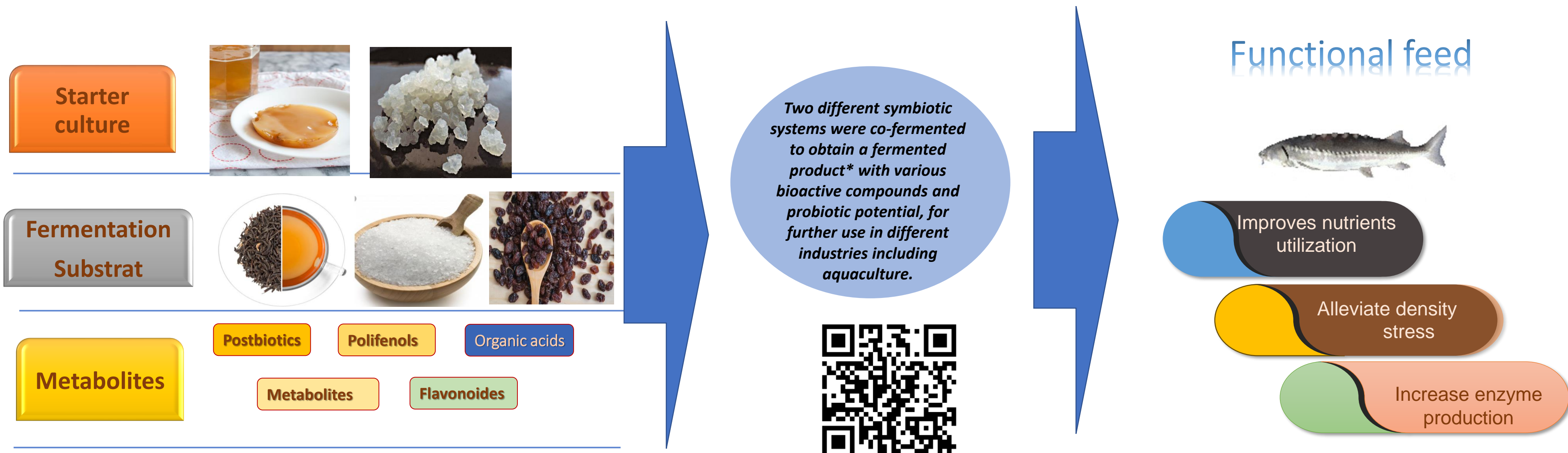


Growth, Lipid Peroxidation, Antioxidant Enzyme Activity and Biochemical Status of Siberian Sturgeon Fed Dietary Fermented Product with Kombucha and Milk Kefir Grains

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The main *objective* of the research is to evaluate the efficiency of a functional feed in which fermented product resulted from an artisanal culture of kombucha and milk kefir grains with black tea was incorporated.



Experimental Design

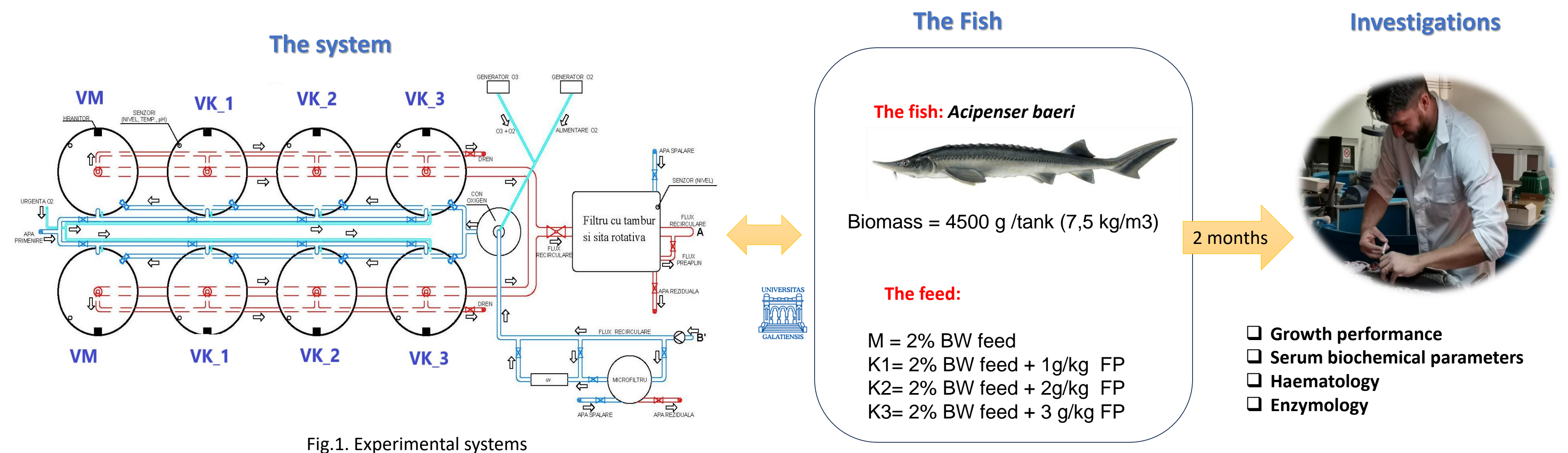


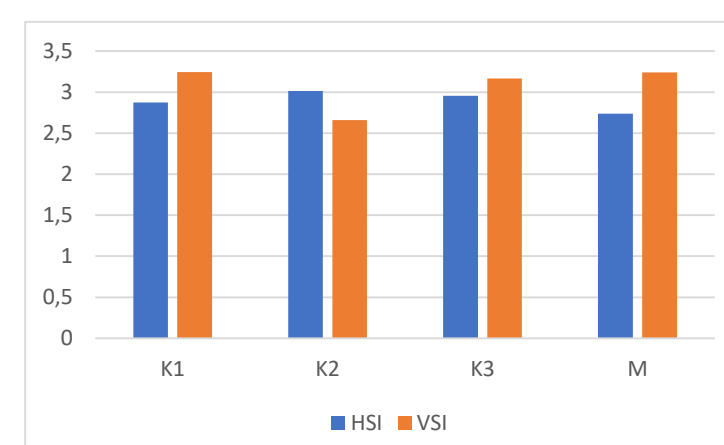
Fig.1. Experimental systems

Results

Fish growth

Table 1. Growth performance parameters

Parameters	K1	K2	K3	M
IW (g)	264,68±1,12	262,50±2,37	264,65±2,75	262,94±3,86
FW (g)	397,29±11,31	395,09±13,17	398,38±5,20	371,94±23,24
WG (g)	132,62±10,19 ^b	132,59±8,79 ^b	133,74±4,45 ^b	109,00±12,24 ^a
FI (g/day)	64,52±0,34 ^b	62,37±0,43 ^a	64,06±0,32 ^b	64,66±0,56 ^b
FCR	1,08±0,07 ^b	0,88±0,03 ^a	1,00±0,04 ^b	1,22±0,07 ^c
SGR	1,16±0,07 ^b	1,19±0,16 ^b	1,17±0,03 ^b	0,99±0,23 ^a
PER	1,88±0,14 ^b	2,11±0,06 ^c	1,85±0,08 ^b	1,52±0,29 ^a



The data for viscerosomatic (VSI) and hepatosomatic indices (HSI) were not showed significant differences for these parameters in sturgeons from different experimental groups (P>0.05). The short period of experiment might be the reason beyond these results. However, a slight increase of HSI comparing with control should be noticed. The VSI in K2 variant is also notable suggesting lower intestinal fat.

The data for gonadosomatic index (GSI) show th highest value for VK1 variant. The increased GSI comparing with the control variant suggest that supplementation with FP accelerated the gonad development. It is known that additives modulate gastrointestinal microbial communities (Hoseinifar et al., 2018) and therefore can affect central nervous system function (Ringø et al., 2018). The relation of these factors can influence reproductive performance through various processes. However the mechanisms behind our results should be demonstrated by dosage of sexual hormones.

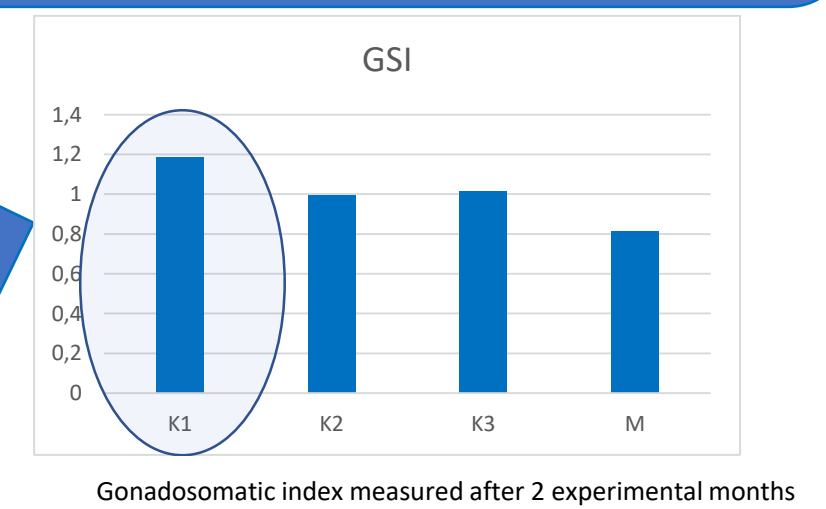


Fig.2. Fish somatic indexes

Health profile

The haematological parameters showed a presumptive metabolic intensification in direct corelation with the concentration of FP. Health profile showed improved parameters for K1 and k2 concentrations.

Table 3. Serum biochemical parameters of fish fed different concentration of FR

	K1	K2	K3	M
ALT (U/L)	11,25±0,89 ^a	12,00±1,83 ^a	12,33±1,51 ^a	13,17±0,75 ^b
AST (U/L)	402,13±17,76 ^a	405,25±16,18 ^a	427,00±18,96 ^b	482,17±16,65 ^c
ALP (U/L)	430,50±59,49 ^b	404,75±39,09 ^a	429,75±30,27 ^b	439,83±33,40 ^b
GLU (mg/L)	42,25±8,19 ^a	42,13±9,66 ^a	46,50±6,21 ^b	44,17±10,82 ^b
TP (g/dl)	2,75±0,46 ^a	2,80±0,11 ^a	2,88±0,35 ^a	3,00±0,63 ^a
CHOL (mg/dl)	112,50±20,79 ^b	118,13±12,65 ^b	121,13±12,40 ^c	90,17±5,74 ^a
TRIGL (mg/dl)	569,50±51,82 ^a	560,00±57,53 ^a	581,38±94,55 ^b	628,67±58,84 ^c
HDL-COL (mg/dl)	23,38±2,97 ^a	25,88±2,36 ^b	26,63±2,50 ^b	22,00±3,10 ^a
TL (mg/dl)	931,50±22,86 ^b	935,50±15,27 ^b	1006,38±19,85 ^c	760,33±24,43 ^a

Table 2. Haematological parameters of fish fed different concentration of FR

	Hb (g/dL)	Ht (%)	RBC (cells X 10 ⁶)	MCV (fL)	MCHC (pg)	MCH (g/dL)
K1	*7,30	*17,57	0,77	*248,38	42,04	*101,58
K2	6,58	16,96	0,74	243,09	40,21	93,61
K3	*7,35	16,16	0,76	235,11	*45,62	*100,80
M	6,64	16,31	0,73	239,05	36,39	92,10

Introducing FP in a dosage of 0,2% in the feed of sturgeon improved oxidative stress parameters.

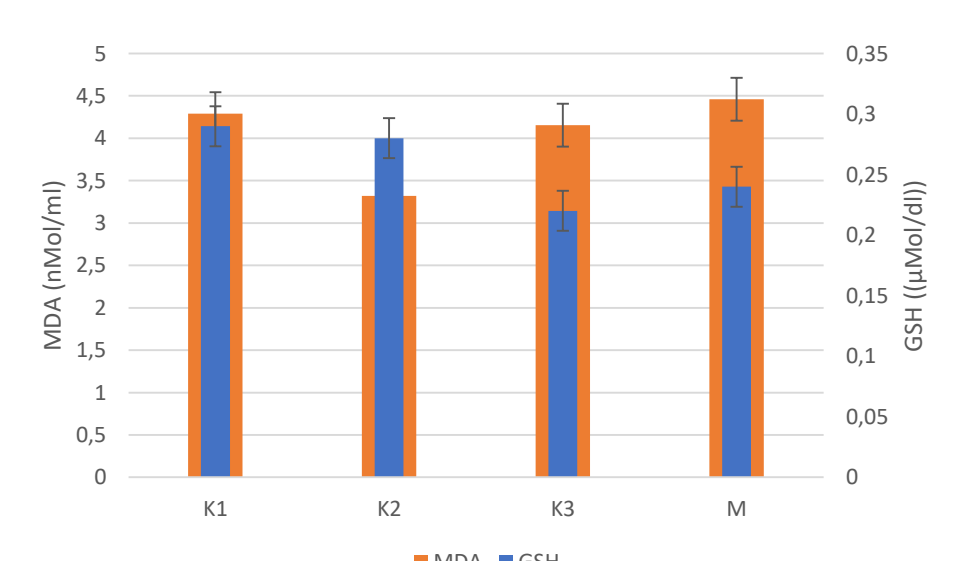


Fig.3. MDA and GSH in fish serum

Conclusions

The use of fermented product resulted from symbiotic activity off microorganisms in aquaculture represents a new promising research direction in the attempt to find environmental friendly feed additives. Our study, in the light of the first preliminary results, reveled that the experimental fermented product obtained from artisanal culture of symbiotic organisms has the potential to improve health status, enhance antioxidant defense system of sturgeons, stimulate maturation and increase feeding efficiency.