32

What if we could spray our way to personalised nutrition?

Nutrition **Spray**

Within Reach Transitional Visionary

Spray-based fortification uses nanoencapsulation and biomass for personalised nutrient delivery, addressing global micronutrient deficiencies and laying the foundation for 3Dand 4D printed food applications.



Advanced Health and Nutrition

Systems, Technology

TRENDS

Food-Water-Energy Nexus Mobilising Innovation New Materials Precision/Personalised Medicine

TECHNOLOGIES

Biotechnology Nanotechnology

SECTORS IMPACTED

Agriculture & Food Health & Healthcare Manufacturing Materials & Biotechnology

KEYWORDS

Biofortification Fortification Microbiome Nutrients Personalised Nutrition

The Global 50 (2025)



WHY IT MATTERS TODAY

Many around the world are deficient in vitamins and minerals needed for good health. Micronutrient deficiencies, also known as 'hidden hunger', affect 50% of preschool children and two-thirds of women of reproductive age globally.¹⁰¹⁷ These deficiencies occur when people lack essential vitamins and minerals, even in individuals who consume adequate calories.¹⁰¹⁸ Over 50% of the global population suffer from deficiencies in key nutrients such as iodine (5 billion) and iron (4 billion), severely impacting health and productivity.¹⁰¹⁹

Fortification – the addition of nutrients – has been proven an effective solution. Strategies include food fortification during processing and biofortification of crops.¹⁰²⁰ But the success stories (e.g. iodine fortification in salt and iron fortification in cereals) come with challenges, such as risk of thyrotoxicosis, high cost, and stability and absorption issues.¹⁰²¹

The market for minerals and vitamins is growing. The consumer health and wellness market was valued at \$1.8 trillion in 2023, growing annually by 5-10%, and personalisation will be key.¹⁰²² Over the past 20 years, supplement use has grown, with heightened demand during the COVID-19 pandemic for immune-boosting products. The market for these products surged by 50% between 2018 and 2020, reaching \$220 billion in 2020, and is projected to reach just over \$300 billion by 2028.¹⁰²³ The United States, Europe and Japan are the largest markets, but emerging markets such as the Middle East are also growing rapidly.¹⁰²⁴ While demand is expected to grow alongside the development of innovative forms and novel supplements, standardised regulations and scientific research will be critical to ensure safety and efficacy¹⁰²⁵ – the number of warning letters the US Food and Drug Administration sent to companies doubled between 2017 and 2022.1026

The consumer health and wellness market was valued at

in 2023, growing annually by 5–10%, and personalisation will be key

12



BENEFITS

populations.

RISKS

Reduced reliance on mass

High production costs; limited

scalability; logistical challenges; unintended toxicity and unwanted side effects.

biofortification; access to essential nutrients; tailored solutions for diverse

THE OPPORTUNITY

Spray-based fortification targets micronutrient deficiencies, which harm health, cognitive development, and productivity, particularly in regions with limited access to nutrient-rich foods.¹⁰²⁷ These innovative sprays, applied directly into the mouth or added to food or drinks, use nanoencapsulation technology – used in drug delivery¹⁰²⁸ – combined with biomass to enhance nutrient stability and absorption.¹⁰²⁹

Nanoencapsulation protects nutrients from degradation while enabling controlled release and targeted delivery.¹⁰³⁰ Sustainable biomass sources such as microalgae and safe-to-use agricultural waste (e.g. mango peel)¹⁰³¹ provide eco-friendly nutrient sources. Customised sprays, with biosensors that analyse blood nutrient levels and the gut microbiome, enable personalised nutrition formulations distributed through kiosks in clinics, schools and remote areas supporting local health initiatives and opening the door to applications in 3D- and 4D-printed foods.¹⁰³²

While demand for supplements is expected to grow, standardised regulations and scientific research will be critical to ensure safety and efficacy