SUPPLEMENTARY FILE 1

Effects of starvation on the growth and fecundity of the snail *Succinea daucina:* interpretation using growth models

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Elaboration of a linear dynamic model of growth reduction due to starvation gap:

The change in body mass in the snail *S. daucina* with different intervals of starvation (from 1 to 6 days) can be analyzed using a simple linear dynamic equation, as an alternative to the growth patterns with different magnitudes of classical von Bertalanffy parameters assessing variation in the growth pattern:

$$\frac{dm}{dt} = E - Km - bg, \ldots\ldots\ldots\ldots\ldots(1)$$

where $\frac{dm}{dt}$ is the rate of change in body mass (m), E and K are anabolic and catabolic constants, g is the feeding gap in days, and b is the growth reduction caused by this starvation gap. Upon integratation of Equation 1, we arrive at:

$$\int_0^m \frac{dm}{E - Km - bg} = \int_{t_0}^t dt$$

$$\int_0^m \frac{dm}{(E - bg) - Km} = \int_{t_0}^t dt$$

$$\left[-\frac{1}{K}\ln(E - bg - Km)\right]_0^m = [t]_{t_0}^t$$

$$-\frac{1}{K}\ln\frac{E - bg - Km}{E - bg} = t - t_0$$

$$\ln\frac{E - bg - Km}{E - bg} = -K(t - t_0)$$

$$\frac{E - bg - Km}{E - bg} = e^{-K(t-t_0)}$$

$$E - bg - Km = (E - bg)(e^{-K(t-t_0)})$$

$$Km = (E - bg) - (E - bg)(e^{-K(t-t_0)})$$

$$m = \frac{(E - bg)}{K} - \frac{(E - bg)(e^{-K(t-t_0)})}{K}$$

$$m = \frac{(E-bg)}{K}(1 - e^{-K(t-t_0)})\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

$$m = (\frac{E}{K} - \frac{bg}{K})(1 - e^{-K(t-t_0)})$$

$$m = (m_\infty - \tfrac{bg}{K})(1 - e^{-K(t-t_0)})\ldots\ldots.(3)$$

m_∞ is the asymptotic body mass.

If we want to apply the same concept of 'b' and 'g' in the von Bertalanffy equation for shell length, we get

$$\frac{dl}{dt} = K(L_\infty - l) - bg$$

$$\int_0^l \frac{dl}{K(L_\infty - l) - bg} = \int_{t_0}^t dt$$

$$\int_0^l \frac{dm}{(KL_\infty - bg) - Kl} = \int_{t_0}^t dt$$

$$\left[-\frac{1}{K}\ln(KL_\infty - bg - Kl)\right]_0^l = [t]_{t_0}^t$$

$$-\frac{1}{K}\ln\frac{KL_\infty - bg - Kl}{KL_\infty - bg} = t - t_0$$

$$\ln\frac{KL_\infty - bg - Kl}{KL_\infty - bg} = -K(t - t_0)$$

$$\frac{KL_\infty - bg - Kl}{KL_\infty - bg} = e^{-K(t-t_0)}$$

$$KL_\infty - bg - Kl = (KL_\infty - bg)(e^{-K(t-t_0)})$$

$$Kl = (KL_\infty - bg) - (KL_\infty - bg)(e^{-K(t-t_0)})$$

$$l = \frac{(KL_\infty - bg)}{K} - \frac{(E - bg)(e^{-K(t-t_0)})}{K}$$

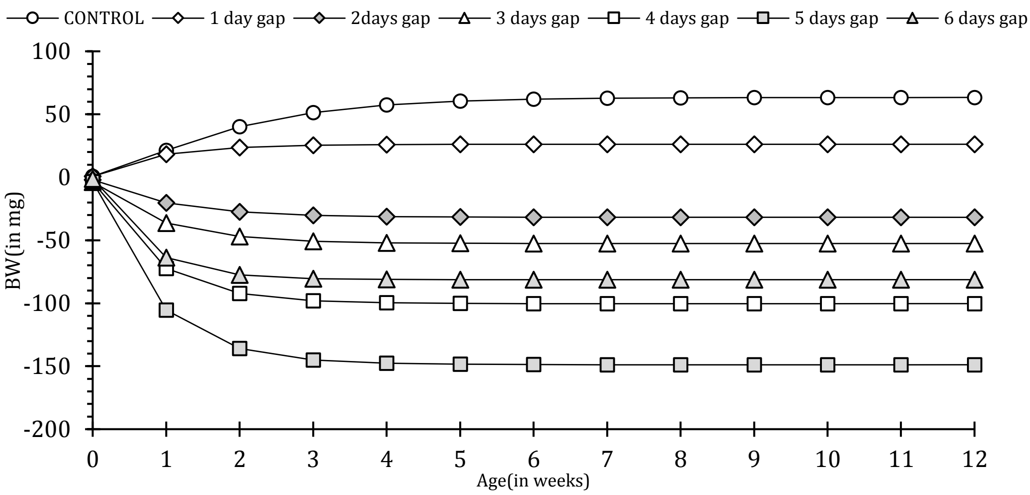
$$l = \frac{(KL_\infty - bg)}{K}(1 - e^{-K(t-t_0)})$$

$$l = \left(L_\infty - \tfrac{bg}{K}\right)\left(1 - e^{-K(t-t_0)}\right), \ldots\ldots\ldots\ldots..(4)$$

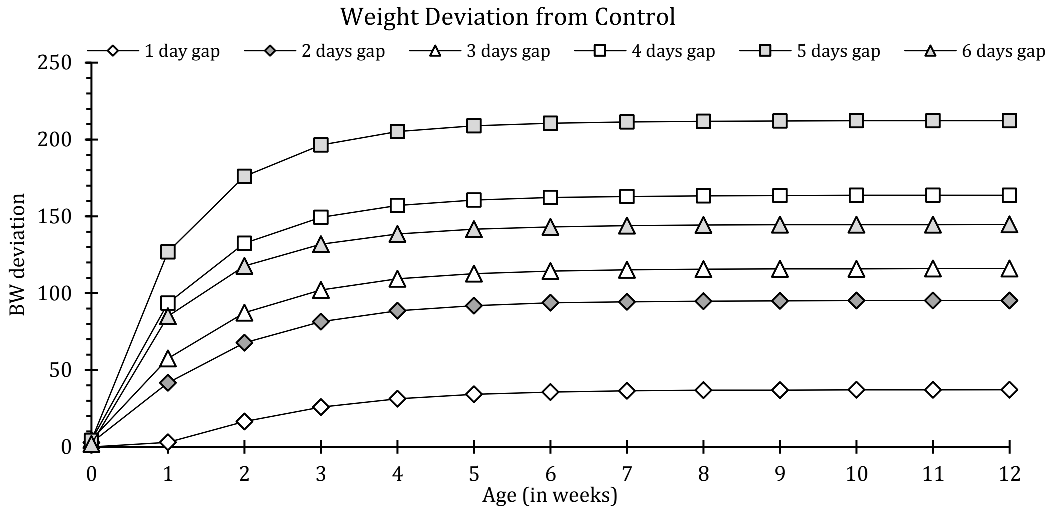
where L_t is shell length in mm at a specific time *t*. L_∞ is asymptotic length, *E* and *K* are anabolic and catabolic constants, t_0 is hypothetical time when size is zero.

Though the dynamic equation is linear, the integrated form becomes exponential due to the presence of $e^{-K(t-t_0)}$, which again in turn bends the growth curve to a plateau, making us unable to find the growth loss with the feeding gap, linearly.

Equation 2 may represent the change in body mass more accurately if we could be able to analyze the energy of metabolism and deduce the numerical value of *K* and *E*, the change in biomass could be assessed using Equation 2, other than traditional von Bertalanffy growth equation. In this mode, however, we are considering relative weight, i.e. weight loss in different levels of the treatment (starvation gap of 1 to 6 days) compared to the control (fed regularly).

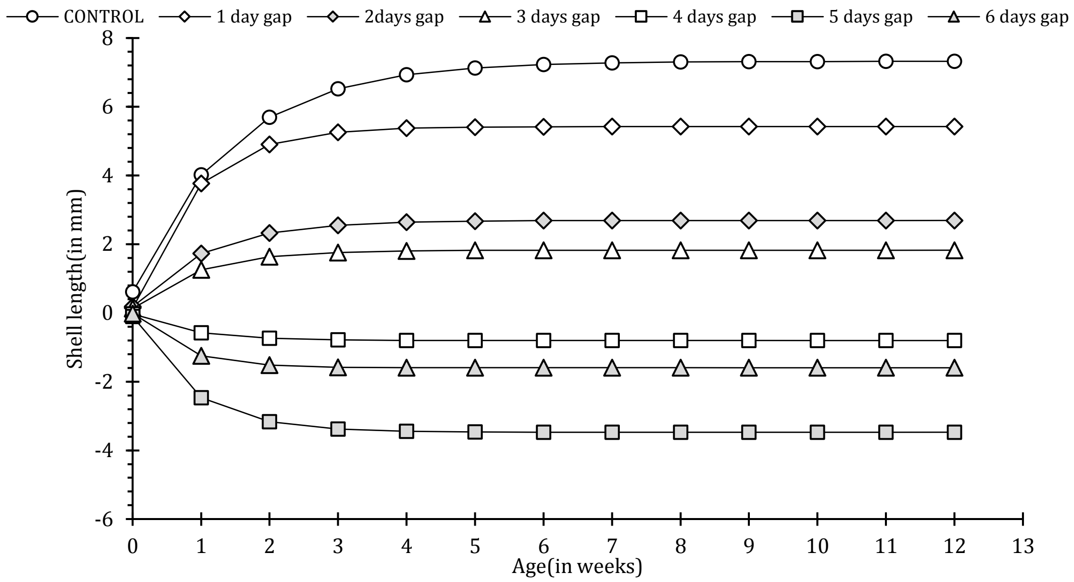


(a)

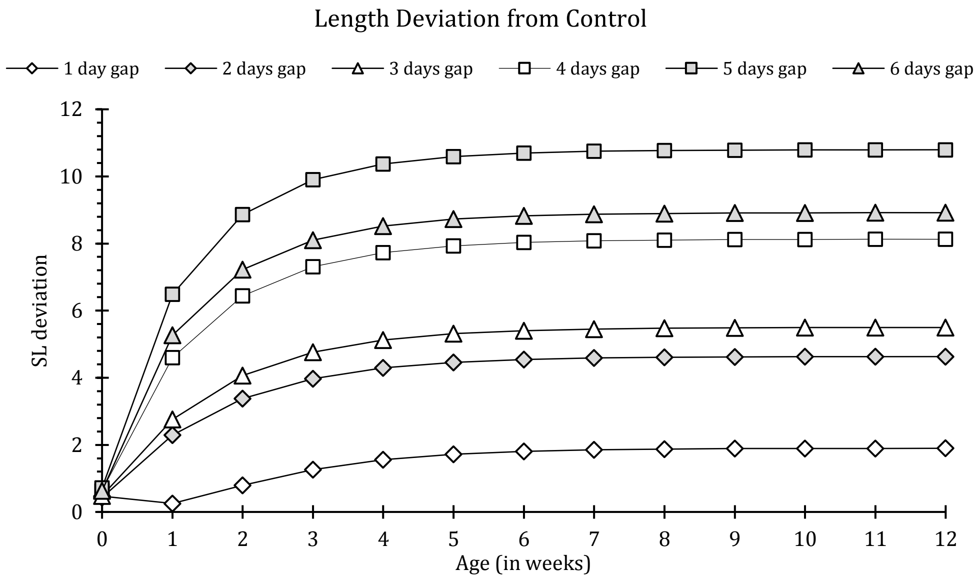


(b)

Figure1. The growth of *S. daucina* starved and the control shown in (a) based on the change in body weight with age following the derived Equation (Equation 3) above. For each treatment (extent of starvation), deviation from the control is presented in (b) for each week based on body weight.



(a)



(b)

Figure 2. The growth of *S. daucina* starved and the control shown in (a) based on the change in length with age following the derived Equation (Equation 4) above. For each treatment (extent of starvation), deviation from the control is presented in (b) for each week based on shell length.