

Effects of dietary nano-selenium on the growth performance, antioxidant capacity, immunity and intestinal microbiota of Tibetan naked carp (*Gymnocypris przewalskii*)

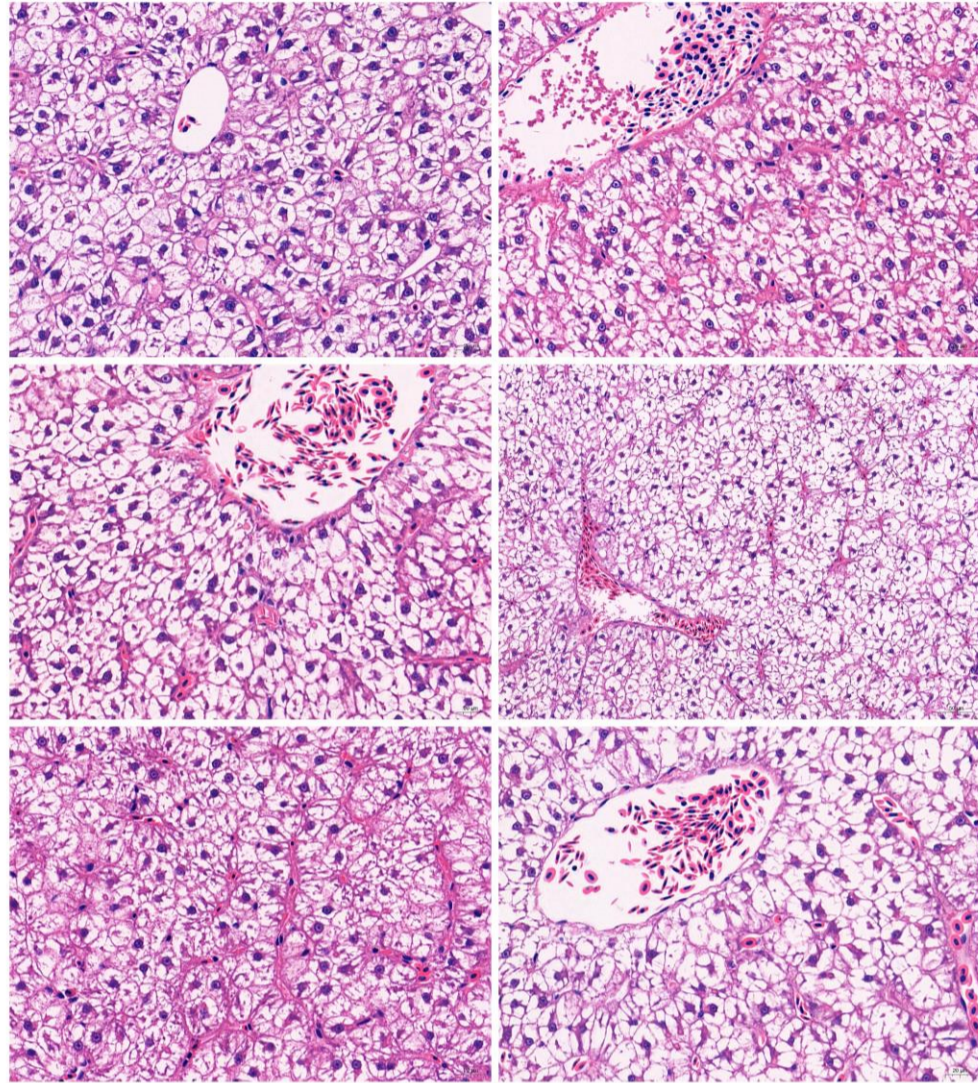
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WHY STUDY THEM ?

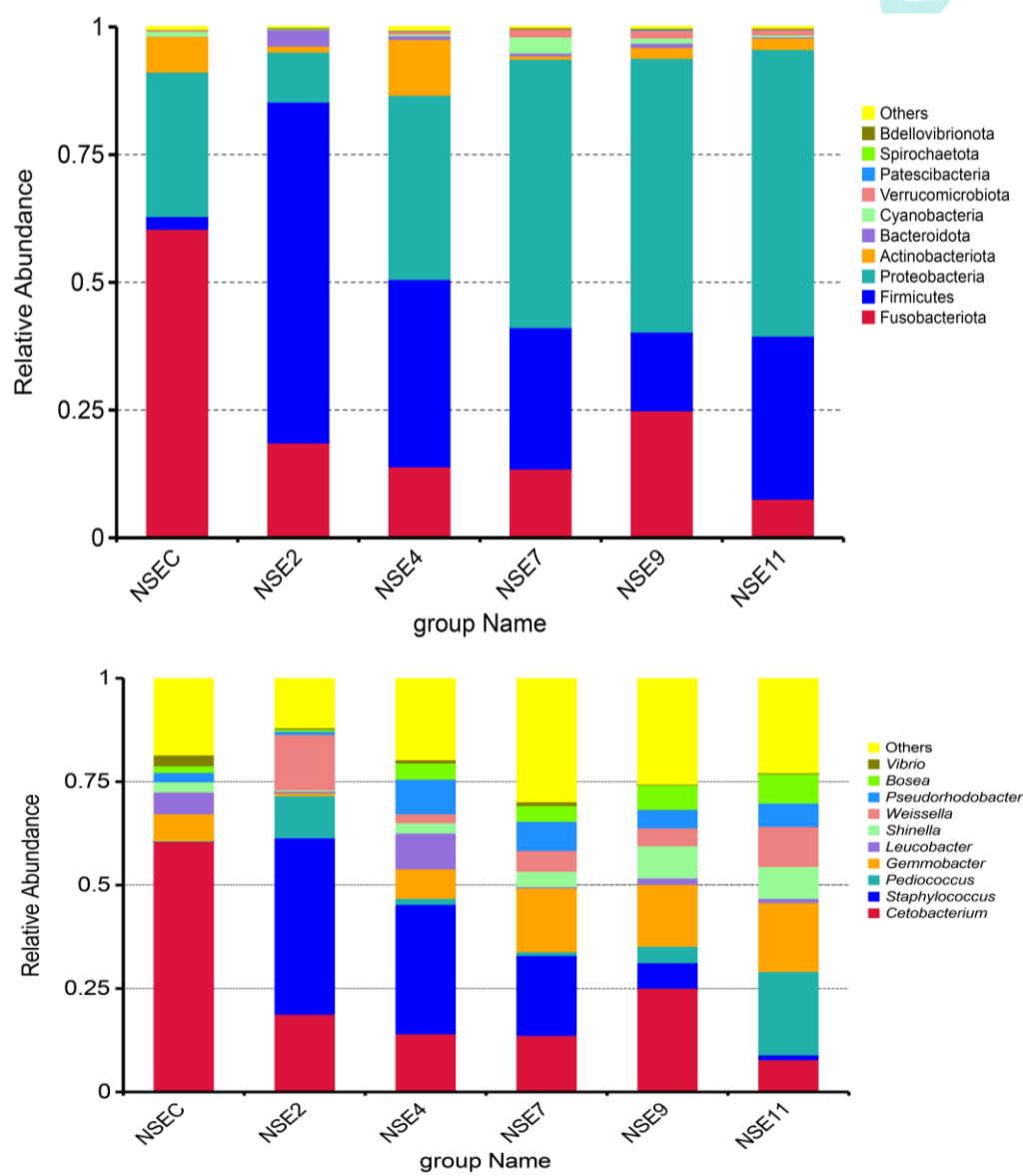
In Qinghai Lake, *G. przewalskii* is a significant wild fish with commercial value. Artificial breeding and release are important measures for restoring the wild resources of *G. przewalskii*. Adding feed additives to diets is one of the most widely used ways to prevent environmental stresses from negatively affecting fish.

AIM: This research will enhance our understanding of the possible uses of nano-se and provides guidelines for protecting and restoring wild *G. przewalskii* as well as optimizing diet formulations for *G. przewalskii* bred in captivity.

STUDY SITE: The experimental juveniles of *G. przewalskii* were provided by the Key Laboratory of Breeding and Protection of *G. przewalskii* in Qinghai Province. A total of 720 healthy fish (22±3 g) were randomly allocated into six groups, The experimental diets supplemented with 0, 2, 4, 7, 9, or 11 mg/kg nano-se were fed to the fish. The feeding study lasted 8 weeks. Growth performance was then calculated, and antioxidant enzyme activity, immune and liver histopathology and intestinal flora were detected



Histopathologic section of liver tissues.



Bar plot of relative abundance of intestinal microbiota.

RESULTS

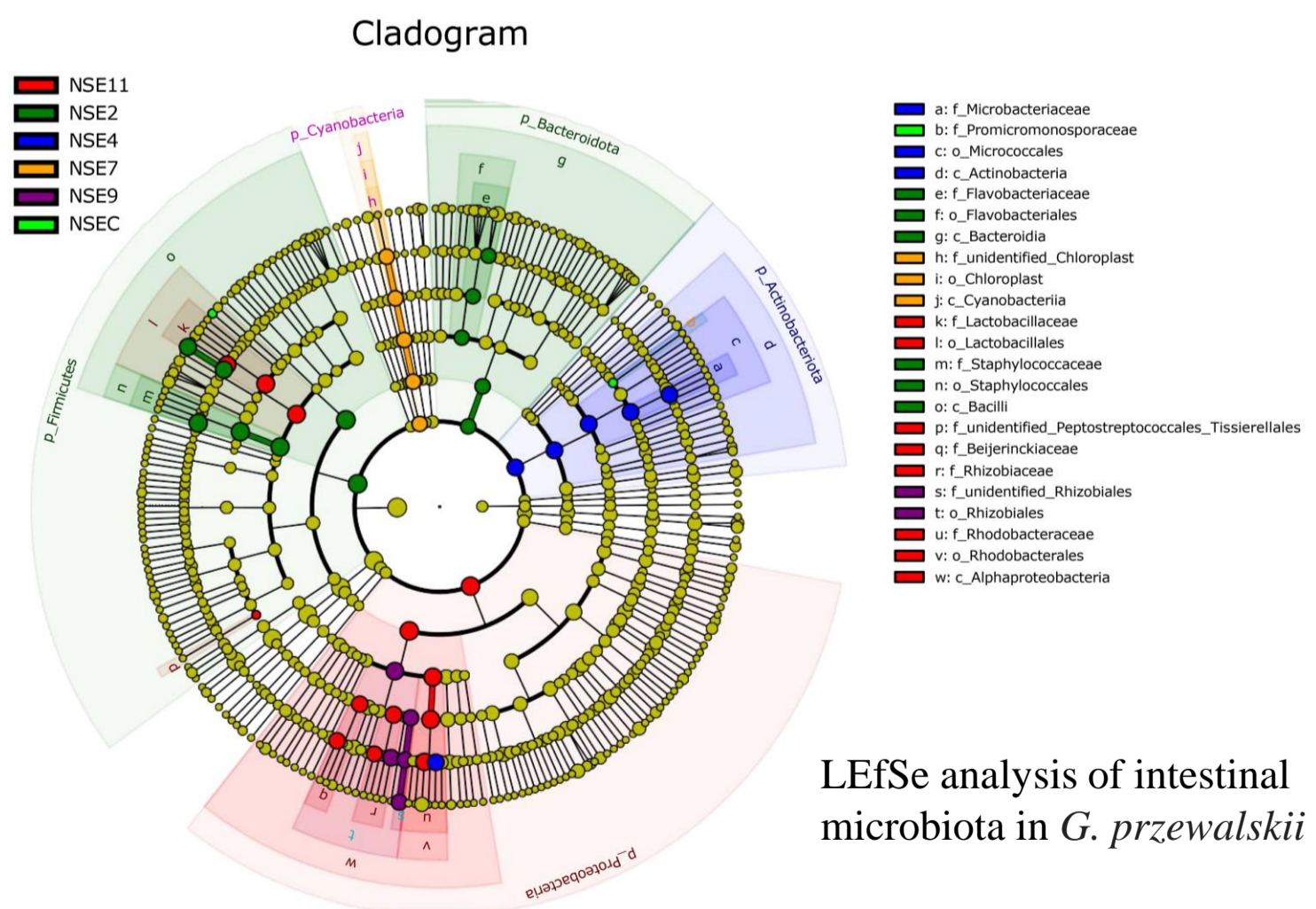
Table 1 Effects of dietary nano-selenium on serum indices of *G. przewalskii*

Items	A0	A1	A2	A3	A4
TP(gprot/L)	14.88±2.17 ^a	15.45±0.84 ^a	17.13±2.53 ^a	16.36±2.82 ^a	14.85±0.42 ^a
SOD(U/mgprot)	128.62±16.99 ^a	145.48±16.06 ^a	146.92±23.84 ^a	152.12±20.85 ^a	144.94±12.30 ^a
GSH-PX(U/mgprot)	12.94±2.32 ^b	13.49±4.94 ^b	14.43±0.76 ^{ab}	21.49±4.84 ^a	15.37±5.26 ^{ab}
CAT(U/mgprot)	13.67±7.29 ^a	15.78±5.06 ^a	16.38±4.64 ^a	18.13±3.89 ^a	17.10±1.710 ^a
T-AOC(U/mL)	2.99±0.21 ^a	3.05±0.08 ^a	3.27±0.24 ^a	3.40±0.33 ^a	3.09±0.10 ^a
Alb(g/L)	14.67±3.01 ^a	15.16±3.73 ^a	16.01±2.17 ^a	18.55±3.32 ^a	16.43±1.04 ^a
TG(mmol/L)	3.46±1.06 ^a	3.51±0.44 ^a	3.74±0.65 ^a	4.42±0.93 ^a	4.85±1.35 ^a
GR(U/gprot)	11.25±5.57 ^a	11.25±4.25 ^a	12.33±4.64 ^a	16.61±7.93 ^a	13.93±2.46 ^a
LZM(μg/mL)	0.54±0.11 ^a	0.65±0.11 ^a	0.76±0.58 ^a	1.16±0.38 ^a	0.91±0.33 ^a
IgM(μg/mL)	0.81±0.48 ^a	0.91±0.49 ^a	1.10±0.76 ^a	1.47±1.42 ^a	1.49±0.46 ^a

Table 2 Effects of dietary nano-selenium on liver immune indices of *G. przewalskii*

	NSEC	NSE2	NSE4	NSE7	NSE9	NSE11
IL-1β (pg/mL)	8.02±0.09 ^c	9.63±0.09 ^a	8.84±0.28 ^b	8.00±0.08 ^c	8.01±0.22 ^c	7.87±0.08 ^c
IL-6 (pg/mL)	2.27±0.07 ^{abc}	2.43±0.13 ^{ab}	2.55±0.19 ^a	2.18±0.28 ^{bc}	2.17±0.12 ^{bc}	2.01±0.11 ^c
IL-8 (pg/mL)	10.86±0.18 ^{cd}	13.16±0.22 ^a	12.10±0.30 ^b	10.93±0.12 ^{cd}	11.18±0.29 ^c	10.71±0.21 ^d
IL-10 (pg/mL)	12.98±1.68 ^a	15.02±0.74 ^a	14.78±1.78 ^a	11.35±0.21 ^a	16.06±4.19 ^a	10.95±5.44 ^a
TGF-β (pg/mL)	9.07±0.23 ^{bc}	9.61±0.20 ^a	9.07±0.23 ^a	8.70±0.39 ^c	9.44±0.37 ^b	7.98±0.25 ^d
TNF-α (pg/mL)	5.34±0.19 ^c	6.26±0.30 ^a	5.94±0.18 ^{ab}	5.47±0.30 ^{bc}	5.83±0.30 ^{ab}	5.13±0.19 ^c
IgM (μg/mL)	1.22±0.19 ^a	1.39±0.22 ^a	1.45±0.13 ^a	1.28±0.09 ^a	1.35±0.08 ^a	0.73±0.11 ^b

Note: Means with different letters in the same line are significant difference between groups ($P < 0.05$), and means with the same letter in the same line are not significant difference between groups ($P > 0.05$).



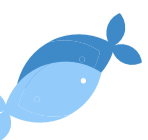
LEfSe analysis of intestinal microbiota in *G. przewalskii*

CONCLUSIONS

Nano-se dietary supplements may enhance the growth performance, antioxidant capability, immunity, and intestinal health of *G. przewalskii*. The liver had the greatest ability to accumulate selenium. Supplementation with an appropriate amount of selenium to the diet improved the symptoms of vacuolization, hepatocyte swelling and inflammatory cell infiltration. The appropriate dose of nano-se supplemented in the diets of juvenile *G. przewalskii* was 4.8 mg/kg.



- The molecular mechanism of nano-selenium regulation of *G. przewalskii* in response to alkalinity stress
- Comparative analysis of the effects of different antioxidants on the environmental adaptability of *G. przewalskii*



WHAT NEXT ?