Selenium, Stress and the Gut

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Selenium (Se) is an essential dietary nutrient, shown to reduce inflammation and support a healthy immune system(1). The aim of this research was to investigate whether Selenium supplementation can reduce gut inflammation caused by stresses encountered during everyday life including (i) low oxygen supply (hypoxia) which occurs naturally during aging and results in gut inflammation and damage, and (ii) bacterial infections.

Can optimising our intake of Selenium reduce such risks?

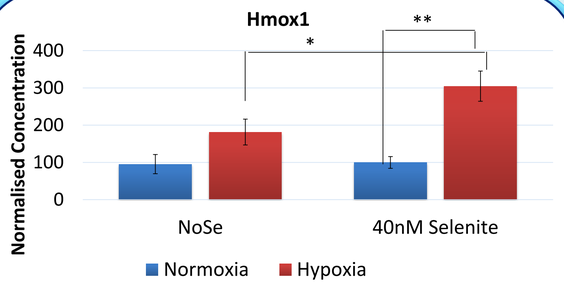


Figure 1: Cells challenged with low oxygen (hypoxia) show increased expression of Hmox1; **cells supplemented with selenium show further significant (**p<0.05) increase.**

Hmox 1 protects the gut against against oxidative stress and cell damage (2).
Selenium increased protection in low oxygen levels. Se helps protect against stress damage

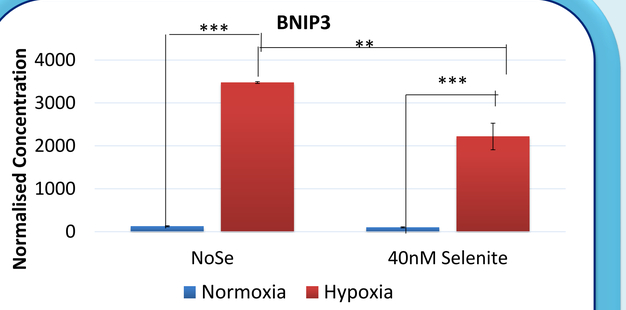
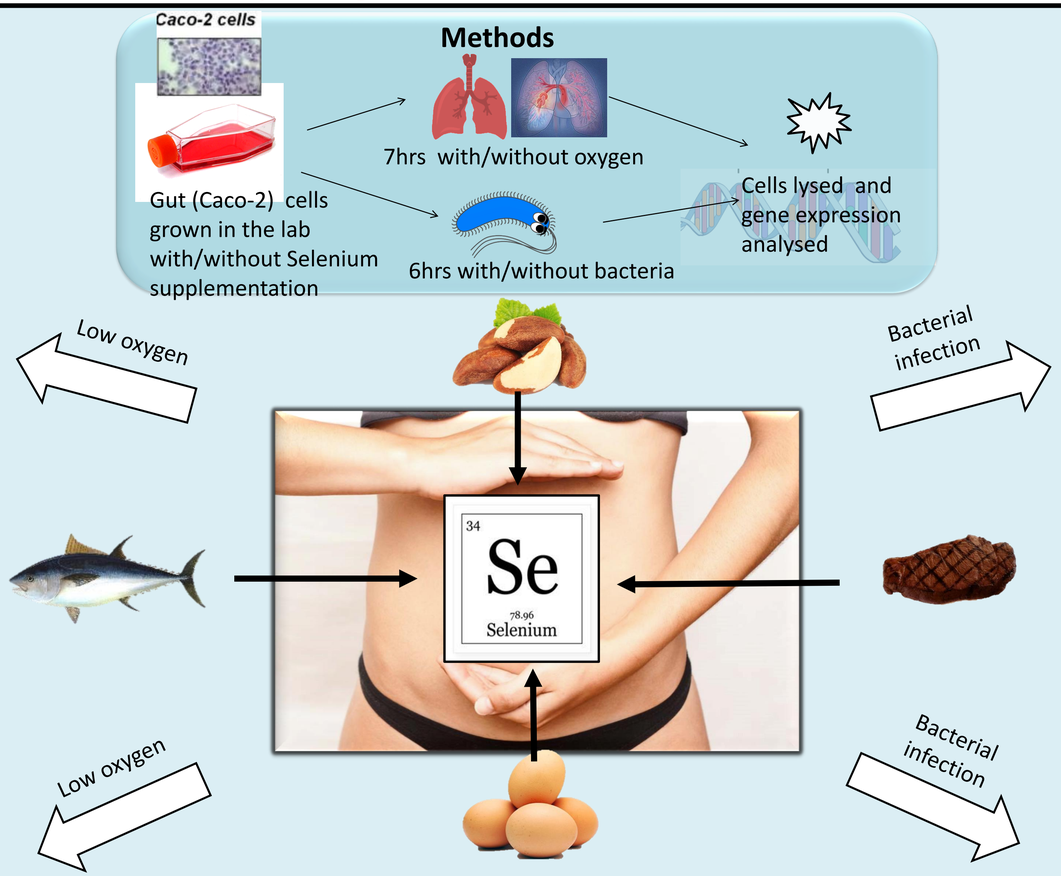


Figure 2: Cells challenged with low oxygen (hypoxia) show significantly increased expression of BNIP3. **This increase is significantly lower (***p<0.05) in gut cells supplemented with selenium.**

BNIP3 initiates cell death during inflammation(3). Selenium reduced cell death, maintaining the cellular barrier of the gut. Se helps protect against stress damage



Conclusions

- Selenium supplementation protects the gut cells from damage when oxygen levels are low, by stimulating expression of protective mediators such as Hmox1 and BNIP3.
- In response to bacterial infection, gut cells produce antimicrobial and protective mediators such as Tr1 and hBD2. However, Selenium supplementation had little effect on the synthesis of these factors.
- Message: Encourage dietary Se intake (nuts, meat, fish, eggs) in aging populations to help protect against gut inflammation and damage due to low oxygen levels caused by reduced blood flow.

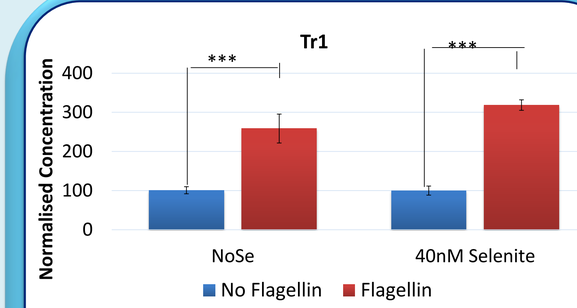


Figure 3: Cells challenged with bacteria (flagellin) show significant (***p<0.05) increase in expression of Tr1.

Tr1 is another molecule that prevents cell damage and protects against oxidative stress(4). This was increased during bacterial infection but Selenium had no significant effect.

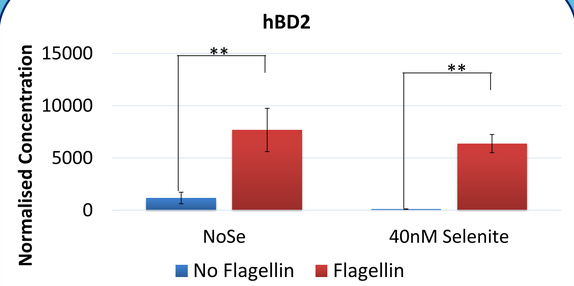


Figure 4: Cells challenged with bacteria (flagellin) show significant increase (**p<0.05) in hBD2 expression.

HBD2 is a natural antimicrobial produced by gut cells that kill invading bacteria(5). HBD2 was increased during infection but Selenium had no significant effect.

1. Kudva AK,et al (2015). 'Selenium and inflammatory bowel disease', *Am J Physiol Gastrointest Liver Physiol*, 309:G71-7.; **2.** Cheng H-T et al (2015). 'Ferritin heavy chain mediates the protective effect of heme oxygenase-1 against oxidative stress', *BBA*, 1850:2506-17.; **3.** Graham RM et al (2015). 'BNIP3 promotes calcium and calpain-dependent cell death', *Life Sciences,* 142:26-35.; **4.** Cunniff B et al (2014). 'Resolution of oxidative stress by thioredoxin reductase: Cysteine versus selenocysteine' *Redox biol*, 2:475-84.; **5.** Wang S et al (2015). 'Functions of Antimicrobial Peptides in Gut Homeostasis', *Curr Protein Pept Sci*, 16:582-91.

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