

### **Module 3C Questions:**

1. Researchers want to know whether glucose response differs across three diets:

- **Chow**
- **Low-fat**
- **High fat (HFD)**

Each mouse receives a behavioral activity score from 1–10. The distributions are skewed and not normally distributed. The RANKED scores have been provided next to the numbers in the table.

<b>Chow</b>	<b>Low-Fat</b>	<b>High-Fat</b>
118 (9)	120 (10)	162 (15)
116 (8)	115 (7)	160 (14)
114 (6)	113 (5)	158 (13)
110 (2)	112 (4)	154 (12)
108 (1)	111 (3)	152 (11)

Note: you can use either of the following two equations to calculate H (they are equivalent algebraically). The one that we covered during lecture is:

$$H = \frac{N - 1}{N} \sum_{i=1}^k \frac{n_i(\bar{R} - E_R)^2}{\sigma^2}$$

The advantage of using the above equation is that, if you get stuck on the mechanics of calculating H, you can refer to the following worked example on this website (which is clear): [https://numigo.com/tutorial/kruskal-wallis-test#hypothesis\\_and\\_question](https://numigo.com/tutorial/kruskal-wallis-test#hypothesis_and_question)

The second equation (slightly fewer calculations) is:

$$H = \frac{12}{N(N + 1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N + 1)$$

A. State whether there is evidence that median glucose differs across diets.

- B. The non-parametric unplanned comparison that corresponds to TukeyHSD for Kruskal-Wallis is called Dunn-Bonferroni. You don't need to do that but give an interpretation of which diet(s) differ and a justification of your reasoning.
2. Choose fixed or random effects for the following scenarios and explain **why** (in one sentence).
- Mice are randomly assigned to one of three diets: **Chow**, **Low-Fat**, or **High-Fat (HFD)**. Your scientific question is whether weight gain differs between *these three specific diets*. Should **diet** be modeled as a fixed effect or a random effect?
  - Mice are housed in **12 cages**, with 2–3 mice per cage. You do **not** care about differences between specific cages; you simply want to control for variation due to housing conditions. Should **cage** be modeled as a fixed effect or a random effect?
  - You measure activity across **six inbred strains** (B6, BALB/c, CAST, 129S1, NOD, DBA/2). Your scientific question is: “Do these strains differ in activity?” You care about *these specific strains* as named biological entities. Should **strain** be modeled as a fixed effect or a random effect?
  - You obtain mice from **eight litters**, but litters are not biologically meaningful for your research question. They simply generate random developmental variation. You do **not** want to compare litter A vs litter B; you only want to account for their variance. Should **litter** be modeled as a fixed effect or a random effect?