RECENT TRENDS & ISSUES IN FEED FORMULATION & ON-FARM FEED MANAGEMENT

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AQUAHANA

Top 20 aquaculture producers in 2020

(metric tonnes; APR % 2015-2020; FAO, 2022)

Top 10 aquaculture producers

	Country	Tonnes	APR %
1	China	70,483,538 (57.5%)	3.5
2	Indonesia	14,845,014 (12.1%)	-1.0
	India	8,641,286 (7.0%)	10.1
4	Viet Nam	4,614,692 (3.8%)	5.8
5	Bangladesh	2,583,866 (2.1%)	4.6
6	Korea Rep.	2,327,903 (1.9%)	6.8
7	Philippines	2,322,831 (1.9%)	-0.2
8	Egypt	1,591,896 est (1.3%)	6.3
9	Chile	1,505,486 (1.2%)	7.3
10	Norway	1,490,412 (1.2%)	1.5

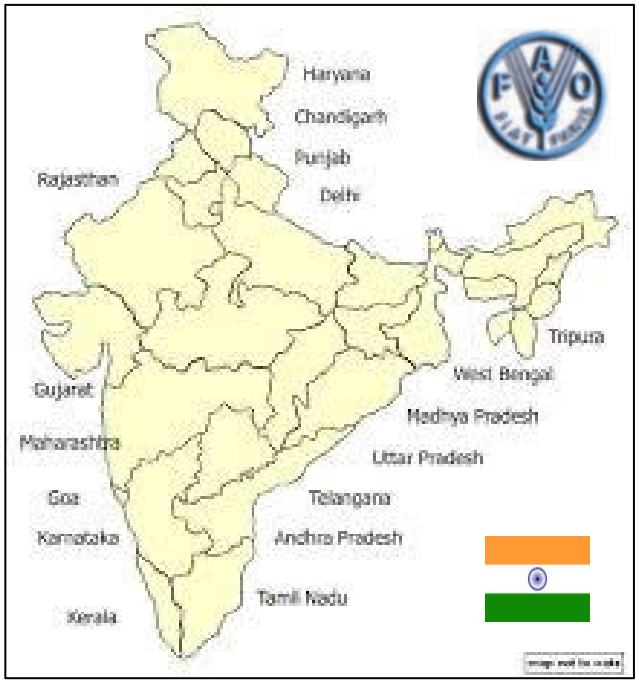
Top 11-20 aquaculture producers

	Country	Tonnes	APR %
11	Myanmar	1,145,018	2.7
12	Japan	996,297	-2.1
13	Thailand	962,467	0.9
14	Ecuador	774,568	12.7
15	Korea DR	680,300 est	3.7
16	Brazil	630,200	1.7
17	Iran	480,500 est	6.8
18	USA	448,535	1.0
19	Turkey	421,411	11.9
20	Cambodia	400,000 est	22.5

Total aquaculture production in 2020 was 122,580,187 tonnes & valued at US $ 281.5 billion

FISH	7,678,945 (88.9%)
CRUSTACEANS	944,041 (10.9%)
MOLLUSCS	13,000 (0.15%)
AQUATIC PLANTS	5,300 (0.06%)
TOTAL	8,641,286

INDIA - AQUACULTURE - 2020



Catla	3,286,134
Roho labeo	1,371,590
Freshwater fishes nei	1,223,417
Whiteleg shrimp	894,772
Striped catfish	613,600
Silver carp	549,460
Mrigal carp	289,619
Torpedo-shaped catfish	143,457
Marine fishes nei	118,724
Giant tiger prawn	31,032
Grass carp	29,072
Common carp	26,070
Orangefin labeo	15,647
Giant river prawn	9,128
Green mussel	9,000
Orange mud crab	7,900
Manipur osteobrama	5,665
Barramundi	5,311
Red seaweeds	5,300
Indian white prawn	1,209

Values given in Metric tonnes (FAO, 2022)

Top fed aquaculture species groups in 2020

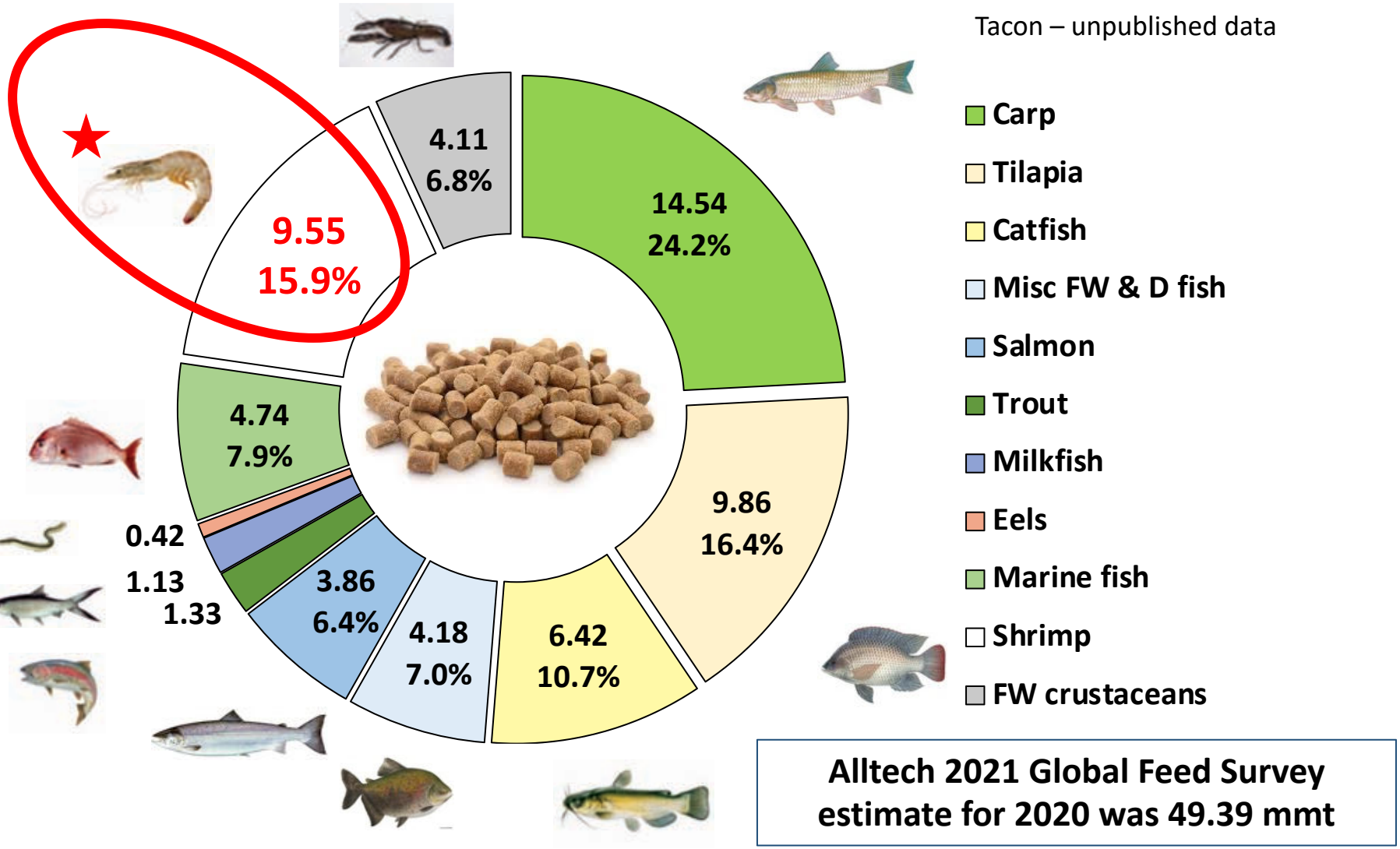
(FAO FishStatJ version 4.02.04, March 2022)

Top fed species	Million Tonnes	APR 2015-2020	$ Billion	Top producer
Chinese carp *	14.25	1.47%	32.76	China 89.0%
Shrimp	6.86	7.30%	41.55	China 31.4%
Tilapia	6.10	2.25%	12.30	China 27.1%
Catfishes	6.02	3.97%	9.69	Viet Nam 25.5%
Misc FW/D fish	5.68	4.02%	18.93	China 46.5%
FW crustaceans	3.81	14.51%	35.56	China 94.3%
Marine fish	3.48	7.34%	15.34	China 50.5%
Salmon	2.97	2.96%	16.67	Norway 46.7%
Milkfish	1.28	2.86%	2.04	Indonesia 63.2%
Trout	1.02	5.63%	4.73	Iran 19.3%
Eel	0.28	2.49%	2.13	China 87.9%
Total	51.77		191.7	

- Whiteleg shrimp is now the worlds top cultured fed species at 5,812,180 tonnes in 2020 (FAO, 2022)
- India – Whiteleg shrimp production estimated at 894,772 tonnes & Giant tiger prawn 31,032 tonnes

Total estimated global compound feed usage by major fed species groups was 60.14 million tonnes in 2020

(values given in million tonnes and as % total)

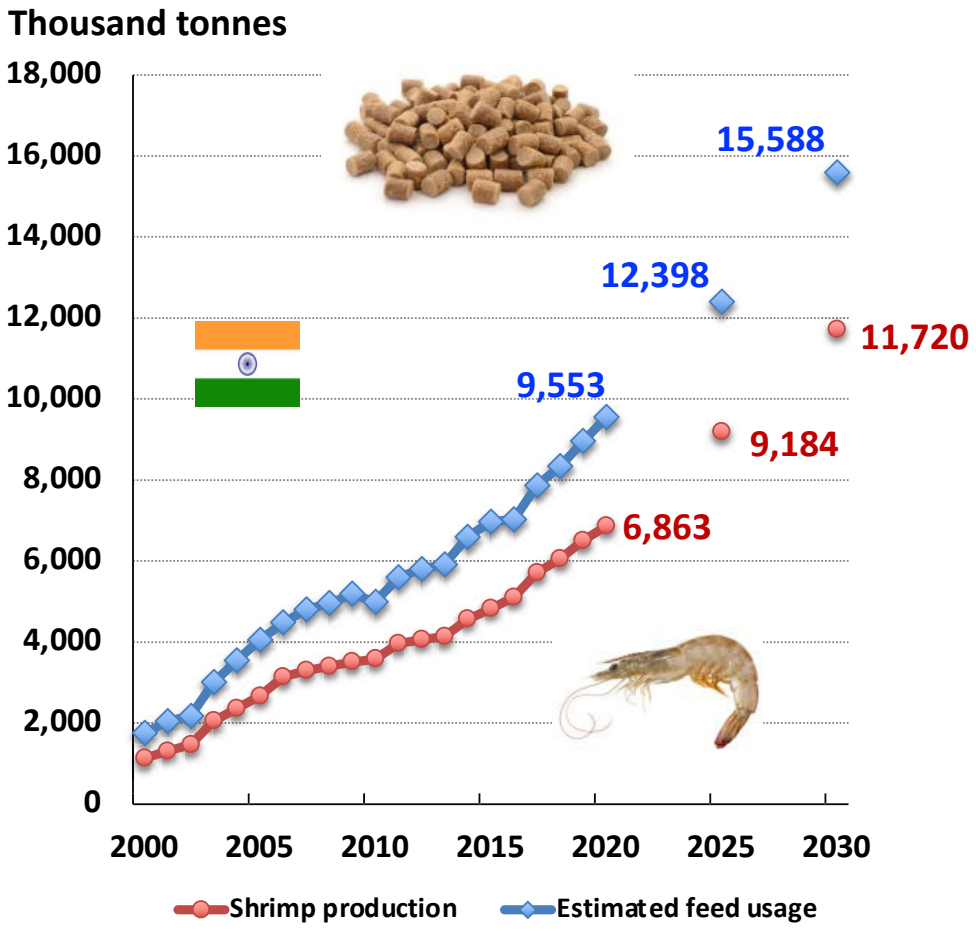


Alltech 2021 Global Feed Survey estimate for 2020 was 49.39 mmt

Shrimp production 2000 to 2020 (FAO, 2022) & estimated commercial feed usage 2025 to 2030

Total Shrimp feed usage estimated at 9.55 million tonnes (Mt) in 2020, and expected to rise to 12.4 Mt by 2025, and 15.6 Mt by 2030

Major country producers (tonnes)	
China	2,152,703 (31.4%)
Viet Nam	929,989 (13.5%)
India	927,013 (13.5%)
Indonesia	880,722 E (12.8%)
Ecuador	760,879 (11.1%)
Thailand	388,592 (5.7%)
Mexico	188,781 (2.7%)
Bangladesh	76,505 (1.1%)
Philippines	64,152
Brazil	63,170
Major species (tonnes)	
Whiteleg shrimp	5,812,180 (84.7%)
Giant tiger prawn	717,138 (10.4%)
Penaeid shrimp nei	145,050 (2.2%)
Total production	6,863,413 tonnes
Total value	41.55 US $ billion
Production APR	7.30%/year (15/20)





Feeds & Feeding – Biggest Cost for Farmer

Need to tailor our feeds to the intended farming system & species, and assist the farmer with the management of their feed

IF THE FARMER SUCCEEDS WE ALL SUCCEED

But if the farmer fails we sell no feed however good our feed may be

Need for close partnership between the feed company & the Farmer






Bottom line


Many different feeds in the market with different marketing claims, nutrient levels & costs

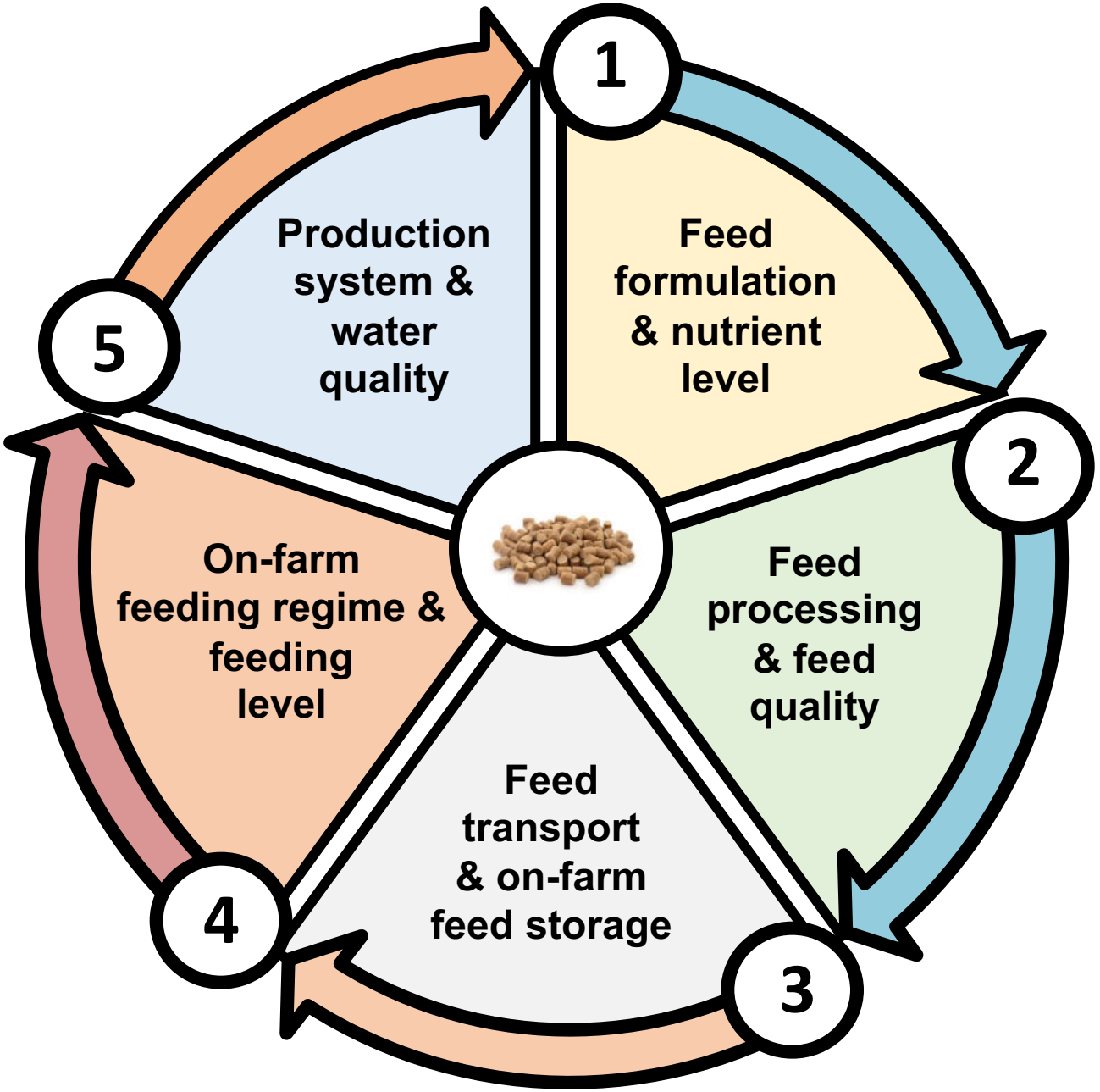
******* the bottom line is *******

Feed performance & shrimp/fish cost/kg production

however

Every farm is different, depending upon farming system & on-farm feed & water management

Main Factors affecting Feed Performance



Main Factors affecting Feed Performance

Technical services Support

Feed formulation & processing

1 Feed formulation & nutrient level

2 Feed processing & feed quality

3 Feed transport & on-farm feed storage

4 On-farm feeding regime & feeding level

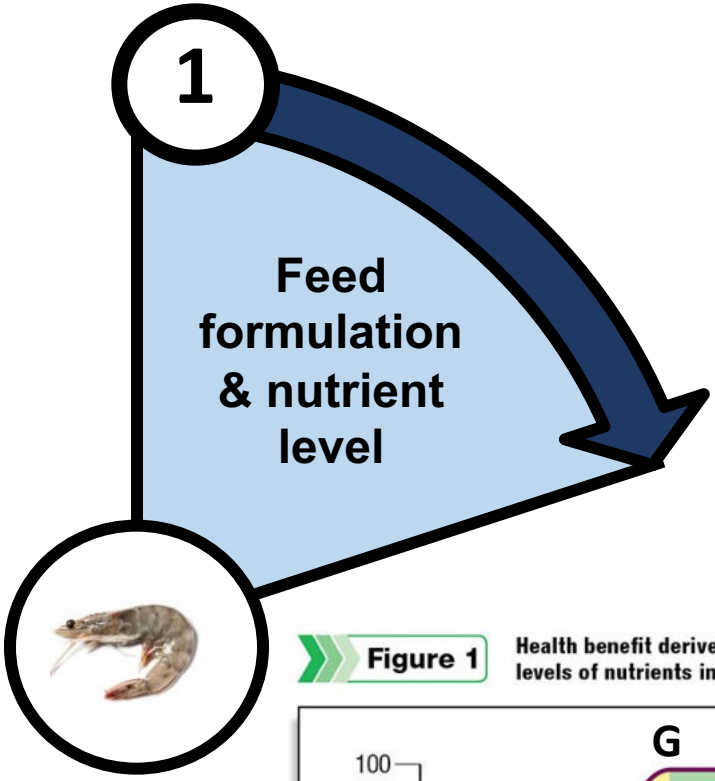
5 Production system & water quality

Control by the farmer

Control by feed company

Feed formulation & nutrient level considerations

- **Minimum dietary nutrient profile for each size group: Larval, nursery, grow-out & broodstock feed**
- **Feed ingredient selection & use (min & max constraints), including feed additives**



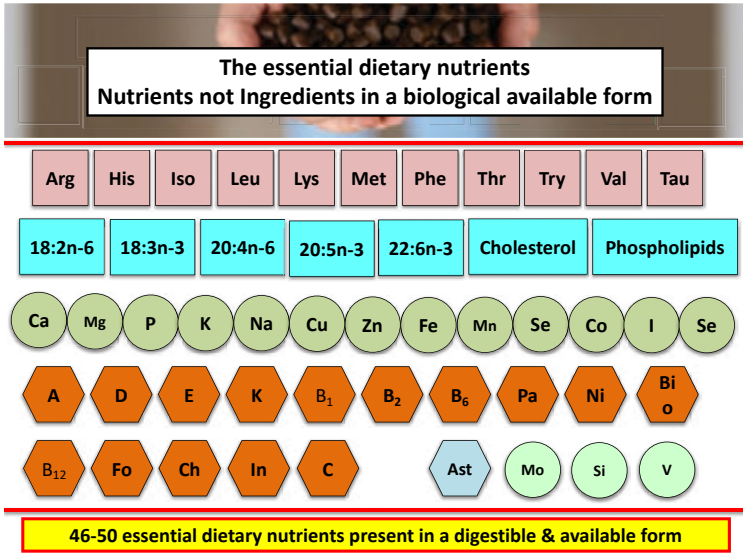
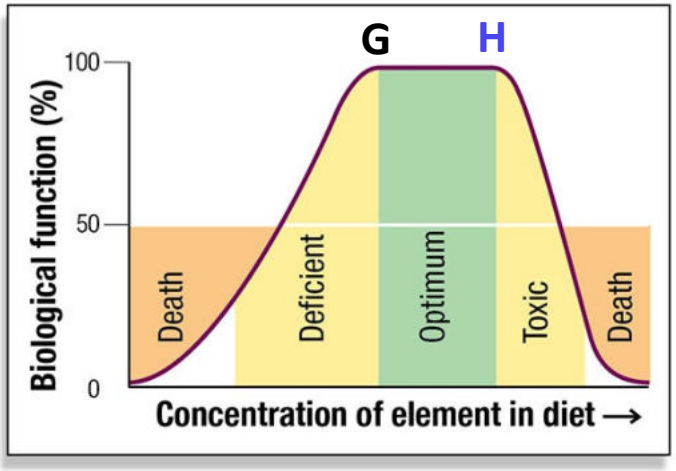


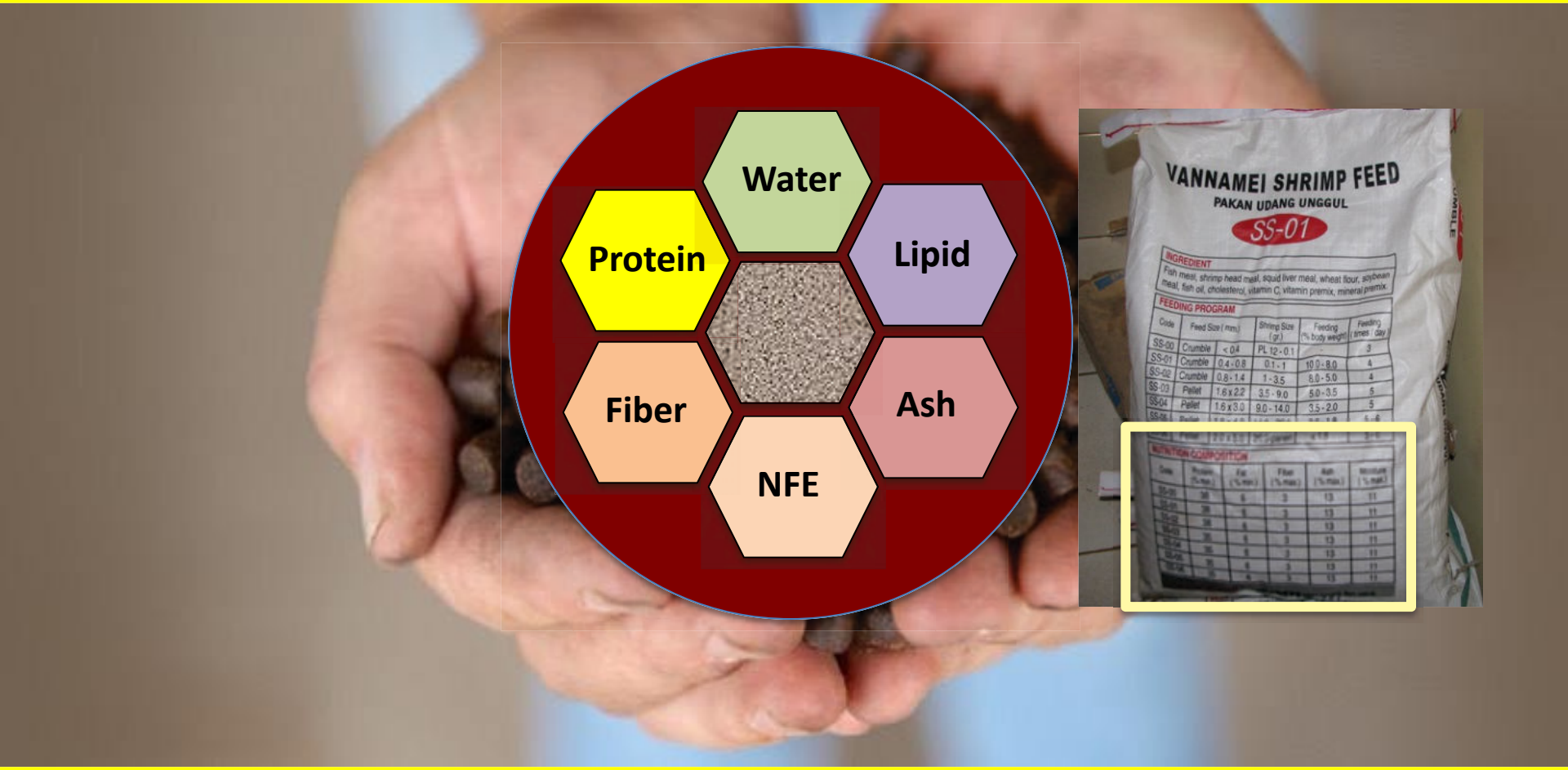
Figure 1 Health benefit derived from different levels of nutrients in the diet



More is better when the level of the nutrient in the diet is in the deficient range but the key point is that more is not better when the level is in the optimum range and is indeed harmful thereafter.

The essential dietary nutrient requirements of Shrimp

H_2O	CARBOHYDRATES	PROTEINS	LIPIDS	ASH



There is no specific dietary requirement for protein, lipid or ash

The essential dietary nutrients of shrimp

Arg | His | Iso | Leu | Lys | Met | Phe | Thr | Try | Val | Tau

18:2n-6 | 18:3n-3 | 20:4n-6 | 20:5n-3 | 22:6n-3 | Cholesterol | Phospholipids

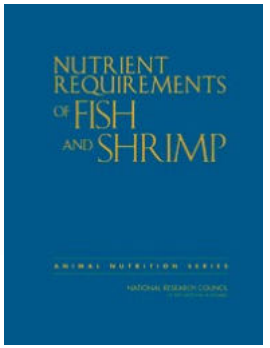
Ca | Mg | P | K | Na | Cu | Zn | Fe | Mn | Se | Co | I | Se

A | D | E | K | B_1 | B_2 | B_6 | Pa | Ni | Bio

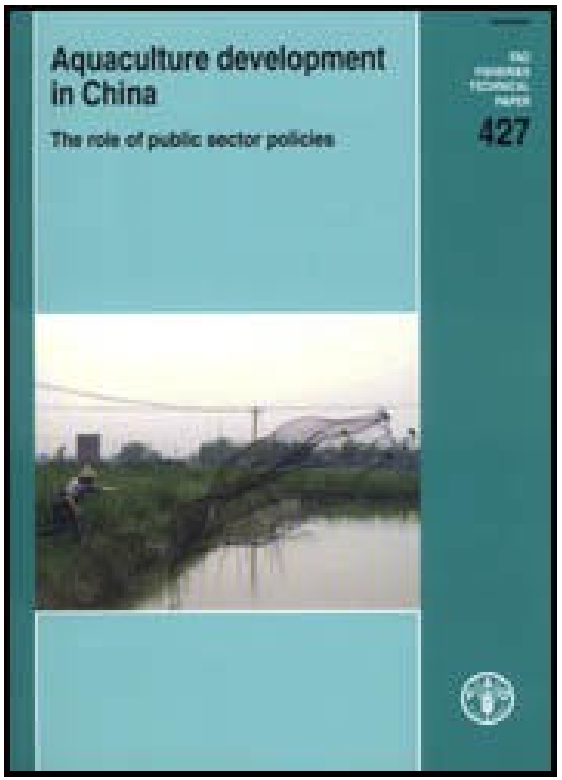
B_{12} | Fo | Ch | In | C | Ast | Mo | Si | V

46-50 essential dietary nutrients present in a digestible & available form

Approaches currently used by feed companies to formulate their shrimp feeds



1. Formulating feeds based on published NRC/total nutrient basis (where data is available) or on government guidelines (60-70%);

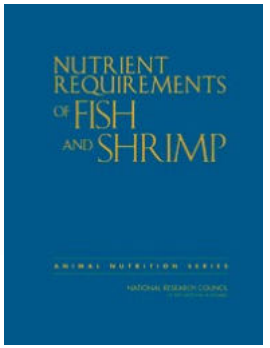


Recently, the Government started paying attention to the quality of feed used in aquaculture. It has set feed standards for some important species such as carps, tilapia, trout and eel. Most of these standards were formulated in 1997. Some of them are: "*Nutritional Standard of Formulated Feed for Common Carp, SC/T 1026-1997*" for common carp, "*Nutritional Standard of Formulated Feed for Grass Carp, SC/T 1024-1997*" for grass carp, "*Nutritional Standard of Formulated Feed for Tilapia, SC/T 1025-1997*" for tilapia, "*Technical Criteria in Rainbow Trout Culture-Formulated Pellet Feed for Rainbow trout, SC/T 1030-1997.7*" for rainbow trout and "*Formulated Feed for Japanese Eel, SC 1004-1992*" for eel.

COMPOUND FEED FOR WHITE LEG SHRIMP
TCVN 10325:2014
Ministry of Agriculture, Hanoi 2014

Feed #	1	2	3	4	5	6
Feed diameter mm	0.6	0.8	1.2	1.8	2.2	2.5
Length/diameter	1.5-2	1.5-2	1.5-2	1.5-2	1.5-2	1.5-2
Crumble/dust % max	1	1	1	1	1	1
Water stability h min	1-2	1-2	1-2	1-2	1-2	1-2
Moisture % max	11	11	11	11	11	11
Crude protein % min	38	36	34	34	33	32
Crude lipid % min	5-7	5-7	5-7	4-6	4-6	4-6
Crude fibre % max	3	4	4	4	4	4
Ash % max	14	14	15	15	16	16
Sand % max	1.0	1.2	1.3	1.5	1.5	1.7
Lysine % min	1.8	1.8	1.7	1.6	1.5	1.5
Methionine % min	0.8	0.8	0.7	0.7	0.6	0.6
Calcium % max	2.3	2.3	2.3	2.3	2.3	2.3
Ca/Phosphorus	1-1.5	1-1.5	1-1.5	1-1.5	1-1.5	1-1.5
Salt % max	2	2	2	2	2	2
Insects	ND	ND	ND	ND	ND	ND
Salmonella	ND	ND	ND	ND	ND	ND
Aspergillus flavus	ND	ND	ND	ND	ND	ND
Aflatoxin B_1 max ug/kg	10	10	10	10	10	10
Melamine max mg/kg	2.5	2.5	2.5	2.5	2.5	2.5
Antibiotic	ND	ND	ND	ND	ND	ND

Approaches currently used by feed companies to formulate their shrimp feeds

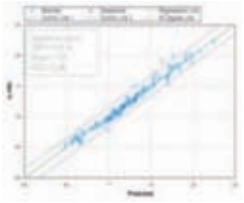


1. Formulating feeds based on published total nutrient basis (where data is available) or on government regulations (70-80%);

2. Formulating feeds on a digestible nutrient basis, based on existing published data from researchers (10-15%);

3. Formulating feeds on a digestible nutrient basis, based on in-house data on the nutrient digestibility of the different feed ingredients used (10-15% total aquafeed production);

NIRS



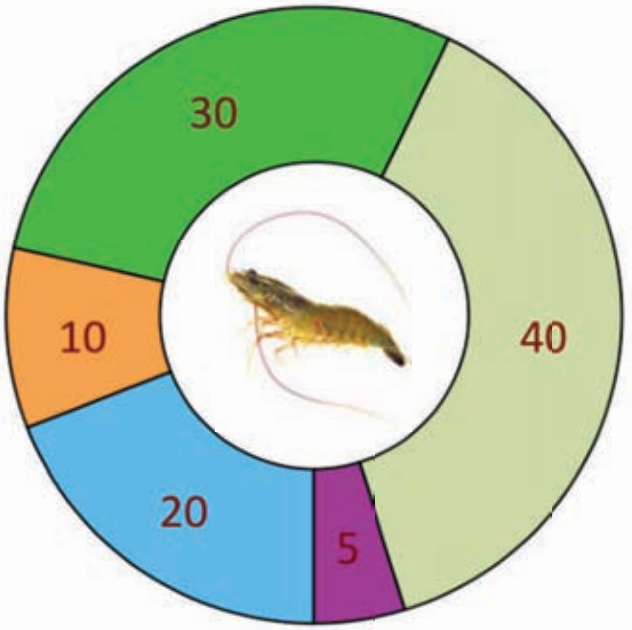
Aquatic protein meals & oils	5-20%
Fishmeals & oil: wild & farmed	5-20
Squid meal, krill meal	2-10
Seaweed meals & products	1-5
Cultured microbial biomass	1-5

Terrestrial animal proteins & oils	5-10%
Poultry by-products	5-10
Porcine by-products	2-5
Ruminant by-products	2-5
Terrestrial invertebrates	1-5

Terrestrial plant proteins & oils	10-30%
Oilseed protein by-products	10-30
Cereal protein by-products	5-15
Pulse protein by-products	5-15
Other plant proteins	5-15

Other plant meals & fillers	25-40%
Cereal meals & by-products	15-50
Root meals & extracts	2-10
Fruit meals & by-products	1-5
Forage & leaf meals	1-5

Ingredients commonly used in feeds for PENAEID SHRIMP SPECIES



Feed additives	0-5%
Vitamins, antioxidants, pigments, emulsifiers, MCTs	
Minerals, trace elements, salt	
Amino acids, nucleotides, feeding attractants	
Enzymes, gut modifiers, prebiotics, probiotics, acidifiers	
Immune enhancers, anti-fungal, anti-viral, anti-parasitical	
Binders, growth promoters, hormones, antibiotics	

Functional ingredients with reported health benefits

Nutrients

EAA - amino acids
Nucleotides
Fatty acids
Sterols
Vitamins
Minerals

Others

Enzymes
Emulsifiers
Essential oils
Organic acids

Prebiotics
Probiotics
Alginates
Beta glucans
Carageenans
Chitosans
Lactoferrin
Mannans
Peptidoglycan
Plant extracts

Ingredients with functional properties may improve health & survival but are not a panacea to eliminate a disease problem

Improving the utilization of feed ingredients

Use of renewable nutrient sources

EXOGENOUS MICROBIAL ENZYMES

- **Improved nutrient digestibility**
- **Improving feed efficiency**
- **Release of trapped nutrients**
- **Breakdown of anti-nutritional factors**
- **Improved gut health**
- **Reducing environmental impacts (N, P)**

Phytase	β – glucanase	Amylase	Lipase	Mannanase
Xylanase	Cellulase	Protease	Micotoxinase	α - galactosidase

Product Data Sheet

ProPhorce™ SR 130

Unrivaled butyric acid power for Aquaculture

Product Description

Butyric acid has been demonstrated to exert multiple beneficial roles on gut health and animal performance in farmed aquatic species. However, finding ways to prevent its absorption before reaching the intestines and controlling its unpleasant smell has been a challenge for decades.

[redacted] is based on butyric acid glycerol-esters and is considered one of the most efficient ways to deliver butyric acid to the intestine for aquaculture species due to its insolubility in water, high concentration and consequent targeted release.

Recent research and field validation trials have shown that ProPhorce™ SR 130 provides further support to performance for aquatic species.

25 years of experience in esterification provides Perstorp with a standout position with regards to knowhow in production and product application.

Segment Application

Aquaculture

Delivery Forms

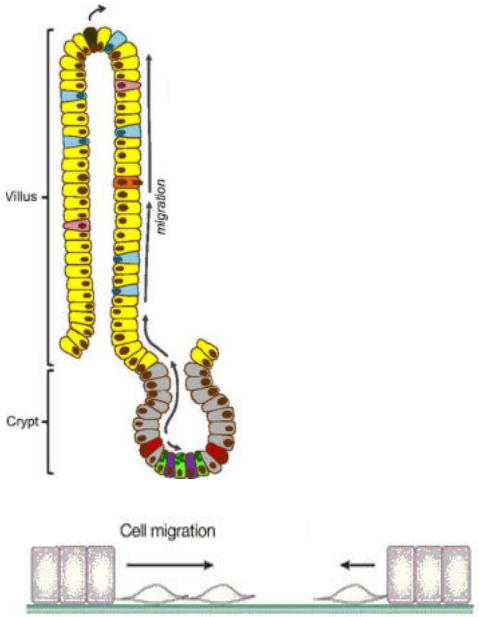
25 kg bags/1000 kg FIBC.

[redacted]

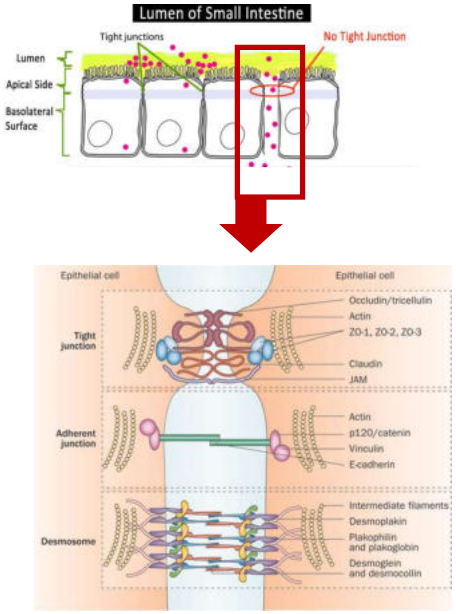
- Insoluble in water
- Broad mode of action to support gut health
- Thoroughly tested to enhance performance
- Targeted release

Butyrate production in the gut has beneficial functions

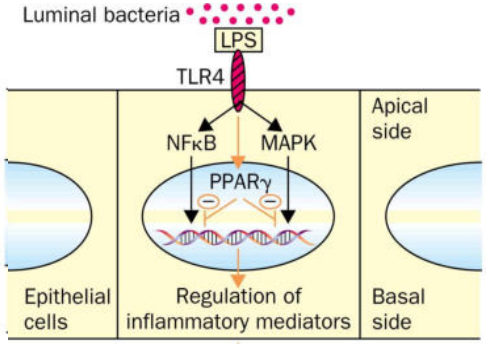
Cell proliferation and migration



Tight junction repair/strenghtening



Anti-inflammatory responses



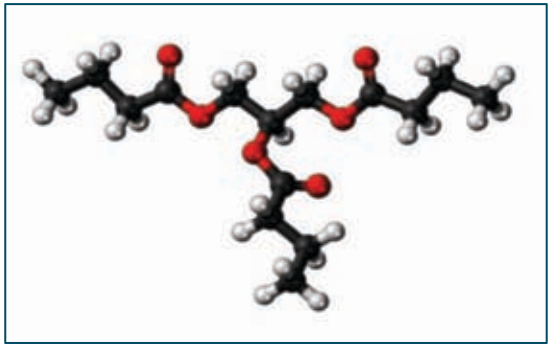
PPARY activation = anti-inflammatory transcription factor

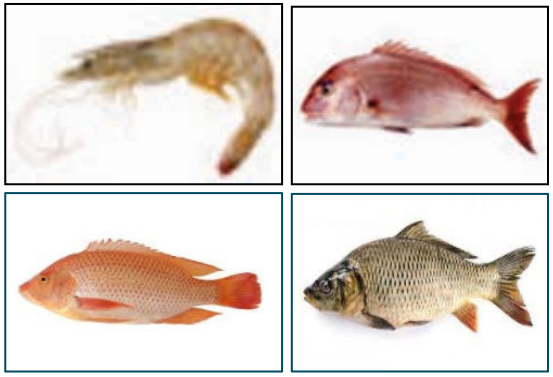
Filip Van Immerseel
Ghent University

Demonstrated beneficial effects of ProPhorce™ SR130 on shrimp & fish health, growth & feed efficiency

ProPhorce™ SR 130 is a tributyrate-based feed additive which on hydrolysis in the fish/shrimp gut yields butyric acid (a short-chain fatty acid) which has numerous health benefits, including:

- **Improved gut health & function**
- **Improved nutrient digestibility**
- **Improved growth & feed efficiency**
- **Improved immune & antioxidant capability**
- **Improved health & disease resistance**
- **Improved tolerance to higher dietary use of plant feed ingredients, including soybean meal**





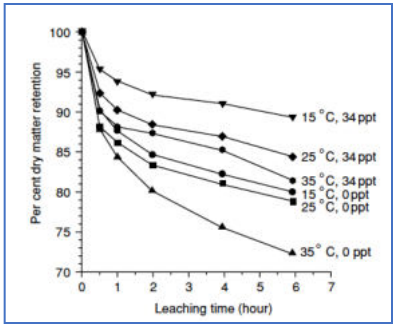
Feed processing & feed quality considerations

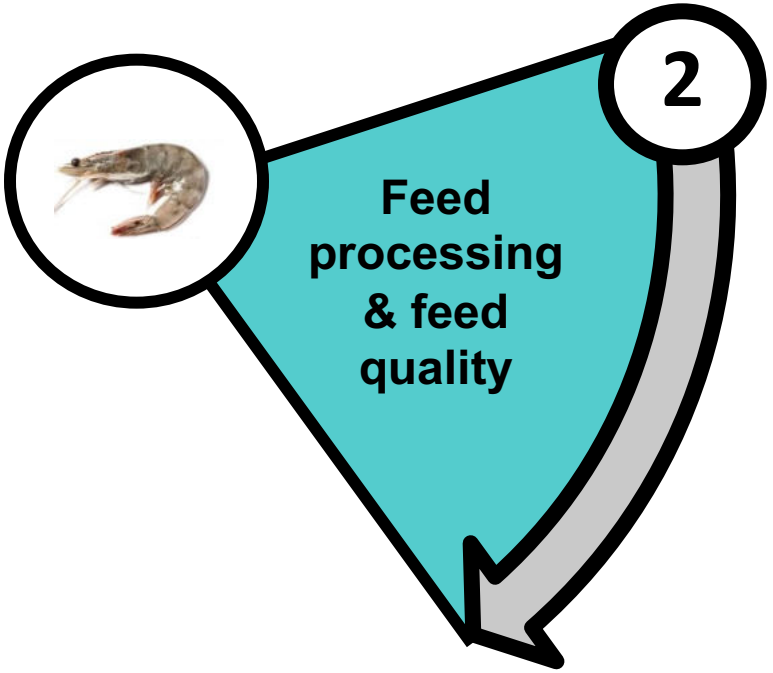
- **Feed processing method**

  - Pelleting, extrusion cooking
  - Size reduction (grinding)
  - Pre & post-pellet conditioning
  - Pellet drying, top coating
  - Sifting, crumbler
  - Percent fines & reuse
  - Bagging & labeling
  - Use of specific BMPs or GMPs

- **Feed quality control**

  - Ingredient & feed storage
  - Quality control methods
  - Parameters measured
  - Water stability & nutrient leaching (if known)
  - Feed safety controls
  - Pest control measures





Major Innovations: Improved shrimp growth & feed efficiency through the use of extruded shrimp feeds with higher nutrient digestibility & ability to make smaller feeds

Benefits of extruded feeds

- Reduced feed ingredient costs
- Improved feed water stability
- Reduced nutrient leaching
- Improved nutrient digestibility
- Increased oil & energy addition
- Higher starch gelatinization
- Improved feed efficiency
- Less fines & feed wastage
- Facilitate use of wet waste streams
- Improved feed biosecurity


Fines/dust

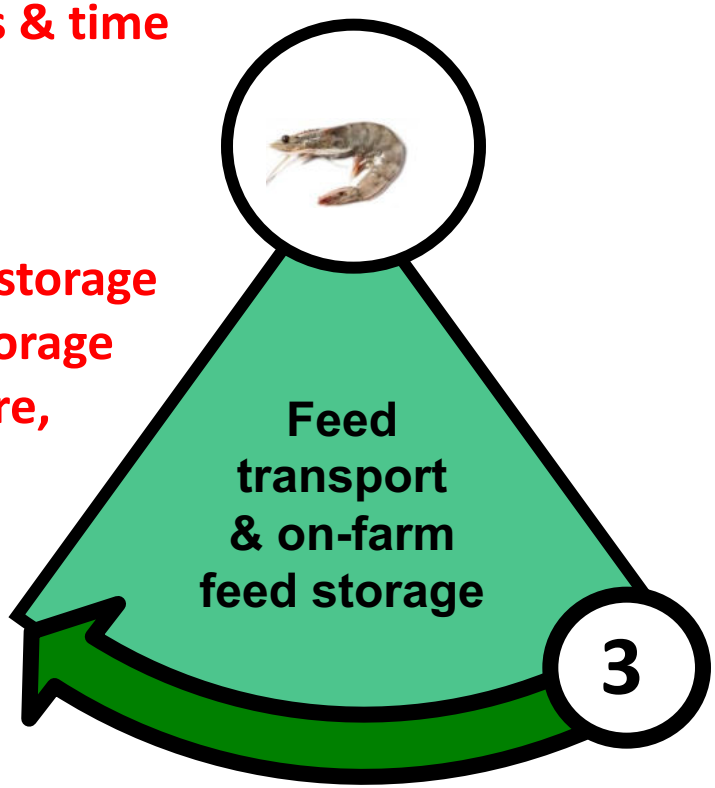
Feed transport & on-farm feed storage considerations

- **Feed transportation to farmer**

  - Method of transport - truck, boat, rail, plane
  - Packaging - big bags, sacks, containers
  - Protection from elements – sun, water, pests
  - Location of feed depots & time taken to reach depots

- **On-farm feed storage**

  - Feed record keeping & storage
  - Feed storage area & storage conditions - temperature, ventilation, prevention from water damage, pest control
  - Use of expired feeds



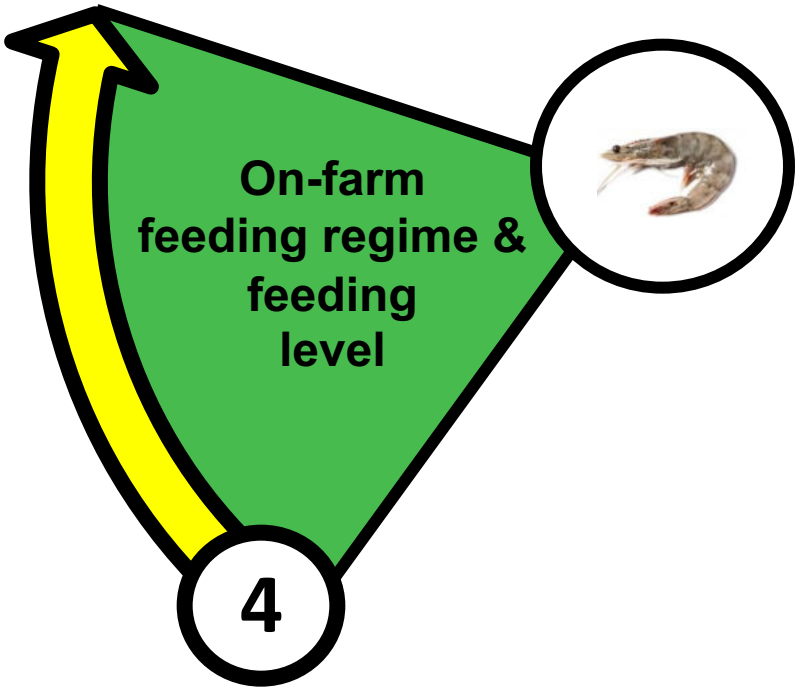
Need for improved feed transportation & on-farm storage practices & posters


Prize
Catch


UA

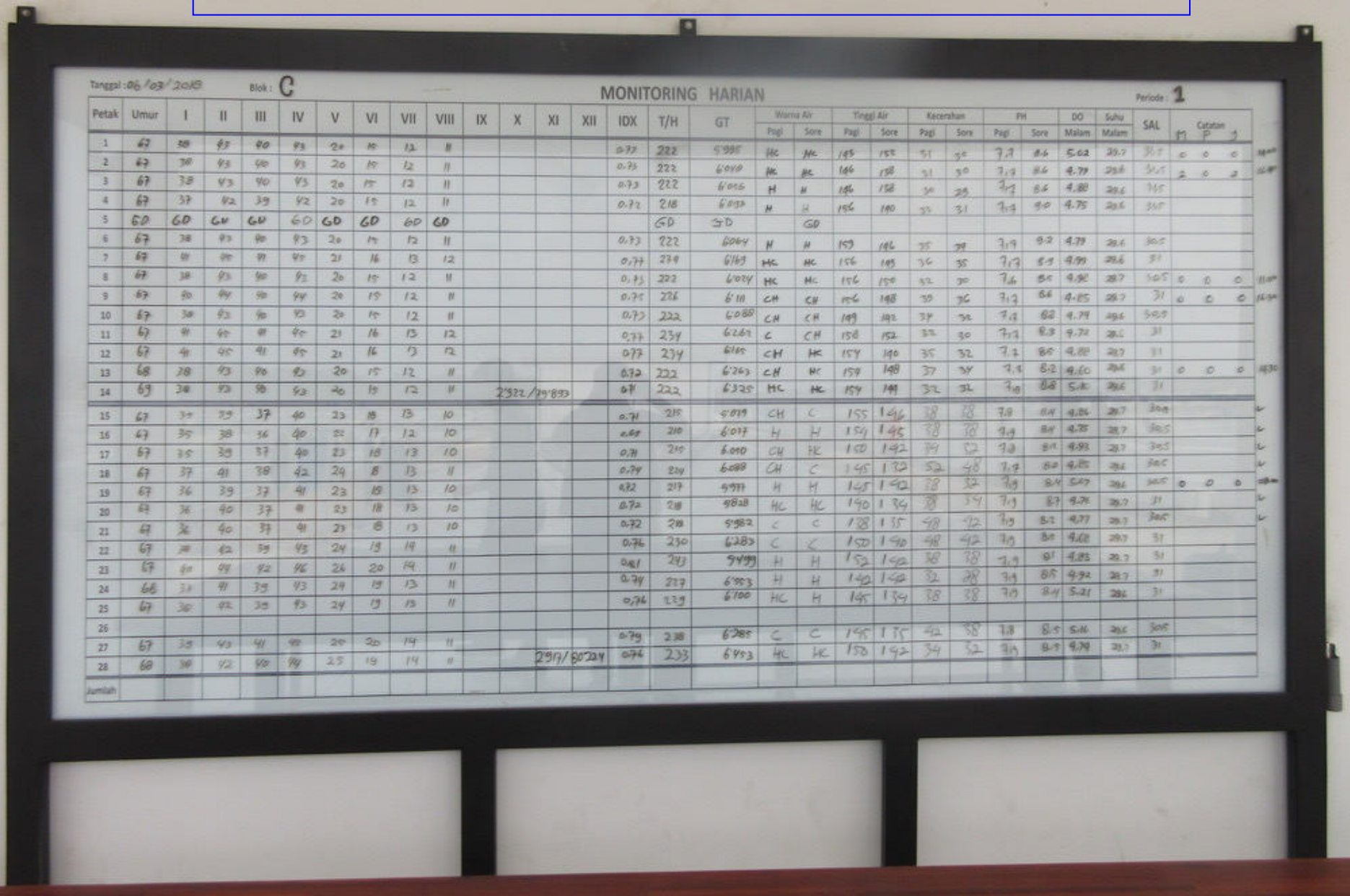

PECES 25

On-farm feeding regime & feeding level considerations



- **On-farm feed management practice**
  - ➢ **Feeding method - by hand, boat, tray, auto-feeder, truck**
  - ➢ **Feed application criteria - feed table, appetite, trays, past experience, water quality**
  - ➢ **Frequency of feed application for each size age class**
- **Application of specific feed additives prior to feeding**
  - ➢ **Probiotics, vitamins, additives & method of application**
  - ➢ **Record keeping concerning feed use - book, board, laptop**

Importance of good record keeping



MECANIZAÇÃO DA ALIMENTAÇÃO DE PEIXES E CAMARÕES

Por:
Alberto J.P. Nunes, Ph.D.
alberto.nunes@ufc.br
LABOMAR - Instituto de Ciências do Mar
Universidade Federal do Ceará

Aquaculture Feed Innovations:

Development of improved on-farm feed management technologies, including data management & feed distribution, including video & acoustic feeding control;

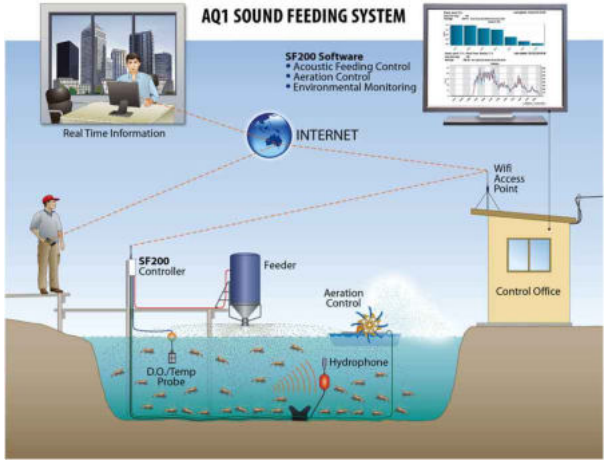
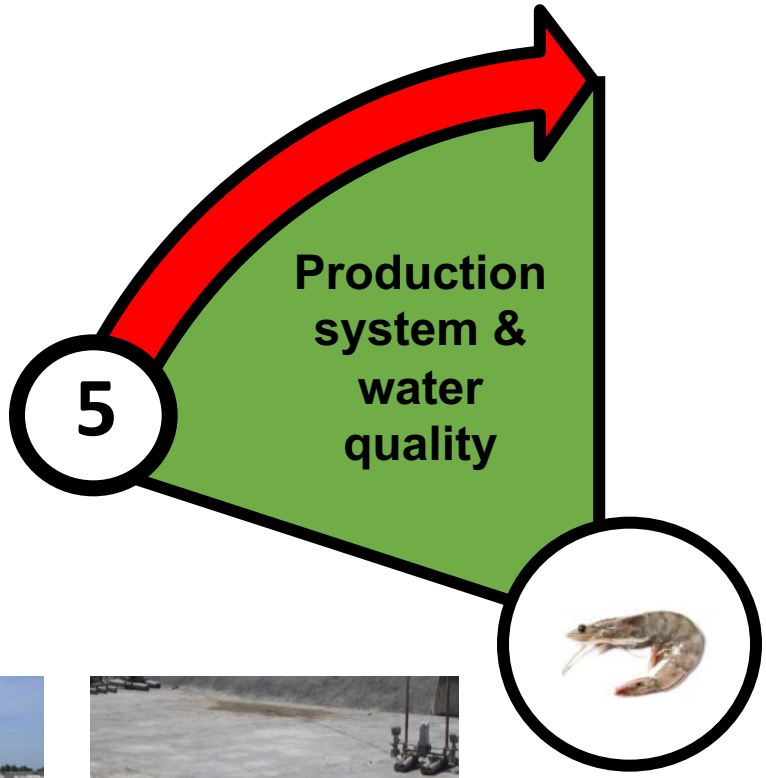


FIGURE 11

Feeding trays used in floating cages when sinking pellets are used (top photos) and feeding enclosure and platform constructed in a large ex-mining pool to congregate the tilapia during meal time (bottom centre)

COURTESY OF W.-K. NG.

Production system & water quality considerations



- **Production system**

  - Raceway, earthen pond, lined pond, indoor tank
  - Stocking density
  - Water management - green water, floc or semi-floc, zero-water exchange, flow-through
  - Aeration method used
  - Application/use of probiotics
  - Natural food availability over culture period

- **Water quality variation (24h)**

  - Water temperature - min/max
  - Dissolved oxygen – min/max
  - NH_3 $N0_2$ pH PO_4 alkalinity
  - Bacterial levels
  - Phytoplankton/zooplankton
  - Algal blooms/crashes

New - Aerotubes, Nanobubbles

The future – full biosecurity, environmental & stress control

Aquaculture production moving indoors

Main Factors affecting Feed Performance

Technical services Support

Feed formulation & processing

1 Feed formulation & nutrient level

2 Feed processing & feed quality

3 Feed transport & on-farm feed storage

4 On-farm feeding regime & feeding level

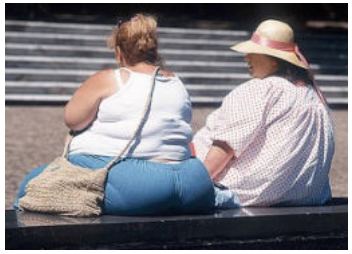
5 Production system & water quality

Control by the farmer

Control by feed company

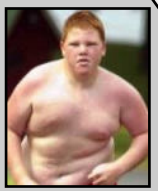
MALNUTRITION
represents
The World's Greatest Preventable Health Challenge

The double-burden of Malnutrition



Under-nutrition
- Wasting
- Stunting
- Underweight
- Vit & mineral deficiency

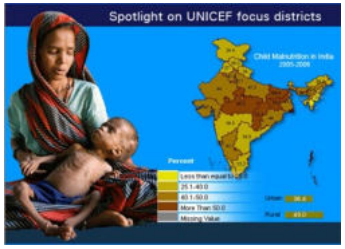
World Health Organization

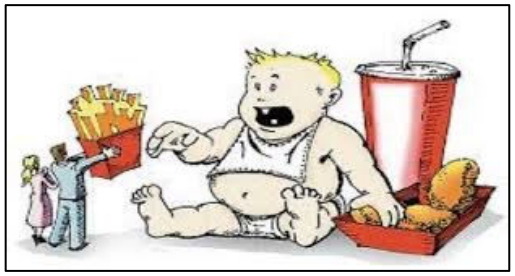


Over-nutrition
- Obesity
- Heart disease
- Hypertension
- Stroke
- Diabetes

A vision for increased aquaculture production in India

Addressing the national malnutrition dilemma & need for more Healthy & Nutritious Foods





Overweight India vs Underweight India

India has an alarmingly high number of people either overweight or underweight.

- 9.8 million Indian men overweight. 20 million obese Indian women
- This is 3.7% and 5.3% of global population
- 102 million Indian men and 101 million Indian women underweight

40%

India home to 40% of global underweight population

CHINA HAS EDGED OUT U.S. AS HOME TO MOST OBESE PEOPLE

INDIA IS HOME TO MOST UNDERWEIGHT WHILE CHINA IS DISTANT SECOND

Source: Study published in The Lancet journal

The rise in Obesity in India Facts and Reasons

The CEO Story

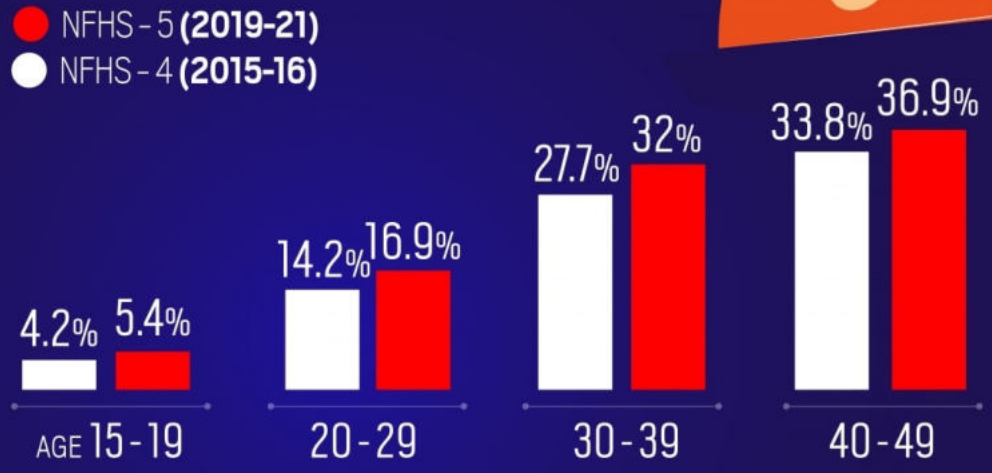
LACTONOVA

INDIA RANKS SECOND HIGHEST IN THE NUMBER OF OBESE CHILDREN IN THE **WORLD.**

INDIA TODAY GROUP

INDIA'S WEIGHTY PROBLEM: 1 OUT OF EVERY 4 PERSONS OBESE NOW

Age-wise incidence of obesity



Urban-rural divide in incidence of obesity

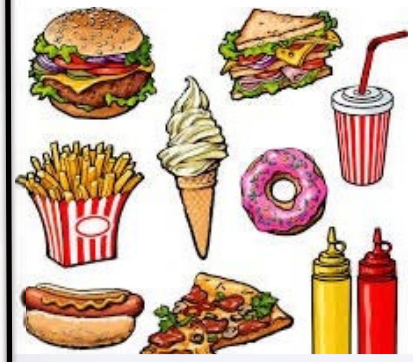
Note: NFHS 4 & 5 data for women shown above
BMI ≥ 25 is overweight or obese
Source: National Family Health Survey

DIU DATA INTELLIGENCE UNIT

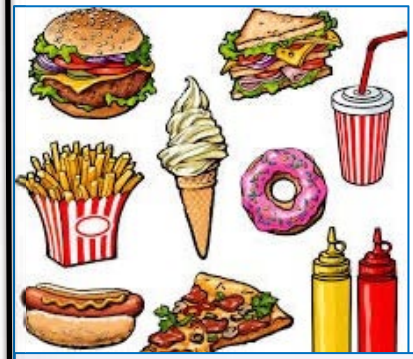
Overnutrition & Obesity

Over past 50 years rapid increase in the incidence of malnutrition, and in particular over-nutrition and associated ailments, including obesity, coronary heart disease, diabetes & hypertension;

Primarily due to the increased consumption of lower cost fast-foods, red meats & dairy produce, together with a less active & sedentary lifestyle



FAST-FOODS



Refers to food items that can be prepared and served quickly, and include:

- processed red meat products (hot-dogs, hamburgers, sausages, bacon, ham, spam, etc.),

- processed/refined carbohydrates (biscuits, cookies, donuts, pancakes, muffins, crackers, bread, pizza, pasta),

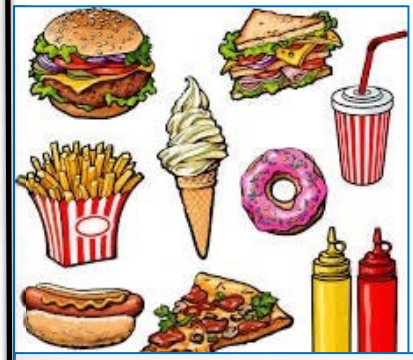
- fried foods (french fries, hash browns, fried chicken, chicken nuggets),

- sugary drinks, sweets & ice cream;

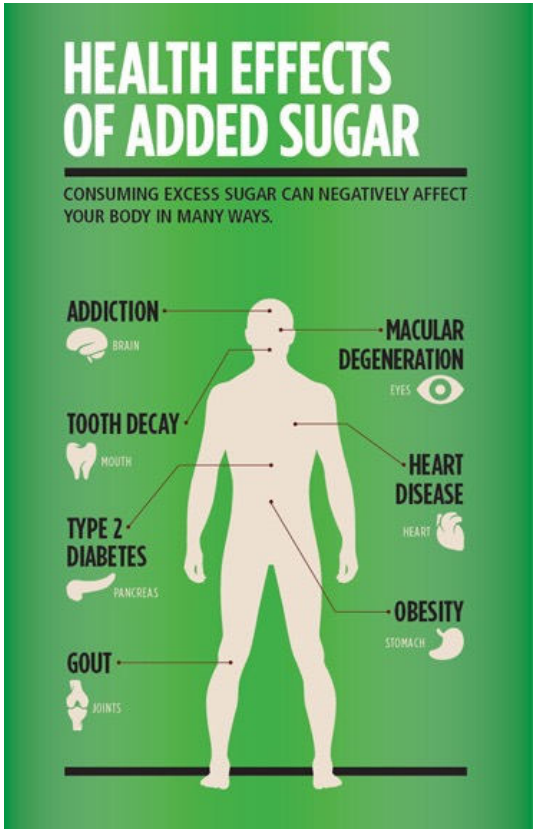
The Rise of Fast Foods

It is generally believed that the increased proportion of total caloric intake derived from fast food has been due to numerous factors, including:

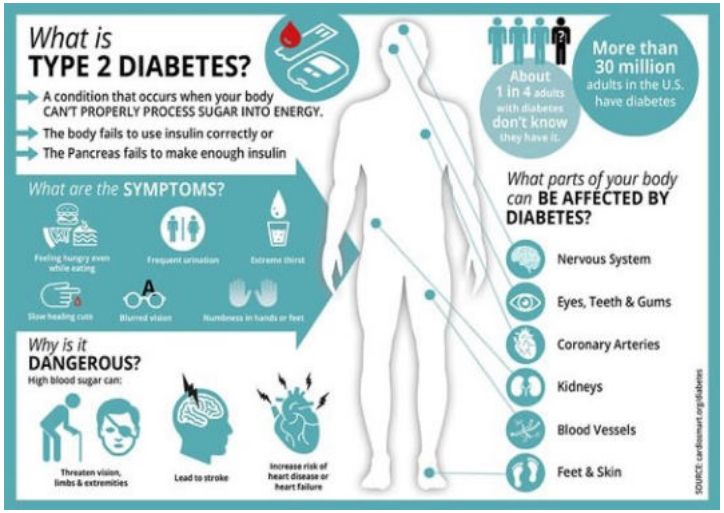
- lower cost/affordability,
- bigger portion sizes,
- increased convenience
- taste, and accessibility




LOOKING FOR SUGAR?
It goes by many names.
BROWN RICE SYRUP CORN SYRUP
HONEY FRUIT NECTAR
MAPLE SYRUP MALT SYRUP
AGAVE NECTAR MOLASSES
EVAPORATED CANE JUICE CORN SYRUP SOLIDS
GLUCOSE
SUCROSE
SUGAR
FRUCTOSE FRUIT JUICE CONCENTRATE
GALACTOSE GLUCOSE-FRUCTOSE SYRUP
CRYSTALLINE FRUCTOSE MALTOSE
DEXTROSE HIGH-FRUCTOSE CORN SYRUP
If a sweetener is listed in the first three ingredients, the drink is loaded with sugar.
Drink water or low-fat milk.
PLAY EVERY DAY


HEALTH EFFECTS OF ADDED SUGAR
CONSUMING EXCESS SUGAR CAN NEGATIVELY AFFECT YOUR BODY IN MANY WAYS.
ADDICTION
BRAIN
TOOTH DECAY
MOUTH
TYPE 2 DIABETES
PANCREAS
GOUT
JOINTS
MACULAR DEGENERATION
EYES
HEART DISEASE
HEART
OBESITY
STOMACH


LIVELIGHTER
FACTS ABOUT SUGARY DRINKS
6.5KG
WEIGHT GAIN IN ONE YEAR
1.28 BILLION LITRES
47%
OF CHILDREN
DRINKING A SUGARY DRINK EACH DAY
TOOTH DECAY AND EROSION
23 KILOS OF SUGAR
$1095
AUSTRALIA IS IN THE TOP 10 COUNTRIES
FOR PER CAPITA CONSUMPTION OF SUGARY DRINK


What is
TYPE 2 DIABETES?
A condition that occurs when your body CAN'T PROPERLY PROCESS SUGAR INTO ENERGY.
The body fails to use insulin correctly or
The Pancreas fails to make enough insulin
About 1 in 4 adults with diabetes don't know they have it.
More than 30 million adults in the U.S. have diabetes
What are the SYMPTOMS?
Feeling hungry even while eating
Frequent urination
Extreme thirst
Slow healing cuts
Blurred vision
Numbness in hands or feet
Why is it DANGEROUS?
High blood sugar can:
Threaten vision, limbs & extremities
Lead to stroke
Increase risk of heart disease or heart failure
What parts of your body can BE AFFECTED BY DIABETES?
Nervous System
Eyes, Teeth & Gums
Coronary Arteries
Kidneys
Blood Vessels
Feet & Skin
SOURCE: cardiosmart.org/diabetes

WORLD OBESITY

COVID-19 and Obesity: The 2021 Atlas

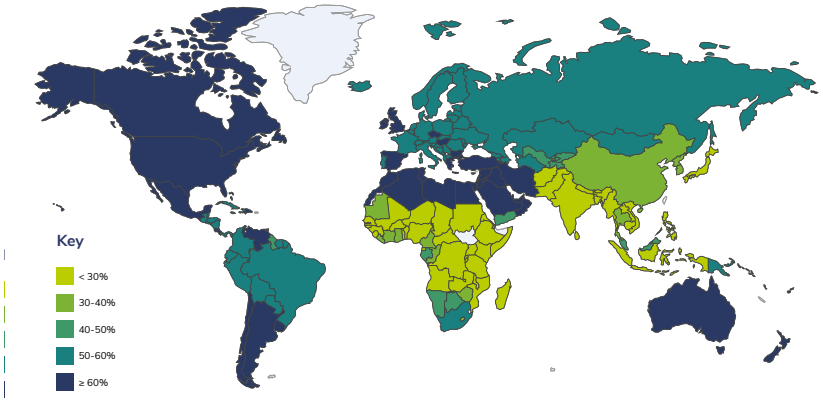
The cost of not addressing the global obesity crisis

March 2021

www.worldobesity.org

2. Prevalence of overweight in adults

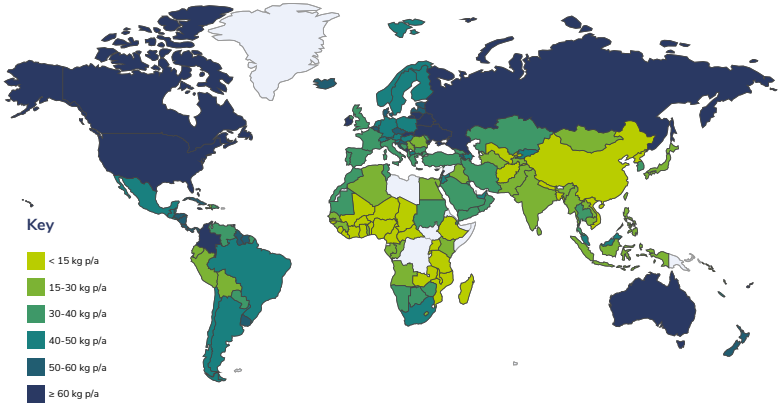
Adult overweight BMI > 25kg/m²



Source: World Health Organization, Global Health Observatory.

11. Consumption of sugars

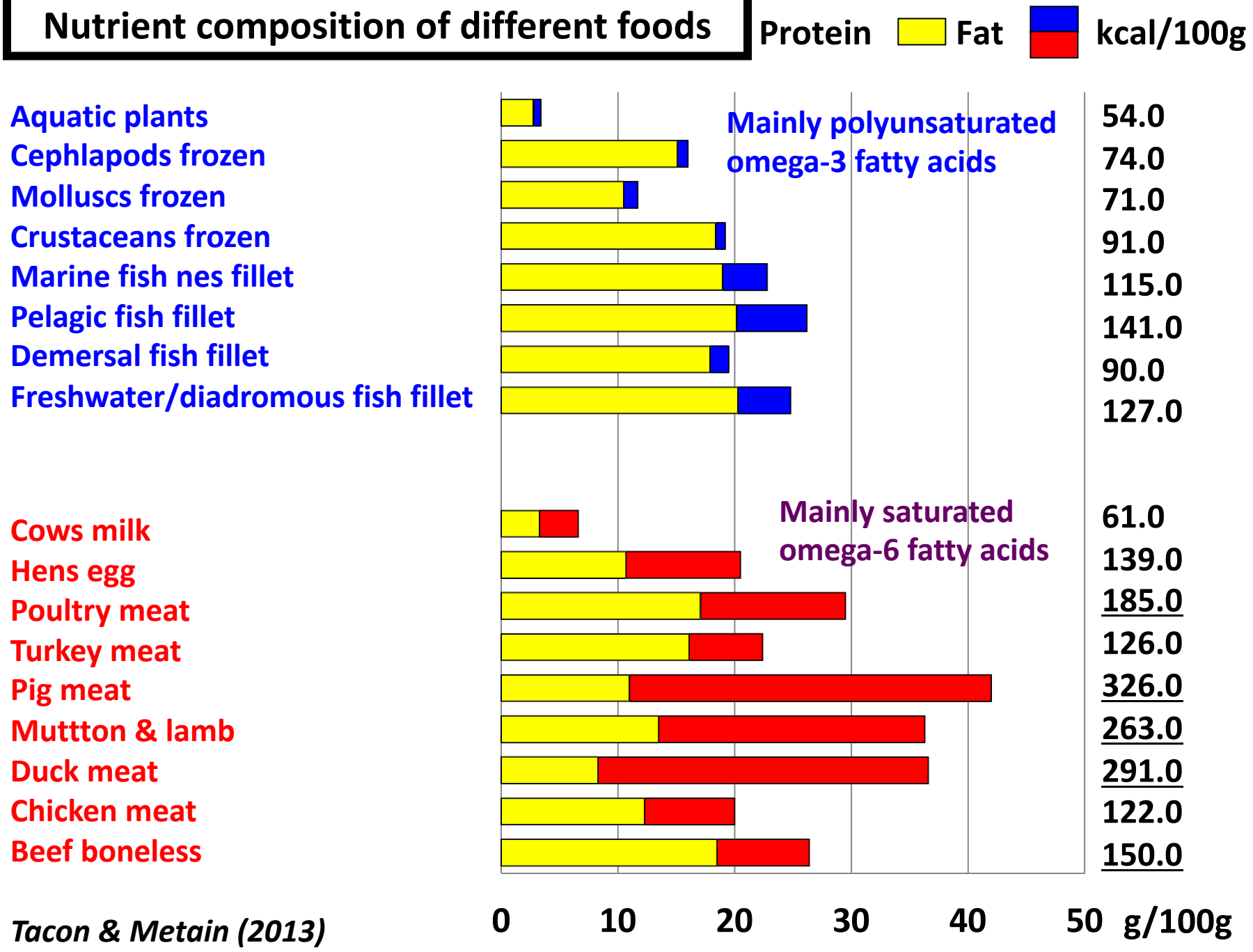
Kilograms per person per year



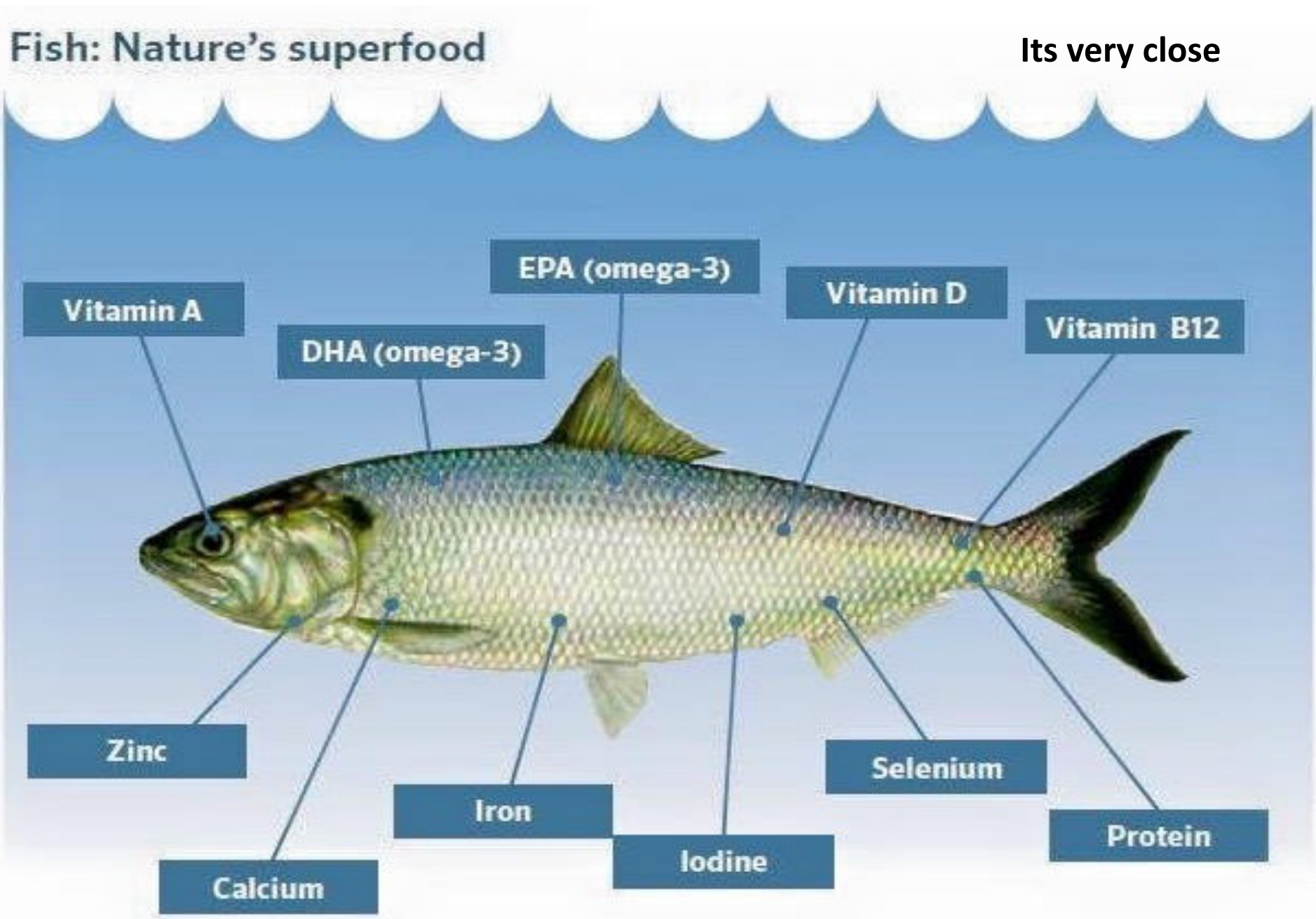
Source: UN Food and Agriculture Organization, Food Balance Sheets.

Global importance of aquatic foods in human nutrition as a much needed healthy food source

Nutrient composition of different foods



Tacon & Metain (2013)



.. Phosphorus, Magnesium, Manganese, Fluorine, Folic acid, Choline & Vitamin E ..

Reported health benefits of consuming fish & fishery products, including:

- **Reduced risk of death from coronary heart disease & stroke (FAO/ WHO, 2011; Forouhi et al. 2018; He 2009; Hellberg et al. 2012; Verbeke et al. 2005; Wallin et al. 2012),**
- **Reduced risk of diabetes (Wallin et al. 2012),**
- **Increased duration of gestation & improved visual & cognitive development (Hellberg et al. 2012),**
- **Improved neurodevelopment in infants & children when fish is consumed before & during pregnancy (FAO/ WHO, 2011), and**
- **Reduced risk of thyroid cancer in women through seaweed consumption (Michikawa et al. 2012).**

Healthy Heart
A healthier environment for healthier hearts





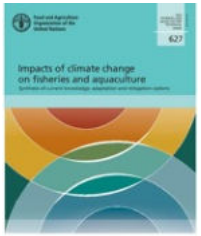
Per capita food supply in Japan, World, India & US in 2019

(FAO Food Balance Sheets, 2022)

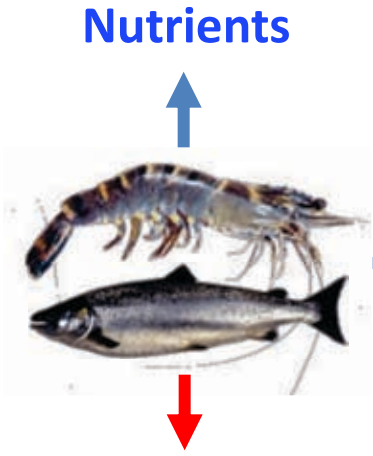
	JAPAN	WORLD	INDIA	USA
Calories (kcal/day)	2,691	2,963	2,581	3,862 +
Fish & seafood (kg/year)	46.06 ++	19.91	6.76	22.13
Fish & seafood (g protein/day)	16.68	5.47	1.99	5.40
Fish & seafood (g fat/day)	5.76 ++	1.22	0.42	1.29
Fish % animal protein supply	33.9 ++	16.5	12.9	7.1
Animal protein (g/day)	49.17	33.16	15.44	75.93 +
Animal fats (g/day)	35.74	38.89	19.73	81.11 +
Terrestrial meat (kg/year)	51.11	43.16	4.95	128.44 +
Sugar & sweeteners (kg/year)	26.39	26.07	22.16	66.11 +
Sugar & sweeteners (% total cal)	9.2	7.8	8.3	15.3





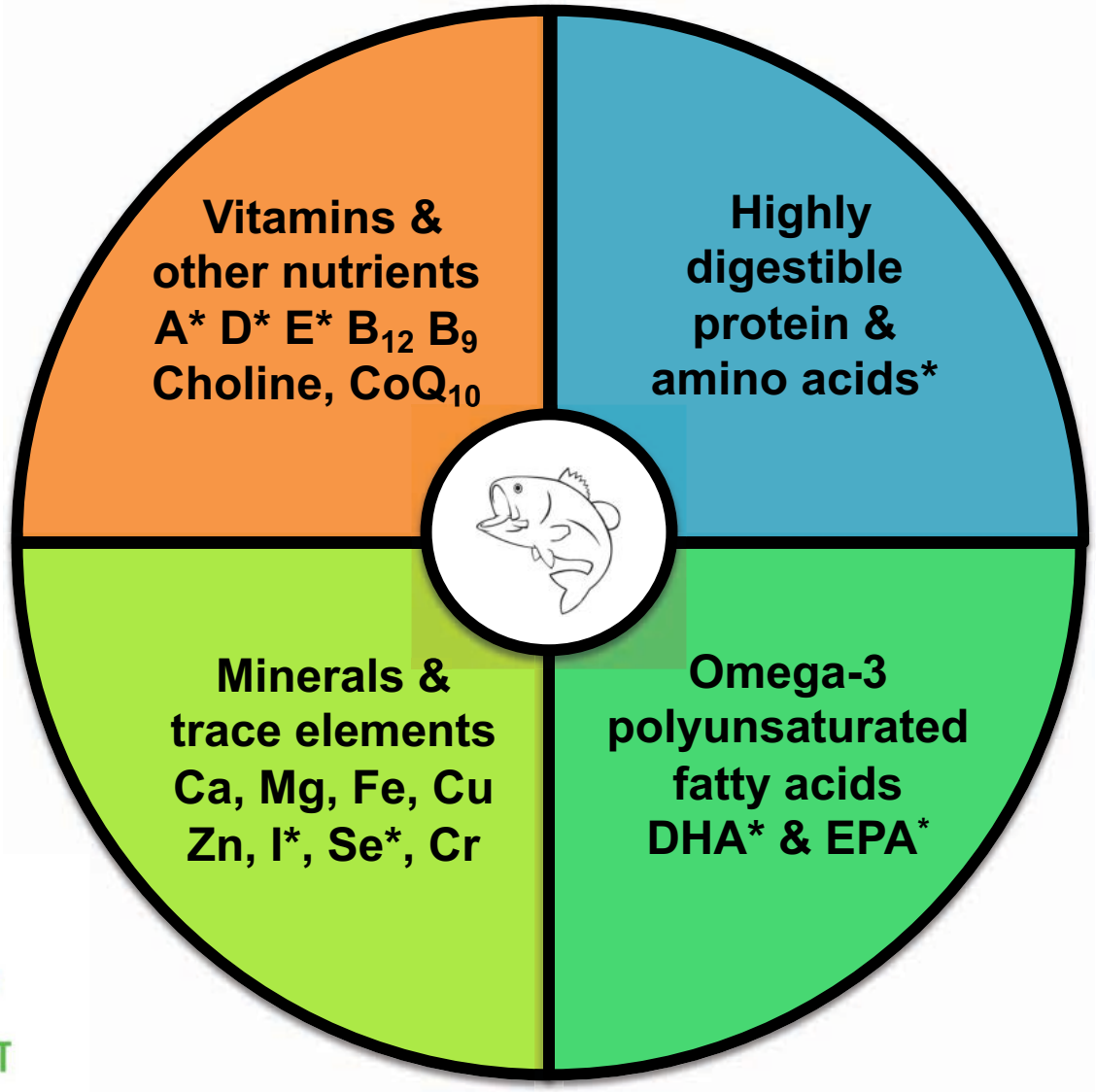

Realization that the nutritional profile of the cultured fed fish or shrimp can be manipulated & tailored to meet the needs of the consumer through the use of supplemental omega-3 fatty acids level (EPA/DHA), trace minerals (iron, zinc, selenium, iodine, chromium), vitamins (A, D, E), and/or fillet protein/lipid/calorific energy content;



Maximum nutrient & health benefits

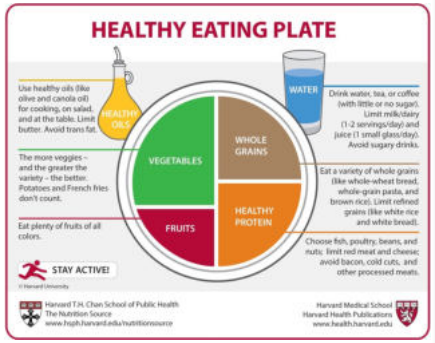
Farm Fish: A Superfood with many health attributes

[1] Tissue levels in farmed fish which have been shown to be able to be manipulated through dietary fortification



HEALTHY DIET

healthy hearts



Fish for Health

Urgent need to increase public awareness and understanding concerning the nutritional merits & health-benefits of increased consumption of fish and seafood products, including the inclusion of fish and aquatic foods as an essential component of a healthy diet and national dietary nutrient requirement guidelines, as well as the dangers of high intakes of processed foods and fast-foods on overweight, obesity, coronary heart disease, diabetes & associated ailments (HHP, 2011; Mozaffarian and Ludwig 2010; NHMRC, 2013; Skerrett and Willett 2010; USDHHS/USDA, 2015).

Peixe para a Saúde

Fish for health – improved nutritional quality of cultured fish for human consumption

Pescado para a saúde – melhora da qualidade nutricional do pescado cultivado para consumo humano

FAPESP NPOP-SP (May, 2020)

The overall aim of the project is to promote the increased use of farmed fish & seafood products as a more healthy alternative to the consumption of processed red meat products & fast-foods in the fight against obesity, coronary heart disease & diabetes

REVIEWS IN FISHERIES SCIENCE & AQUACULTURE
https://doi.org/10.1080/23308249.2020.1762163

Taylor & Francis
Taylor & Francis Group

REVIEW

Fish for Health: Improved Nutritional Quality of Cultured Fish for Human Consumption

Albert G. J. Tacon[a], Daniel Lemos[b], and Marc Metian[c]

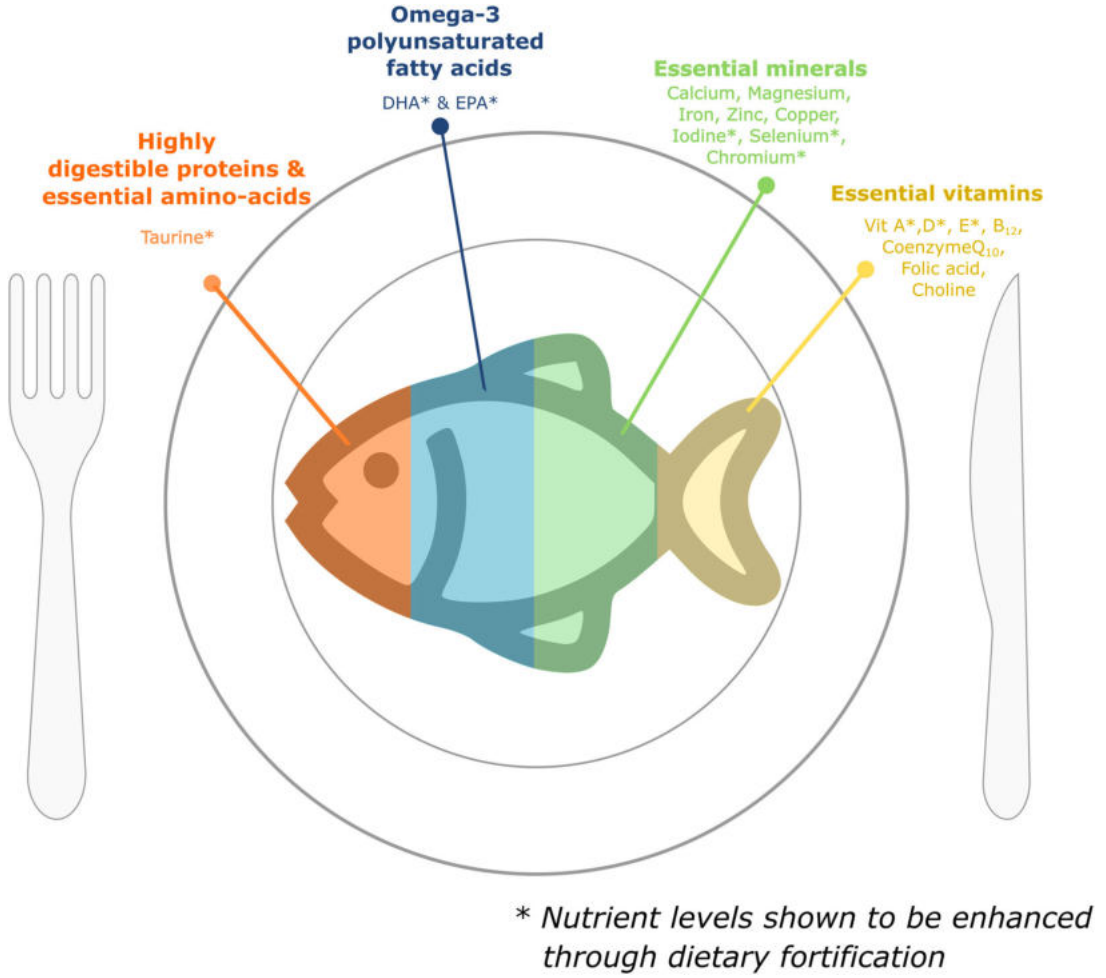


Figure 2. Farmed fish: a superfood with multiple health attributes.

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