The Evolution of Personalised Nutrition: Introduction

Background

Personalised Nutrition services providers operate at the intersection between the food system and health advisory, using personal consumer data to provide highly tailored nutritional advice to optimise health and wellbeing. Start-ups active in this area have been gaining increasing media attention over the past five years, and technology push as well as investor interest are driving rapid expansion of the PN sector. Personalised nutrition is based on a scientific understanding that the specific physiological response of an individual to food intake, and certain food ingredients, is determined by genetic background, variations in certain genes, specifics of the gut microbiome, lifestyle factors, as well as phenotypic parameters, such as age, sex, and health status.

Wider uptake of PN services may affect how consumers interact with the food system in the UK, and may in the longer-term impact consumer health at the population level. Therefore, the FSA needs to understand this emerging industry to fulfil its regulatory remit, on the one hand to protect consumers from potential risks of PN services and PN-based personalised food products, and on the other to support developments that may be of benefit to society. Should a personalised food sector evolve from PN services by connecting with various food producers that would be certainly a development to closely watch with regard to FSA remit. Moreover, as PN services are based on scientific data and information personal to individual consumers, the FSA needs to gain a better understanding of how well PN providers represent the underlying science base of their offerings, and how trustworthy their interpretation of personal scientific data is in relation to advice given. This is important because PN providers base their health claims linked to foods and nutrients on scientific results that are specific to individual consumers rather than on population-based studies, and it is currently not clear to what extent their activities related to food would fall under FSA remit. For example, consideration is needed as to whether the science base of their health claims would warrant some kind of "labelling" or certification framework, so that consumers can make an informed choice of provider.

It is not only rising consumer interest in health, nutrition and wellness that drive growth of the PN sector, but also public health concerns of national healthcare providers. Currently, most countries show alarming trends of increasing disease burden through non-communicable diseases (NCDs) often linked to obesity, such as type 2 diabetes, cardiovascular disease (CVD), but also chronic lung disease, auto-immune disease, and cancer, among others. The World Health Organization estimates that NCDs account for over 70% of deaths globally with enormous costs to societies (WHO, 2021). The role of food intake in many of these diseases is considered as causal, and policy makers hope that PN could be part of a solution to these public health issues. Personalised approaches are considered in particular because several studies have shown in the past that general, "one size fits all" dietary advice has not been successful in changing food intake behaviour at the population level. In addition, NCDs are strongly correlated with low income and poverty in all societies, and make them a social policy issue that clearly goes beyond health

policy alone (WHO, 2021).

Scientific support for the PN sector came recently from [Food4Me](#), an EU-funded research consortium of 25 partners from 12 European countries. The project involved a web-based randomised controlled trial of personal nutrition, to date the largest interventional trial, across eight EU countries investigating a large range of aspects of PN from the science base to specific diseases to social factors and consumer behaviour. One main result of the trial was that personalised nutritional advice might be more effective in changing food intake behaviour when based on personal, scientific information and feedback, and when achieved in a shared decision making context (Livingstone et al., 2021; Ordovas et al., 2018).

Personalisation of advice was shown to significantly increase the Healthy Eating Index (an overall measure for "healthfulness" of dietary behaviour) of participants, compared to other conventional dietary advice approaches. This effect was not however dependent on specific, more complex scientific data, such as genomics, metabolomics, or gut microbiome data – it simply reflected the individuals' behavioural response to personalised dietary advice. In addition, within the context of this study it seemed that when participants were grouped into categories of whether their dietary intake would meet European dietary recommendations, those with the most inadequate diets benefited most from PN advice, confirming data from population studies (Livingstone et al., 2016; Trestini et al., 2021). Hence policy makers are looking toward the potential of PN to achieve public health goals, and a number of European countries support Research & Development in the PN sector with various funding schemes (Deloitte, 2021).

As there is currently no specific regulation of PN services, a dynamic start-up sector is rapidly expanding, with the US leading the trend and Europe representing 27% of the PN market growth in 2019 (ResearchAndMarkets, 2020). Increasingly, large industrial players in the food and nutrition or in the biomedical and biotechnology sector are joining the PN market, either directly or via partnerships. In addition, big data and data analytics companies are increasingly a driving force behind PN offerings creating software platforms specifically for the PN sector. They act as connectors between consumers, D2C blood, DNA or microbiome testing laboratories, or glucose monitoring services, dieticians, nutritionists, and web-based scientific information. As some of the PN providers entering the market sell food products or supplements together with their advice, either directly or through third parties, it becomes important for the FSA to understand the market dynamics with regard to PN offerings and personalised foods, types of business models, and speed of sector development, in order to anticipate any potential threats and opportunities for consumers and society at large.

Objectives

This report looks specifically at the impact of the emerging sector of Personalised Nutrition on food safety and consumer choice in the UK, provides a framework for understanding the current state of the PN industry, and gives a forward look at how the industry might evolve over the next ten years.

This report provides an analytical framework for assessing the relevant current trends in science, consumer behaviour, economic activity, and the regulatory environment that currently shape the PN industry.

PN as a service is currently not regulated. In addition, it is ill defined in terms of regulatory responsibilities, likely because of its position somewhere between health advice/wellness, the food sector, and personal data that were so far considered to belong to the medical and healthcare domain. Hence this report aims to present a clear picture of the scientific, economic, and social foundations of PN, so that the FSA can assess to what extent certain aspects of PN might fall within its remit. This assessment should also include the possibility that FSA might wish to consider expanding current remit definitions.

This report provides an overview of the PN market globally and in the UK, its commercial players, and start-up trends, and gives an indication of the time frames within which PN services and products will impact the UK. These time frames will be presented with the intention of the FSA in mind to take an anticipatory approach to regulation.

This report will draw conclusions based on analysis of currently available data in the public domain and give recommendations where the opportunities for the FSA could lay as a regulator to act at the intersection between food and public health.

Key research questions

This report seeks to address the following research questions:

- What does the current market for personalised nutrition look like in terms of its offerings and consumer reach?
- What is the current state of scientific understanding underpinning the personalised nutrition industry? For example, considering the potential for our understanding of the impact of the gut microbiome on individuals' health and nutrition - is there consensus on our understanding of its function and implications, and if not, what are the key areas of disagreement and uncertainty and their potential impact on the development of consumer products?
- What are the likely trends in how personalised nutrition will evolve in the next 10 years? What are the potential barriers and accelerants to its development?
- What are the current food safety risks (if any) from the personalised nutrition industry?
- How might the likely changes in the personalised nutrition industry impact on food safety risk?
- How might the likely changes in the personalised nutrition industry affect food regulation? What steps might the FSA need to take to protect consumers, both through ensuring food safety, and supporting any positive benefits to be derived from personalised nutrition?

Methodology

This research took the form of an evidence assessment and synthesis of the available academic literature, industry reports including evidence already generated within the FSA, and a review of the personalised nutrition start-up scene. The assessment process consisted of desk-based research, and analysis and review were undertaken using standard evidence review protocols.

Academic databases were interrogated for the academic literature searches, and the research also draws on news articles, industry reports, and several food sector start-up focused databases (for example, Food Navigator, 2021; Forward Fooding, 2021). This report draws upon several decades of interest in this topic, and in particular the rapid growth in interest over the past decade. Where possible, we sought to identify multiple, most recent articles on each topic of interest to ensure a balanced perspective, and took into consideration more highly cited articles, or those from leading global institutions and research groups, and government agencies.

Definition of Key Terms

Biomarker: short for biological markers, are a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes or pharmacological responses to a therapeutic intervention. Used for clinical assessment such as blood pressure or cholesterol level and to monitor and predict health states in individuals or across populations.

Blood parameter: measurable characteristics of blood cells, such as white blood cell count, red blood cell count, hemoglobin, platelet count, etc. In a more general sense also, any other molecular parameter measured in a blood sample, such as glucose, or certain hormones.

Genotype: An organism's complete set of genetic material or totality of all genes characteristic for an organism. The genotype is expressed when the information encoded in the genes' DNA is used to make ribonucleic acid (RNA) and protein molecules.
Metabolism: The chemical processes that occur within a living organism in order to maintain life, for example, the chemical reactions in the body's cells that change food into energy.

Personalised nutrition: (alternatively referred to as precision nutrition) is individualised dietary advice or nutrition guidelines based on a combination of an individual's genetic, environmental and lifestyle factors, including dietary habits, health status, phenotype, gut microbiome, and genotype, and focuses on health promotion.

Phenotype: set of observable characteristics of an individual resulting from the interaction of its genotype with the environment. Some traits are largely determined by the genotype, such as height, eye colour, and blood type, while other traits are largely determined by environmental factors.

Physiology: the organic biochemical processes of an organism or any of its parts or of a particular bodily process that maintain life and bodily functions of an organism.

Structure of the Report

The following section (chapter 2) of this report presents an overview of the foundations of personalised nutrition, its development over the past several decades, the scientific methods underpinning PN, and the key types of PN services on offer. Chapter 3 discusses the global and UK PN market, its characteristics, business models and expected interactions with the wider food system as well as future evolution. Chapter 4 takes a thorough look at the currently used science underpinning PN services and its limitation and future developments. Chapter 5 highlights the drivers and challenges for businesses linked to technology trends and current market limitations. Chapter 6 interrogates wider societal trends that impact the evolution of PN services. Chapter 7 gives an overview of the relevant regulatory environment that may impact the currently unregulated PN sector and discusses relevant food safety issues that may arise from the sector. Chapter 8 summarises key findings. Chapter 9 draws conclusions from the research and offers recommendations for the FSA, followed by suggestions for future research.