Histopathological changes in fish intestine and application of mucosal cells as novel histopathological markers

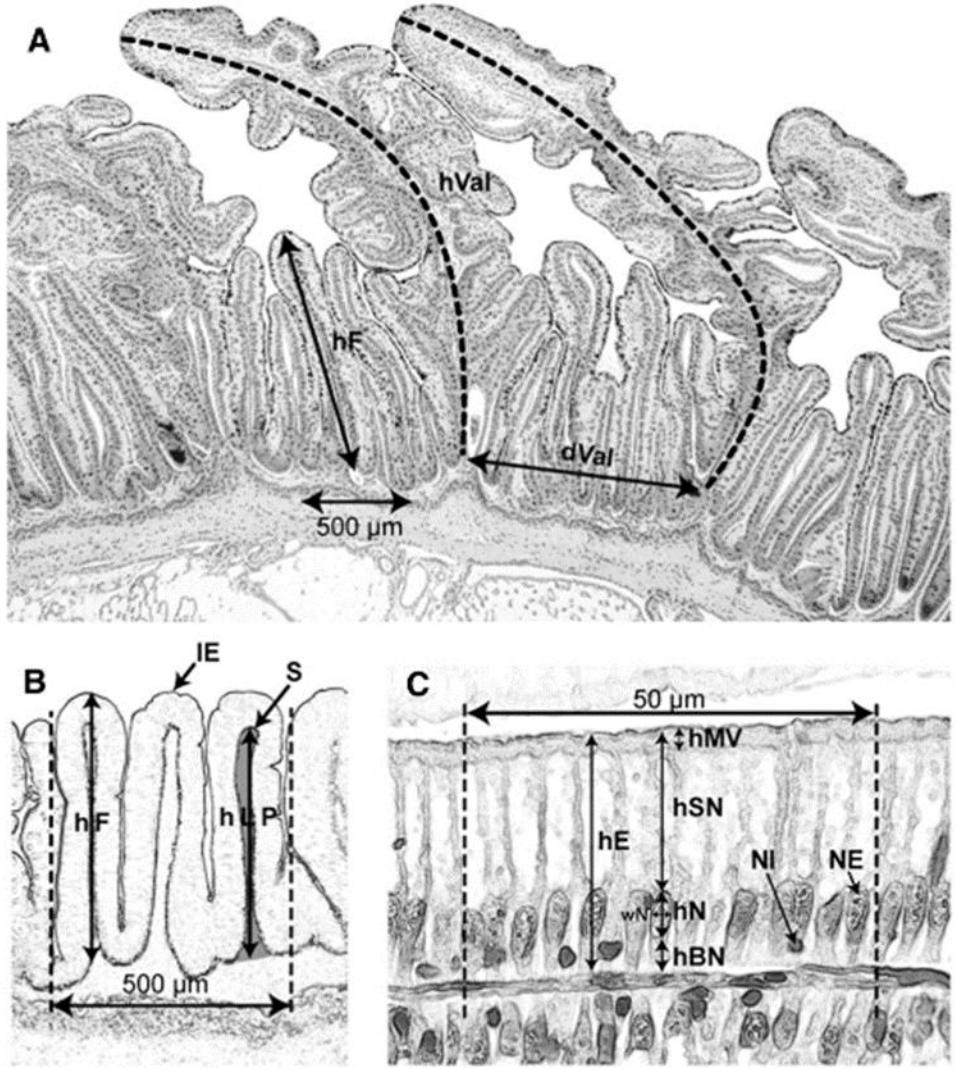
FINAL PROJECT MEETING

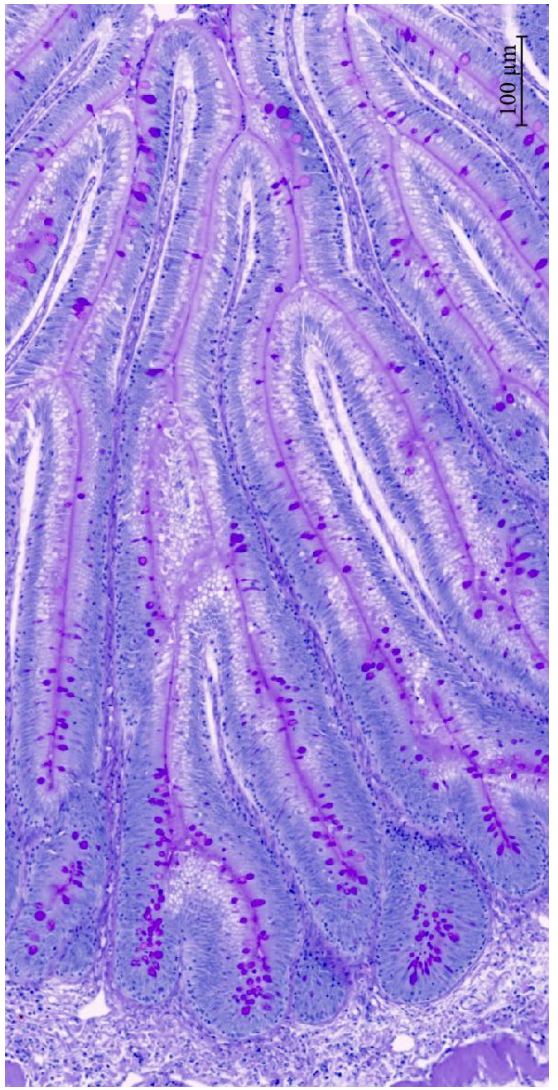
Integrated evaluation of aquatic organism responses to metal exposure: gene expression, bioavailability, toxicity and biomarker responses (BIOTOXMET)

Zagreb, 17th February 2025

Josip Barisic, WELLFISH TECH

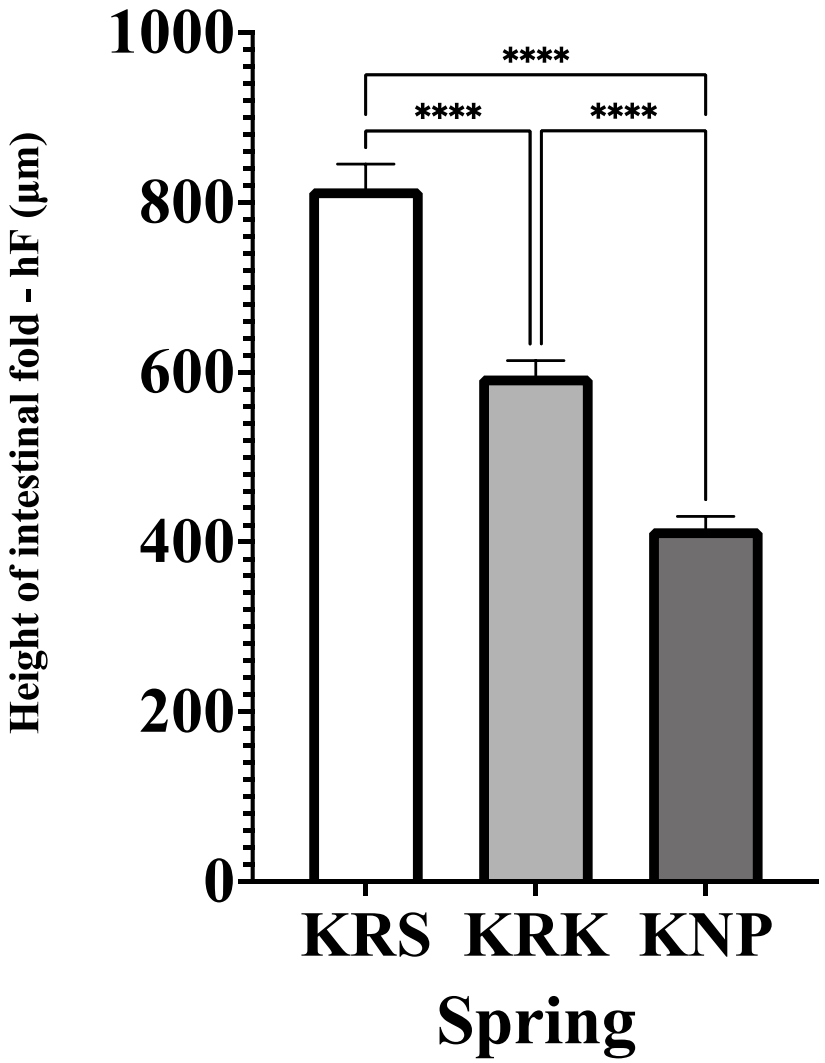
Quantitative histopathology

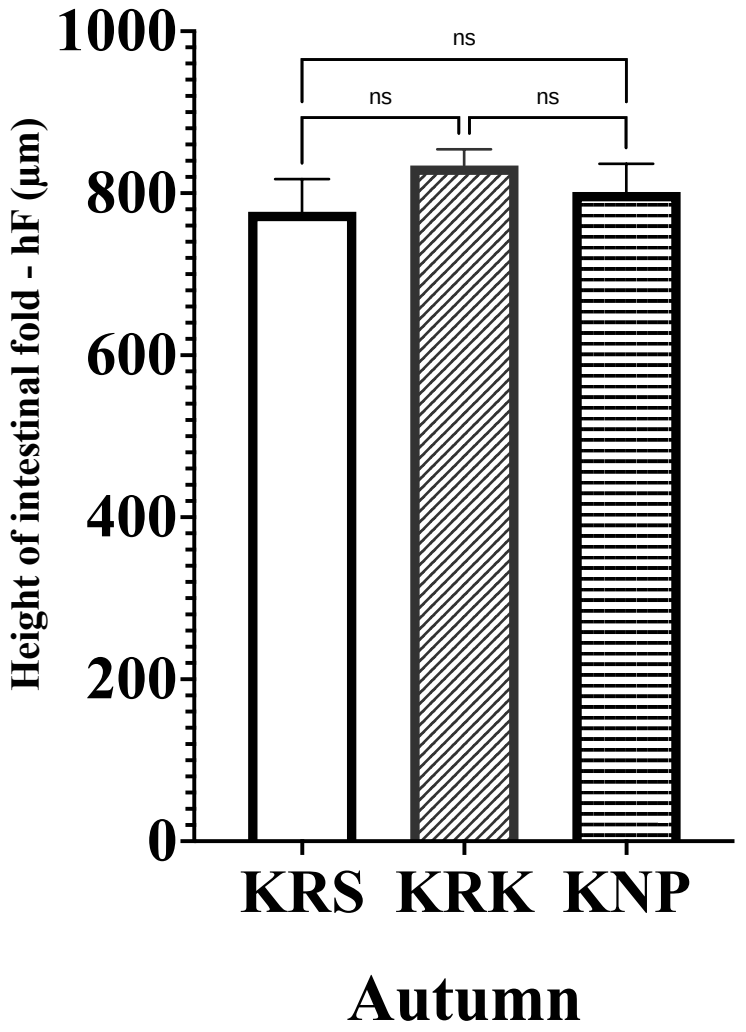


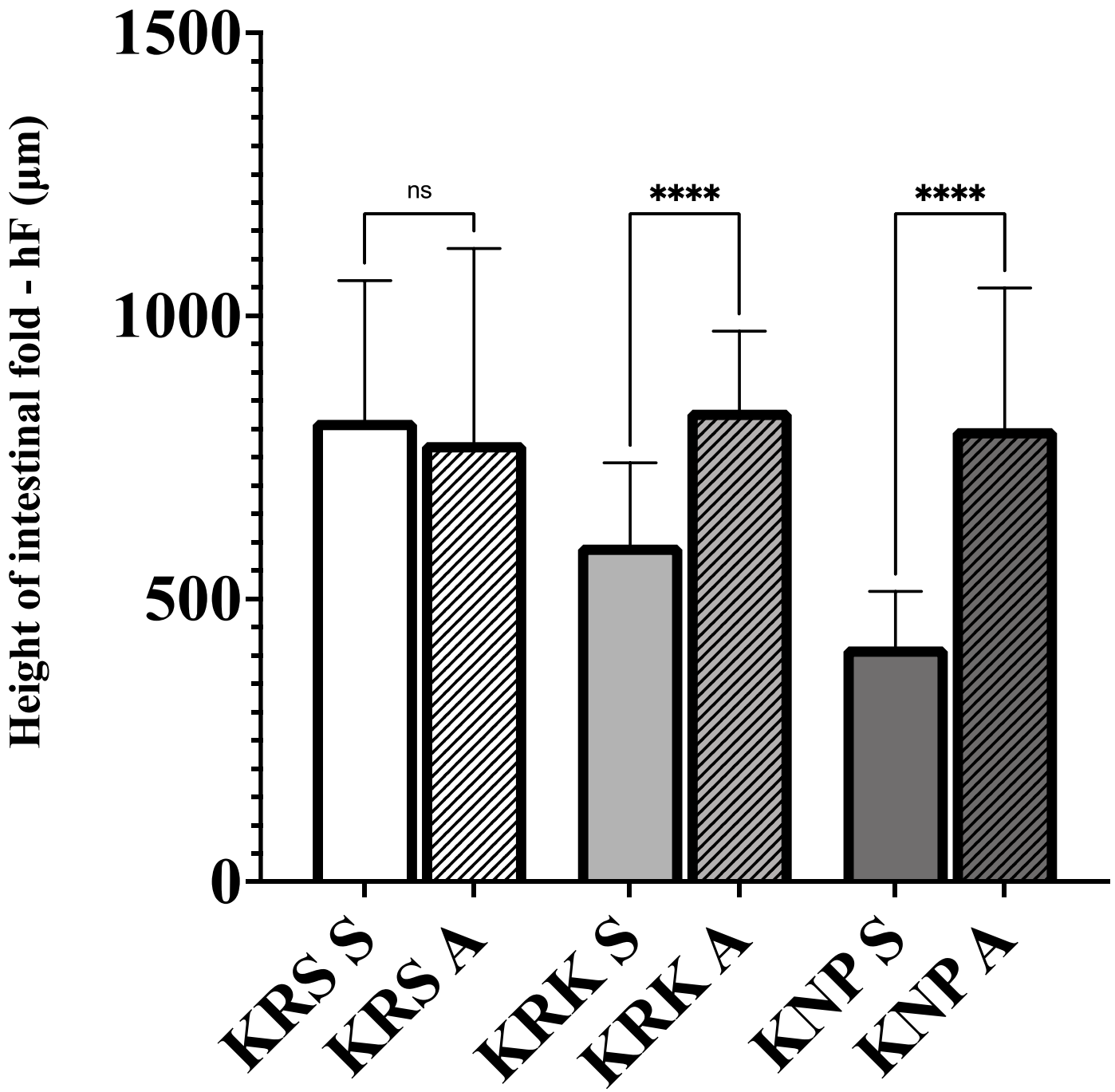


Morphometric measurements included:

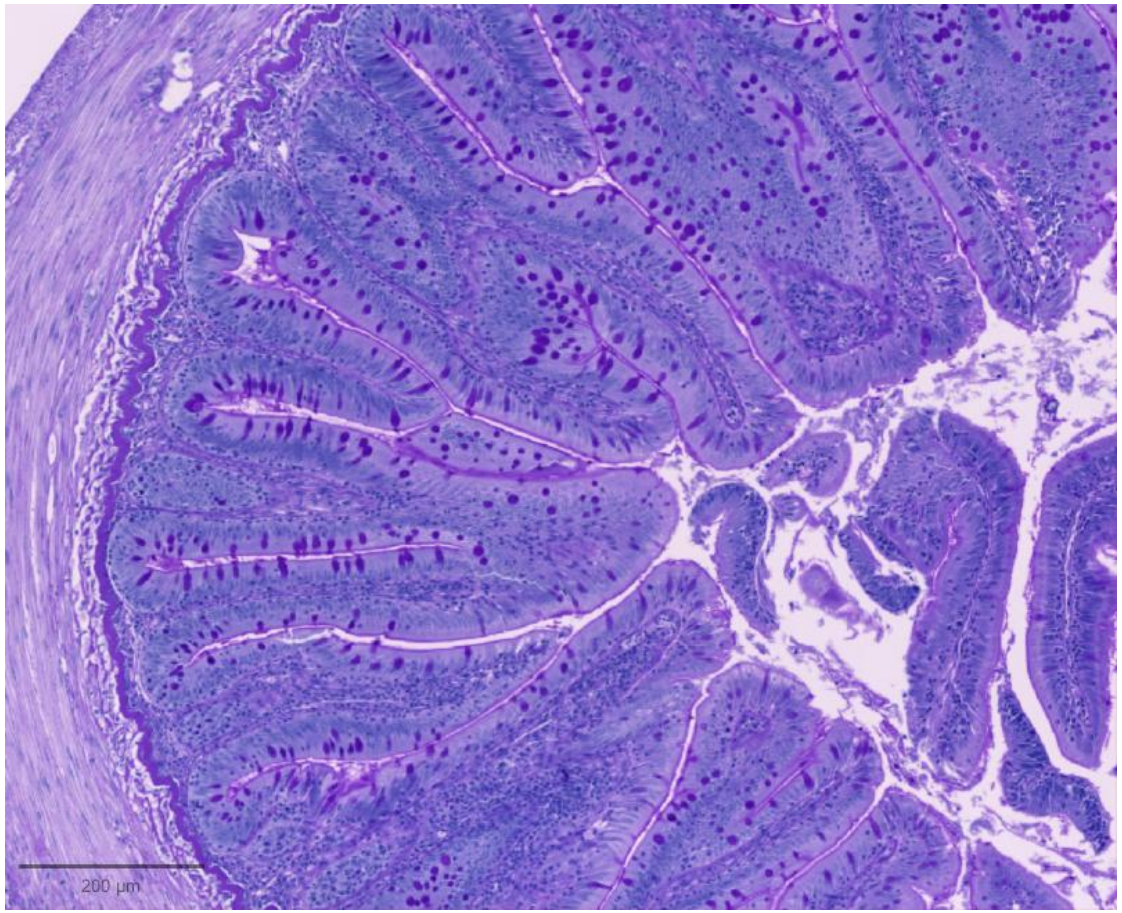
- **Height of intestinal lumen (hL)**
- **Width of intestinal lumen (wL)**
- **Height of intestinal fold (hF)**
- **Width of intestinal fold (wF)**
- **Total enterocyte height (hE)**
- **Microvillus estimated height (hMV, PAS-positive stained zone)**
- **Height of epithelia (hE)**
- **Height of supranuclear space (hSN)**
- **Nucleus height (hN)**
- **Nucleus width (wN)**
- **Number of enterocyte nuclei per 100 µm fold distance (nNE)**
- **Number of mucous cells per 100 µm fold distance (nM)**
- **Mucous cell volume (vMC)**


Height of intestinal fold - hF (µm)
1000
800
600
400
200
0
****
****
****
KRS
KRK
KNP
Spring

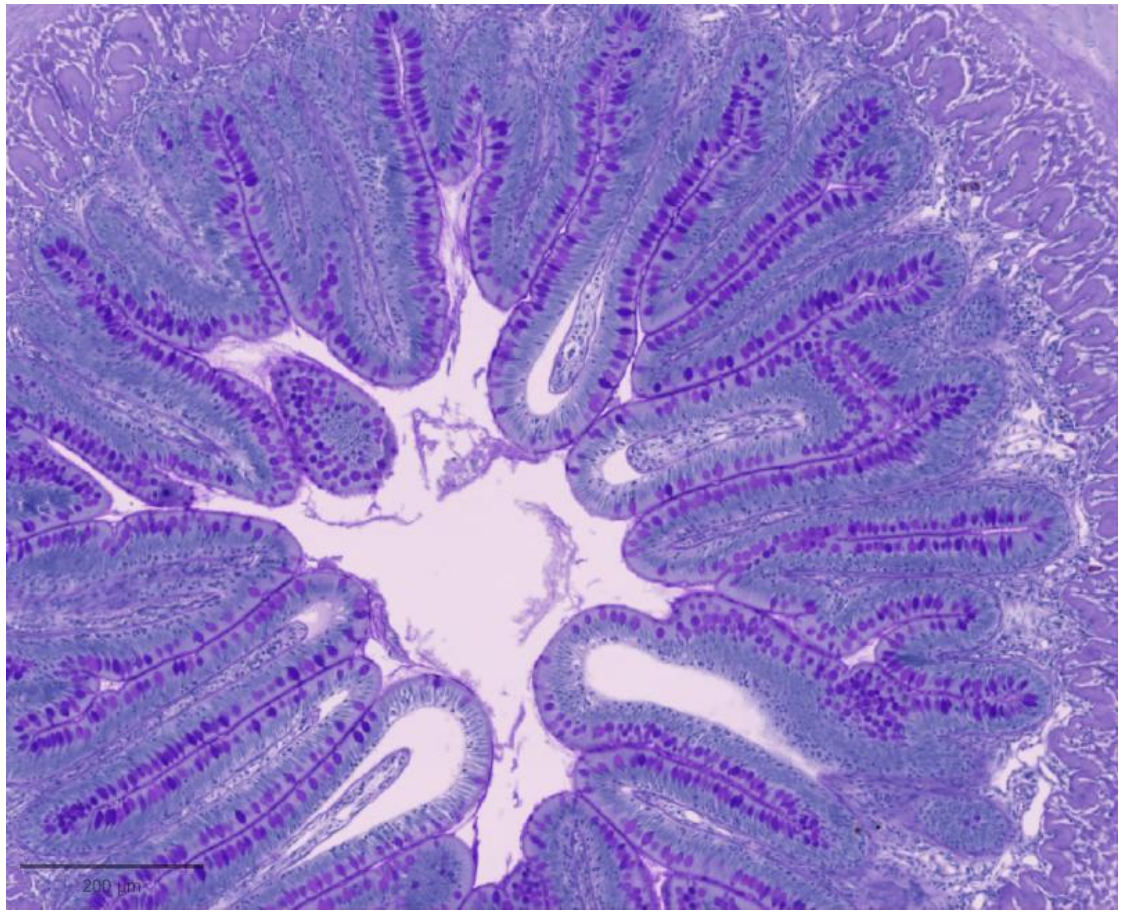

Height of intestinal fold - hF (µm)
1000
800
600
400
200
0
ns
ns
ns
KRS
KRK
KNP
Autumn

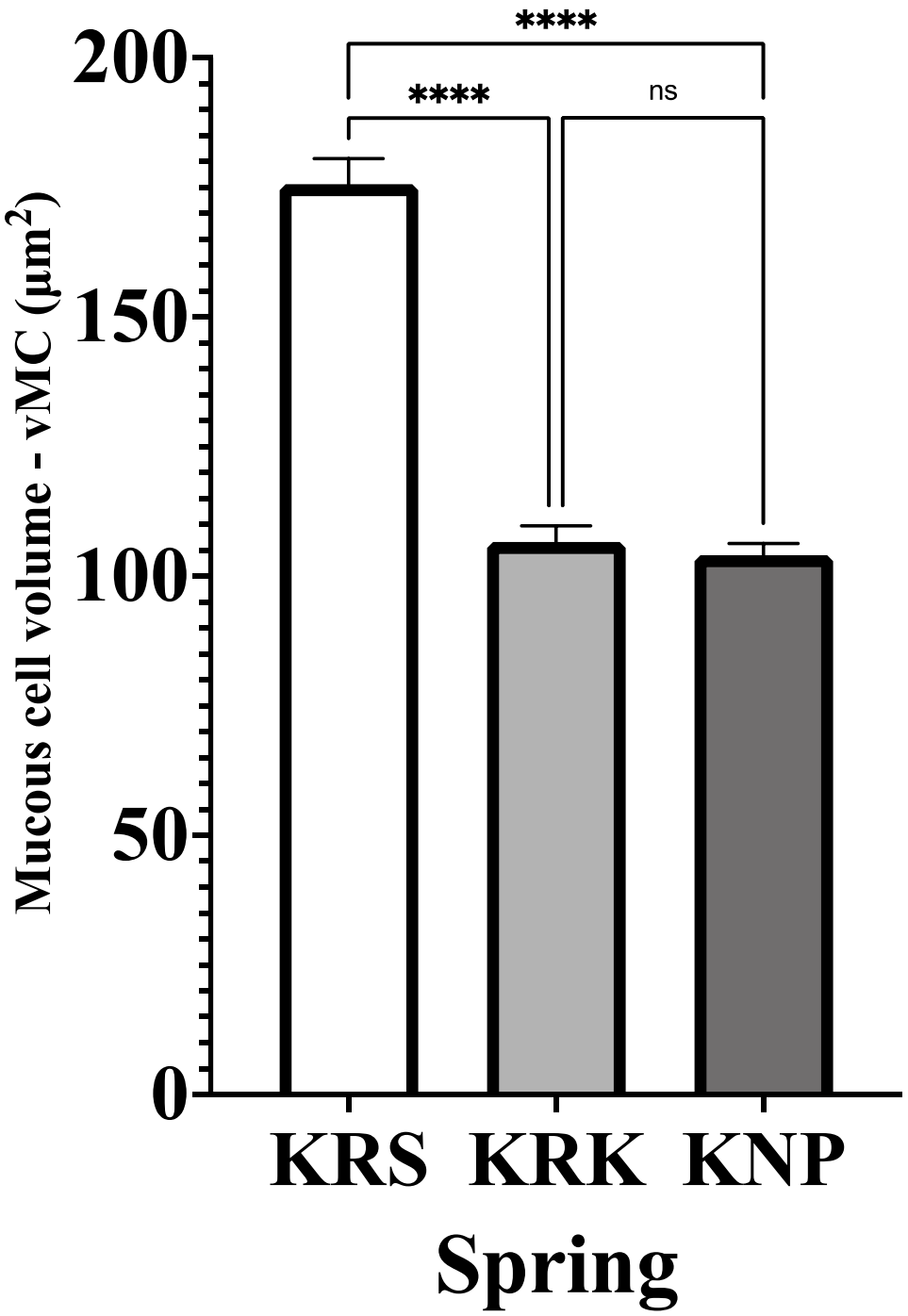

1500
1000
500
0
Height of intestinal fold - hF (µm)
ns
****
****
KRS S
KRS A
KRK S
KRK A
KNP S
KNP A

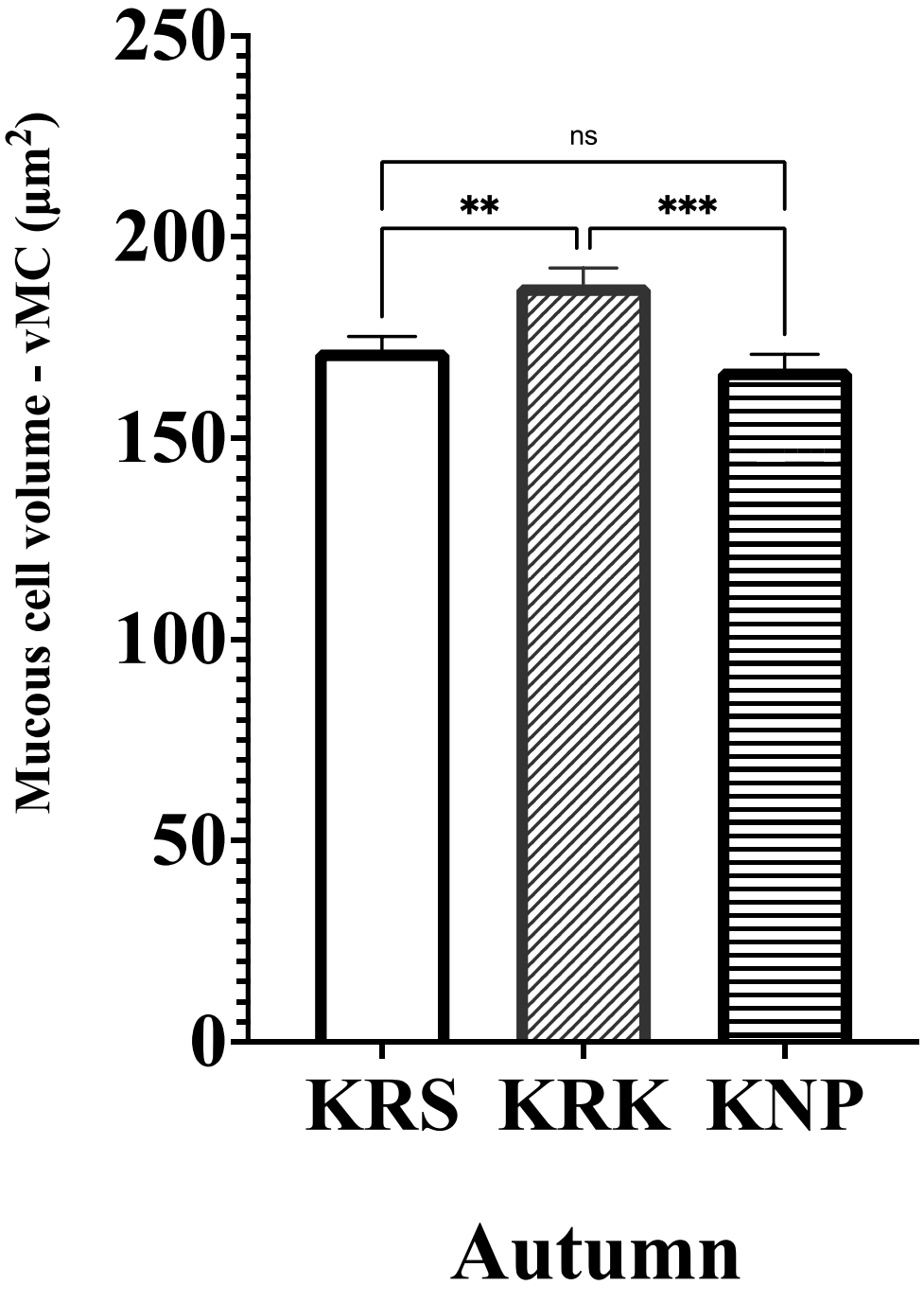
KNIN

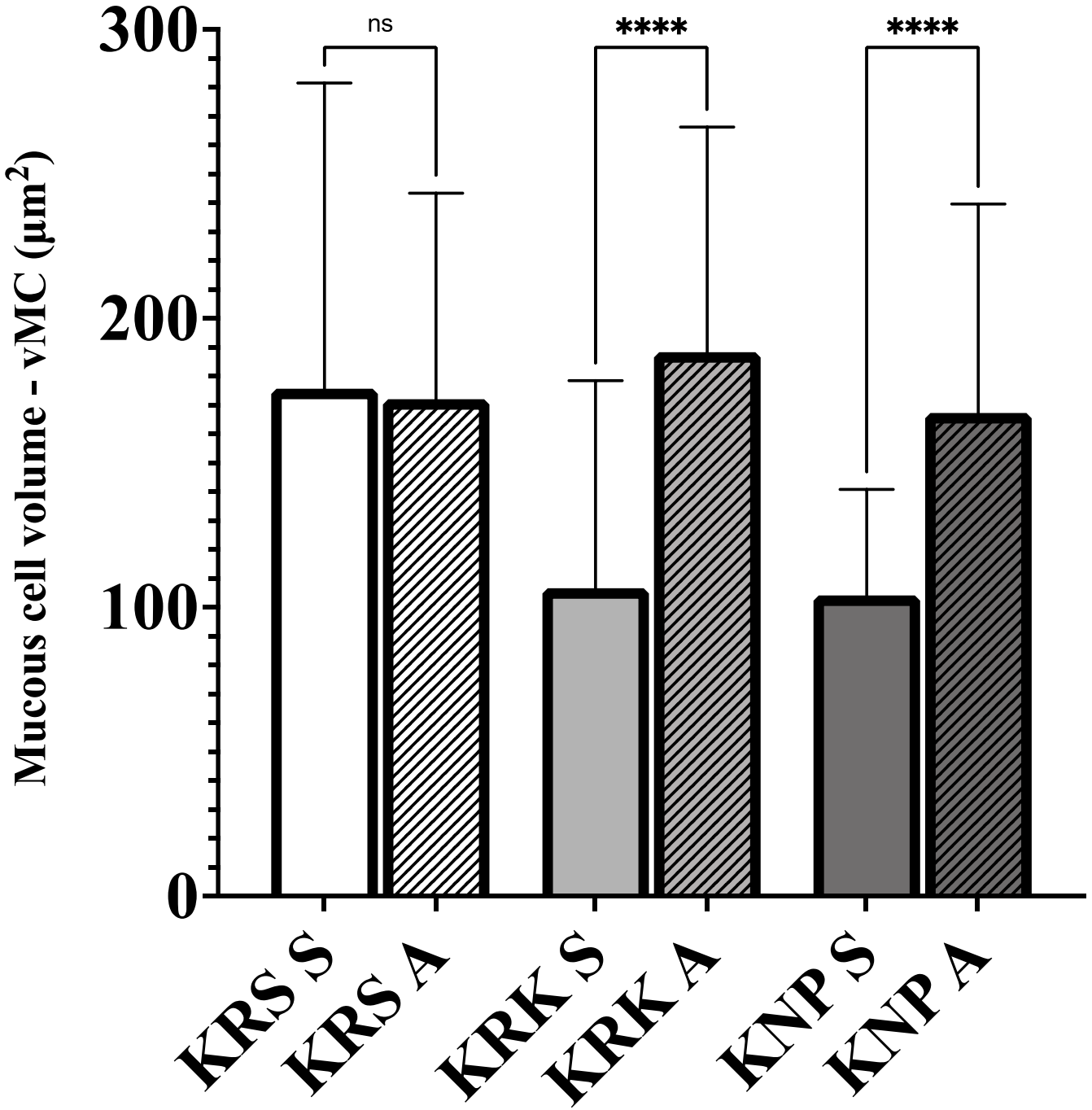


KRKA SOURCE

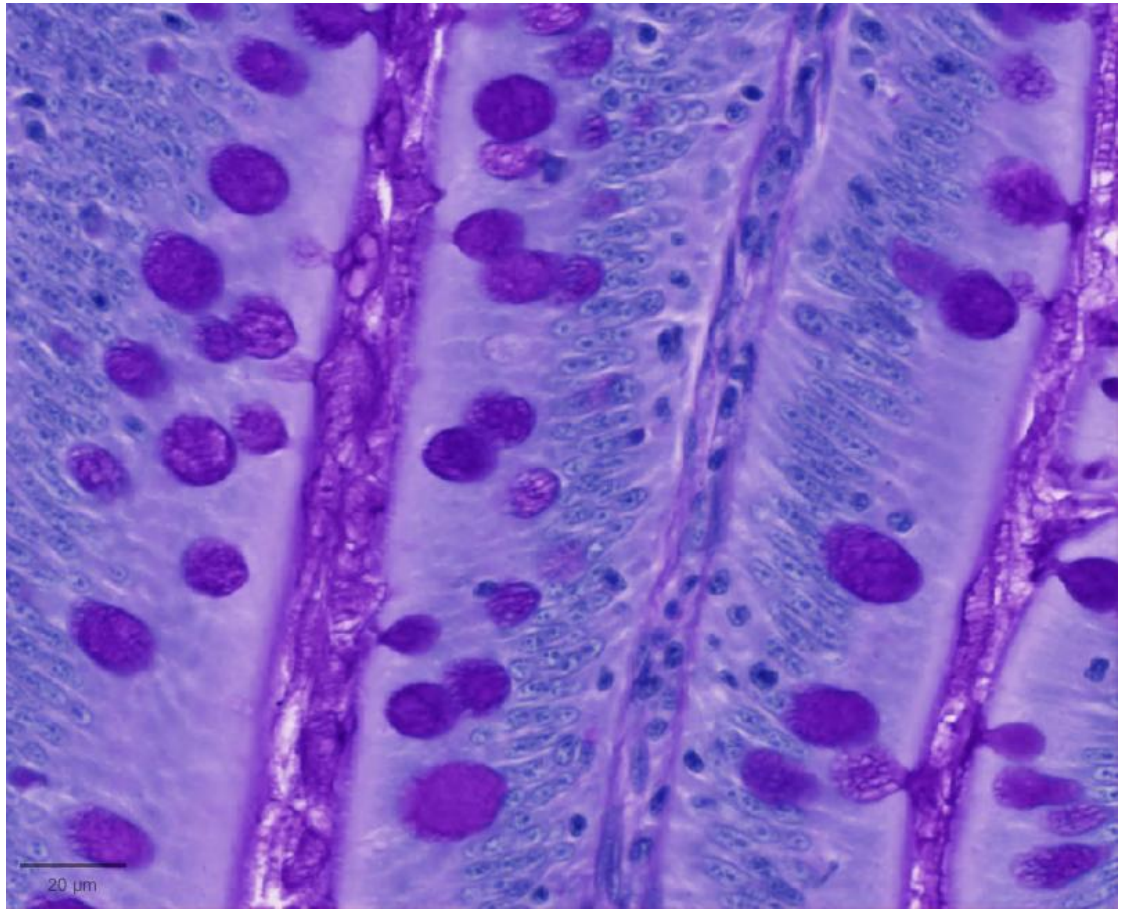



****
****
ns
200
150
100
50
0
Mucous cell volume - vMC (µm²)
KRS
KRK
KNP
Spring

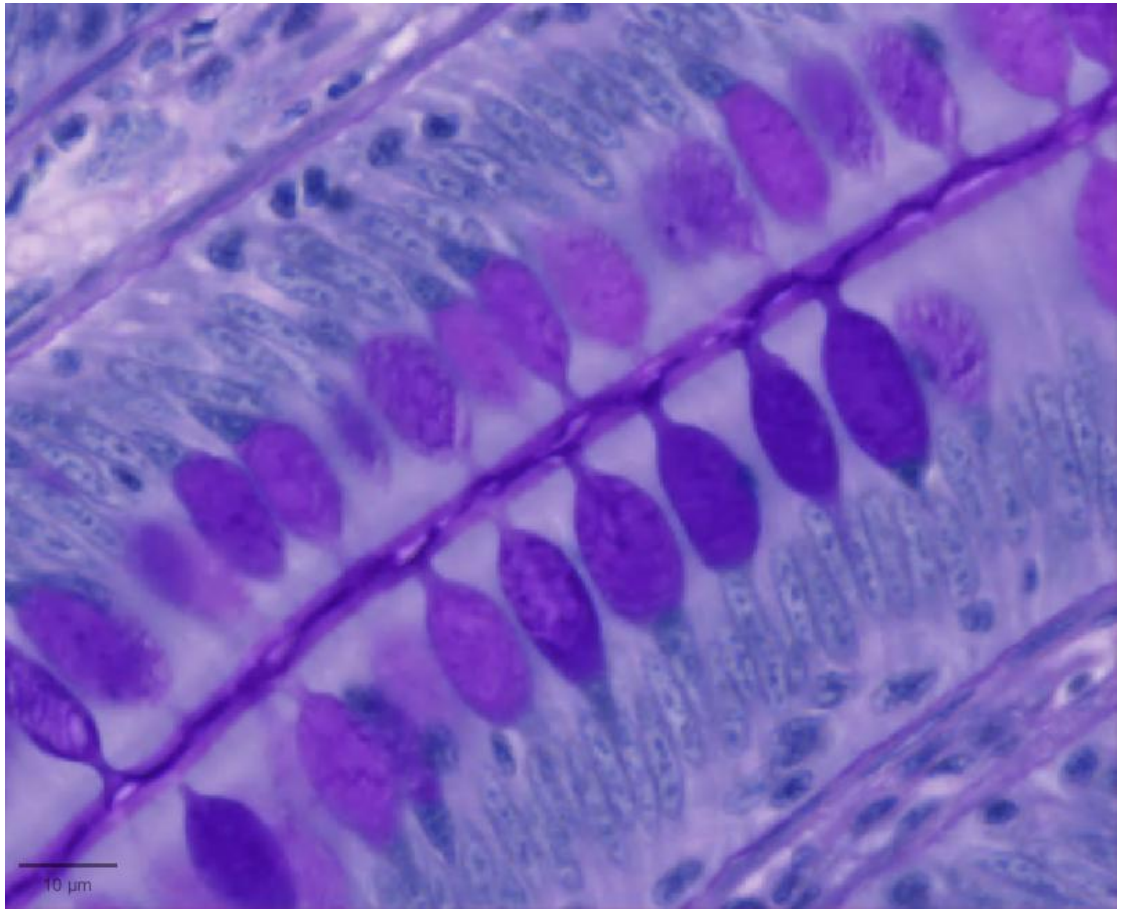

ns
**
***
250
200
150
100
50
0
Mucous cell volume - vMC (µm²)
KRS
KRK
KNP
Autumn

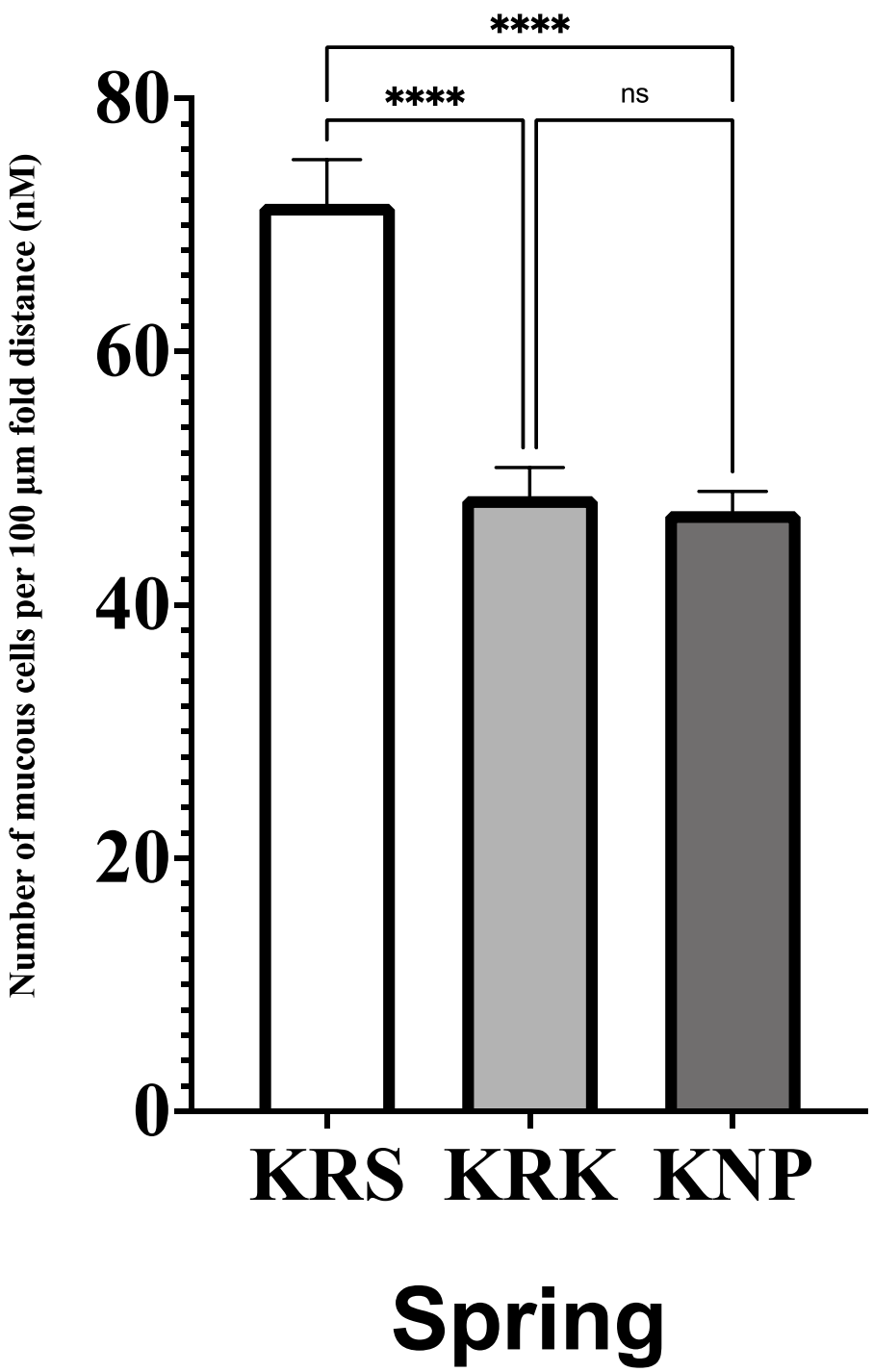

300
200
100
0
Mucous cell volume - vMC (µm²)
ns
****
****
KRS S
KRS A
KRK S
KRK A
KNP S
KNP A

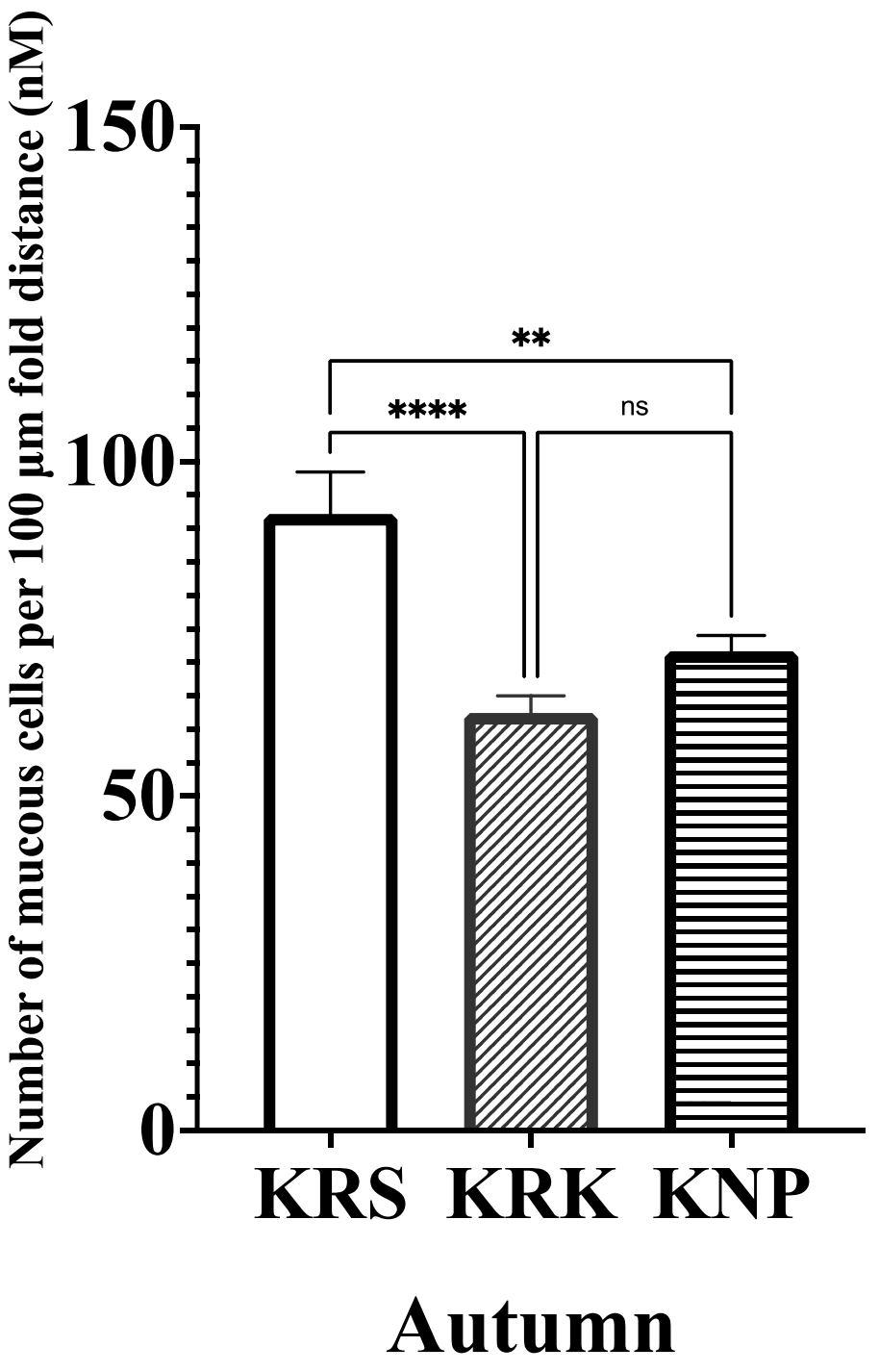
KNIN

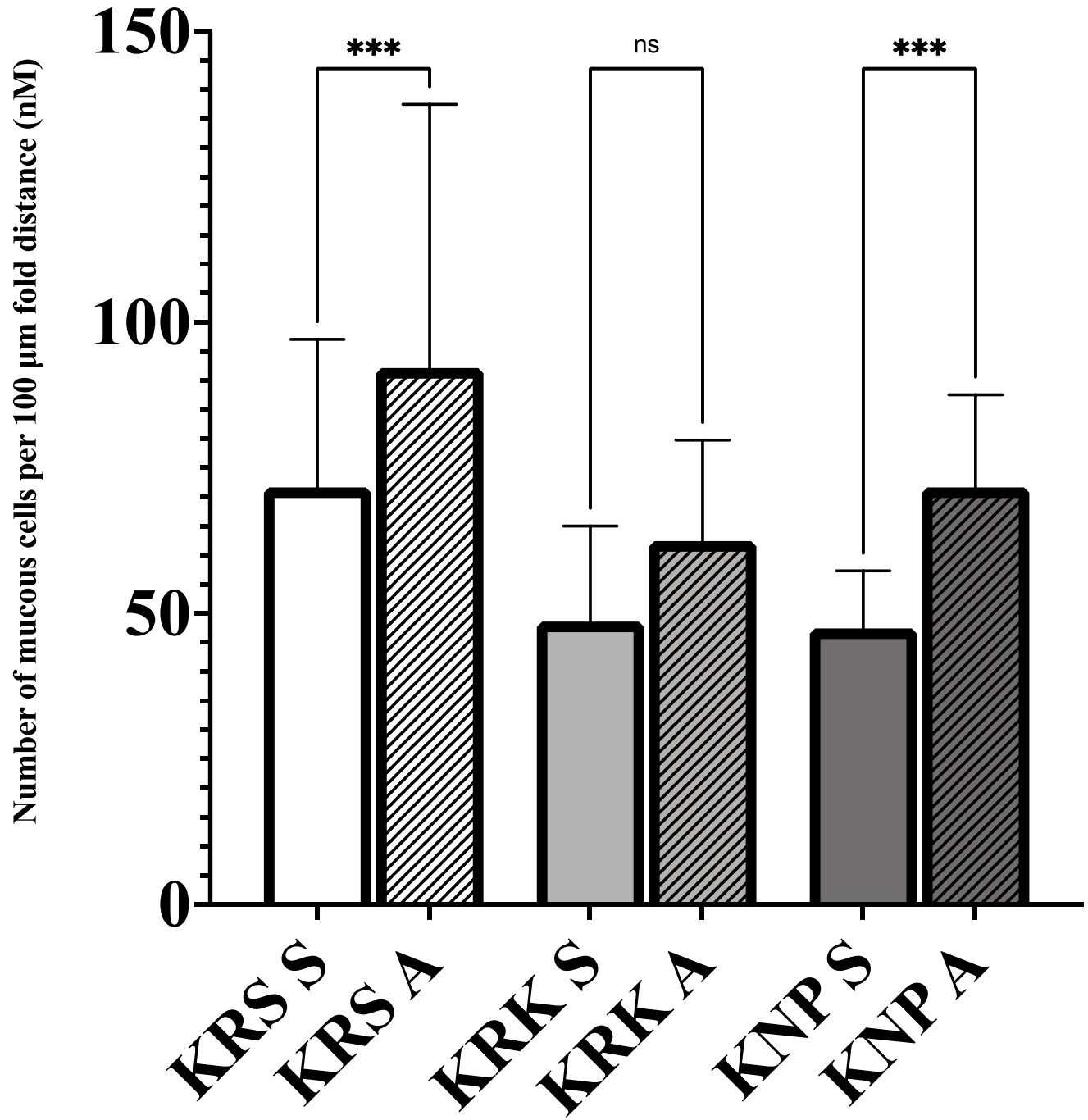


KRKA SOURCE

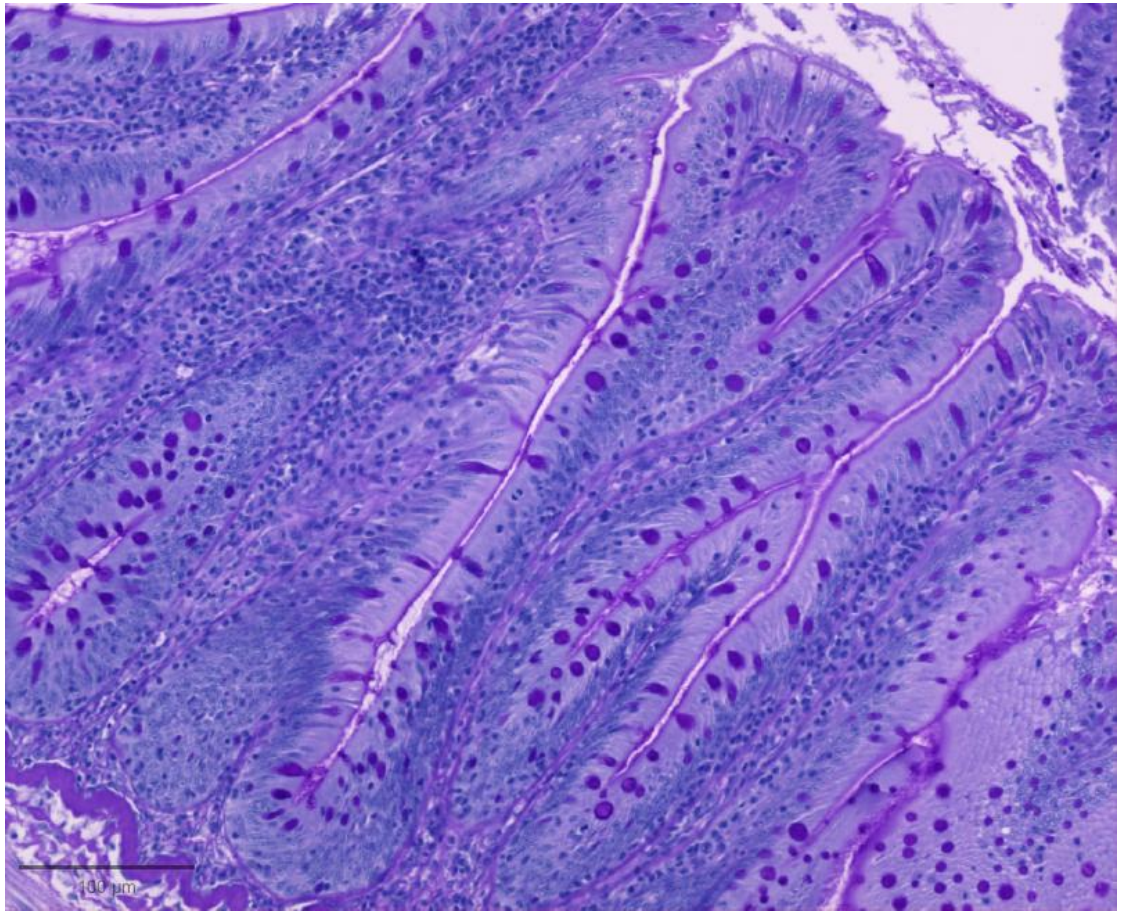



****
****
ns
80
60
40
20
0
Number of mucous cells per 100 µm fold distance (nM)
KRS
KRK
KNP
Spring

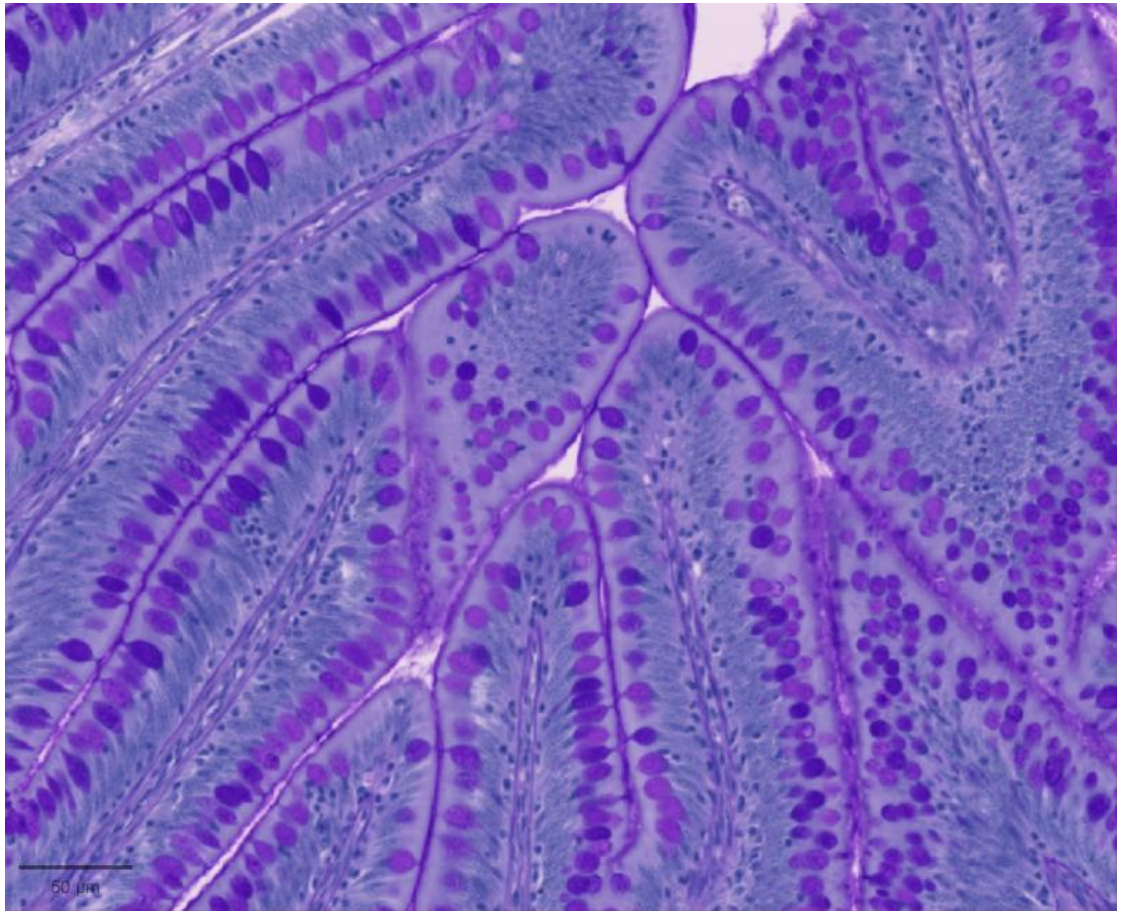

**
****
ns
150
100
50
0
Number of mucous cells per 100 µm fold distance (nM)
KRS
KRK
KNP
Autumn

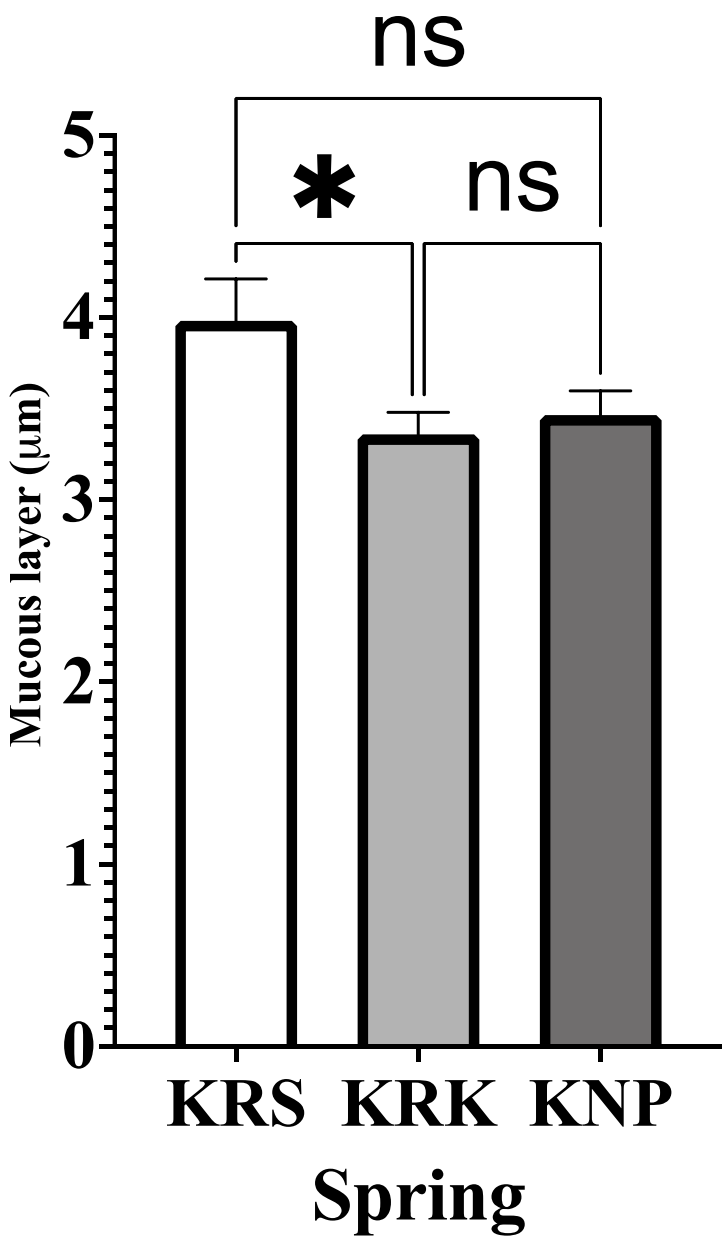

Number of mucous cells per 100 µm fold distance (nM)
150
100
50
0
***
ns
***
KRS S
KRS A
KRK S
KRK A
KNP S
KNP A

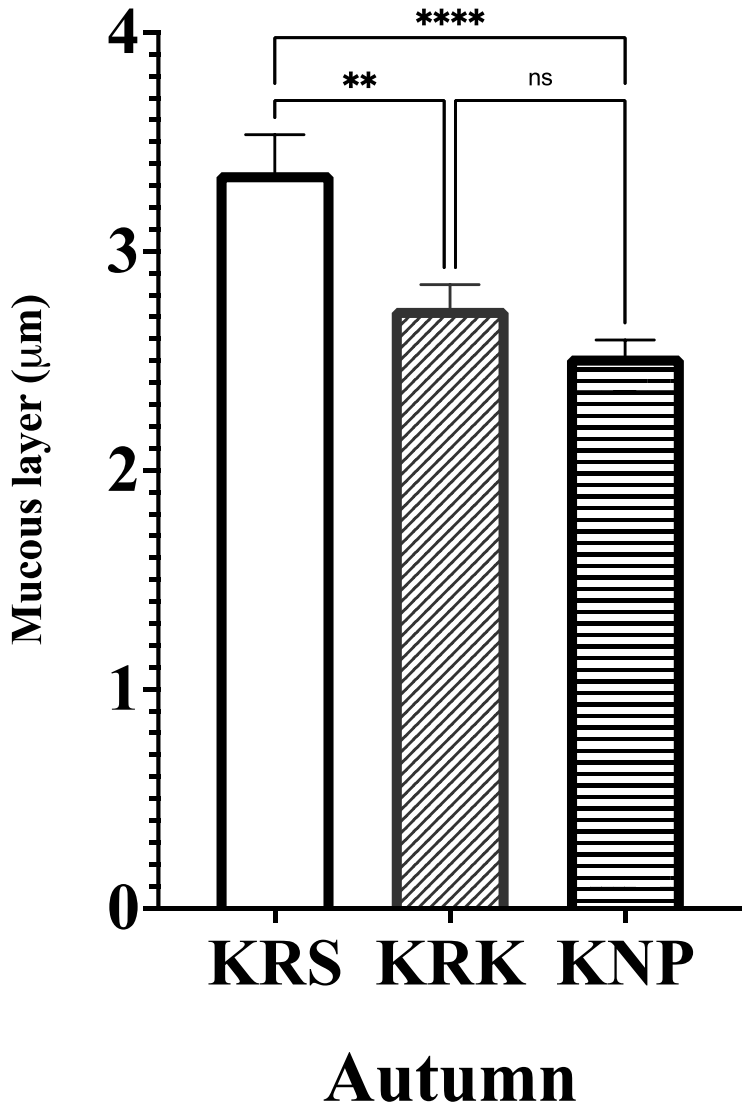
KNIN

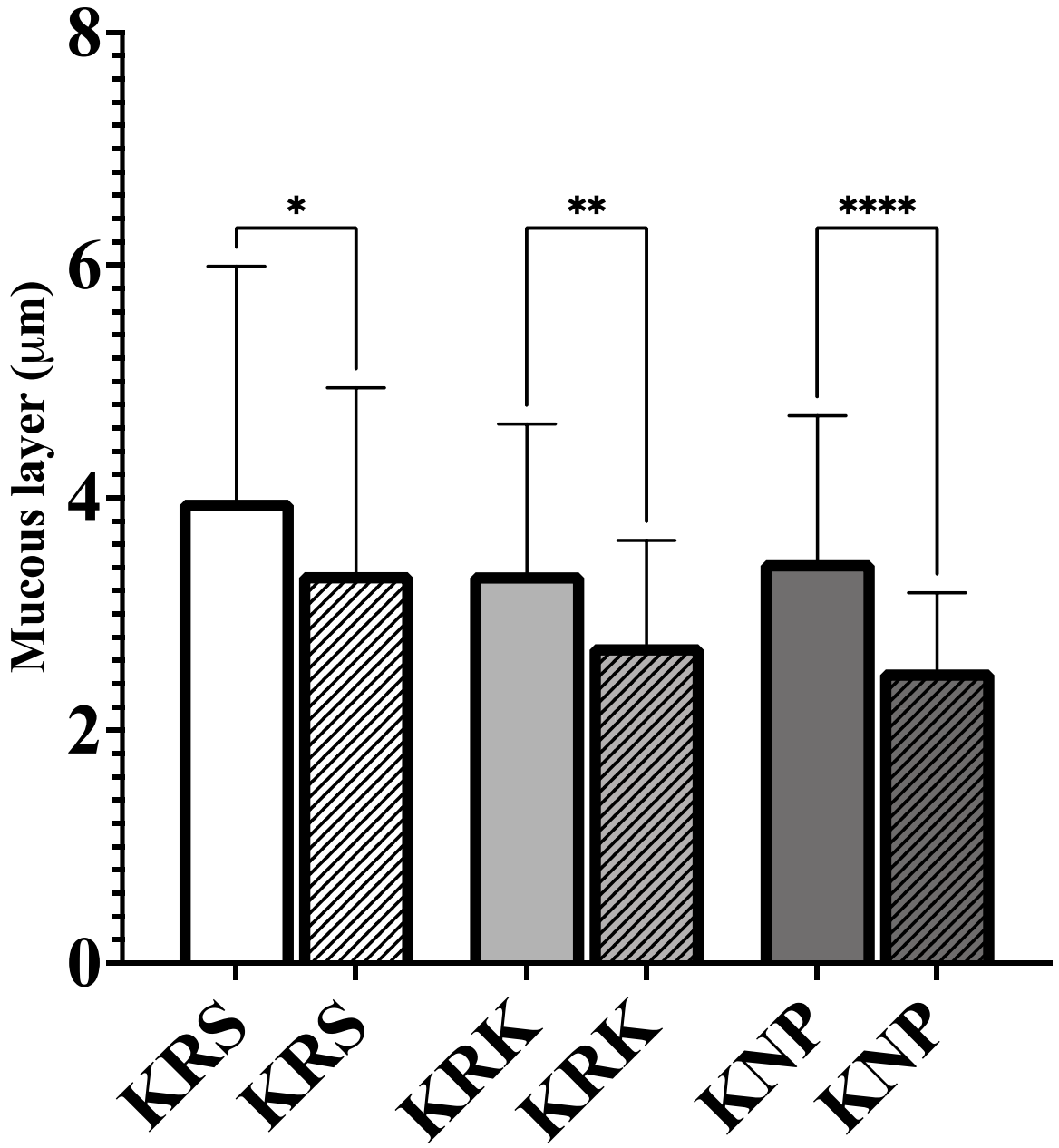


KRKA SOURCE

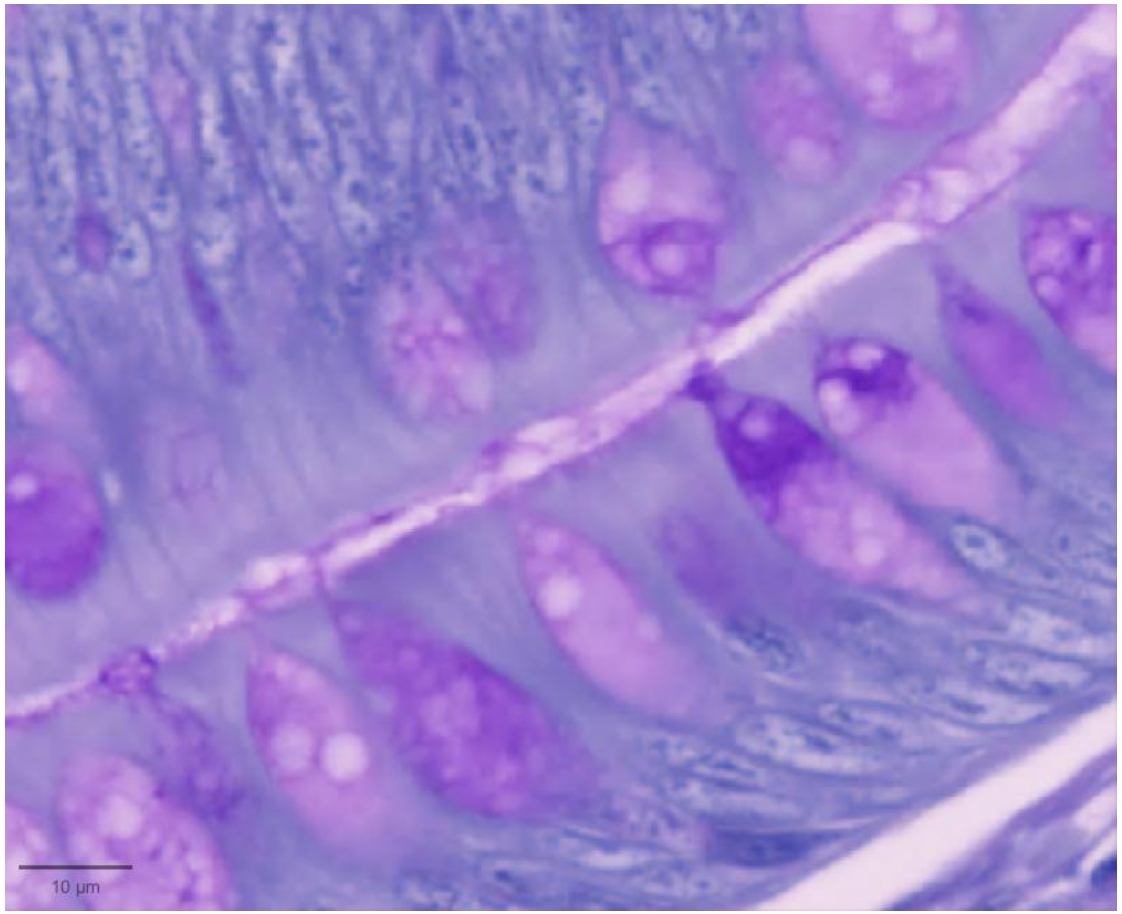



ns
*
ns
Mucous layer (μm)
5
4
3
2
1
0
KRS
KRK
KNP
Spring

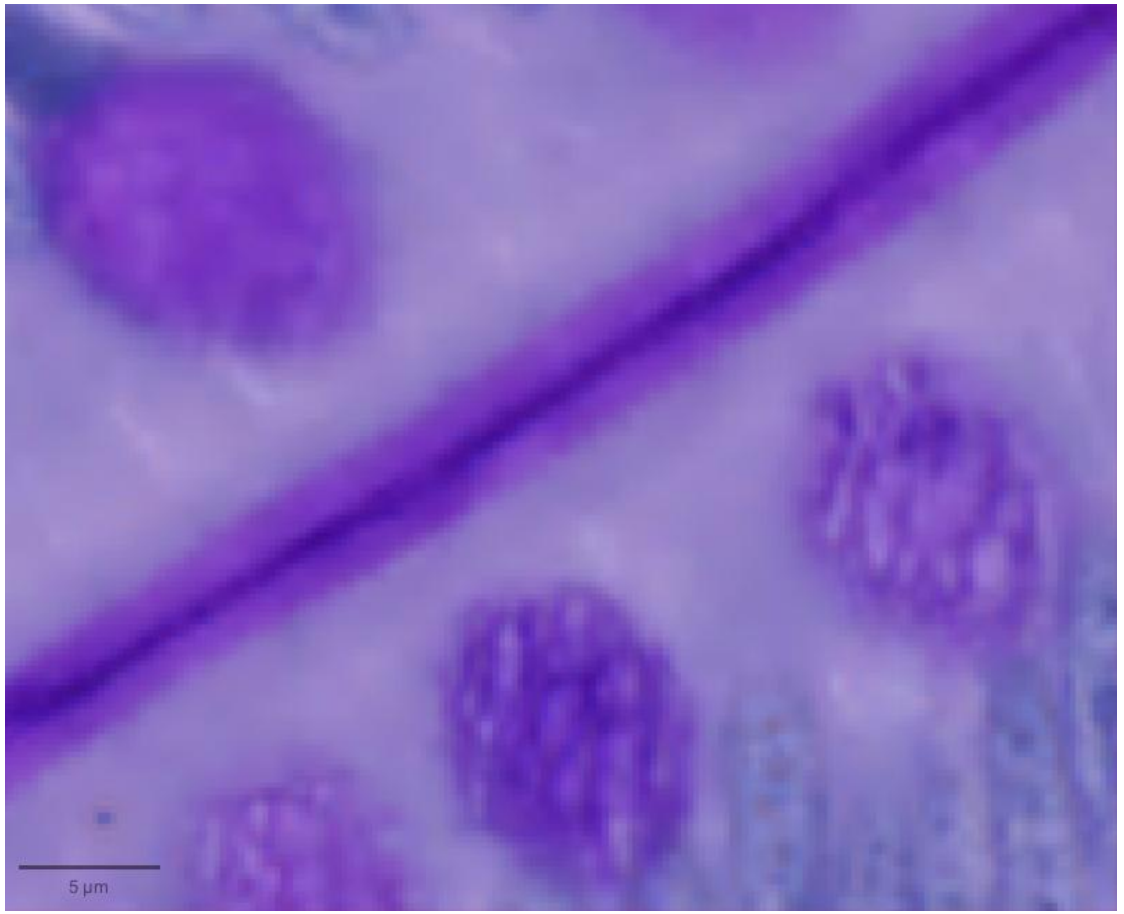

****
**
ns
Mucous layer (μm)
4
3
2
1
0
KRS
KRK
KNP
Autumn

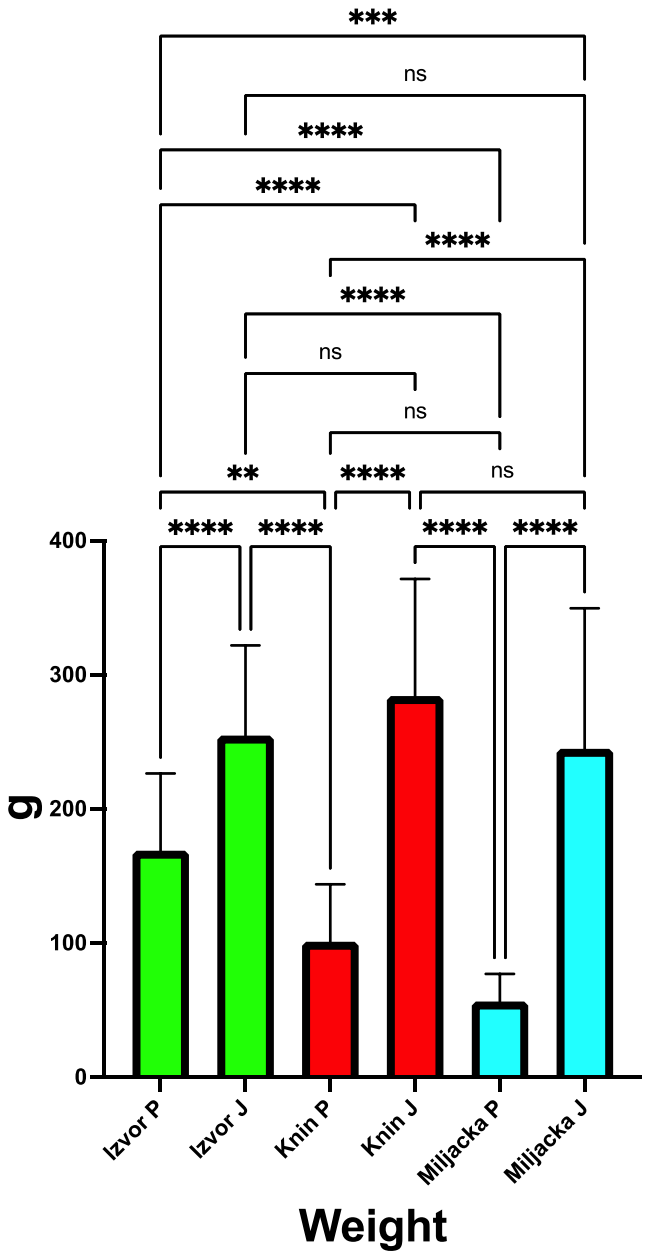

Mucous layer (μm)
8
6
4
2
0
*
**
****
KRS
KRS
KRK
KRK
KNP
KNP

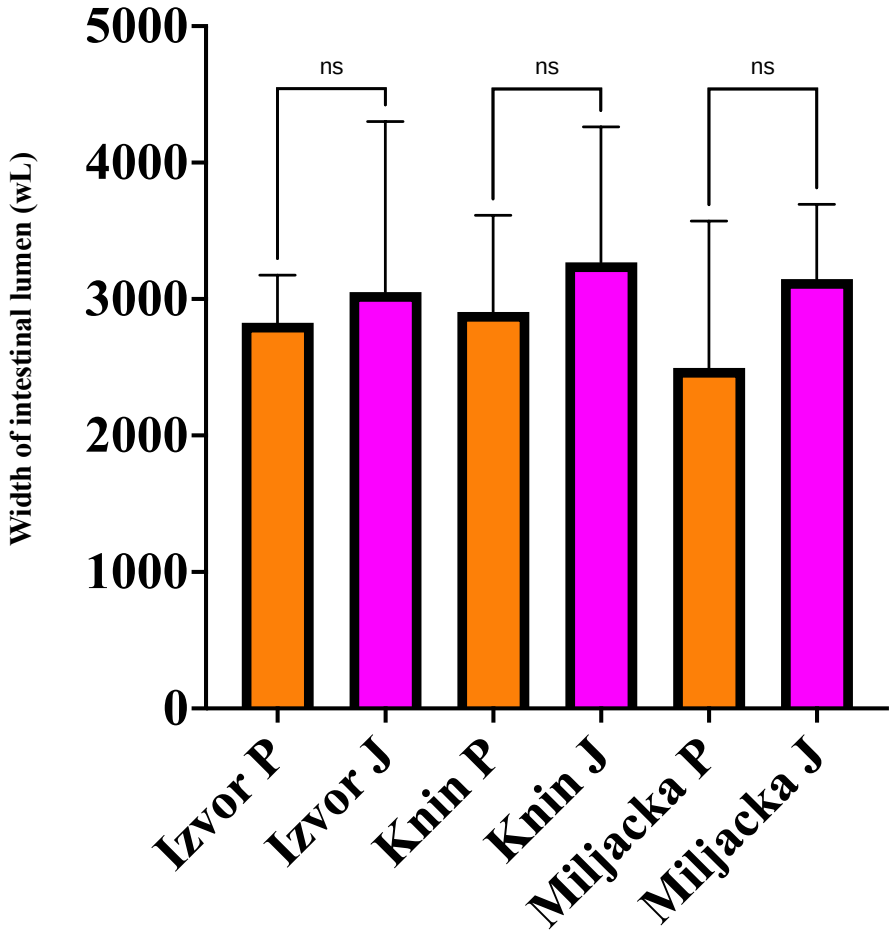
KNIN

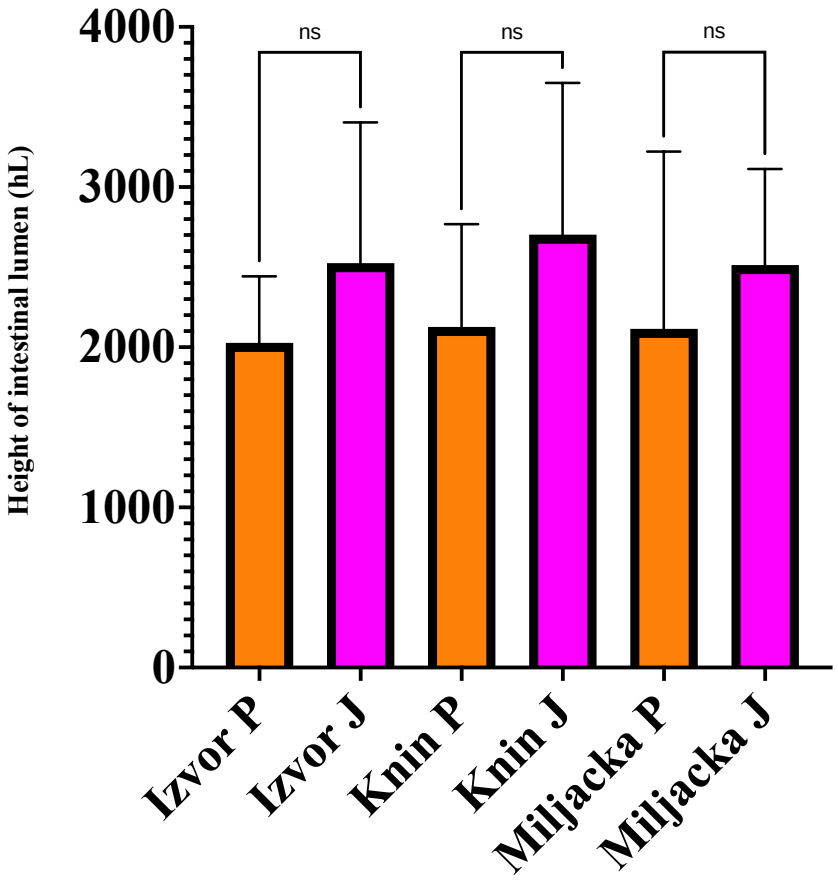


KRKA SOURCE




***
ns
****
****
****
****
ns
ns
**
****
ns
****
****
****
****
400
300
200
100
0
g
Izvor P
Izvor J
Knin P
Knin J
Miljacka P
Miljacka J
Weight


5000
4000
3000
2000
1000
0
Width of intestinal lumen (wL)
ns
ns
ns
Izvor P
Izvor J
Knin P
Knin J
Miljacka P
Miljacka J


4000
3000
2000
1000
0
Height of intestinal lumen (hL)
ns
ns
ns
Izvor P
Izvor J
Knin P
Knin J
Miljacka P
Miljacka J

Thank You for attention

FINAL PROJECT MEETING

Integrated evaluation of aquatic organism responses to metal exposure: gene expression, bioavailability, toxicity and biomarker responses (BIOTOXMET)

Zagreb, 17th February 2025

Josip Barisic, WELLFISH TECH