Table S1 Formulation and nutritional composition of the experimental diets

Ingredient	Con	HC	HS1	HS5	HAS1
Fish meal	10	10	10	10	10
Wheat bran	10.6	10.6	10.6	10.6	10.6
α-Starch	15.6	21.4	21.4	21.4	21.4
Maltodextrin	3	3	3	3	3
Sodium carboxymethyl cellulose	2	2	2	2	2
Microcrystalline cellulose	5.8	0	0	0	0
Soybean oil	6.3	6.3	6.3	6.3	6.3
Soybean meal	16	16	16	16	16
Cotton seed meal	12	12	12	12	12
Rape seed meal	13.5	13.5	13.5	13.5	13.5
Squid meal	2	2	2	2	2
Ampicillin	0	0	0	0	0.0005
Metronidazole	0	0	0	0	0.0005
Neomycin	0	0	0	0	0.0005
Vancomycin	0	0	0	0	0.00025
SeNP	0	0	0.0001	0.0005	0.0001
Choline chloride（50%）	0.5	0.5	0.5	0.5	0.5
Vitamin premix	0.5	0.5	0.5	0.5	0.5
Mineral premix	0.5	0.5	0.5	0.5	0.5
Calcium dihydrogen phosphate	1.5	1.5	1.5	1.5	1.5
Sodium Ascorbyl Phosphate	0.2	0.2	0.2	0.2	0.2
total	100	100	100	100	100
Nutrition value(%)					
Dry matter	89.95	90.61	90.58	90.52	90.45
Crude protein	30	29.8	29.7	29.84	29.81
Crude lipid	8.46	8.9	8.92	8.87	8.92
Total sugar	39.46	44.66	44.63	44.68	44.62

Note: The vitamin premix was provided by Jiangsu Heanyuan Feed Co., Ltd., and the mineral premix was provided by Jiangsu Kaicheng Animal Husbandry Technology Co., Ltd.

Table S2 Primer sequences used for RT-qPCR

Gene	Primer	Sequence（5'-3'）	Gene	Primer	Sequence（5'-3'）
β-actin	F	CCACACAGTGCCCATCTACG	*g6pt*	F	CCGAAAGTGGTATGAGCCGT
	R	CCACGCTCTGTCAGGATCTT		R	CAGCACAGAAAATGCCCGAC
tnfa	F	CAACGCTGGTCTCACTCA	g6pca2	F	TTCAAGCCTCCCACGCATAC
	R	GCATTGCCTCCTCTGTCT		R	GTGCTGGTTCAGAGATCGGT
*nfkb*1	F	ATCAGAAATGCTGCCGCTAT	*foxo1a*	F	AATGGACGGGGACTCATTGG
	R	GGAGCCTTGCTGTCGTAGAT		R	AGCTATGCGTGGTGGTCTTC
il-6	F	TTTGAGCACCATTTCCAG	*acc1*	F	GCCTGCATTAGCATTCCAGC
	R	CGAGTAGATGAGCAGACCCT		R	TACCAGATCAGAGTGGCGGA
il-1β	F	CCAGCAGGGATGAGATTG	*plin2*	F	ATTGAGTCCCGCACCTTGAC
	R	CAGCGATGGGTGTAGGGT		R	CTGGATGTGGTTGGGGAGAC
tbk1	F	GGCCAAGACTTTCCCCAAGA	*cptl*	F	TAACACCTCCCGCATCCC
	R	AGTCTTTGCGTAGCTGGCAT		R	CAGCCGCCCATCATAAAA
irf3	F	CTGGGTGATGGCTTGGAAGT	*ppar-α*	F	CGGTGTTTACGAAGCCCTCT
	R	AATCTCTTGGGGCTGTCTGC		R	GCTCCAGAGAGTTGAAGCGT
sod1	F	TTTTGAAGGGAACTGGC	*lipg*	F	ACTGGCTTCAGGATGAGCAC
	R	ATGATTCTTGTTGTAGGGA		R	ATTCTGCCAATGGTCCCTCG
cat	F	CAACATGCCACCAGGAA	*apln*	F	TGGTGATTGTGCTCTTGGTGT
	R	CACATCGGACCATCACG		R	GCGTCTTCTCTTTGAGCTGGT
gpx4a	F	AAACGCTCATCCTCTGTG	*lpl*	F	CACTGAATGGCTCACCGACT
	R	ATCATCCAAGGGTCCATA		R	AGAGGTCGGGTAGTGCTGAT
gpx1a	F	GTGCCCTGCAATCAGTTTGG	*hsl*	F	CTGTTGAGCGTCTGGTCACT
	R	TCACAAACAAACCCAGGCCT		R	CCAAAACCTTGACCAGCGTG
hk1	F	TGATGACTTGCGGCTACGAG	*atgl*	F	CCAAAGATGCGAGAAAGCGG
	R	CACACATGCGGCCATTATCG		R	GTGAGAGAGATTCCCAGCCG
gck	F	TGCCACGATGATTTCCTGCT	*atf3*	F	CGAAGCACCCTCTCCACATT
	R	AAGTCCTCTAGCTCCCCGTT		R	CCTCTTCTGCCTACAGCGAG
glut1b	F	ATTGGAAGCGATCATGGGCA	*ccl11*	F	CCGTGCTGCGTTGATGTTAC
	R	GGAGCTTCTTCAGCACGGAT		R	ATCGGAGCAAAGCTGACCAT
glut4	F	TCTATACCCACCGGCTTCCA	*il-8*	F	ATTCTTCCCAACTCCCACTGC
	R	GTTTGATGTTGCTCTGCCCG		R	GGGCCTCAGGATTAAGGCAAA
glut6	F	AGGCATCACACCAATCCTGG	*junb*	F	TGAGTCGCCGGTTTATGAGG
	R	ATGGCAGCATCATACCTGGG		R	AGAAGGACATAGTGGGGGCT
irs1b	F	CAGCCTTGCACGTTACACAC	*ncf1*	F	TCAGCGAACCACAGAGGAAC
	R	ACACGAGGGTAGGAGCAGAT		R	TTCTTGCGGGTGTTGTCAGT
akt2	F	TGTTAGACAAGGACGGCCAC	*jnk*	F	CTCATCACGCCACCTAGCAT
	R	TACATCACCACGCCCAATCC		R	GCTCCTGTACTTGTGCCCTT

pepck1	F	TGTGCTCATCCCAACTCTCG	*p38*	F	TCCAGAAAACGACGTGGGAC
	R	AACACCTTCTGGTCTACGCC		R	AAGGCCGGTAGAGCTTCTTG
pk1	F	TTCGTTCAAATGCTGTGCCG			
	R	TGGAAGAGGGCAGGAAACAC			

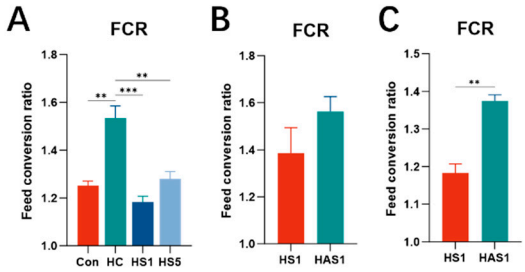

Figure S1. Feed conversion ratio (FCR) of tilapia under different experimental. **(A)** FCR at 4 weeks; **(B)** FCR at 2 weeks; **(C)** FCR at 4 weeks.