Aquatic Food Dispenser:
Standardising Laboratory Zebrafish Diet

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Aim: To compare a standardised method of feeding adult zebrafish using an Aquatic food dispenser versus the current, less precise method.

Introduction

The Zebrafish is a small tropical fish native to Southern Asian countries such as India, Bangladesh, Nepal and Pakistan. They can be found within a variety of water bodies such as lakes, rivers, ponds, streams and floodplains. Their natural diet consists of small insect larvae and vegetation.

Zebrafish are becoming increasingly popular within the field of research due to a number of benefiting attributes. These include transparent embryos for embryonic studies, small and easy to maintain, rapid development and short generation time. They have a high tolerance to stress and environmental change, due to its harsh geological background and this has contributed to a wide variety of husbandry methods being employed to keep zebrafish in scientific research. To that end this trial was designed to see if a standard method could be found to provide the fish with a sufficient amount of food for health and growth.

Methods

Three different wildtype strains were used (AB x TL,TL and TU) and three different food regimes: our usual diet, as a control; two commercial diets. Each combination was housed in triplicate tanks of 15 fish each. Prior to the commencement of the trial, all fish were weighed and measured in order to obtain a baseline for the purpose of post-trial comparison.

Two types of feeding dispensers were used in this trial: the current method of a 500 ml squeeze bottle (fig 1) and a specialised 'food dispensing gun' (fig. 2), specifically designed to provide dry food that is the equivalent of 5% body weight to 15 fish.

Fig 1: The typical tool used in the current feeding method; a squeeze bottle which is filled with artemia and dry food

Fig 2: The newly designed 'food gun', or aquatic food dispenser. The falcon tube on top can be removed and refilled with dry food as needed. The trigger will release food that is equal to 5% body of 15 fish

All of the fish were fed for 5 weeks. Each tank was fitted with a 100 µm cell strainer to measure the amount of food lost per feed. At the end of the proscribed period, each fish was weighed and measured again.

Results

At the end of 5 weeks, all the fish were remeasured to identify changes from the trial, and recorded (see Table 1).

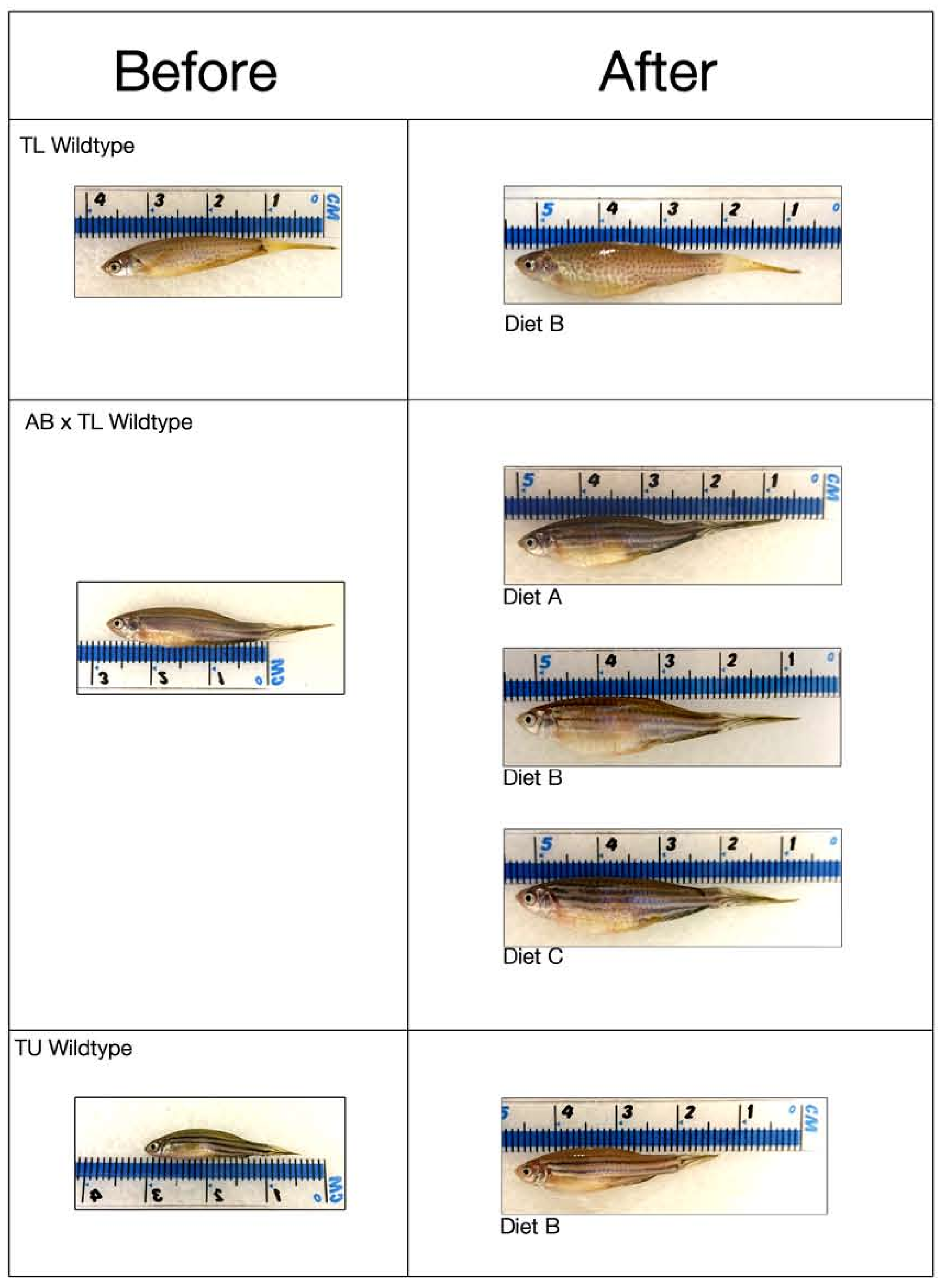


Table 1: The measuring and weighing of the fish pre- and post-trial. The TL and TU wildtypes were fed Diet B only; the AB x TL wildtypes were fed 3 diets (A, B, and C).

From the data, we calculated the averages of body mass, length and width. Both data sets from body length and body width did not indicate a significant difference to warrant further analysis, albeit a change was noted (fig. 4). However, body mass showed to have a higher variation from the beginning to the end of the experiment (fig 3), and consequently investigated further.

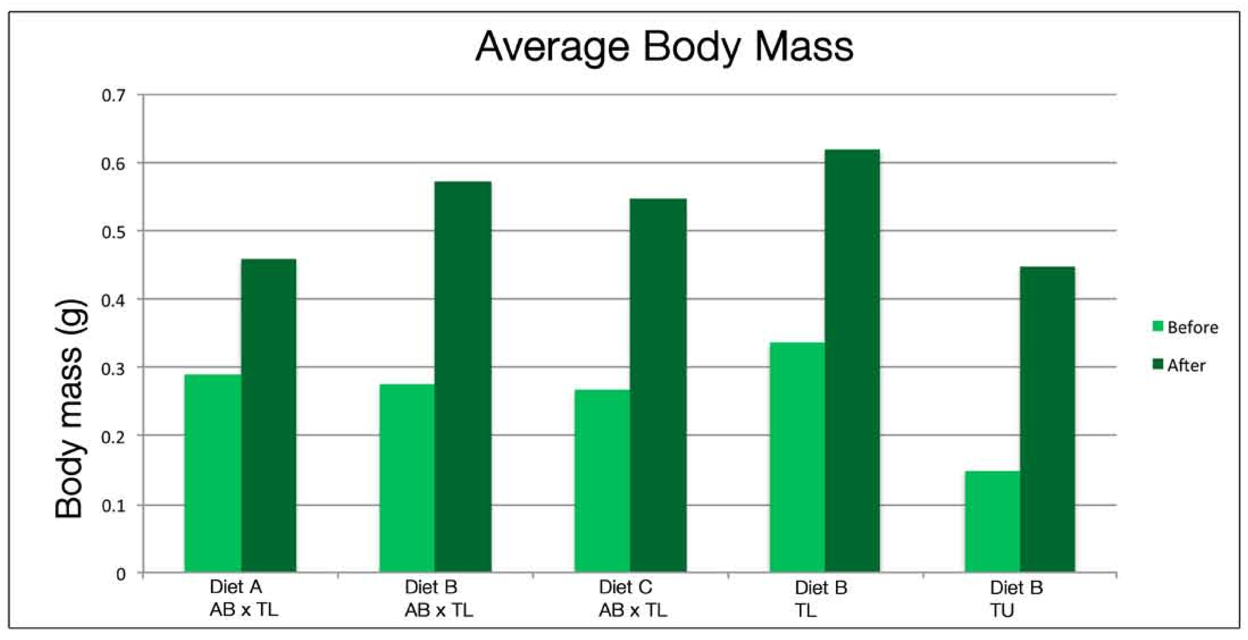


Fig. 3: The average body mass difference between the diets and strains, indicating a large enough differene between the two to warrant further analysis

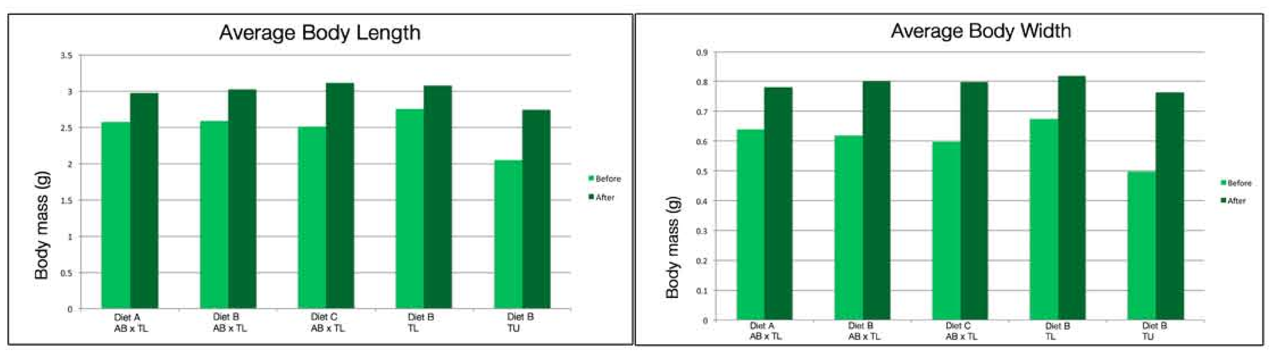


Fig. 4: The average body length (left) and the average body width (right) diference between the two diets and strains. Whilst a difference is evident, it was deemed minimal.

Using the body mass data from before and after the trial we performed an ANOVA test comparing Diet A with the Diets B and C, the latter being dispensed through the 'food gun'. The analysis showed that the current method and that of the dispenser are significantly different. Previous to the trial, the data showed that there is a significant difference in the different wildtype lines (fig. 5). After the trial, Diet B, with the AB x TL wildtype strain, has a $p<0.001$ whereas Diet C of the same strain has a $p<0.01$; however, the Diet B with the TL wildtype strain, has a $p<0.0001$ (fig. 6).

Fig 5. Comparisons of the initial body weight of AB/TL,TL and TU strains at the beginning of the feeding trial. One way-ANOVA *p<0.01, **p<0.001, ***p<0.0001

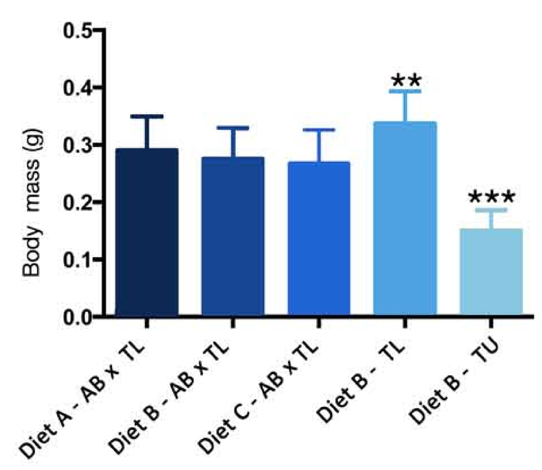
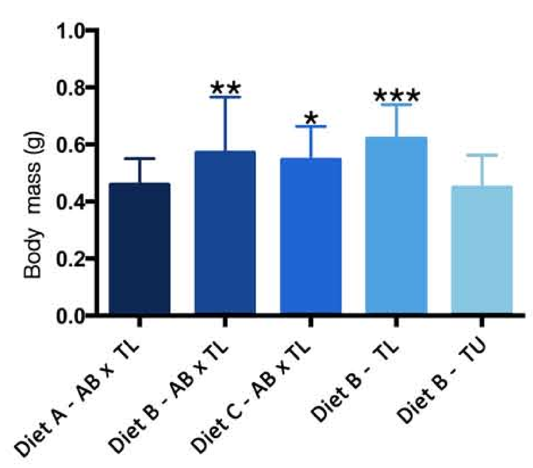


Fig. 6: Comparisons of the final body weight of AB/TL,TL and TU strains at the end of the feeding trial. One way-ANOVA * p<0.05, **p<0.01, ***p<0.001, ****p<0.0001



Discussion

It is clear that using the food gun across the different diets produced different and significant results. Using the food gun to feed 5% of body weight of Diet B and C resulted in fish gaining significantly more body mass compared to fish fed on Diet A (the squeeze bottle). Since significant differences were only detected in body mass, not in either length or width, this may suggest that the percentage of body weight being fed using the squeeze bottle is less than 5%. In the case of the TL strain, the body mass increase is also significant, but further investigation is needed to determine if this is also a strain difference. The results obtained in the TU line may also require further investigation, as these were younger at the time of trial, which may reflect a faster growth and food conversion rate in this period of development. Investigation of excess and uneaten food trapped by fine filters at the back of the tanks also revealed that more excess food left from the food guns than from the squeeze bottles (data not shown), suggesting that the food being fed from the squeeze bottle is less than 5% body weight.

Further Work

It would be interesting to determine how the additional mass is being distributed and whether that is advantageous to the fish, in terms of long term health, fertility and fecundity, and whether faster maturation time is a desirable trait. If it is not,and as we know the food guns can reliably lower body percentage rates of food, can we use the guns to drop the body percentage being fed and what would the effect of that be? Furthermore, would these fish be more standardised because the diet is more standardised? This maybe a very useful attribute for their continued use as a scientific model.

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