

Lost in Translation: Challenges in Commercialisation of Functional Foods



Ali Rashidinejad (PhD)

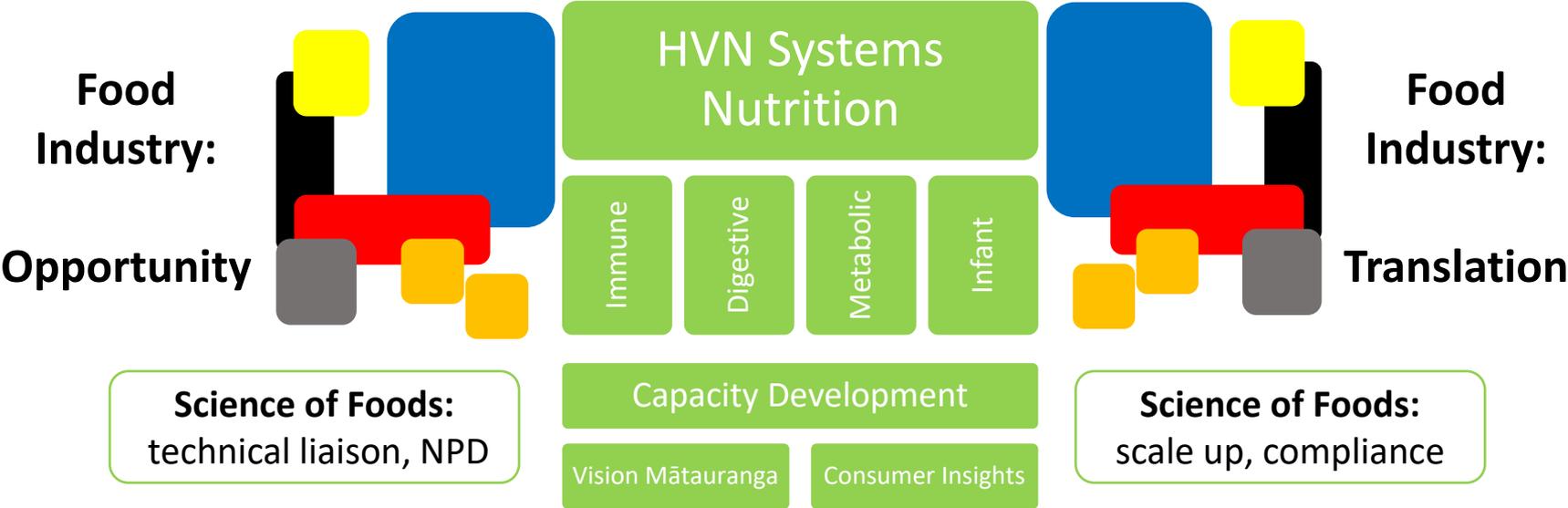
Riddet Institute

Massey University

Challenge Host

Challenge Collaborating Parties

Science of Food within HVN



**FLEXIBLE APPROACH
WRAPAROUND SUPPORT**

Contents

- Introduction (definition and purpose)
- Functional foods manufacture and opportunities
- Challenges
- Conclusion



<https://www.nutritionfact.in>

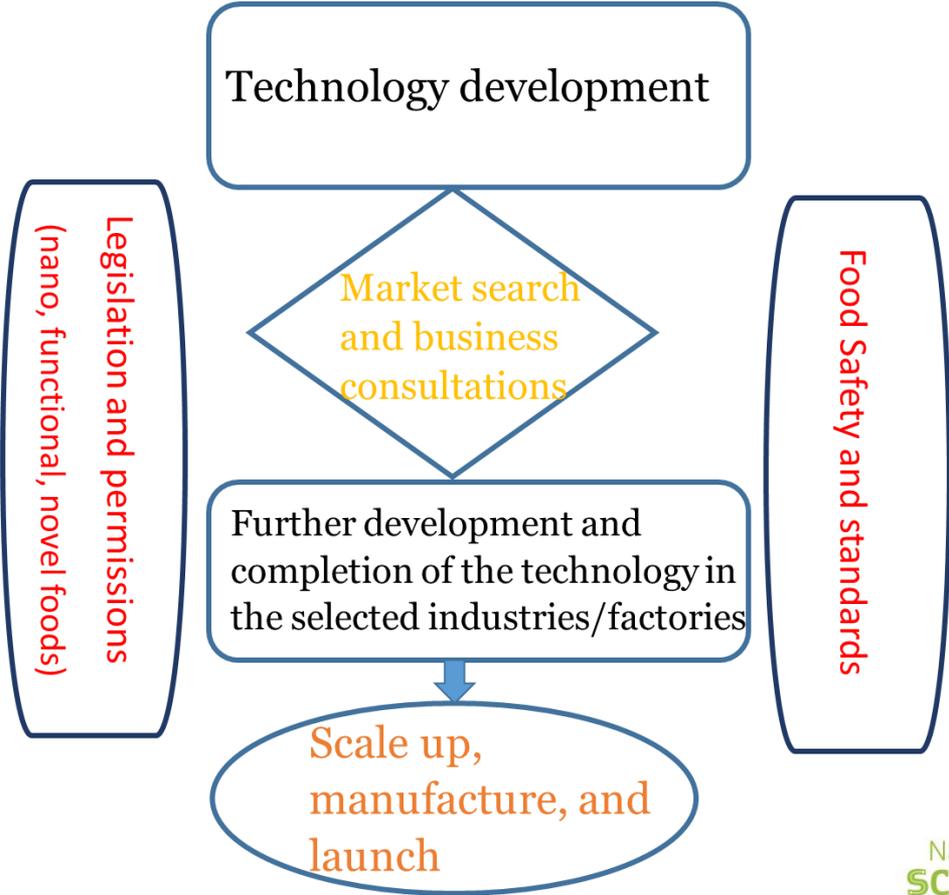
Functional foods?



- A food claimed to have an additional function (often one related to health promotion or disease prevention) beyond basic nutrition.
- By adding **new ingredients** or **more of existing ingredients**.
- Traits purposely bred into existing edible plants (e.g., purple potatoes having increased anthocyanins).
- “May be **similar in appearance** to conventional food and consumed as part of a regular diet”.
- The term was first used in the 1980s in Japan (government approval process for functional foods called Foods for Specified Health Use (FOSHU)).

https://en.wikipedia.org/wiki/Functional_food

Functional Food Manufacture/Development



Opportunities



Health-promoting effects of bioactives (e.g., antioxidants)



Fast growing market for functional foods



Declining market for supplements



Preventive strategies becoming more popular



Consumer awareness towards healthier and natural products

Functional foods market



GlobeNewswire



November 19, 2020 20:00 ET | Source: Precedence Research

OTTAWA, Nov. 19, 2020 (GLOBE NEWSWIRE) -- The global functional food market size was valued at USD 173.26 Billion in 2019 and expected to reach USD 309.00 Billion by 2027 and poised to grow at a compound annual growth rate (CAGR) 7.5% during the forecast period 2020 to 2027.

Functional foods are ingredients that provide health benefits that extend beyond a human's nutritional value. For example, they may prevent nutrient deficiencies, protect against disease, and promote proper growth & development. Some types of functional foods contain supplements or other additional ingredients that are designed to improve the health.

Publications

Google Scholar functional foods 

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Functional foods: the US perspective [HTML] oup.com
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JA Milner - The American journal of clinical nutrition, 2000 - academic.oup.com
... in the coining of the term **functional** food, although agreement about what is and what is not a **functional** food is lacking. Public interest in **functional foods** is increasing because of higher ...
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[HTML] Functional foods: An overview [HTML] springer.com
Full View
S Kaur, M Das - Food Science and Biotechnology, 2011 - Springer
... It also provides an overview on various **functional** ... -based development and research on **functional foods**, the key factors ... health claims of **functional foods** by conducting longitudinal ...
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[HTML] Functional foods [HTML] nature.com
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CJ Henry - European Journal of Clinical Nutrition, 2010 - nature.com
Humankind has always been interested in food. This, although a platitude, is worth remembering. The science of **functional foods** is the convergence of two major events in our lives—...
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Studies on functional foods in Japan—state of the art [PDF] oup.com
Check for Full Text
S Arai - Bioscience, biotechnology, and biochemistry, 1996 - academic.oup.com
... "ing **functional foods** in terms of "foods for specified ... **functional foods**. Other basic and applied studies directed toward the tertiary) function, with future perspectives for **functional foods**...
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Related searches

functional foods nutraceuticals	fermented functional foods
functional foods probiotics	functional foods consumer
functional foods health and disease	functional foods ingredients
functional foods dietary supplements	functional foods prebiotics

Functional foods Check for Full Text
DR Farr - Cancer Letters, 1997 - Elsevier
... (aka Japan Health and Nutrition Food Association) approves 'Foods for Specific Health Use' (FOSHU). Such **foods** carry an emblem for use on approved **functional foods** which states '...
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Patents



functional foods



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www.google.co.nz/patents/WO2004047543A1?cl=en

Functional foods and process for producing functional food



App. · Filed 21/11/2003 · Published 10/06/2004 · Masayuki Suzuki · Meiji Dairies Corporation

It is intended to provide **functional foods** such as dairy products capable of ... The ACE inhibitory activity of such a **functional food** is controlled to 5000 ...

[Overview](#) · [Related](#) · [Discuss](#)

www.google.co.nz/patents/CN101223986A?cl=en

The healthy and functional foods for the obesity patients ...



App. · Filed 17/07/2007 · Published 23/07/2008 · 李妍熙 · 马铃薯百利公司 (株)

Disclosed is a novel healthy and **functional food** having an obesity-suppressing activity. The healthy and **functional food** according to the present invention ...

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www.google.co.nz/patents/CA2507675A1?cl=en

Functional foods and process for producing functional food



App. · Filed 21/11/2003 · Published 10/06/2004 · Masayuki Suzuki · Meiji Dairies Corporation

It is intended to provide **functional foods** such as dairy products capable of ... The ACE inhibitory activity of such a **functional food** is controlled to 5000 ...

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Products ???



Challenges in Commercialisation of Functional Foods

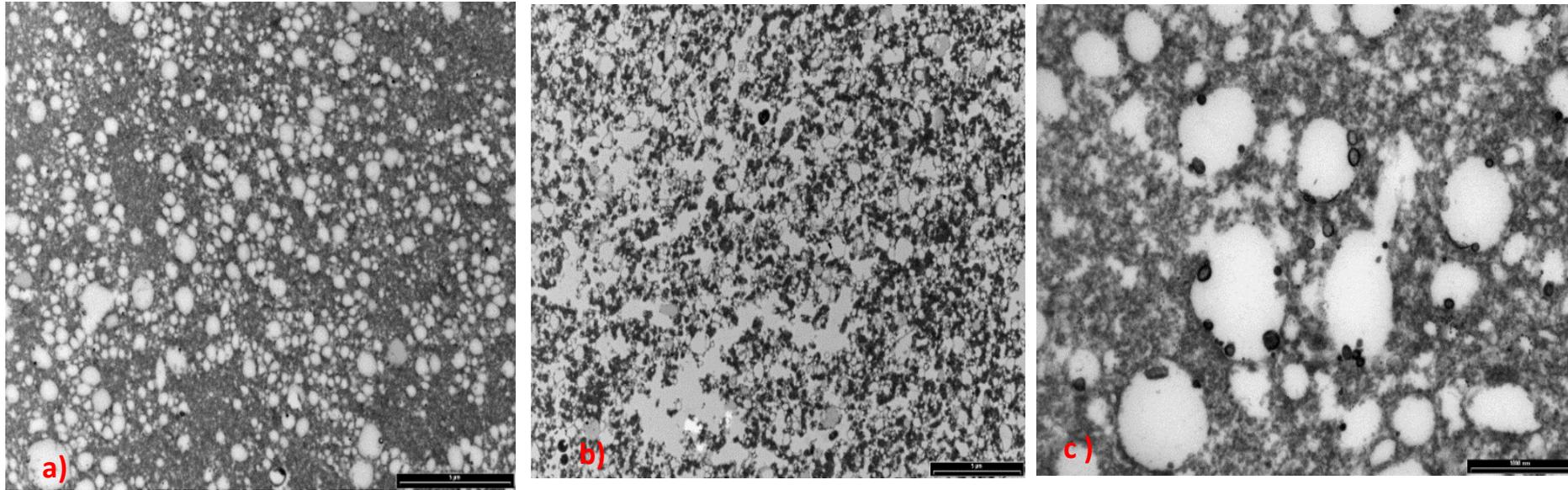


1. Undesirable properties and instability of the bioactives during process and storage

- Low water solubility (high crystallinity)
- Low stability
- Low bioavailability
- Bitterness/astringency
- High dosage required (**500 mg/day/single dose; single serve**)
- Interaction with food components



Effect on microstructure of the food



TEM micrographs of mature full-fat cheese samples. a) no green tea catechin (control cheese), b) 500 ppm free Green Tea Extract, c) 500 ppm encapsulated Green Tea Extract. Scale bar 5 µm. Rashidinejad (2015).

2. Scalability of the manufacturing process

Google Scholar search results for "encapsulated polyphenols". The search bar shows "encapsulated polyphenols" and the results section indicates "About 44,600 results (0.07 sec)".

Articles

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[HTML] **Encapsulation of polyphenols**—a review
[Z.Fang, B.Bhandari](#) - Trends in Food Science & Technology, 2010 - Elsevier
... **encapsulation** of the more widely used **polyphenols**, ... **encapsulation of polyphenols** is summarized in this paper. The characteristics of capsules produced by the various **encapsulation** ...
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[HTML] Emulsion-based **encapsulation** and delivery systems for **polyphenols**
[Wu Lu, Al Kelly, S Miao](#) - Trends in Food Science & Technology, 2016 - Elsevier
... stability and bioavailability of **polyphenols**. A wide range of technologies have been developed to **encapsulate polyphenols**. Among these, emulsion-**encapsulation** is regarded as one ...
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Encapsulation of natural polyphenolic compounds; a review
[A Munin, F Edwards-Lévy](#) - Pharmaceutics, 2011 - mdpi.com
... on the most commonly used **encapsulation** methods applied to **polyphenols**, and discusses ... **encapsulation of natural polyphenols** on the micro scale will be the main topic of this article. ...
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β-cyclodextrin encapsulated polyphenols as effective antioxidants
[P.Roy, AK Dinda, S Chaudhury, S Dasgupta](#) - Biopolymers, 2018 - Wiley Online Library
... to **encapsulate the polyphenols** and studied its antioxidant properties along with that of free **polyphenols**... forming rings of ECG and EGCG become **encapsulated** in the cavity of β-CD and ...
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Related searches



3. Possible toxicity (nanoparticles, extracts, isolated bioactive compounds)



Reviews | 4 January 2005

Meta-Analysis: High-Dosage Vitamin E Supplementation May Increase All-Cause Mortality

Edgar R. Miller III, MD, PhD , Roberto Pastor-Barriuso, PhD, Darshan Dalal, MD, MPH, ... [See More +](#)

[Author, Article, and Disclosure Information](#)

<https://doi.org/10.7326/0003-4819-142-1-200501040-00110>

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Background:

Experimental models and observational studies suggest that vitamin E supplementation may prevent cardiovascular disease and cancer. However, several trials of high-dosage vitamin E supplementation showed non-statistically significant increases in total mortality.

Purpose:

To perform a meta-analysis of the dose-response relationship between

Conclusion:

High-dosage (≥ 400 IU/d) vitamin E supplements may increase all-cause mortality and should be avoided.

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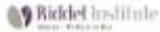
4. Lack of Clear Regulations

- Lack of **clarity**; pure bioactives vs extracts, nanoparticles in food, etc.
- Regulations differ in different **countries**.
- The regulation of food **label/function claims**.
- The primary distinction is in the **claims made for benefits**, other than nutritional, attributed to the functional food.
- **Strict examination** of some of the claims.
- Food label structure/function claims: Claims using the term '**healthy**'; **Antioxidant** content claims; **Omega-3** fatty acid content claims.
- Medical food and food for special dietary use.
- The health claim may be **implicit** ("rich in vitamin C"), or **vague** ("strengthens the body's defence system")



Novel Food Navigation Tool

June 2021



- ◆ Prepared by Michelle Cubitt, Smart Regulatory Solutions
- ◆ With the support of Riddet Institute
- ◆ Funded by High Value Nutrition

The Riddet Institute together with Michelle Cubitt, Regulatory Consultant Smart Regulatory Solutions, has published an HVN Novel Foods Navigation Tool. This will help businesses identify whether potential foods or ingredients would be considered Novel, and provides a roadmap for how to navigate the associated regulatory processes for a Novel Foods Application.



HVN Novel Foods Navigation Tool

The HVN Novel Foods Navigation Tool is designed to help businesses identify whether potential foods or ingredients would be considered Novel, and provides a roadmap for how to navigate the associated regulatory processes for a Novel Foods Application.

- [HVN Novel Foods Navigation Tool](#)
- [Supplementary Information](#)

Resources from the Ministry for Primary Industries (MPI)

The Ministry for Primary Industries (MPI) has compiled a list of regulatory considerations for High-Value Nutrition (HVN) Ko Ngā Kai Whai Painga programmes:

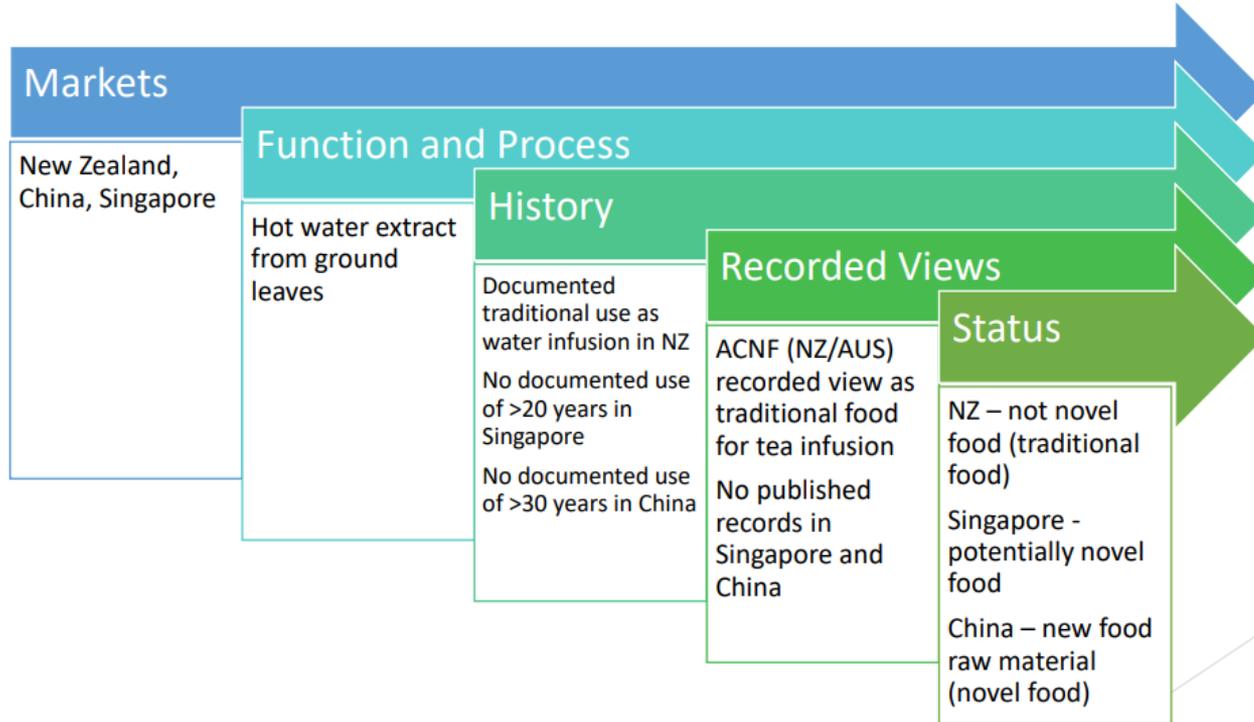
- [Key regulatory considerations for HVN programmes \(MPI May 2019\)](#)

For further information contact Donnell Alexander (donnell.alexander@mpi.govt.nz) or Karen Lau (karen.lau@mpi.govt.nz).

Other useful resources from MPI

- [Labelling and composition requirements for food sold in New Zealand](#)
- [Requirements for health claims on high value foods](#)

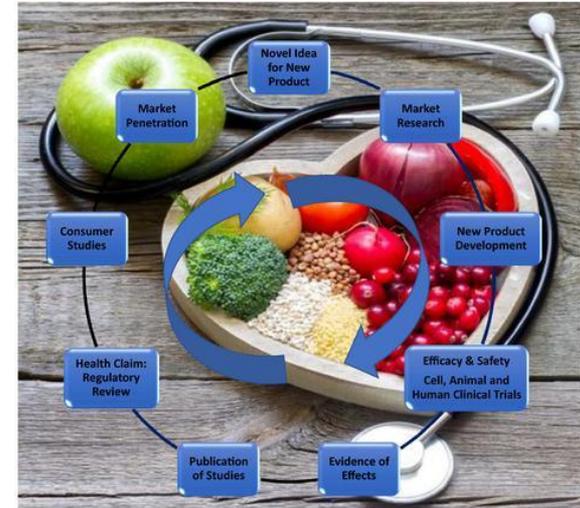
Case Study: Kawakawa (*Piper excelsum*)



Credit to Michelle Cubitt

5. Limited data on the clinical translation

- Cost; clinical trials are **expensive**
- Time; clinical trials are **time consuming** (ethics, recruitment, execution)
- Must be well designed in order to optimise the **quality of the data** they provide
- Specific **expertise**
- Specific **equipment/facilities**



6. Limited interest from the Food Industry

- Additional cost
- Availability of the material
- Regulatory status
- Process compatibility
- Large capital investment
- **Link between science and commercialisation** (science communication)
- Lack of training
- Expertise
- Risk taking



7. Consumer scepticism and awareness

- **Benefits** associated with consuming the products may be **difficult to detect**.



[Int J Environ Res Public Health](#). 2022 Feb; 19(3): 1217.

Published online 2022 Jan 22. doi: [10.3390/ijerph19031217](https://doi.org/10.3390/ijerph19031217)

PMCID: PMC8835010

PMID: [35162240](https://pubmed.ncbi.nlm.nih.gov/35162240/)

Consumer Acceptance toward Functional Foods: A Scoping Review

[Mathew T. Baker](#),* [Peng Lu](#), [Jean A. Parrella](#), and [Holli R. Leggette](#)

Paul B. Tchounwou. Academic Editor



The five categories of determinants were **product characteristics, socio-demographic characteristics, psychological characteristics, behavioral characteristics, and physical characteristics**. Each of the determinants were more fully described by sub-determinants in our scoping review. These determinants should be considered and used by leaders and scientists in product development to aid decision making and, ultimately, the successful launch of novel functional foods.

Successful case studies:

1) FERRI-PRO

2) FlavoPlus

EP2866576A1
European Patent Office

[Find Prior Art](#) [Similar](#)

Other languages: German, French

Inventor: Vikas Ashok MITTAL, Ashling ELLIS, Shantanu Das, Aiqian Ye, Harjinder Singh

Current Assignee : Societe des Produits Nestle SA

US20220000160A1
United States

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Inventor: Abby Kerrin Thompson, Alejandra Acevedo Fani, Ali Rashidinejad, Harjinder Singh, Simon Derek Miller Loveday, Zhigao Niu

Current Assignee : Massey University

Worldwide applications

2019 * [JP](#) [EP](#) [US](#) [WO](#) [AU](#) [CN](#)



FERRI-PRO

Invention

+

Business model =

Innovation



EP2866576A1

European Patent Office

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Other languages: German, French

Inventor: Vikas Ashok MITTAL, Ashling ELLIS, Shantanu Das, Aiqian Ye, Harjinder Singh

Current Assignee: Societe des Produits Nestle SA



- Risk of iron deficiency in children and women
- Nestlé fortifies affordable foods and beverages with iron for this purpose
- The acquisition of this technology will enable Nestlé to continue to make progress with above*

FERRI PRO: Iron fortification technology applied to fortify food in affordable nutrition category

- Fulfill consumer need
- Give consumer more choice
- Make profit



FERRI PRO: Iron fortification technology

*<https://www.nestle.com/randd/news/allnews/nestle-ferri-pro-technology-iron-deficiency>

Credit to Dr Shantanu Das

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Food giant Nestle acquires Massey technology to fix iron deficiency

George Heagney · 17:15, Jan 29 2019



WARWICK SMITH/STUFF

From left, Nestle research and development innovation manager Dr Birgit Hoist; Nestle Research and Development research scientist Dr Joeska Husny; Nestle research and development vice-president Deborah McRonald; and Riddet Institute director, distinguished professor Harjinder Singh, talk iron deficiencies.

Nestlé acquires new fortification tech to tackle iron deficiency

By Will Chu

31-Jan-2019 · Last updated on 31-Jan-2019 at 08:59 GMT



©iStock

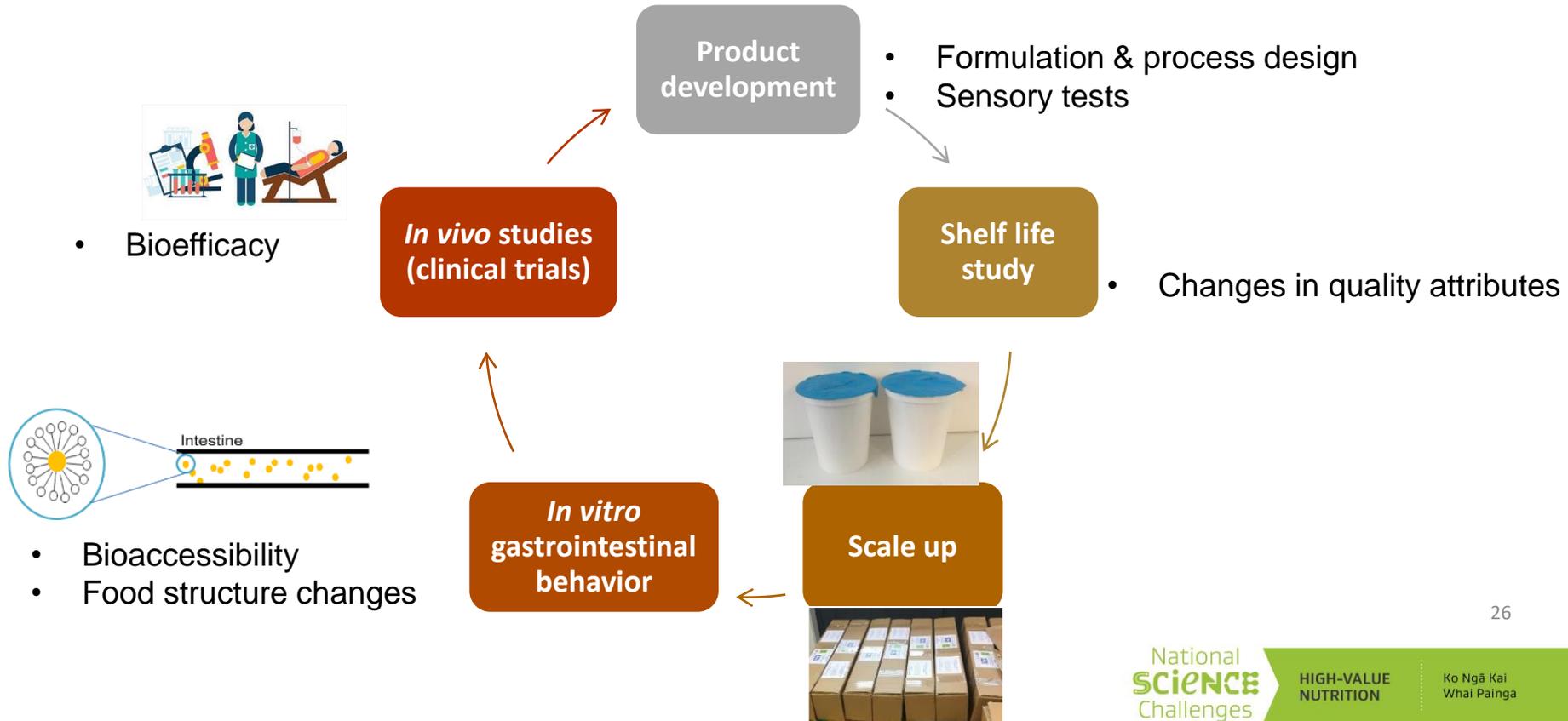
Swiss food giant Nestlé aims to step up its global fight against iron deficiency after acquiring a new food fortification technology developed by researchers in New Zealand.

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Development of a functional polyphenol-fortified foods using FlavoPlus



Conclusions

- **Functional food market** will grow rapidly (**big opportunity**).
- **Undesirable properties** and **instability** of the bioactives during process and storage.
- **Scalability** of the manufacturing process in the food industry.
- Need for clear **regulations** ...
- **Toxicity** of specific types and concentrations of bioactives and nanoparticles.
- Limited data on **clinical translation**.
- **Limited interest** from the Food Industry.
- **Consumer scepticism** and awareness.
- Successful case studies.

Acknowledgements

Dis. Professor Harjinder Singh

Melanie Ruffell

Professor Geoffrey Jameson

Dr Alejandra Acevedo-Fani

Michelle Cubitt

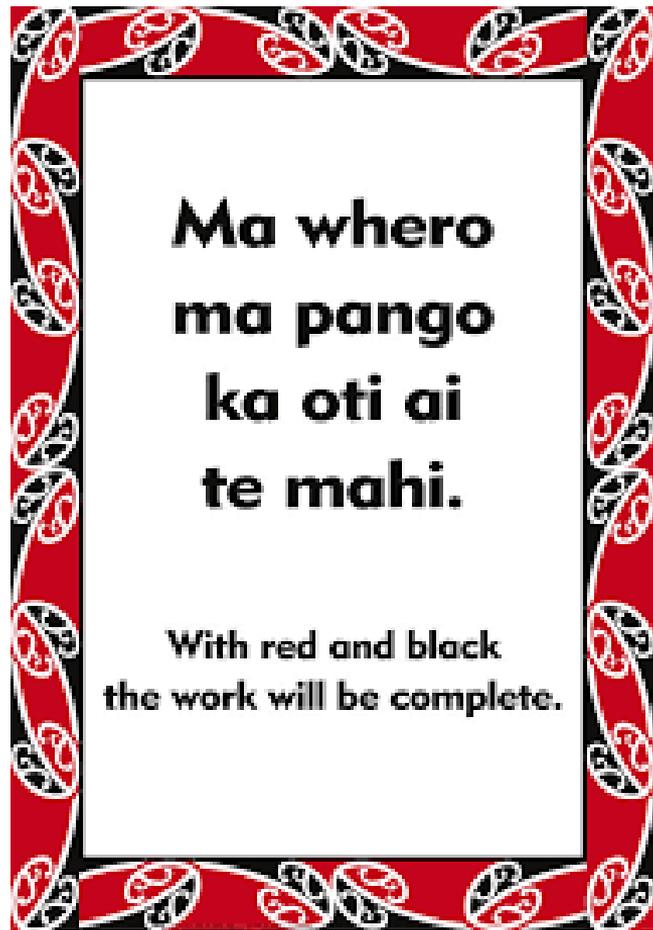
Students:

- Charles Primard
- Céline Sounanthanam
- Elisa Embareck
- Matthijs Nieuwkoop
- Hamid Gharanjig
- Auriane Gree

- **High Value Nutrition National Science Challenge (funding)**
- Technical teams and administrative staff at **Riddet Institute**
- The New Zealand High Value Nutrition National Science Challenge
- The Manawatu Microscopy and Imaging Centre (MMIC)
- The MacDiarmid Institute for Advanced Materials and Nanotechnology
- The Allan Wilson Centre for Molecular Ecology
- Massey University, Palmerston North, New Zealand



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