

OPTIMAL STRATEGIES FOR PRODUCT NUTRITION IMPROVEMENT

Steve B. Zhou, University of Houston Downtown, Houston, U.S.A.
Angela Yan, The Hockaday School, Dallas, U.S.A

[dx.doi.org/10.18374/JABE-24-4.2](https://doi.org/10.18374/JABE-24-4.2)

ABSTRACT

It is widely known that school lunches in the U.S. possess a deficiency in nutritional content, contributing to possible health concerns including, but not limited to, adolescent obesity, nutritional deficiency, food poisoning, and others. Addressing the issue of nutritional deficiency in school food is imperative to society. However, this issue remains unexplored in academic research. In this research, mathematical models are used to study how to improve the nutritional level in school lunches. We examine if investing in improving food nutrition is attractive for producers and what optimal nutrition level the producers should add. Through mathematical models, we drive the optimal nutrition level the producers can provide for schools while allowing the producers to earn higher profit. The results suggest that when the producers invest in enhancing school lunch nutrition, it is beneficial for them to do so. However, the optimal nutrition level and corresponding price must be set so that all parties can benefit. Furthermore, we also show that the market valuation of product nutrition and the cost-effectiveness of nutrition improvement significantly impact the producer's motivation to invest in nutrition improvement.

Keywords: Nutrition improvement; Mathematical model; Price; Profit; Optimization

1. INTRODUCTION

Nutritional deficiency in food leads to serious health issues including, but not limited to, adolescent obesity, nutritional deficiency, food poisoning, and others. For example, several school food items were tested and found to contain very high levels of glyphosate, which can cause nervous system damage, liver, and kidney damage, and even damage reproductive organs. High levels of hormones, veterinary drugs, and heavy metals are also found in school food at alarming levels. Zen Honeycutt, the director of Moms Across America, discovered that “the nutrient density of the food is almost completely deficient, leaving children’s bodies starving for nutrients, unable to develop properly, and lacking nutrients that their brains need to learn and make sound decisions” (Cervarich, 2022). Unhealthy school food also contributes to the increasing obesity rates. Recent research found that schools with unhealthy food experience obesity prevalence compared to schools with healthier school food environments (Ohri-Vachaspati et al, 2023). Even worse, some schools were reported to have served spoiled food like spoiled and moldy spaghetti and pizza, discolored sandwich meat, etc., and students got sick from eating spoiled food (Fernandez, 2023; Vang & Goss, 2023). However, outside the United States, lunch food is very different. For example, in Japan, the food used for school lunches is grown locally and rarely frozen; lunches are freshly prepared with balanced nutrition and focused on rice, vegetables, fish, and soups (Harlan, 2013).

Children with access to nutritious meals can have better academic performance through supporting cognitive development and improved concentration, memory, and overall academic achievement. Further, children who consume a nutritional diet are more productive and have more energy in their daily activities. Hence, addressing the issue of nutritional deficiency in school food is imperative to society. However, it remains unexplored in the extant literature. Nowadays food nutrition has become more and more important. It is imperative to initiate some new strategies to improve food nutrition. Past research in literature has not addressed the following questions: how to improve food nutrition effectively and what are the optimal strategies to improve food nutrition? In this research, we examine how to improve the food nutrition level from the perspective of mathematical models and improvement and create a Pareto result for both the producer and the school food nutrition program. Specifically, our research addresses the following important question: Is it always beneficial for the producer to invest in nutrition improvement? If not, what is the optimal