

Innovations in Infant Feeding

Subjects: Nutrition & Dietetics

Contributor: Julio Alvarez-Pitti

The field of nutrition in early life, as an effective tool to prevent and treat chronic diseases, has attracted a large amount of interest over recent years. The vital roles of food products and nutrients on the body's molecular mechanisms have been demonstrated. The knowledge of the mechanisms and the possibility of controlling them via what we eat has opened up the field of precision nutrition, which aims to set dietary strategies in order to improve health with the greatest effectiveness. However, this objective is achieved only if the genetic profile of individuals and their living conditions are also considered. The relevance of this topic is strengthened considering the importance of nutrition during childhood and the impact on the development of obesity. In fact, the prevalence of global childhood obesity has increased substantially from 1990 and has now reached epidemic proportions.

Keywords: pediatrics ; obesity ; cardiometabolic risk factors ; precision nutrition ; eating behavior

1. Introduction

Nutrition is known to play one of the key roles in the prevention and treatment of non-communicable chronic diseases. Many of the molecular mechanisms through which nutrients affect the functioning of our bodies are now known. Promoting the correct functioning of these mechanisms through what we eat is the basis of precision nutrition. The goal now is to find personalized dietary strategies that improve people's health.

Cardiometabolic diseases (CMDs) are the leading global cause of death, among which, obesity is the most frequent in childhood and adolescence ^[1]. Obesity, even during childhood, is a chronic disease with multifactorial etiology. Genetics, lifestyle factors, an unhealthy diet, sedentarism, and poor sleeping habits are some of its main causes, and all of them play an important role in its progression and the development of its comorbidities ^{[2][3]}.

Physiological functions in the body can be modulated by nutrients because of their ability to interact with molecular mechanisms: "Nutritional genomics focuses on the interaction between bioactive food components and the genome, which includes nutrigenetics and nutrigenomics. The influence of nutrients on gene expression is called nutrigenomics, while the heterogeneous response of gene variants to nutrients, dietary components, and developing nutraceuticals is called nutrigenetics" ^[4] (**Figure 1**).

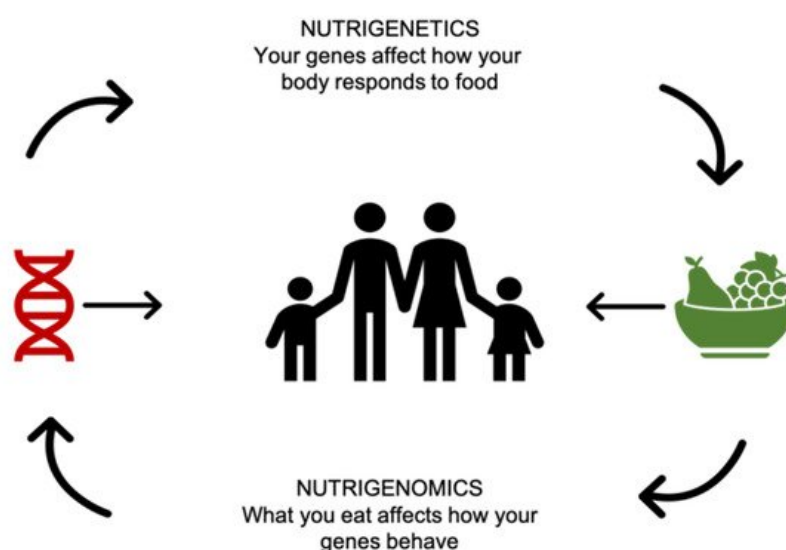


Figure 1. Nutrigenetics vs. nutrigenomics.

Herein, we highlight three of the hypotheses underpinning nutrigenetics and nutrigenomics ^[5]:

- “The health effects of nutrients and nutriomes (nutrient combinations) depend on inherited genetic variants that alter the uptake and metabolism of nutrients and/or the molecular interaction of enzymes with their nutrient cofactor and hence the activity of biochemical reactions.”
- “Nutrition may exert its impact on health outcomes by directly affecting the expression of genes in critical metabolic pathways and/or indirectly by affecting the incidence of genetic mutation at the base sequence or chromosomal level which, in turn, causes alterations in gene dosage and gene expression.”
- “Better health outcomes can be achieved if nutritional requirements are customized for each individual taking into consideration both his/her inherited and acquired genetic characteristics depending on life stage, dietary preferences, and health status.”

The objective pursued by precision nutrition is to design personalized feeding recommendations that allow for the treatment or prevention of CMDs [6]. For this purpose, it is not only based on genetic information, but also other components such as dietary habits, physical activity, the microbiota, and the metabolome.

Purpose of Review

Nutrition plays a critical role during childhood and adolescence. Understanding the impact of nutrition in early life is essential for the development of future intervention strategies in order to modulate both immediate adult, offspring, grand offspring, and further phenotypes. Information on the potential of prescribing personalized nutrition is, however, scarce. Therefore, the aim of this narrative review is to provide an update on the evidence of the results of precision nutrition interventions during the early period of life, focusing primarily on its impact on obesity and cardiometabolic health. We focused our review on interventions (non-randomized pre-post intervention studies, clinical trials) or meta-analysis of interventions, mainly based on a personalized nutrition approach, in which their objective was to prevent or to treat obesity in infants and adolescents. We also included interventions during pregnancy due to the impact of a mother’s nutrition on their offspring. In order to structure the review, we followed the classification of precision nutrition interventions levels, proposed by Ordovás et al. [7].

2. Precision Nutrition Levels

Ordovás et al., propose two levels of personalization of nutrition advice. The first level incorporates a characterization of the subject’s behaviors and phenotype (such as adiposity) in order to develop a personalized nutritional advice. Interventions based in this level of personalization, were reviewed throughout the different pediatric stages (e.g., pregnancy, childhood, and adolescence). The second level of personalization builds on the first layer, while also considering different responses to foods and/or nutrients that are conditioned by genotypic or other biological characteristics (**Table 1**).

Table 1. Levels of personalization of nutrition-based interventions in the prevention and treatment of obesity throughout the different pediatric stages.

Level of Precision Nutrition	Pediatric Stage		
1. Behavioral Level	1.1. Pregnancy [8][9][10][11][12][13][14][15][16][17][18]	1.2. Lactation period [19][20][21][22][23][24][25][26][27][28][29][30][31][32][33][34][35][36][37][38][39][40][41][42][43][44][45][46][47][48][49][50]	1.3. Childhood and adolescence [51][52][53][54][55][56][57][58][59][60][61][62][63][64][65][66][67][68][69]
	First 1000 days		
2. Biological Levels	2.1. Biomarkers [70][71][72][73][74][75][76][77]		
	2.2. Genetics [78][79][80][81][82][83][84][85][86][87]		
	2.3. Metabolomics [88][89][90][91]		
	2.4. Microbiota [92][93][94][95][96][97][98][99][100][101][102][103][104][105][106]		

3. Future Directions

The prevalence of obesity and the associated cardiometabolic risk factors in children and adolescents has been globally increasing since 1990. Nowadays, there is growing evidence from basic nutritional science about the importance of dietary advice, and it is considered one of the main challenges of clinical nutrition. Moreover, tailored nutrition represents a promising approach to prevent and manage obesity. A concerted effort between clinical and basic science researchers is needed in order to establish a comprehensive framework to allow the implementation of these new findings to adequately apply novel and personalized dietary advice.

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