring from commercial-fed females was 0% in both treatments.



Scatter plots of SnL/HL ratios v Trunk Length in the first brood, comparing the offspring from all experimental females fed with wild (Panel A: FW) or commercial (Panel B: FC) diet. A positive linear regression is observed for the commercial diet (B), but not for the wild-caught diet (A). Figures C and D are examples of newborn seahorses derived from a (C) wild-fed and (D) commercially-fed female respectively. The newborn shown in D has an abnormally short snout and therefore low "Snout length/Head Length ratio" in comparison to the newborn shown in C. Bar = 2 mm.



Effects of dietary treatment on fatty acid concentrations (% dry lipid w/w) in the newborn seahorses. Figure 5A-C: data for individual fatty acids, D and E indicate data for % monoenes and % (n-3) HUFA. Significant differences are as indicated. * denotes $P<0.05$ and **denotes $P<0.01$. In the key, W and C represent "wild" and "commercial" diet respectively.

Discussion

- Offspring produced when the males receiving commercial diet were mated with wild-fed females were larger ($P<0.05$) than those produced by wild-fed males.
- But, these large offspring showed poor survival
- When both males and females were fed with commercial diet their offspring were significantly smaller than those from the other treatments.
- When commercially-fed females were mated with wild-fed males, the offspring showed distortion of the snout: head length ratio.
- However, the reduced unsaturated fatty acid content of newborns derived from commercially-fed females is "rescued" by breeding with wild-fed males.

These results support the view that pre-conception diet received by the male and female seahorses differentially affected embryonic development within the pouch and their subsequent survival.

We suggest that the seahorse may be a good model for studying the effects of peri-conception environment on embryonic development and phenotype.

Acknowledgements

We acknowledge funding from the European Union's Seventh Framework Programme FP7 /2007-2013 under AquaExcel network [grant agreement No. 262336]
And the management Committee of the COST Action [FA1201] (Epigenetics and Periconception Environment - Periconception environment as an epigenomic lever for optimising food production and health in livestock), who awarded Dr Otero-Ferrer a Short Term Scientific Mission (STMS).