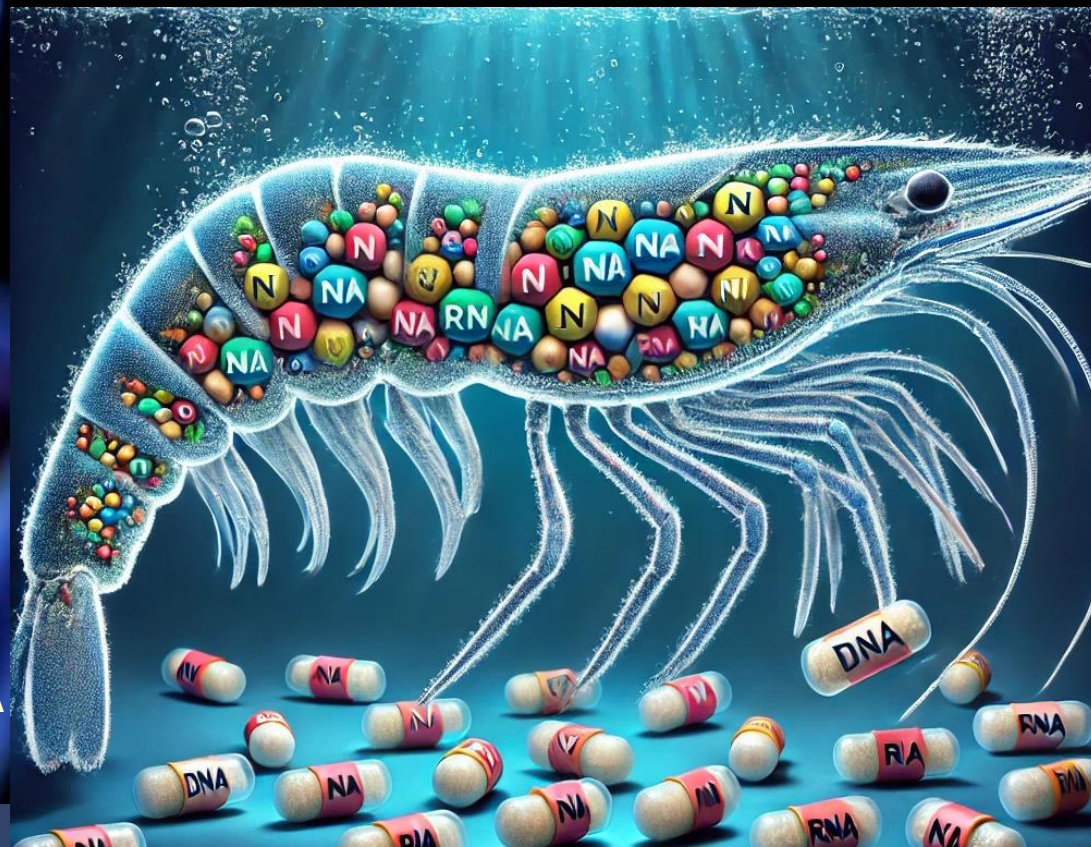
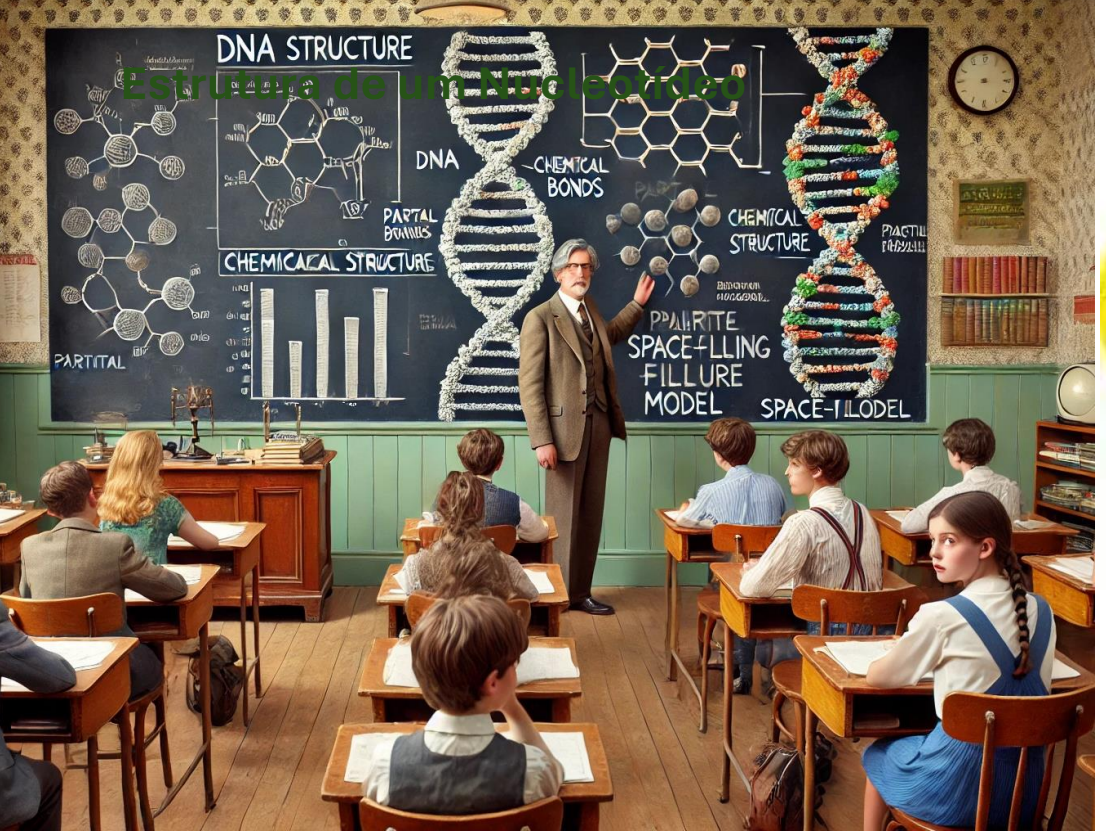
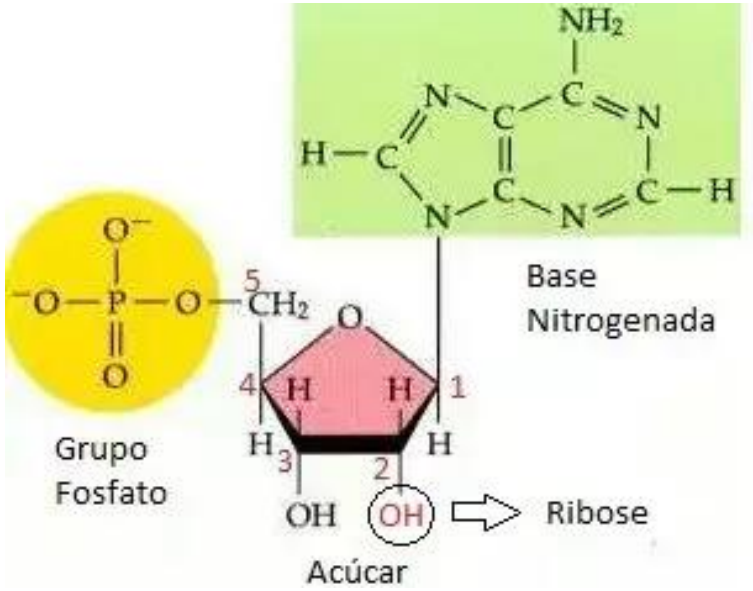
Melhorando a Imunidade e Sobrevivência do *Penaeus vannamei* com Nucleotídeos e Ácidos Nucleicos



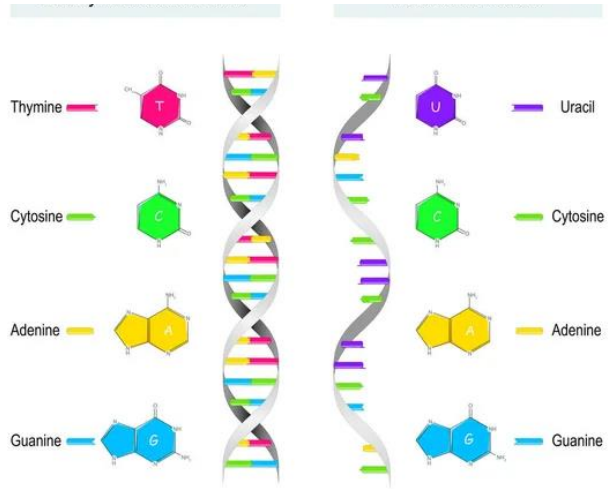
Marcelo Borba
Gerente de Produtos Aqua - Prosol SPA
Natal, 22 de Novembro de 2024



Estrutura de um Nucleotídeo



Estruturas DNA e RNA



Nucleotídeos e Ácidos Nucléicos

- *O que são?*
- *De que são feitos?*
- *Para que servem?*

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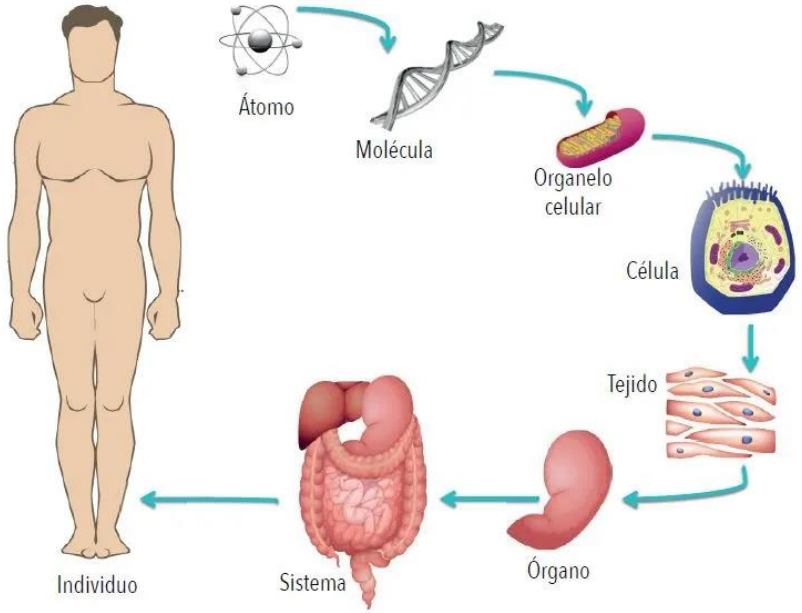
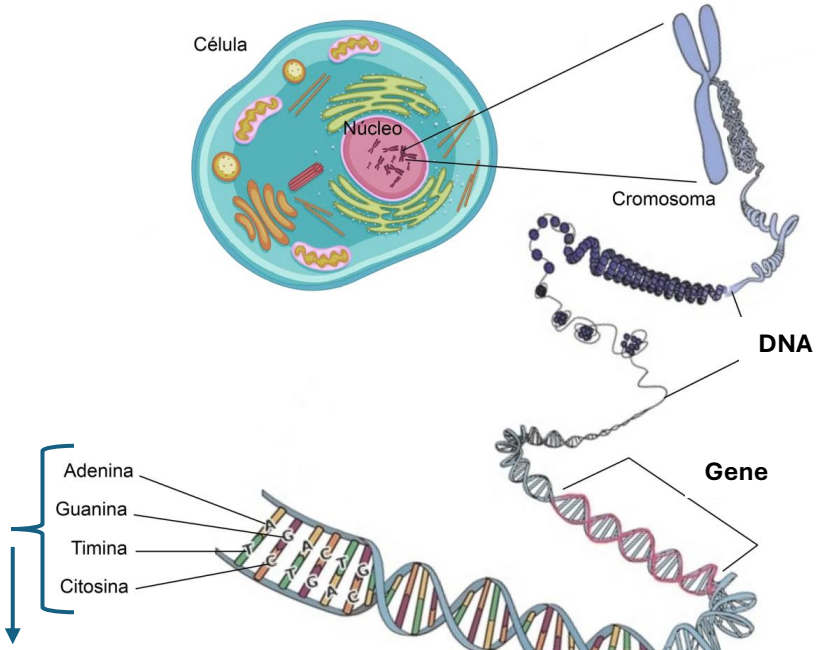
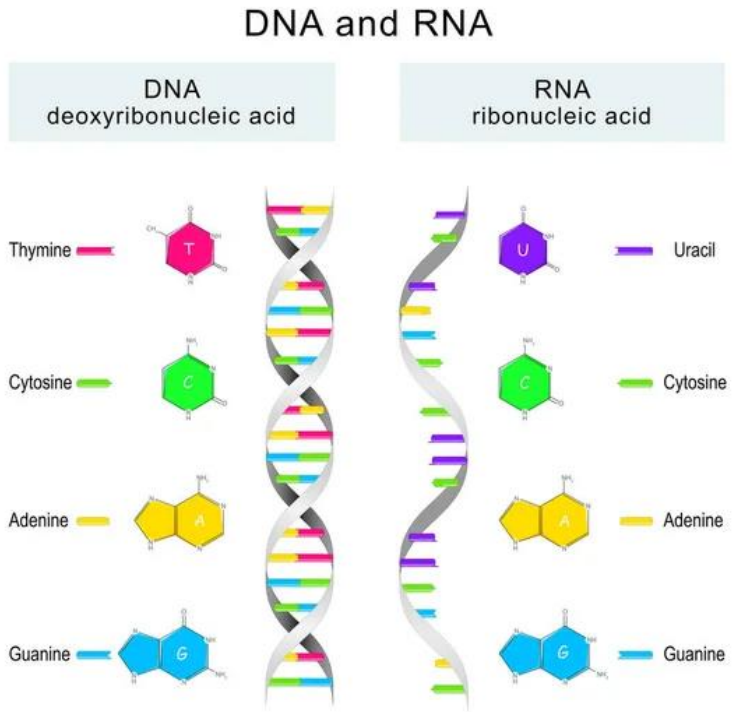
Nucleotídeos e Ácidos Nucléicos

O que são? De que são feitos?





Nucleotídeos



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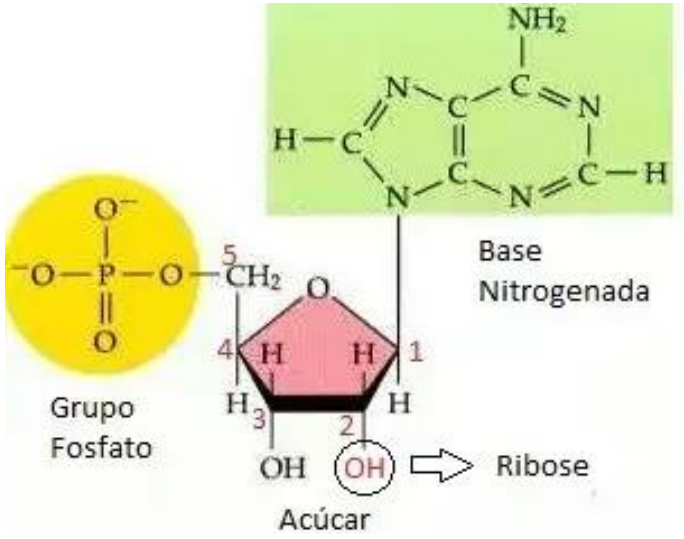
Nucleotídeos e Ácidos Nucléicos

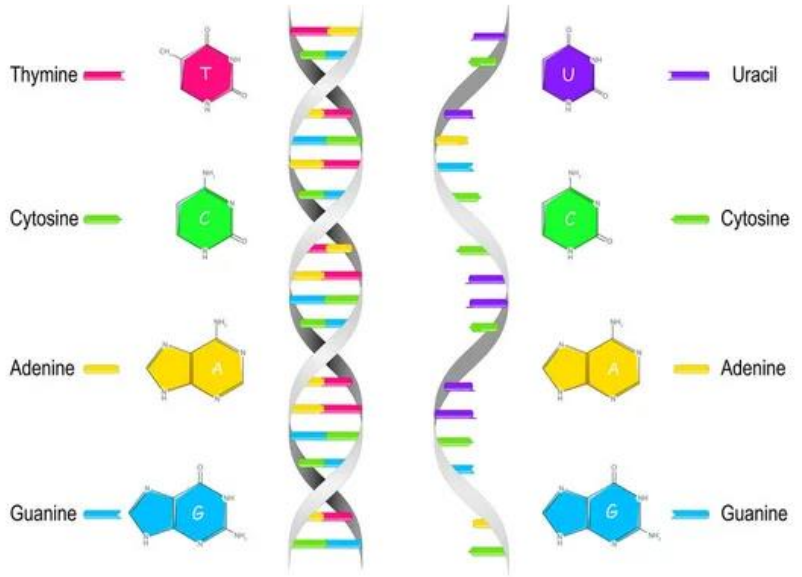
Nucleotídeos:
blocos de formação da vida



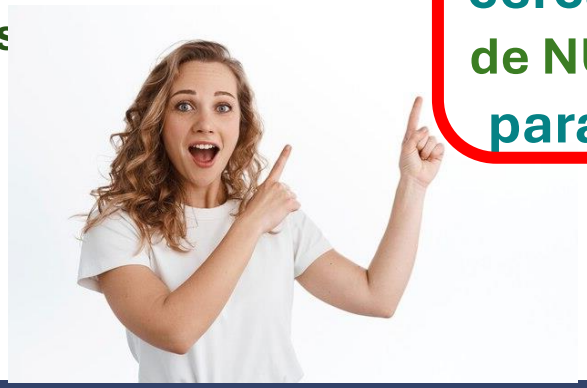
Estrutura molecular
"Monômeros

Cada nova célula necessita de cerca de 1 BILHÃO de NUCLEOTÍDEOS para se duplicar

DNA e RNA



Estrutura Helicoidal
"Polímeros"



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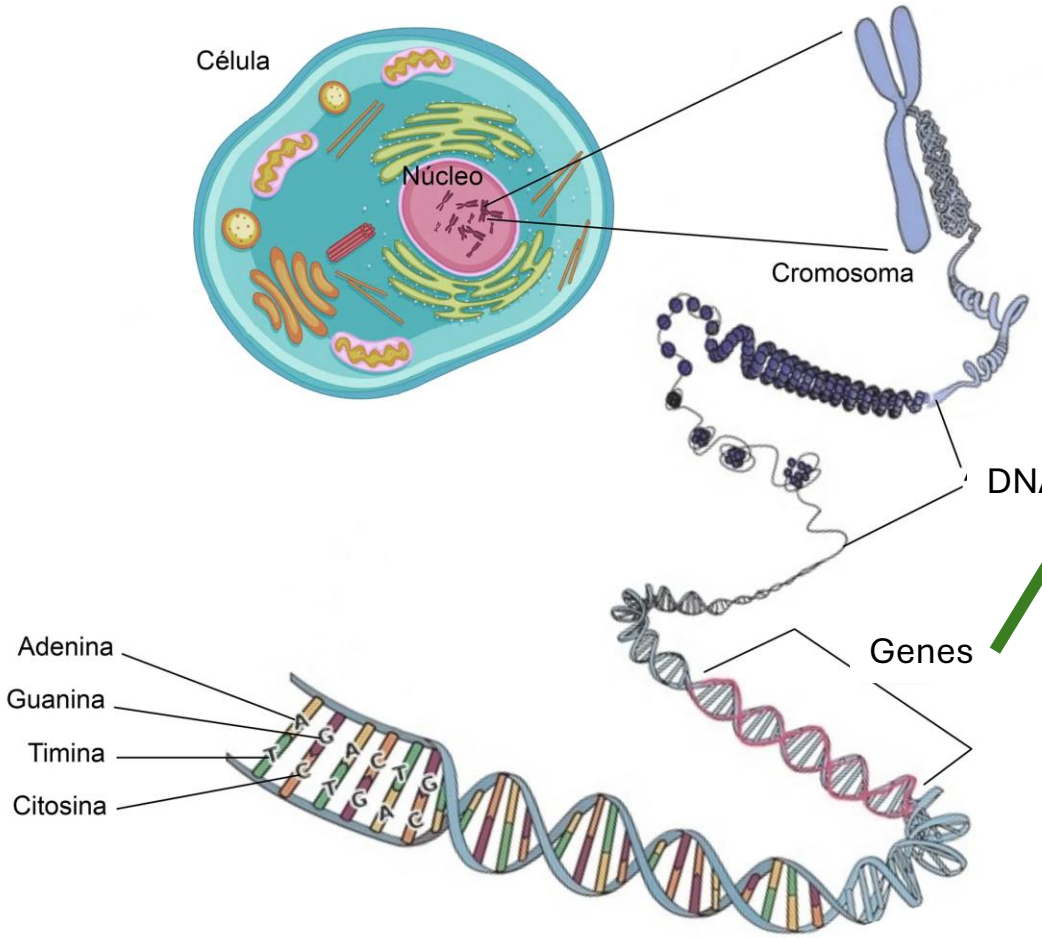
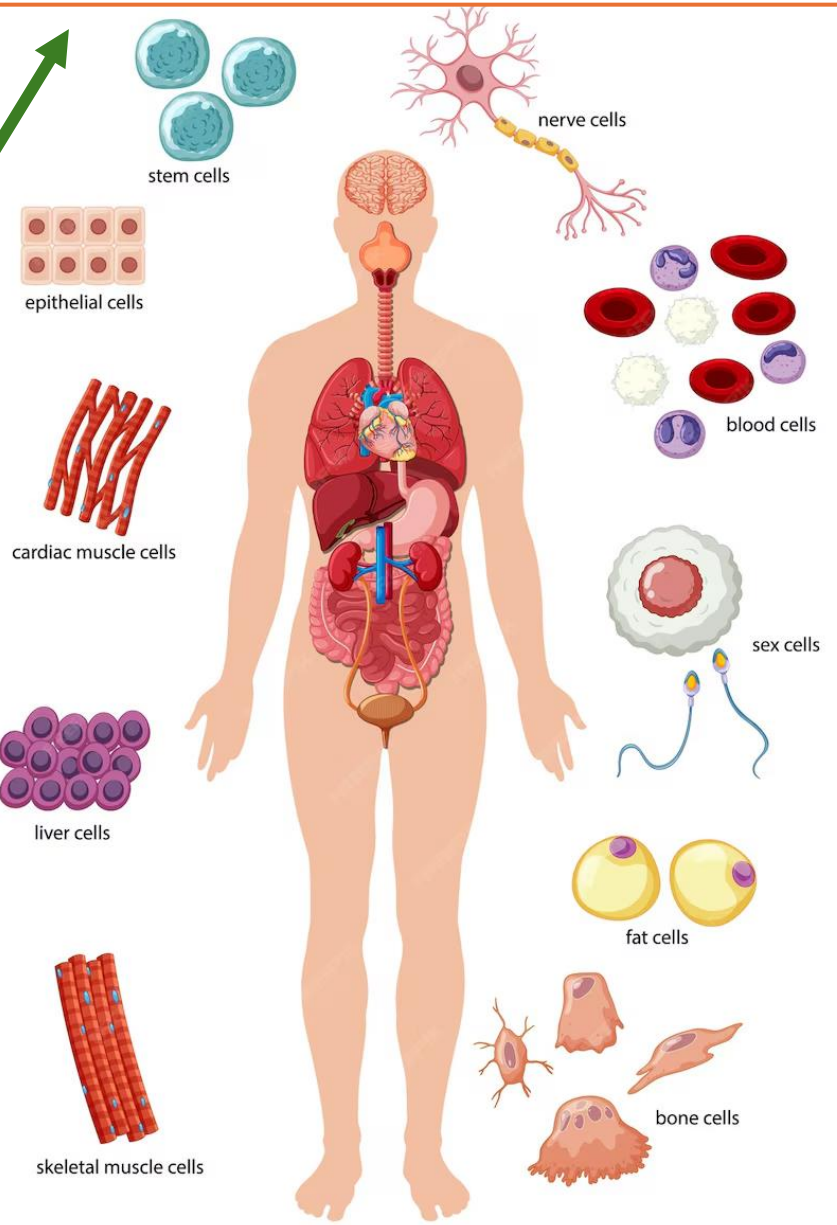
Codificação Genética & Expressão Gênica



Diferenciação Celular



PROSOL

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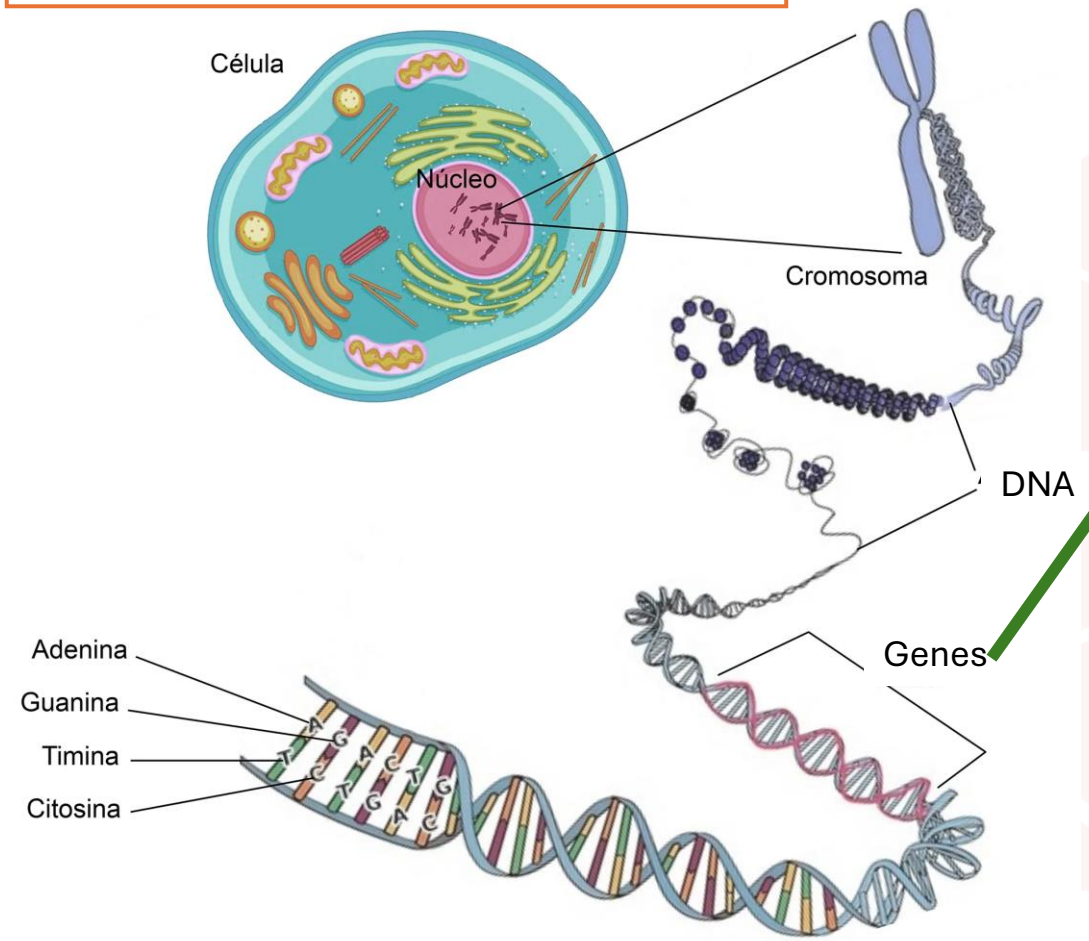
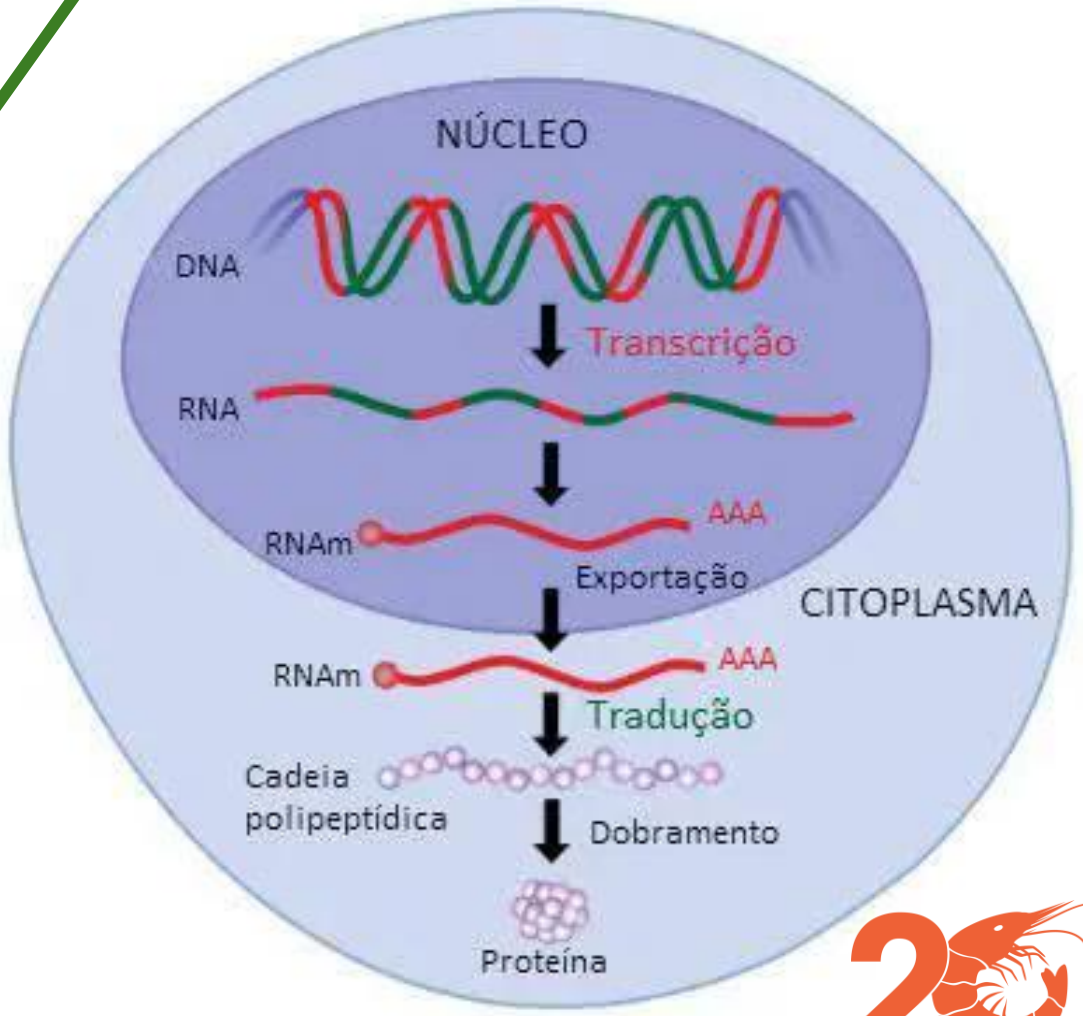
Codificação Genética & Expressão Gênica



Ácidos Nucleicos Síntese de proteínas



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Importância dos Nucleotídeos

Função Estrutural: Blocos de Construção do DNA e do RNA

Função de Transporte: Transferência de Energia Química

Função Metabólica: Síntese de Lipídeos, Carboidratos e Proteínas

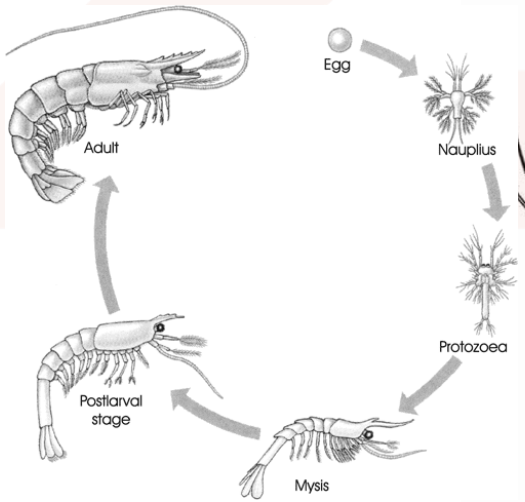
Função Bioquímica Síntese *"De Novo"*

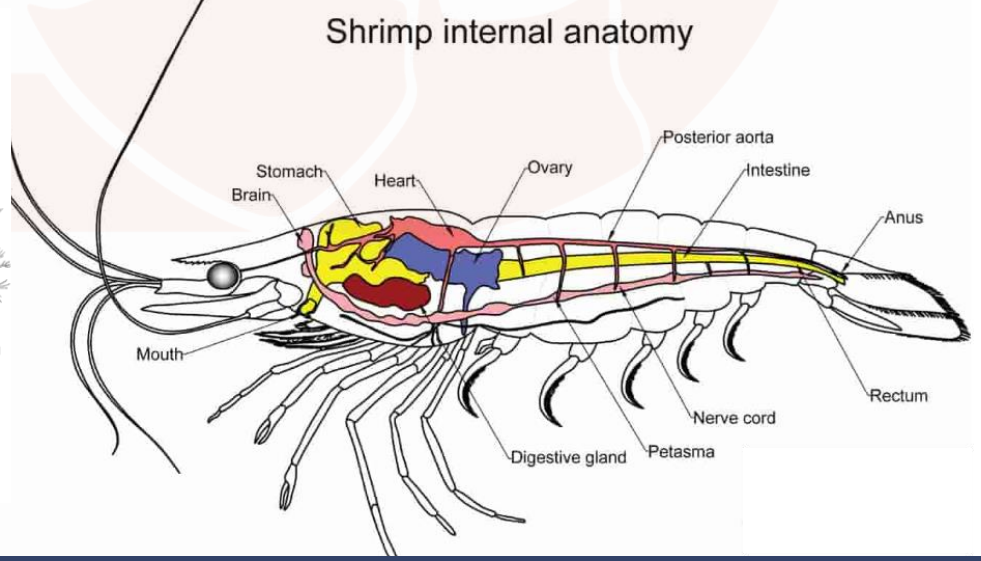
Multiplicação celular

Combustível
ATP, ADP, AMP

Coenzimas
NAD, FAD, CoA

Biossíntese celular



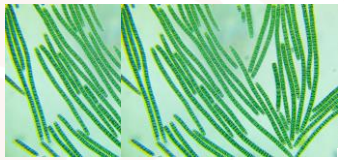


Principais Fontes para Rações Aqua

Farinha de Peixe

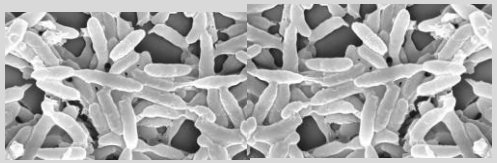
Farinha de Krill

Spirulina

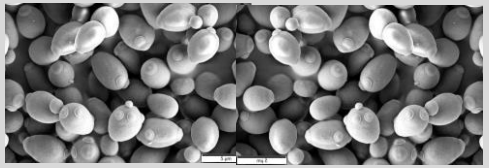


Farinha de Insetos

Leveduras



Kluyveromyces fragilis



Saccharomyces cerevisiae

Gargalos & Desafios

- Disponibilidade
- Qualidade
- Preço
- Questões Ambientais
- Certificações ASC, Global Gap

- Disponibilidade/Oferta
- Qualidade/Perfil Nutricional
- Preço
- Aceitação - Consumidor final

PROSOL

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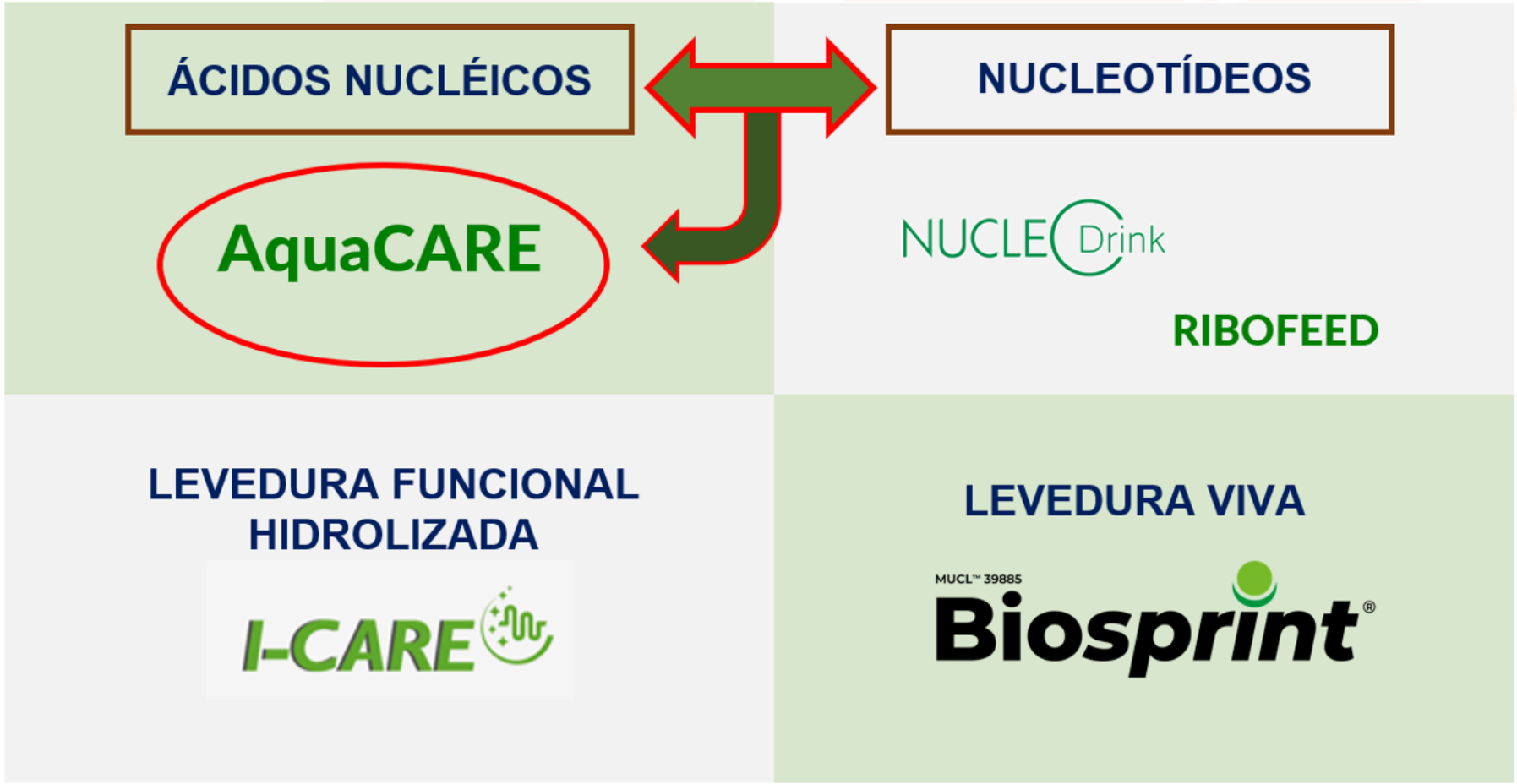
Feed portfolio +

PORTFOLIO *FEED* DA PROSOL

Potencializando a SAÚDE para aprimorar o DESEMPENHO.



Nossos produtos podem ser utilizados em uma ampla gama de aplicações.

20 anos
FENACAM'24

Aquaculture Reports
Volume 20, July 2021, 100738

Dietary nucleotides enhanced growth performance, carcass composition, blood biochemical, and histology features of European sea bass, *Dicentrarchus labrax* L

Fawzy I. Magouz [a], Mohamed M. Abdel-Rahim [b], Ayman M. Lotfy [b], Amira Mosbah [a], Mohamed Alkafafy [c], Hani Sewilam [d e], Mahmoud A.O. Dawood [a]

Aquaculture
Volume 540, 15 July 2021, 736729

Dietary exogenous supplementation of nucleotides strengthens the disease resistance, antioxidant capacity and immunity in the gill of on-growing grass carp (*Ctenopharyngodon idella*) following a challenge with *Flavobacterium columnare*

Huai-Mao Tie [a 1], Lin Feng [a b c 1], Wei-Dan Jiang [a b d], Pei Wu [a b d], Yang Liu [a b e], Jun Jiang [a], Sheng-Yao Kuang [f], Ling Tang [f], Xiao-Qiu Zhou [a b c]

Aquaculture Reports
Volume 21, November 2021, 100840

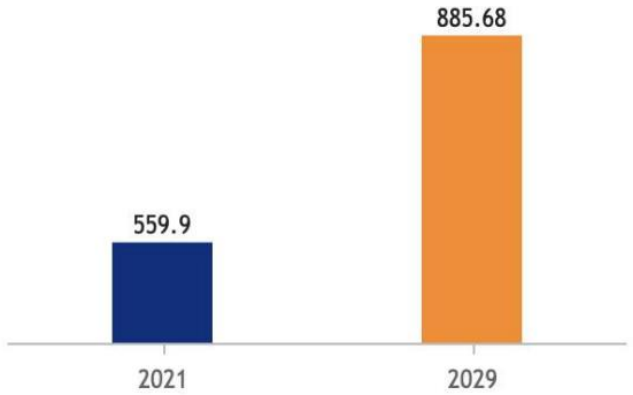
Effects of dietary nucleotides supplementation on growth, total haemocyte count, lysozyme activity and survival upon challenge with *Vibrio harveyi* in pacific white shrimp, *Litopenaeus vannamei*

frontiers | Frontiers in Marine Science
TYPE Original Research
PUBLISHED 18 May 2023
DOI 10.3389/fmars.2023.1145660

Global Feed Nucleotides Market

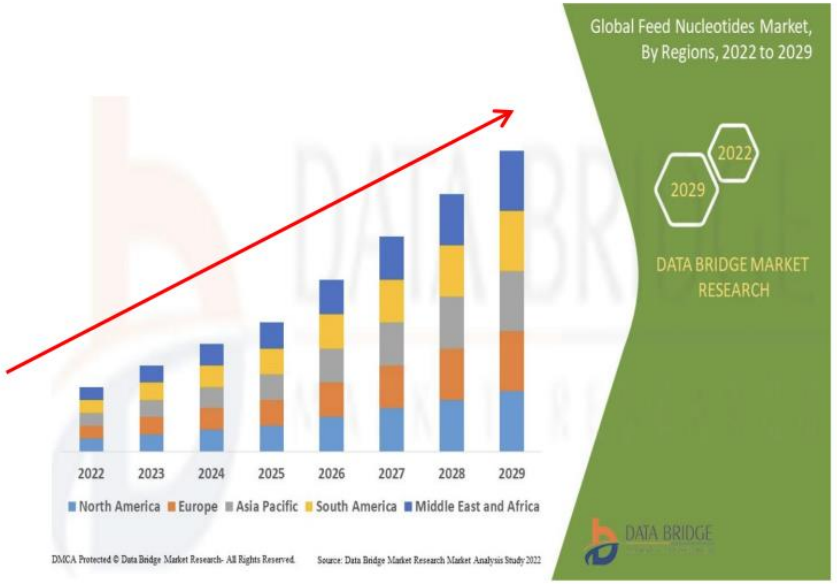
Market Size in USD Billion

CAGR : 5.90%



Source: Data Bridge Market Research Market Analysis Studv2022

Global Feed Nucleotides Market is Expected to Account for USD 885.68 Million by 2029



Source: Data Bridge Market Research Market Analysis Studv2022

Yeast-extracted nucleotides and nucleic acids as promising feed additives for European sea bass (*Dicentrarchus labrax*) juveniles

Nicole Francesca Pelusio[1], Luca Parma[1*], Enrico Volpe[1], Sara Ciulli[1], Francesca Errani[1], Silvia Natale[1], Alessandra De Cesare[1], Valentina Indio[1], Paolo Carcano[2], Oliviero Mordenti[1], Pier Paolo Gatta[1] and Alessio Bonaldo[1]

[1]Department of Veterinary Medical Sciences, University of Bologna, Ozzano Emilia, Italy, [2]Prosol S.p.A., Bergamo, Italy

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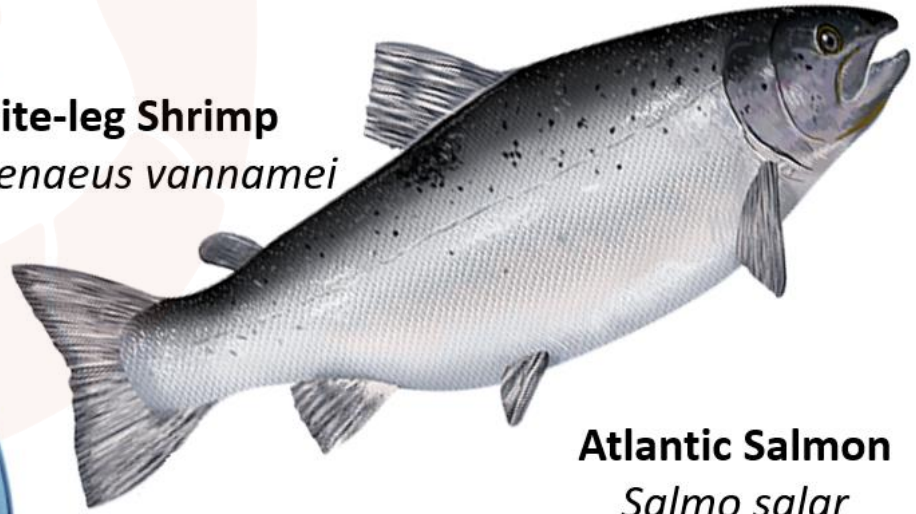
AquaCARE

European Seabass
Dicentrarchus labrax

White-leg Shrimp
Lithopenaeus vannamei



Atlantic Salmon
Salmo salar

20 anos
FENACAM'24
www.prosol-spa.it

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CAMARÕES & PEIXES

AquaCARE é uma nobre especialidade à base de levedura desenvolvida para

Essencial para estágios iniciais e condições desafiadoras, o AquaCARE melhora o desempenho dos animais, reforça a resistência a doenças, suporta o equilíbrio da microbiota e aumenta o status antioxidante.

QUANDO E POR QUÊ?

ESTÁGIOS INICIAIS CAMARÃO & PEIXE	ANTES E DEPOIS DO MANUSEIO	DESAFIOS AMBIENTAIS	DOENÇAS E ESTRESSORES	BAIXA INCLUSÃO DE FARINHA DE PEIXE
Maior Crescimento	Recuperação Mais Rápida	Alívio do Estresse Oxidativo	Resposta Imune Aumentada	Expressão Gênica Anti-inflamatória

prosol-spa.it

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Kasetsart University
Tailândia

Efeitos de nucleotídeos e RNA derivados de levedura na dieta sol desempenho zootécnico, sobrevivência, respostas imunológic resistência à infecção por Vibrio parahaemolyticus em camar brancos-do-pacífico (Litopenaeus vannamei).

Contents lists available at ScienceDirect

Aquaculture Reports

journal homepage: www.elsevier.com/locate/aqrep

Effects of dietary yeast-derived nucleotide and RNA on growth performance, survival, immune responses, and resistance to *Vibrio parahaemolyticus* infection in Pacific white shrimp (*Litopenaeus vannamei*)

Tirawat Rairat [a], Niti Chuchird [a,*], Arunothai Keetanon [a], Paolo Carcano [b], Marcello Comi [c], Wolfgang Koppe [d]

[a] Department of Fishery Biology, Faculty of Fisheries, Kasetsart University, Bangkok 10900, Thailand
[b] Prosol S.p.A., Via Carso, 99, 24040 Madone, BG, Italy
[c] Department of Human Science and Quality of Life Promotion, Università Telematica San Raffaele, Via di Val Cannuta 247, 00166 Rome, Italy
[d] Simplyfish AS, Baldersgate 12, 4011 Stavanger, Norway

ARTICLE INFO

Keywords:
Bacterial diseases
Feed additive
Kluyveromyces fragilis
Nucleotide
Ribonucleic acid

ABSTRACT

Nucleotides (NT) and RNA from yeast extracts are gaining interest as high-value feed additives. The present study intended to evaluate the influences of yeast derived-NT and RNA on the growth performance, survival, immune responses, and resistance to *Vibrio parahaemolyticus* infection in Pacific white shrimp. In Experiment 1, postlarvae were distributed into 7 groups, corresponding to 7 experimental diets: control, NT 0.25, NT 0.50, NT 0.75, RNA 0.25, RNA 0.50, and RNA 0.75 g/kg feed. They were fed the experimental diets for 45 days. Then, their body weights, survival rates, immune parameters, and *Vibrio* spp. counts in the hepatopancreas and intestines were determined. In Experiment 2, the shrimp from Experiment 1 were challenged by immersion with *V. parahaemolyticus* at 10^5 CFU/mL. Each group was fed the same diet for another 10 days to assess the disease resistance performance. The results revealed that the shrimp body weights of all groups were similar suggesting that neither NT nor RNA exerts the growth-promoting effect. However, the average survival rates of the NT and RNA groups were in the range of 89–93 %, significantly higher than that of the control (83 %). These increased survivals were in line with the reduction in the hepatopancreatic and intestinal *Vibrio* spp. counts and the elevated immune parameters in the NT and RNA-fed shrimp. At day 10 after the bacterial challenge, the highest survival rates were observed in the RNA 0.50 and 0.75 g/kg feed groups (81 % and 82 %, respectively), followed by the RNA 0.25 (70 %) and NT 0.75 g/kg feed (68 %), and significantly higher than the positive control (54 %). In short, both yeast-derived NT and RNA, especially the RNA at the dose of 0.50–0.75 g/kg feed groups, showed promising health benefits effects in the Pacific white shrimp, notably the improved immune function and disease resistance.

1. Introduction

Nucleotides (NT) are basic units of nucleic acids (RNA and DNA) and play a key role in several biochemical processes. NT consists of nitrogenous bases (i.e., purines and pyrimidines), pentose sugar (i.e., ribose and deoxyribose), and phosphate group(s). However, NT are traditionally not considered to be an essential nutrient because they can be produced endogenously under normal conditions via a salvage pathway in which the NT is synthesized from the nitrogenous bases and nucleosides formed during RNA and DNA degradation and *de novo* synthesis from amino acids and other molecules (Carver and Walker, 1995; Grimble and Westwood, 2001; Li and Gatlin, 2006). However, the production of NT may be insufficient to fulfill its demand in certain conditions such as infection, stress, or during rapid growth (Hess and Greenberg, 2012; Hossain et al., 2020). Thus, supplementation of exogenous NT can potentially be useful in these circumstances. The beneficial effects of dietary NT on human health regarding gastrointestinal growth and development, hepatic function, and immune system are documented (Carver and Walker, 1995; Hess and Greenberg, 2012). In addition, the advantages of using dietary NT in fish and shrimp

* Corresponding author.
E-mail address: ffisntc@ku.ac.th (N. Chuchird).

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Available online 4 October 2022

AquaCARE

Ingredientes	Porcentagem (%)
Farinha de peixe 58%	3.00
Farinha de peixe 65%	19.00
Farinha de krill	2.33
Hidrolisado de peixe (50% MS)	4.50
Farinha de aves	6.00
Farinha de lula	1.86
Farinha de soja (46% PB)	23.80
Fermento de soja Bio-Pro 480	3.71
Farinha de trigo 33%	17.80
Semente de milho	6.00
Mistura de óleo de peixe/lecitina (1:3)	8.28
Premix vitamínico*	1.30
Carbonato de cálcio	0.09
Aglutinante para pellets	0.56
DL-metionina	0.80
Fosfato monossódico	1.00

Produtos Testados:

Composição	AquaCARE (NA)*	Nucleotídeos (NT)**
Proteína (%)	60	53
Nucleotídeos (%)	8	16,5
Nucleosídeos (%)	1	2,75
Ácidos Nucleicos (%)	26,5	7,7

NA* - Ácidos Nucleicos (RNA) NT** - Nucleotídeos

Foram estudados sete grupos experimentais, conforme a seguir:

Nome da Fórmula	Dieta Controle	NT 1 (g/ton)	NT 2 (g/ton)	NT 3 (g/ton)	NA 1 (g/ton)	NA 2 (g/ton)	NA 3 (g/ton)
Nucleotídeos (NT)	-	250	500	750	-	-	-
AquaCARE (NA)	-	-	-	-	250	500	750

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Desenho Experimental

Ensaio de Crescimento

- **Tanques por Tratamento:** Triplicata
- **Sistema de Água:** Estático
- **Salinidade da Água:** 25-30 ppt
- **Densidade de Estocagem:** 120 PL_{12}/m^2
- **Peso Inicial:** PL_{12}
- **Duração:** 45 dias

Ensaio de Desafio

O ensaio de crescimento foi seguido por um desafio com *Vibrio parahaemolyticus* (causador da síndrome das fezes brancas)

- **Tanques por Tratamento:** Triplicata
- **Duração:** 10 dias
- **Peso Corporal:** 1.5-2.0 gramas
- **Desafio bacteriano:** Por Imersão

Parâmetros Avaliados

- Crescimento
- FCA
- Taxa de sobrevivência(%) antes do desafio
- Contagem de Vibrio no hepatopâncreas e no intestinos
- Parâmetros imunológicos
- Histologia do HP e do intestinos
- Taxa de sobrevivência (%) após o desafio

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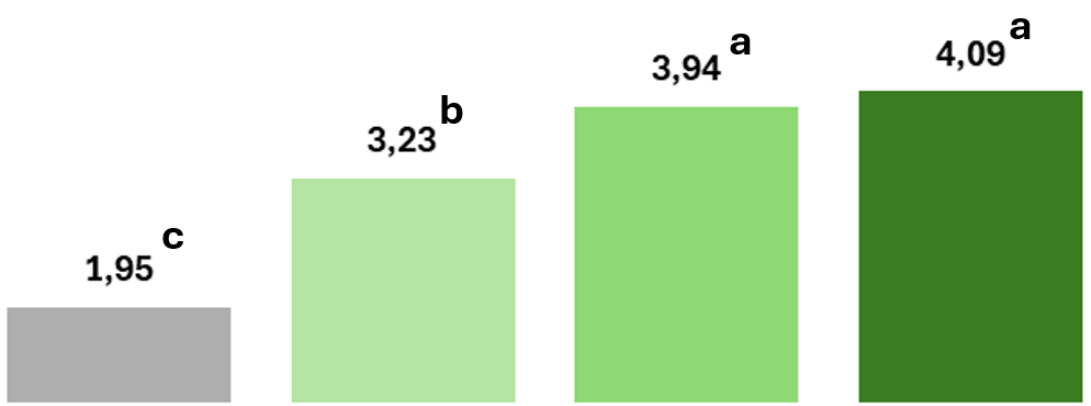
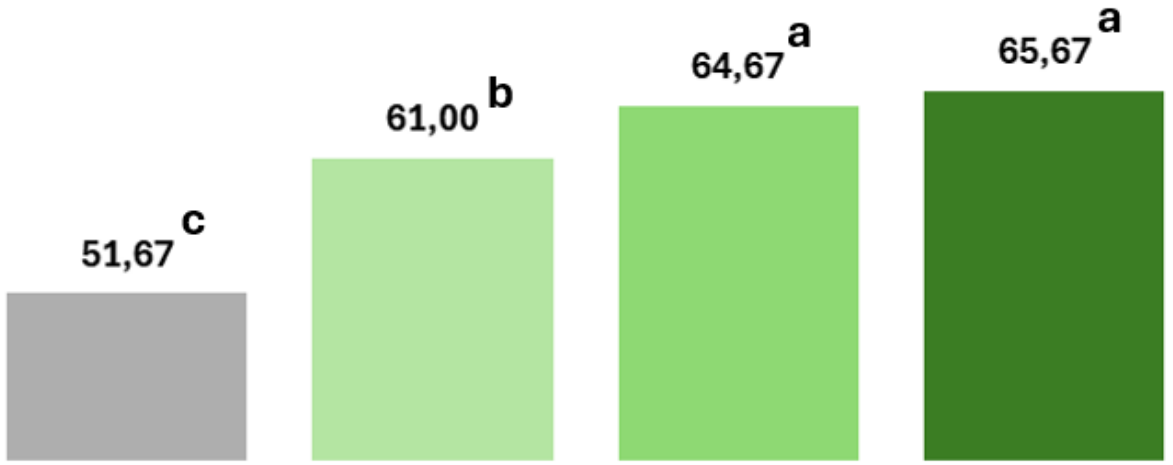
Contagem Total de Hemócitos - CTH
(x 10^6 cell/mL)



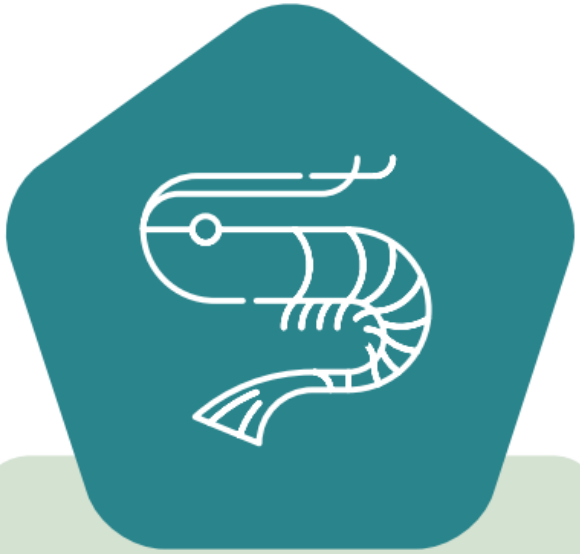
Aumento (%)		Diferença Estatística
Controle	-	c
Controle para AquaCARE (0.25 kg/ton)	65,6%	b
Controle para AquaCARE (0.25 kg/ton)	102,1%	a
Controle para AquaCARE (0.75 kg/ton)	109,7%	a

Atividade Fagocífica (%)



Aumento (%)		Diferença Estatística
Controle	-	c
Controle para AquaCARE (0.25 kg/ton)	18,1%	b
Controle para AquaCARE (0.25 kg/ton)	25,2%	a
Controle para AquaCARE (0.75 kg/ton)	27,1%	a

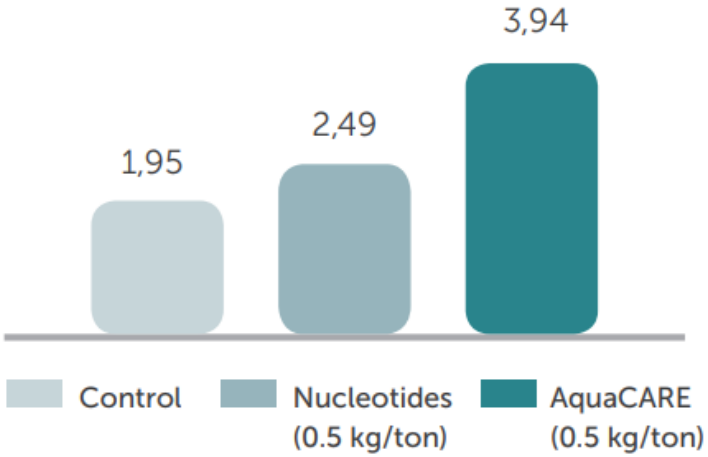
AquaCARE



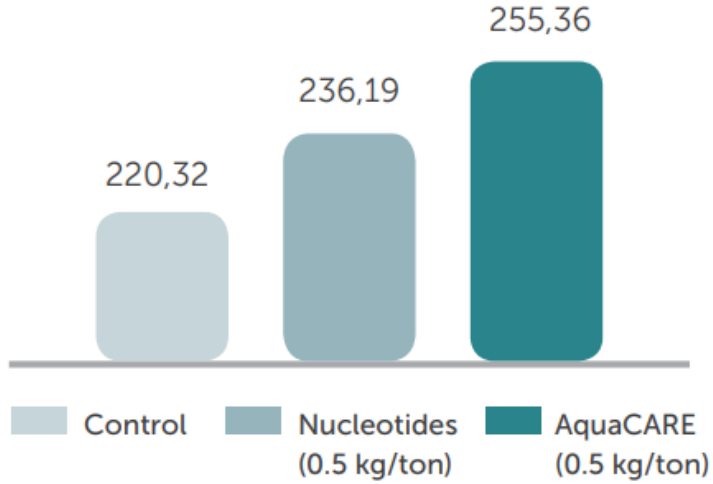
Whiteleg shrimp *L. vannamei* fed AquaCARE supplemented diet achieved better results in immune response, antioxidative status and bacteriological count in the hepatopancreas and intestine, culminating on expressive survival rate.

Bacterial challenge scientific trial with *Vibrio parahaemolyticus* causing White Feces Syndrom.

Total Hemocyte Count (x 10^6 cell/ml)



Phenoloxidase Activity (units/min/mg protein)



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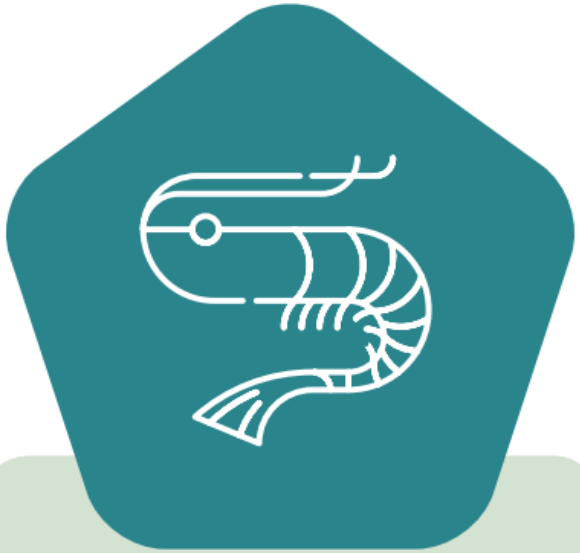
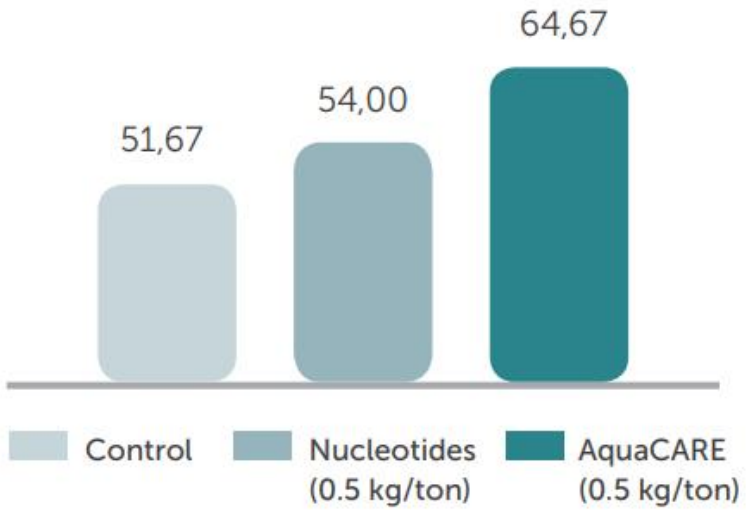
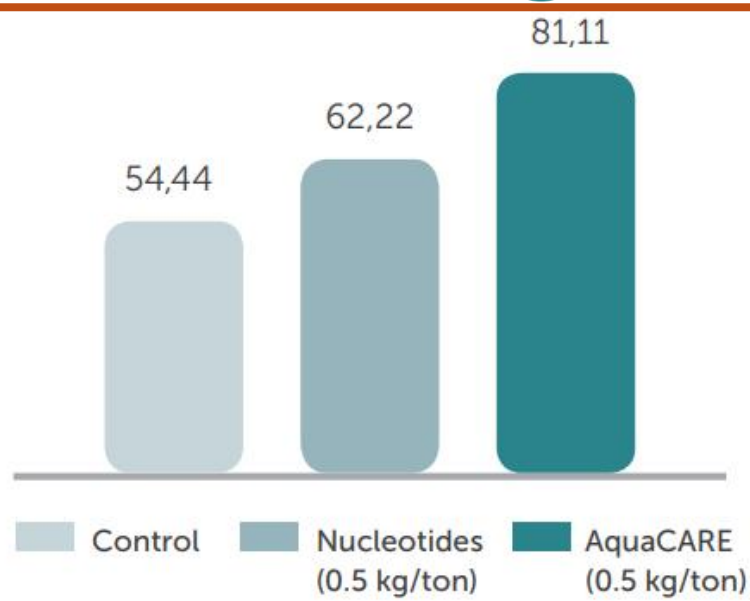


Whiteleg shrimp *L. vannamei* fed AquaCARE supplemented diet achieved better results in immune response, antioxidative status and bacteriological count in the hepatopancreas and intestine, culminating on expressive survival rate.

Phagocytosis (%)



Survival Rate +49% INCREASED SHRIMP SURVIVAL



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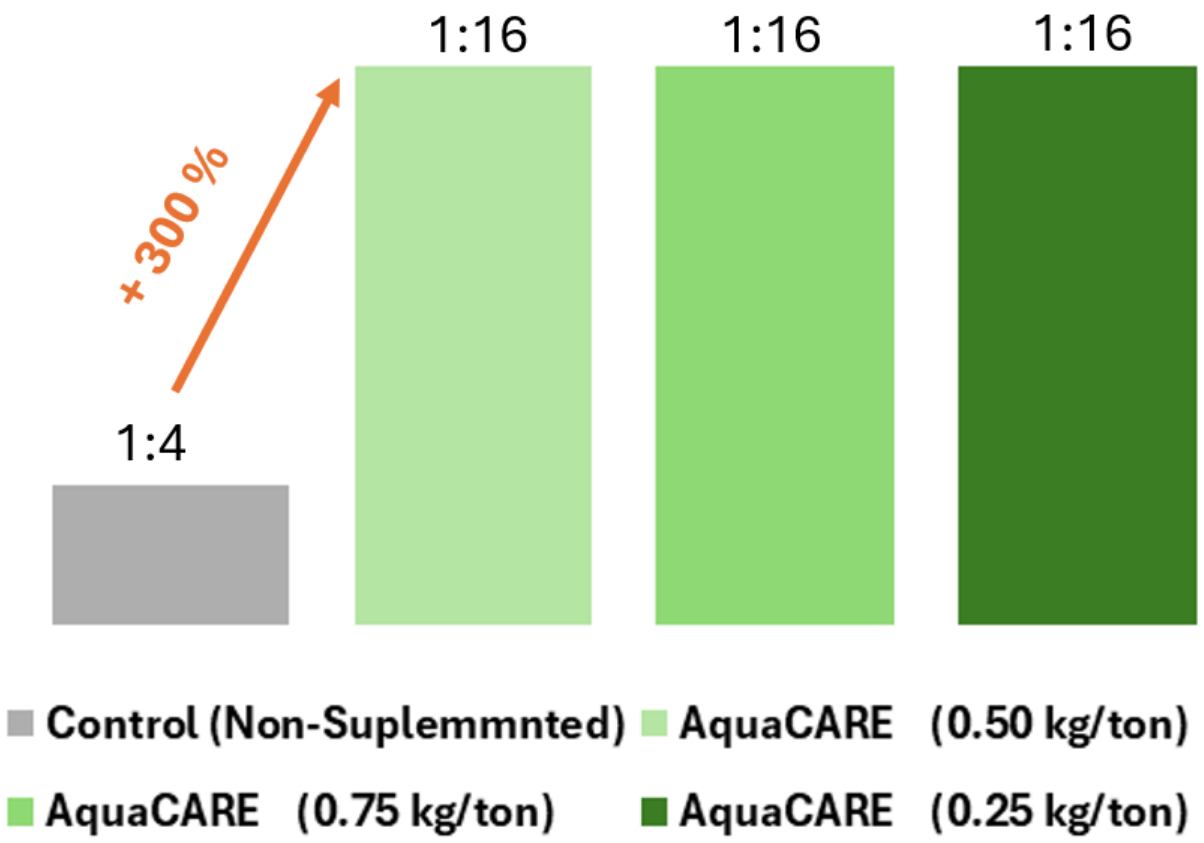
Atividade Bactericida da Hemolinfa



O gráfico representa o aumento da atividade bactericida na hemolinfa do camarão-branco-do-Pacífico quando suplementado com AquaCARE, em comparação com o grupo controle. A atividade bactericida do grupo controle foi eficaz em uma diluição de 1:4, enquanto o grupo suplementado com AquaCARE apresentou uma atividade aprimorada em uma diluição de 1:16, demonstrando um aumento de 300% na capacidade bactericida. Este aprimoramento indica uma melhoria substancial na resposta imune do camarão quando alimentado com o suplemento AquaCARE.

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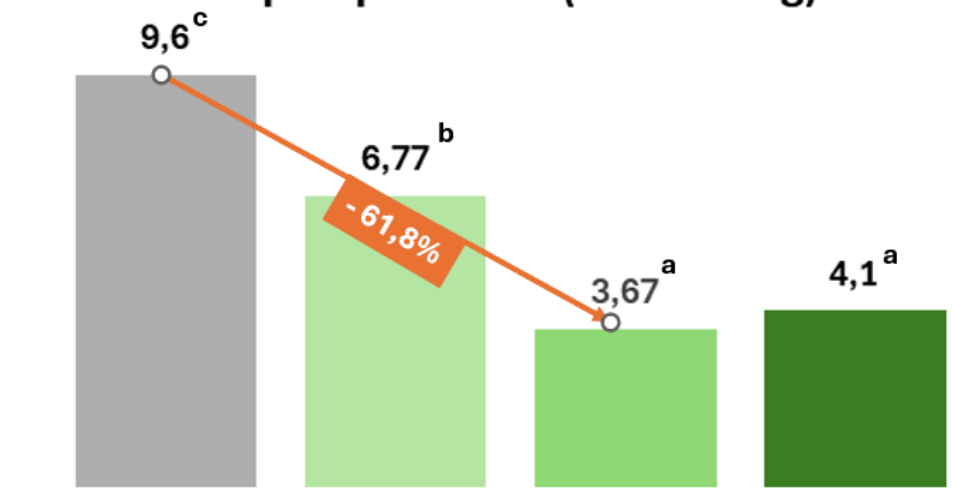
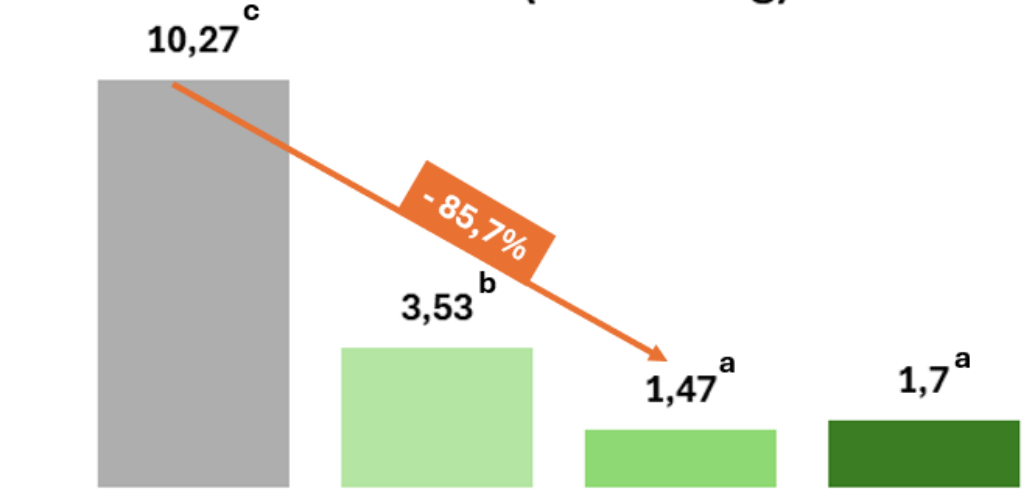
Contagem Total *Vibrio spp.* Hepatopâncreas (10^3 CFU / g)



Aumento (%)		Diferença Estatística
Controle	-	c
Controle para AquaCARE (0.25 kg/ton)	29,5%	b
Controle para AquaCARE (0.25 kg/ton)	61,8%	a
Controle para AquaCARE (0.75 kg/ton)	57,3%	a

Contagem Total de *Vibrio spp.* Intestinos (10^2 CFU / g)



Aumento (%)		Diferença Estatística
Controle	-	c
Controle para AquaCARE (0.25 kg/ton)	65,6%	b
Controle para AquaCARE (0.25 kg/ton)	85,7%	a
Controle para AquaCARE (0.75 kg/ton)	83,4%	a

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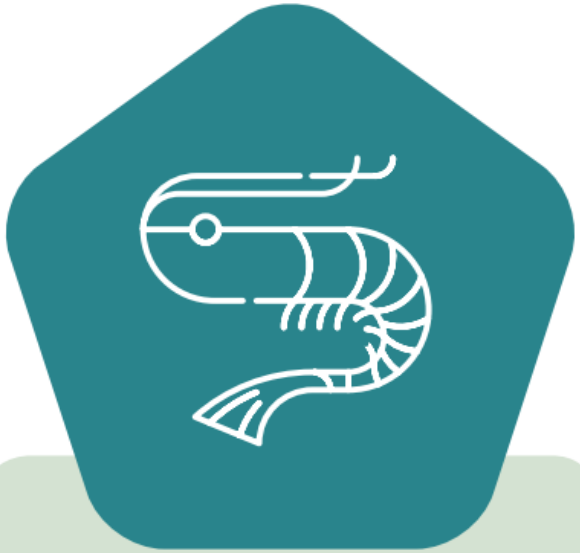
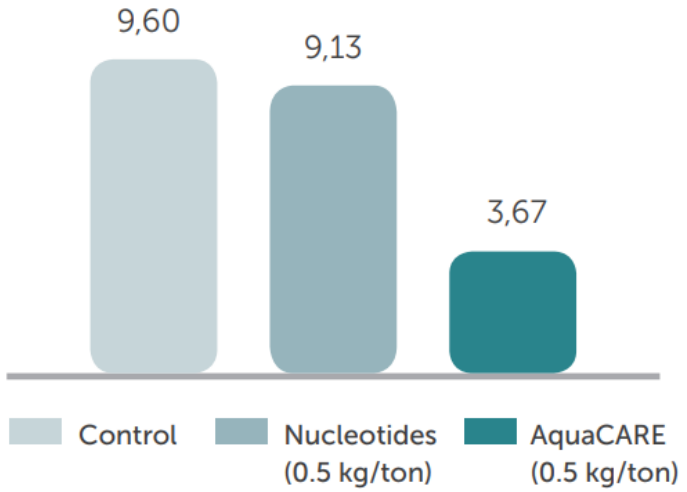


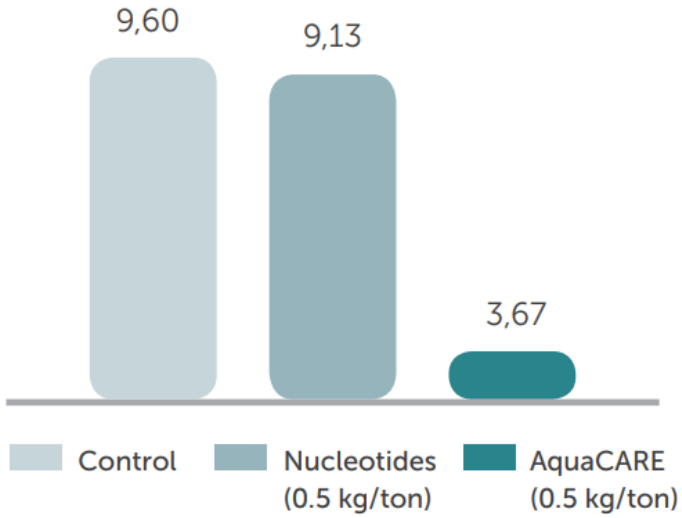
Whiteleg shrimp *L. vannamei* fed AquaCARE supplemented diet achieved better results in immune response, antioxidative status and bacteriological count in the hepatopancreas and intestine, culminating on expressive survival rate.

Bacterial challenge scientific trial with *Vibrio parahaemolyticus* causing White Feces Syndrom.

Average Total Vibrio spp. Count Hepatopancreas (x 10^3 CFU/g)



Average Total Vibrio spp. Count Intestines (x 10^2 CFU/g)



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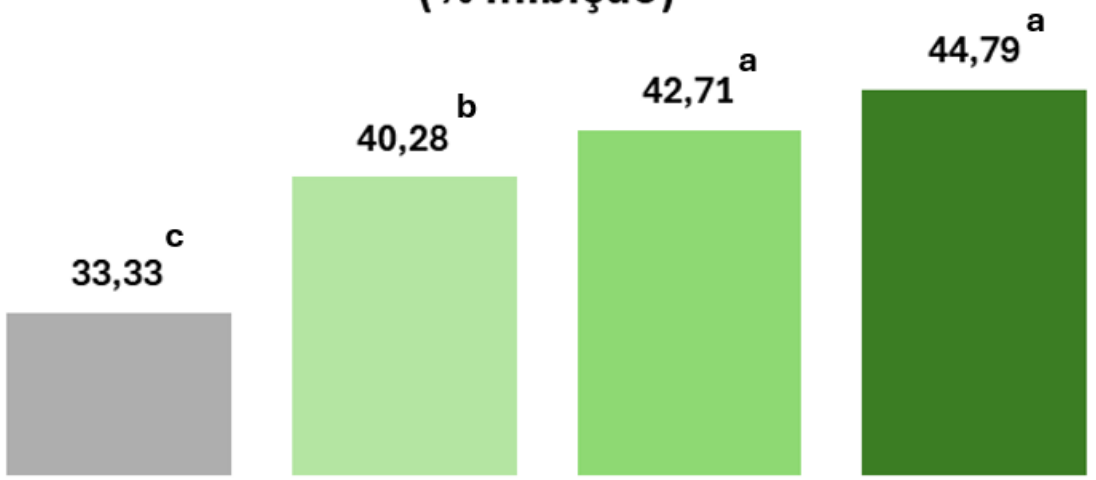
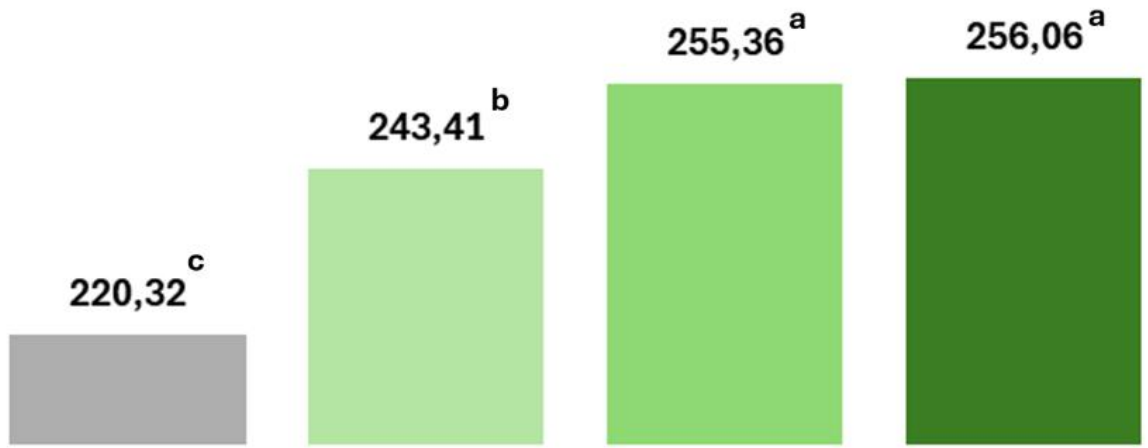
Atividade da Superoxido Dismutase (SOD) (% Inibição)



Aumento (%)		Diferença Estatística
Controle	-	c
Controle para AquaCARE (0.25 kg/ton)	20,9%	b
Controle para AquaCARE (0.25 kg/ton)	28,1%	a
Controle para AquaCARE (0.25 kg/ton)	34,4%	a

Phenol-Oxidase (PO) (units/min/mg protein)



Aumento (%)		Diferença Estatística
Controle	-	c
Controle para AquaCARE (0.25 kg/ton)	10,5%	b
Controle para AquaCARE (0.25 kg/ton)	15,9%	a
Controle para AquaCARE (0.25 kg/ton)	16,2%	a

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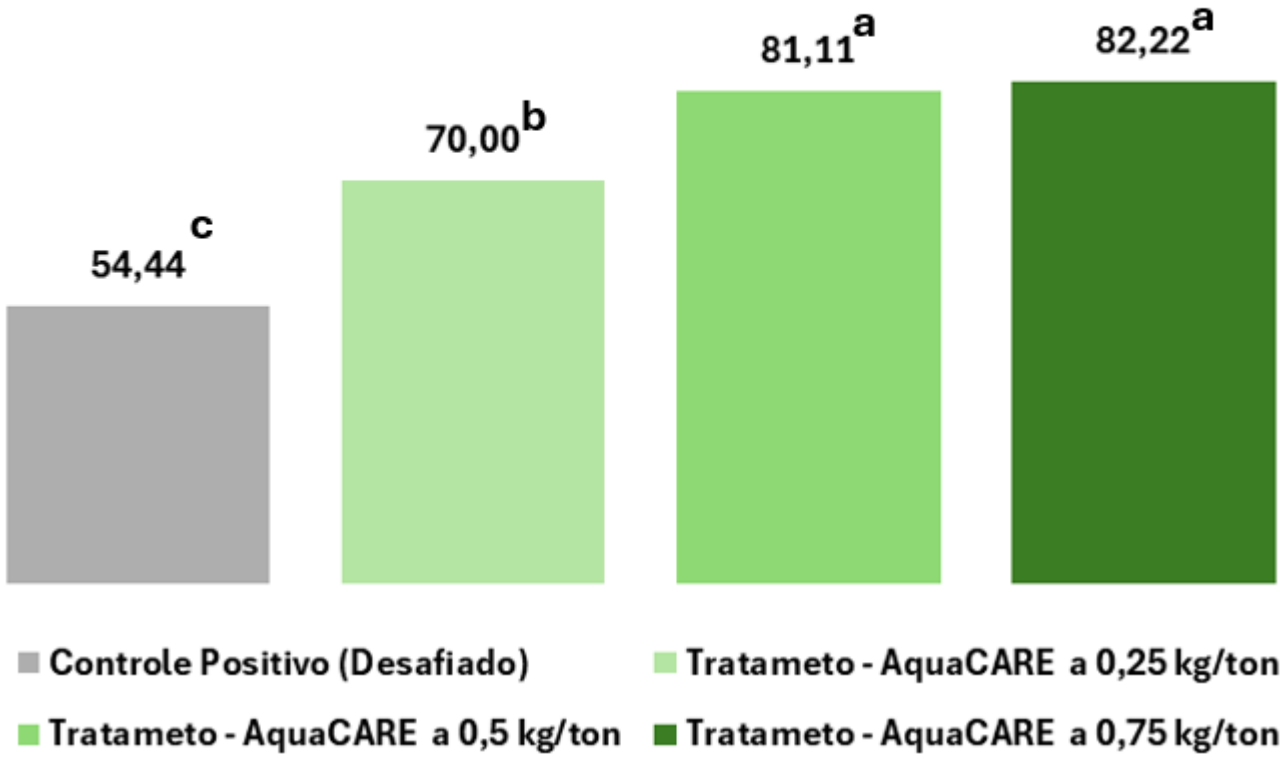
Sobrevivências dos Camarões após Desafio Bacteriano

Vibrio parahaemolyticus (AHPND)



c	b	a	a

Aumento (%)		Diferença Estatística
Controle Positivo (Desafiado)	-	c
Controle para AquaCARE (0.25 kg/ton)	28,6%	b
Controle para AquaCARE (0.25 kg/ton)	49,0%	a
Controle para AquaCARE (0.75 kg/ton)	51,0%	a

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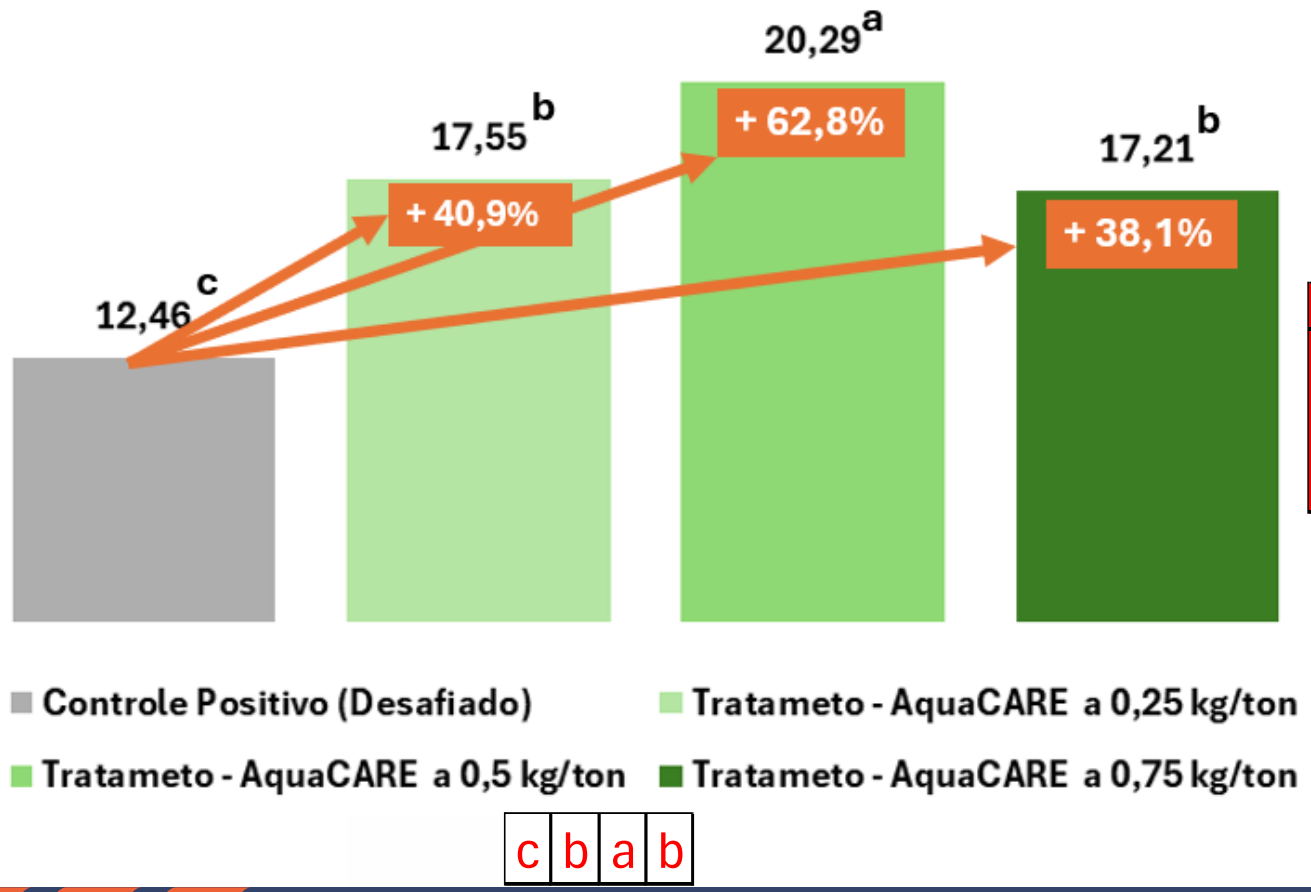
Ganho de Peso (%) pós Desafio Bacteriano

Vibrio parahaemolyticus (AHPND)



Aumento (%)		Diferença Estatística
Controle Positivo (Desafiado)	-	c
Controle para AquaCARE (0.25 kg/ton)	40,9%	b
Controle para AquaCARE (0.25 kg/ton)	62,8%	a
Controle para AquaCARE (0.75 kg/ton)	38,1%	b

c	b	a	b

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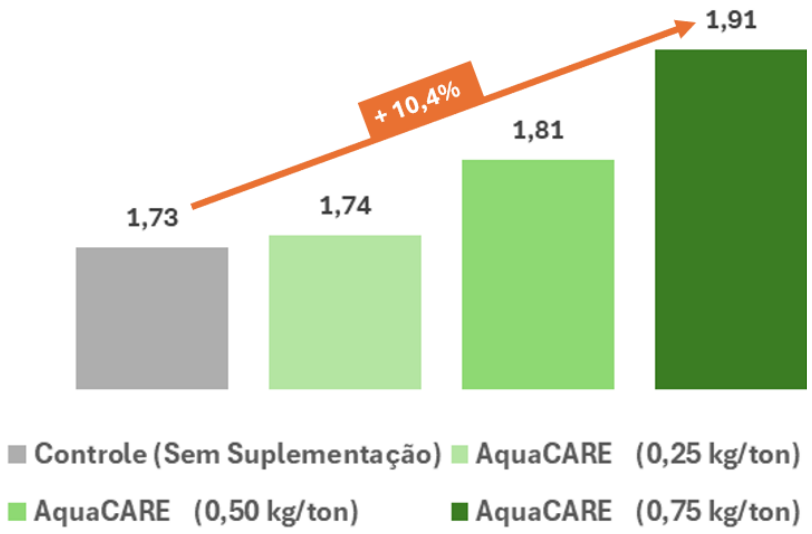
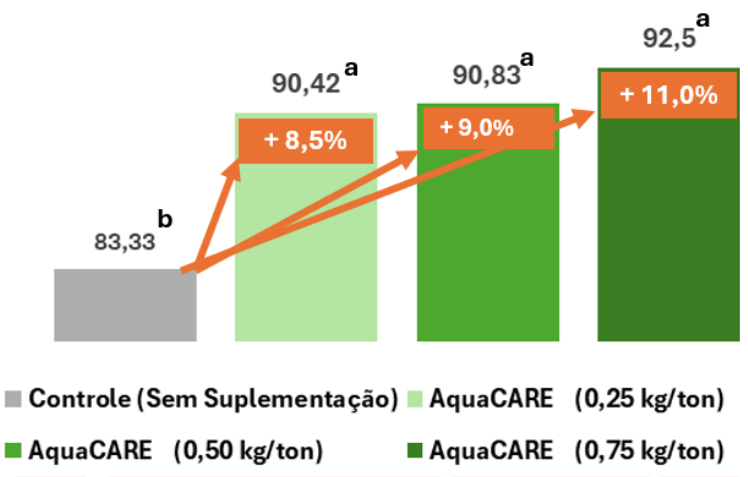
Peso Médio Final (g)

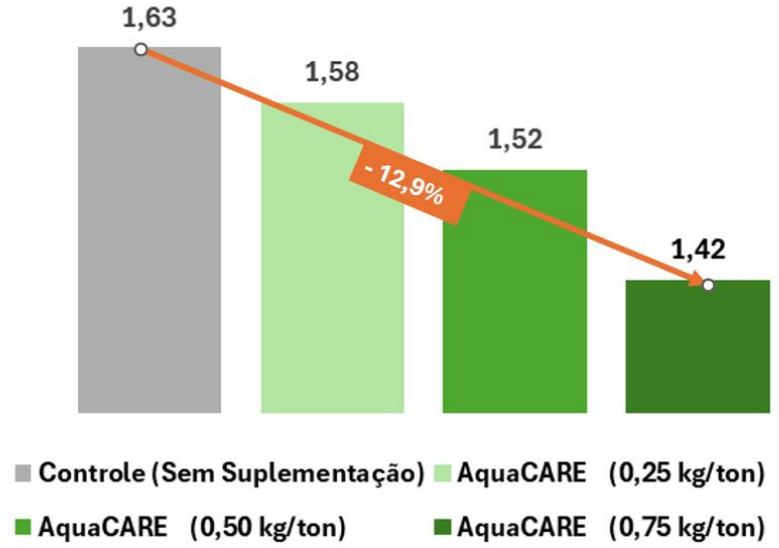


Sobrevivência (%)

Antes do Desafio Bacteriano



FCA



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ESTATÍSTICA GERAL DO ENSAIO

Key Parameters		Numerical and Statistical Differences Across Treatments							
		Control		AquaCARE (0,25 kg/ton)		AquaCARE (0,5 kg/ton)		AquaCARE (0,75 kg/ton)	
Immunological	Total Hemocyte Count - THC (10^6 cell/mL)	1,95	c	3,23	b	3,94	a	4,09	a
	Phagocytic Activity (%)	51,67	c	61,00	b	64,67	a	65,67	a
Gut Health	Total Vibrio spp. count Hepatopancreas (10^3 CFU / g)	9,60	c	6,77	b	3,67	a	4,10	a
	Vibrio spp. count Intestines (10^2 CFU / g)	10,27	c	3,53	b	1,47	a	1,70	a
Anti-Oxidant Enzymes	Superoxide Dismutase - SOD (% inhibition)	33,33	c	40,28	b	42,71	a	44,79	a
	Phenoloxidase - PO (units/min/mg protein)	220,32	c	243,41	b	255,36	a	256,06	a
Zootechnical	Weight Gain (%) after Bacterial Challange Vibrio parahaemolyticus (AHPND)	12,26	c	17,55	b	20,29	a	17,21	b
	Survival after Bacterial Challange Vibrio parahaemolyticus (AHPND)	54,44	c	70,00	b	81,11	a	82,22	a

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Muito obrigado

Many thanks

Muchas gracias

Grazie mille

Marcelo G. Borba
E-mail: m.borba@prosol-spa.it
Webiste: www.prosol-spa.it
Cel/Mob: +55 84 99907-7660