Evolution of nutritional quality in the US: Evidence from the ready-to-eat cereal industry

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HIGHLIGHTS
- The average nutrition quality in the ready-to-eat cereal market has been on a declining trend since late 1980s.
- The nutrition quality has reversed its trend since early 2000s but is still worse than late 1980s.
- Consumption gravitates towards less healthy options available in the market.
- The decline in nutritional quality intake cannot be attributed to pricier or a limited availability of healthier options.

ARTICLE INFO
Article history:
Received 12 August 2014
Received in revised form 13 May 2015
Accepted 16 May 2015
Available online 27 May 2015

JEL classification:
I1
D1

Keywords:
Evolution of nutrition
Obesity
Ready-to-eat cereal

ABSTRACT
We construct historical nutrition quality indices for the ready-to-eat cereal industry and find that: (1) there exists a discrepancy between the nutrition quality of available products and that of the actual intake, (2) nutrition quality declined between 1988 and 2001 but has been increasing since then (although levels are still lower than in 1988), and (3) the decline in nutritional quality intake cannot be attributed to pricier or a limited availability of healthier options.

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1. Introduction

As of 2010, obesity has surpassed smoking to become the number-one cause of preventable diseases and deaths in the United States (Jia and Lubetkin, 2010). The resulting economic consequences are substantial and range from greater public health spending to increased health premiums (CDC, 2013; Jia and Lubetkin, 2010; Finkelstein et al., 2009). It is estimated that annual spending attributable to obesity has doubled from $78 billion in 1998 to $147 billion in 2008 (now approximately 10% of all medical costs), with roughly half of that paid for by Medicare and Medicaid (Finkelstein et al., 2009). Obesity has thus taken center stage in health care policy debates, yet we still have no clear consensus as to what causes lay behind the obesity epidemic.

One natural starting point is a study of how the food we consume as a nation has changed over time, and how those changes relate to declining dietary health. However, past research lacks data sufficiently detailed and comprehensive to track product availability, quantities consumed, and observed prices as they shift over time. As a result, the interaction between nutrition and market factors such as the supply of and demand for food remains largely unexamined.

Combining a novel longitudinal dataset detailing nutrition information with weekly scanner data, we contribute to the literature and the public debate by documenting and analyzing the evolution of: (a) nutrition quality of available products, and (b) nu-
trition quality intake over a period of nearly one quarter century (1988–2011). Our analysis focuses on a frequently studied product in the US: ready-to-eat (RTE) cereals. Furthermore, we investigate two commonly cited claims: (1) that healthier products are significantly more expensive, and increasingly so over time, than their unhealthy counterparts (Darmon et al., 2004; Parker-Pope, 2007; Drewnowski, 2010; Monsivais et al., 2010), and (2) that healthy products are not equally available in all food markets.

We find that, in general, the nutritional quality of food available and consumed has been declining over time, with the exception of a small recent improvement, conforming to noted trends in obesity. Furthermore, we find that consumers favor less healthy products disproportionately given the nutrition profile of products available. With regard to the two popular claims detailed above, we fail to find evidence supporting either. Specifically, our results suggest that nutritional quality is not strongly correlated to prices, and that healthy options are equally available across all markets studied, including poorer ones. Given these findings, our work suggests that policies such as education and advertising aimed at changing consumer preferences are the tools most likely to be effective in the ongoing battle against obesity.

2. Data collection and empirical implementation

We assemble and merge two large national datasets, a unique panel of nutrition information and a comprehensive panel of retail sales data. The first makes use of Netzer’s “The Complete Book of Food Counts”, which provides the nutritional profiles of over 150 top brands of cereal roughly biennially from 1987 through 2011. The second makes use of scanner databases with information on availability, price, and sales volume to track market shares for all top brands across 31 metropolitan areas in intervals of roughly five years from 1988 to 2011.

In conjunction, these two datasets allow us to quantify the nutritional profiles of foods available and foods consumed in a given market in time and place. To do so, we consider both individual nutrient levels (e.g., fat, sodium) as well as the overall healthfulness of a product as measured by the Nutrient-Rich Foods Index (NRF).  

We calculate the NRF value for each product and use these values to construct two indices: (1) a simple average of the NRF of all brands available in each market, and (2) a sales volume-weighted average of the NRF of brands sold in each market. The first determines the overall nutritional quality of products available and serves to demonstrate whether that quality varies over time or geography. Conversely, the second index captures the nutritional profile, and variation therein, of products actually consumed. Taken together, the two indices indicate whether the nutrition profile of available products, the measure most commonly adopted in the literature, differs from the nutrition quality consumed—the metric far more relevant to a discussion of obesity.

3. Main results

Trends in the nutritional profiles of products available and of products consumed in the RTE cereal market from 1988 to 2011 are plotted in Fig. 1 and reveal two clear patterns. First, overall nutrition quality declined steadily through 2001, registering 66% with respect to 1988. However, the decline has not been monotonous; following a drastic decrease in early 2000, nutritional profiles of available cereals have been improving ever since and are now 14% higher than at the beginning of the century, although still short by 16% than in 1988.

More importantly, the market share-weighted index, which tracks actual consumption, always registers substantially below the first index in nutritional quality. This implies that, while healthier alternatives may be available, on average US consumers have disproportionately favored unhealthier cereals. It also suggests that studies based only on unweighted nutrient averages—the metric used in prior work—will be biased upwards.

Furthermore, our results show great heterogeneity across geographical regions in the nutritional quality of cereals consumed—heterogeneity due to differences in consumer preferences, rather than in products available. Fig. 2, comparing the nutritional profile of available products (left panel) and of products consumed (right panel) for each metropolitan area in 2011, illustrates this point by showing that the former is consistent across regions while the latter varies significantly.

Additionally, while heterogeneity in the unweighted index has been on the decline since 1996, the nutritional profile of consumption has remained diverse across the country. This implies function of diverse nutrient quantities, the NPI is based on a discrete point system. Nonetheless, the two indices are highly correlated with a correlation coefficient above 0.77 and the results of our analysis are qualitatively very similar independent of whether they are based on NPI or on NRF.

Variation over time would be due not only to the entry of new brands, but decisions by existing brands to change ingredients or to discontinue old products or introduce new ones.

We do not observe actual at-home consumption and instead proxy for it using household purchases. This approach is valid unless the share of a package actually consumed is significantly correlated to the nutritional value of its contents.
that consumers in some regions tend to choose products along the healthier spectrum while those in others do the opposite. Consequently, regional variation in dietary profiles has remained consistently large even as product offerings became uniform.

4. Supporting results

As discussed, one popular explanation for consumption disproportionately and increasingly favoring less healthy foods is that unhealthy options are cheaper, and becoming increasingly so. To explore this hypothesis, we analyze the relationship between nutrition and prices. Fig. 3 shows brand-level scatter plots of prices and NRF (unweighted) for 1988 and for 2011* and suggests no strong association between prices and nutritional values exists in either time period. Furthermore, the lack of association is consistent over time; prices have been evenly spread across all nutritional values in every year since the late 1980s.

To confirm this casual observation we present in Table 1 correlation coefficients between prices and NRF values. The coefficients range from 0.03 to 0.14, thereby failing to support the hypothesis that, in the market studied, more nutritious products are significantly less affordable. To the contrary, the evidence is consistent with the notion that, equal prices notwithstanding, consumers still gravitate towards less nutritious options. We repeat the same analysis for each of three important nutrients (sugar, sodium, and fiber) and reach a similar conclusion.

The second popular claim is that healthier foods are more available in particular places, namely, wealthier neighborhoods (Beaulac et al., 2009; Treuhaft and Karpyn, 2010). To evaluate this claim in the RTE-cereal market, we first measure the availability of each product within each major metropolitan area by taking a simple ratio between the number of stores offering the product and the total number of stores in that market. We then compute the correlation of this measure to indicators of nutrition quality (both overall NRF and the level of individual nutrients).

Table 2 presents the results and shows that, for example, in 2001 the correlation between NRF value and the number of stores offering a given product was 0.0355. That is, healthier products were available at slightly more stores than unhealthy food. If the hypothesis of discriminatory access to healthy foods were correct, we would expect to see a correlation that is negative and larger in absolute value, indicating that healthy foods are available at significantly fewer stores than unhealthy varieties. Thus, the data fails to support the stated hypothesis.

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* NRF is a continuous index. As a result, values of the index are plotted on a continuum from unhealthy products (red) to health products (green).

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Table 1

<table>
<thead>
<tr>
<th></th>
<th>Correlation in 1988</th>
<th>Correlation in 2001</th>
<th>Correlation in 2011</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRF</td>
<td>−0.1436</td>
<td>0.0298</td>
<td>0.0688</td>
<td>−0.0038</td>
</tr>
<tr>
<td>Sodium</td>
<td>−0.1227</td>
<td>0.2118</td>
<td>0.1944</td>
<td>0.1190</td>
</tr>
<tr>
<td>Fiber</td>
<td>−0.1523</td>
<td>0.0226</td>
<td>0.0951</td>
<td>−0.0202</td>
</tr>
<tr>
<td>Sugar</td>
<td>0.1101</td>
<td>−0.1978</td>
<td>−0.1171</td>
<td>−0.0711</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Correlation in 2001</th>
<th>Correlation in 2011</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRF</td>
<td>0.0355</td>
<td>0.0767</td>
<td>0.0366</td>
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<tr>
<td>Sodium</td>
<td>0.1674</td>
<td>0.0400</td>
<td>0.1301</td>
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<tr>
<td>Fiber</td>
<td>0.0064</td>
<td>0.0638</td>
<td>0.0190</td>
</tr>
<tr>
<td>Sugar</td>
<td>−0.1250</td>
<td>−0.1256</td>
<td>−0.1080</td>
</tr>
</tbody>
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11 Including other years does not change our conclusions.
12 Fat and cholesterol do not occur in significant quantities in the products studied here.

13 We are only able to do this exercise for data after 2000 as we do not have store-level data for earlier years.
5. Closing discussion

Using novel historical data for the RTE cereal industry, we study the evolution of dietary quality in the US over two decades and the potential causes behind its decline. We find that while nutrition has been improving since the beginning of the 21st century, it has yet to fully recover from the long decline it has suffered since at least the 1980s. Understanding the causes driving this trend has important consequences for policy-makers seeking to reverse it with the larger goal of combating obesity and the ever-increasing medical costs that accompany it. We contribute to this understanding by presenting descriptive evidence that suggests that the declining trend cannot be explained by changes in product offerings alone. Indeed, the data indicates that neither prices nor local availability are responsible for unhealthy eating. While our findings are specific to a single product category, they speak to broader policy strategies regarding healthful eating and suggest that efforts to improve dietary intake may be more effective if focused on consumer preferences rather than supply-side regulation. This can be particularly important when policymakers considering producer-focused policies (such as banning an unhealthy ingredients) or consumer-directed interventions (such as nutrition-focused health education in elementary schools) must choose where to most effectively direct resources (see Table 1).

Acknowledgment

The views expressed in this article are solely those of the authors, who are responsible for the content, and do not necessarily represent the views of Cornerstone Research.