

Healthy Eating: How to achieve it?

*If you want to improve the people give it, instead of homilies against sin, better food. **Man is what he eats.***

LUDWIG FEUERBACH
(The Ethos of Dining, 1850)

INTRODUCTION

Evolution did not give us humans the strength and speed of large carnivores, or the specialized digestive tract of herbivores. The diet of hominids was mostly limited to fruits, roots and insects, which is why our species made everything possible to develop, over the years, a technology that would allow them to get food, which was scarce, make it available, safe, transportable and with storage capacity for times of need. (1)

The first technological transformation appeared 2 million years B. C. in the Paleolithic where stone tools for hunting and preparing food in addition to fire for cooking dominated our food culture over 95 % of our existence as a human species. The transformation produced a large increase in the quality and diversity of the diet (e.g., large animals, tubers, nuts) and was accompanied by the development of a larger brain and the appearance of the Homo sapiens.

Only about 12000 years B.C., with the domestication of cereals (wheat, rice, maize) and animals (cattle) the Agricultural Revolution started, leading to a huge increase in the available calories and consequently to a massive expansion of human population and the beginning of civilization. But due to protein and micronutrient deficiencies it also introduced famines and diseases, which led to several centimeters height reduction in the transition from the nomadic hunter-gatherer to the sedentary agricultural-village lifestyle.

Finally, barely 200 years ago, in the 19th century, the third revolution in food technology took place allowing mass production of concentrated sugars and refined flours, initiating a period that could be referred to as based on food commodities.

In the last 50 years a new revolution appeared with the emergence and fast acceptance of highly processed foods, which resemble natural food but actually represent a new radical creation, so that they should not be referred to as food commodities but as real industrial products by food companies .

The vast variety of highly processed products found on the market today originate from the extreme chemical and mechanical handling of three vegetable species - corn, wheat and soy- and from animals fed with these food commodities, which transformed the

diversity of species with which we fed to the monotonous variety of industrial products of our current diet.

During food processing water removal facilitates the extension of the product's shelf life and lowers transportation cost, but, in turn, it increases the amount of calories per bite of food. As people regulate food intake more by volume than by calories, in the long-term regular food energy density is directly related to body weight and inversely related to diet quality. High energy density diets promote overconsumption, especially in the context of oversized portion promotion, because the brain loses the ability to use internal mechanisms of satiety in the modern food environment.

Highly processed products are concentrated in calories but deficient in fiber, micronutrients and phytochemicals, plant substances that may facilitate some of the protective effects of vegetables and fruits against diabetes, heart disease and cancer. A serving of 238 grams and 90 kcal of strawberries has 5 grams of fiber, a significant amount of various vitamins and minerals and dozens of phytochemicals, whereas a ten times lower serving, 23.8 grams, of Strawberry Fruit Gushers Splash has also 90 kcal, but only a negligible amount of strawberries, possibly for marketing purposes, and virtually none of the beneficial constituents of fresh strawberries. (1)

We should note that highly processed food puts its emphasis in sugar, salt and fat because products are seasoned with an intense taste, often facilitated by artificial ingredients which allow bypassing endogenous satiety mechanisms and produce addiction-like behaviors.

Observational studies suggest that a diet based on highly processed products from the food industry, such as fast foods, cause excessive weight gain and chronic disease.

Food processing is a fundamental aspect of human culture and industrial methods are needed to supply the nourishment of a world population now exceeding 7 billion people. The current problem is that an unhealthy dietary pattern has been created based on a manufactured, durable, highly palatable diet, aggressively presented on the market , ready to eat or by simple heating, composed of highly processed, cheap ingredients and additives.

A more adequate use of technology motivated by long-term individual and public health needs, and not by the short-term economic considerations of food industries is required.

To achieve a healthy diet begins with the personal behavior that affects energy balance; actually not so personal as people are formed under the social and cultural influence in which they live (including food marketing, especially in children, serving sizes, physical proximity to food shopping and offer), economic options (system affecting food prices by taxes or subsidies) and finally the food policy regulation that may even include compulsory composition changes. We will review the information available for these items. (2)

SPECIAL DIETS: IS IT TIME TO FINISH THEM?

Quoting J. T. Winkler's observations: "*Nutrition policy has failed. Everywhere, people grow fatter and fatter. It is time to do something different, something that works...*"

"Special diets do not work. They are transformative for some people, but most resign or relapse. Dieting is not a public health solution for societies where more than half of adults are overweight..."

"The most important reason for the failure is one that nutritionists are more reluctant to admit: many people are not interested in healthy eating. Some people have different priorities with food. Others are repulsed by well-meaning advice that is intimidating". (3)

Since the obesity epidemic continues to persist, the time has come to end the search for the "ideal" diet to lose weight and prevent diseases. The debate in the scientific community about weight loss diets focused on optimal macronutrients which is transmitted to the media, sheds little light on obesity treatment and may mislead the public on how to manage body weight properly. (4)

Numerous randomized clinical trials comparing diets with different macronutrient compositions (e.g., low carbohydrates, low fat, or others) have shown differences in weight loss (about 1 kg) and small changes in metabolic risk factors, with inconsistent results. In the last year we published four meta-analysis studies comparing diets and one of them summarizes 13 to 24 clinical trials. (5)

The only relevant feature in the meta-analyses is that the degree of adherence to continue or achieve the program objectives is strongly associated with weight loss. The long history of clinical trials that show a modest difference culminate with the last major study of 5145 people (Look Ahead Trial), which suggests that the continuation of clinical trials comparing diets with varied macronutrients will not produce significant findings in the progression of a solution for the obesity problem.

The Look Ahead Trial included overweight or obese patients with type 2 diabetes. The standard treatment with drugs and dietary recommendations was compared with intensive intervention with multiple activities (frequent exercises, group meetings, diet delivery and more frequent monitoring). During the first four years corresponding to a follow-up plan of 13 years, results seemed promising, since the inter-

vention was associated with greater weight loss (6 % vs. 1%), with a decrease in systolic blood pressure (2.3 mm Hg) and glycosylated hemoglobin. (6)

However, in September 2012 the trial was stopped after a median follow-up of 9.6 years due to futility on the primary endpoint (cardiovascular death, nonfatal MI, nonfatal stroke, or hospitalization for angina) since near the end of the monitoring period the difference in weight between the groups had narrowed (6% vs. 3.5 %) and in addition the event rate was similar (1.83 % vs. 1.92 % per year, HR 0.95, 95 0.83 to 1.09 %).

Therefore, we can turn the page on controlled trials of specific diets with macronutrients.

LABELING WITH NUTRIENTS IN THE MENU AT THE FRONT OF PREPARED FOOD PACKAGES AND BEVERAGE CONTAINERS

Calories on the menu

The best designed recent study to supplement menu labeling with calorie recommendation was conducted in 2008, two months before and two months after calorie posting on the restaurant menus in the state of New York. (7)

At lunchtime, 1121 costumers in two McDonald's restaurants (one in Manhattan and one in Brooklyn) were randomly assigned to three branches: 1) delivery of a page showing the recommended daily calorie intake (2000 for women and 2400 for men), 2) delivery of a page with the recommended calorie intake per meal (650 or 800, respectively), or 3) no additional recommendations (control group). On leaving, the customer was invited to answer a survey and hand the recommendation page he had received along with the food receipt, for which he was paid \$ 5.

The results showed that providing calorie information neither reduced the calories in food purchase nor seemed to help participants to improve the utilization of the calories posted on the menu. Actually, evidence was found that the recommendations appeared to promote more calorie purchase. One can speculate that the recommendations provided are an anchor with which to judge the food main component (intake of hamburger or another sandwich), and the fact that many popular intakes are below the recommended guidelines (e.g., the Big Mac contains 570 calories) could provide a false sense of being below the tolerance range, giving customers approval for more purchase, ignoring that the sum of calories from these other components would push the total food beyond the recommended amount.

Leaving aside the reduction effect in calorie consumption, the obligation of posting them on the menu increases the transparency of what is eaten and generates an attentive audience to consumer products. However, these results have clear implications for public health, since they do not support the introduction of the acceptable levels of calories recommended as a means to increase the impact of calorie

information on the menu.

The last bibliographic review included studies conducted in laboratories, schools cafeterias and fast food restaurants, using experimental or quasi-experimental designs comparing a menu with printed calories with a menu without reference to calories. Two of the included studies were judged to be of good quality and the remaining five of moderate quality. Studies conducted in the cities, after the implementation of mandatory placement of calorie counts on the menu, were inaccurate in measuring the effect. In turn, the experimental studies conducted in laboratory settings were difficult to generalize to real world behavior. Only two of the seven studies reported a statistically significant reduction in purchased calories among consumers who used menus with posted calories.

Current evidence suggests that calorie labeling does not have the desired effect of significantly reducing the purchase or consumption of calories. (8)

Traffic Lights

The labels providing nutrient information designed by various food industries lead to consumer confusion, because they include the nutrients that the industry wants to indicate, using many different signs with very small print and the lists of nutrients may be changed according to the companies' wish. Greater confusion is generated when a high number of nutrients surpass the limit and fall into the unhealthy category, but which may be described as healthy by the addition of any promoted component (calcium, phytosterols, etc.). Furthermore, the concept of the recommended daily value (% DV), when available, for calories, saturated fat, sodium and sugar, is not easy to communicate or to understand, considering that the buyer examines a package for a few seconds before making a decision. (9)

But mostly because they leave the companies' hands free to fortify foods with questionable nutritional value, in order to reward themselves with more positive labels.

The system, developed in the UK to assess the nutritional value of food by "traffic lights" avoids this defect, since this system does not give points for the addition of nutrients.

The evaluation by "traffic lights" disturbs food industry, which spent \$ 1500 billion lobbying against the European Union not to accept the application, opposing even more aggressively to the use of the red light, claiming nothing is too high in food.

The public health target of the labels on the "front-of-package" is to enable consumers to know the nutritional value and risk associated with the product with a quick and easy look. In addition, it allows a rapid assessment of the relative merits of several similar products on a supermarket shelf. (9)

In the system of "traffic lights", developed at Oxford University, the green light indicates a low amount, the red light a high amount and the yellow light an intermediate amount of the considered nutri-

ent. This system allows buyers to maximize the proportion of green and yellow items in their shopping cart and minimize the proportion of red items, and thus combat the mantra of food and beverage industries, who never tire of repeating, that "there is no bad food".

Finally, the great value of the "traffic lights" approach is the ability to motivate manufacturers to reformulate their products to reduce red light qualifications, keep up their sales and as a byproduct, improve the overall quality of health food offerings.

In the UK, the scheme of "traffic lights" (Table 1) was announced in October of this year and while some industries signed the voluntary agreement, on the other hand, the largest industries, which include Coca Cola and Cadbury did not adopt the system, claiming that they prefer to continue using their recommended daily value guides (% DV) instead of the new system of "traffic lights". (10) Perhaps the only way to impose them will be to make them mandatory after a trial period.

This year the UK Health Department published guidelines to create "front-of-package" nutrition labels per 100 g of product or per serving if the size is larger (Table 1). (11)

Controlled studies to assess consumer understanding of different front-of-package nutrition labels, have already begun. For this purpose, 480 participants were randomly assigned to five groups: 1) no label; 2) multiple traffic light (MTL); 3) MTL plus daily caloric requirement icon (MTL + caloric intake); 4) traffic light with specific nutrients to limit based on food category (TL+SNL); or 5) the Choices logo. Total percentage correct quiz scores were created reflecting participants' ability to select the healthier foods.

The MTL + caloric intake (73.3 %) and Option Choices group (72.5 %) significantly outperformed the no label group (67.8 %) and the LT + NEL group (65.8 %) in selecting the healthier product from the list between two products. The MTL and MTL + caloric intake groups achieved higher average scores of more than 90% on the saturated fat, sugar and sodium quizzes, which were significantly better than no label (34 %) and Choices group (47 %) scores. (12)

How would the traffic lights qualify our traditional "Melba" (Terrabusi / Kraft) cookies, if a 3 unit serving is eaten at breakfast? They contain 465 kcal/100g (158 kcal per serving of 3 cookies), 17 g/100 g total fat (5.9 g per serving), 7.8 g/100 g saturated fat (2.6 g per serving) 71 g/100 g sugars (13 g in 3 cookies) and 0.6 g/100 g salt (0.2 g per serving). Figure 1 shows that total and saturated fats as well as sugars qualify with "red"; noteworthy, in the reference intake ratio (% RI) based on the percent contribution of daily energy and nutrient requirements (see Table 1) these 3 cookies alone account for almost 8% of the daily energy and 13% and 15% of saturated fats and sugars, respectively, because the designed product has high caloric density (4.65 kcal per gram of food).

Nutrients	Daily requirements	Traffic lights			
		Green (low)	Yellow (intermediate)	Red (high)	Red (serving)
Fats	70 g	≤ 3.0 g/100 g	> 0.3 g to ≤ 17.5 g/100 g	> 17.5 g/100 g	> 17.5 g/100 g
Saturated	20 g	≤ 1.5 g/100 g	> 1.5 to ≤ 5.0 g/100 g	> 5.0 g/100 g	> 5.0 g/100 g
Sugars	90 g	≤ 5.0 g/110 g	> 5.0 to ≤ 22.5 g/100 g	> 22.5 g/100 g	> 22.5 g/100 g
Salt	6 g	≤ 0.3 g/100 g	> 0.3 to ≤ 1.5 g/100 g	> 1.5 g/100 g	> 1.5 g/100 g

Table 1. "Traffic lights" criteria: green (low), yellow (intermediate), red (high) per 100 grams or per serving if the size is greater than 100 grams

It seems that multiple traffic lights + the percentage of daily caloric intake are shown as the most promising nutritional labeling system (front-of-package) for consumer understanding. In order to complete this first impression, additional assessments in different populations are required. However, it is clear that the intention of buying the products was not influenced by any labels, suggesting that nutrition labels placed at the front-of-package may have in general, a limited influence on the buyer's conduct.

THE PSYCHOLOGY OF HEALTHY EATING

Although we intuitively appeal to encourage healthy food choices by providing information and education, it is well known that knowledge alone is typically insufficient for behavioral change. While the vast majority of people know what they 'should' and 'should not' eat, turning intentions into action is notoriously difficult. Fewer than a quarter of people who embark on a healthy eating plan still stick to it 12 months later and around 50% of people with good intentions fail to act on them at all. (13)

In response to the disappointing results of attempting to change the eating behavior through information, behavioral economists have proposed a new approach suggesting that "nudging" may help people to make healthier choices. (14) Known as "asymmetric paternalism" or "libertarian paternalism", this approach has two main principles. First, as specified by the term libertarian, they try to influence choices in a way that will make subjects better off, as judged by themselves, without restricting their ultimate freedom of choice. Second, as embodied in the term "asymmetric" it refers to policies designed to help people who behave irrationally and so are not advancing towards their own interests, while interfering only minimally in the decisions of these behaviors. (15-17)

The essence of the approach is to use decision errors that ordinarily hurt people instead of helping them. For example, the status quo bias, the tendency to stick with the current or default option even when superior options are available - can be used to help people if healthy options are made by default. Setting the desired option by default has been shown to in-

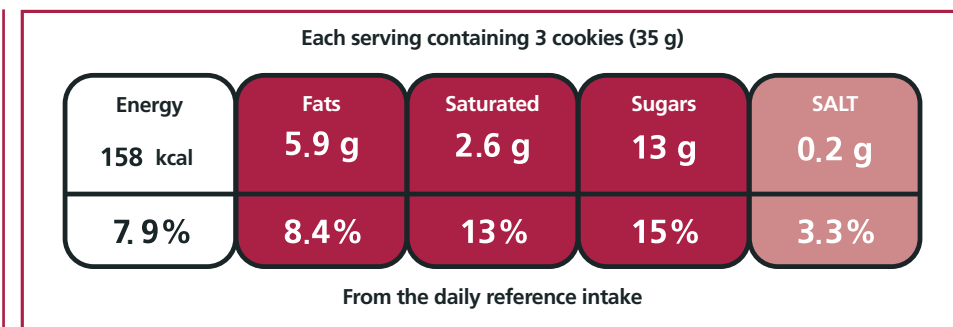
crease for example organ donation rates. In so culturally similar countries like Denmark and Sweden, the choice to become an organ donor ranges from 4.25 % in the first to 85.9 % in the second. The extraordinary difference is that in Denmark they are not donors by default but can opt to become donors, whereas in Argentina and Sweden individuals are donors by default but can opt out. Individuals have the same choices in both circumstances, but one might think that not even with unlimited funds to educate and implore the population to become organ donors, the 98% enrollment that is found in countries where donation is simply by default could be reached. (2)

Here are some studies that have evaluated the information effect versus asymmetric paternalistic intervention; for example that which made healthier sandwiches slightly more convenient to order.

In what we call the "sandwich study", a free meal was offered (a sandwich, side dish and drink) in exchange for completing a survey. The real objective was to understand the behavior to choose the food. To that end, customers were enrolled in a randomized and blind 2 × 2 × 3 factorial design, which included the following variables: (1) the provision (or not) of a calorie recommendation, which was presented in terms of daily targets for men and women with sedentary versus active lifestyles; (2) the provision (or not) of specific calorie information for all menu items; and (3) the provision of a binder with a first page containing 5 sandwich options: a) unhealthy (with more calories) as more convenient, b) healthy (with less calories) as more convenient or c) a mixed option. At the end of the page, in great letters, they were informed that additional menus were at the back of the binder.

Providing calorie information had no effect on choosing the low calorie sandwich ($p = 0.18$) nor did daily calorie recommendation ($p = 0.92$), or the interaction between these variables. In contrast to these results, manipulation by placing five convenient options had a strong impact on the sandwich, so it was more likely that participants would chose lower calorie sandwiches when it was more convenient (by default) to do so. Compared with the mixed menu and adjusted by all the other predictors, it was 48% more

Fig. 1. Qualification of a cookie serving (35 g) according to traffic lights.



probable that those offered a healthy menu would choose low calorie sandwiches ($p < 0.001$), while it was 47% less probable in those receiving an unhealthy menu ($p < 0.001$). Controlling by other model predictors, it was on average 71% more likely that people on a diet ordered low calorie sandwiches ($p < 0.005$). However, when they knew the information about calories, it was 76% less probable that they ordered a low calorie sandwich. ($p < 0.001$). The interaction is quite disturbing and suggests that the provision of the information increases selective calorie intake in people trying to reduce weight. (14)

The effect of conveniently receiving a healthy menu (by default) decreases significantly total food calories compared with the control condition of a mixed menu. To summarize, the convenient manipulation of asymmetric paternalism has a substantial and significant effect on calorie reduction both for people who are dieting as for those who are not. Conversely, the provision of calorie information has a limited effect in food choice, and there is some evidence of an adverse effect of calorie increase in the provision of information to people on diet.

The same group of investigators evaluated the effect of implementing the New York City Department of Health legislation, which from July 1, 2007, determined that all the food establishments should standardize advertisements with calorie information on their menus.

A study was performed before and after application of the legislation, in a Manhattan cafeteria and two hamburger restaurants of the same food chain (one in Manhattan and another in Brooklyn). When leaving the establishment, each client was paid 5 dollars for handing the receipt and answering a survey. In addition, they conducted an experimental intervention in which randomly selected people were provided with the suggested calorie intake per day or per meal (dividing the recommended daily intake by three) before entering the restaurant.

In the cafeteria there was no impact of the incorporated legislation ($p = 0.79$) and neither in the randomized study with any of the calorie recommendations. The only significant effect was that Afro-Americans consumed more calories than the other groups ($p < 0.05$).

In the Manhattan hamburger restaurant, there was again no significant effect of the legislation ($p = 0.73$), but in the Brooklyn restaurant, however, less calories were consumed pursuant to the legislation applicability ($p < 0.05$) and calorie consumption was negatively associated with age but not with race. (14)

Finally, the recommendations of food calories marginally interacted paradoxically in both hamburger restaurants ($p = 0.07$ in both) since this recommendation increased calorie consumption in those who were dieting but not in those who were not.

Therefore, the provision of a calorie objective, whether on a daily basis or per meal, does not seem to have a beneficial effect and even may have an adverse effect on calorie consumption, such as promoting a higher calorie intake in people on diet. Conversely, the convenient manipulation of asymmetric paternalism has a sufficiently large effect on sandwich choice, resulting in a meal with less total calories.

The limitation is that these studies evaluate the impact of manipulating a single meal and we do not know if participants use compensatory eating mechanisms during the rest of the day.

This and other studies indicate the potential effectiveness of asymmetric paternalism interventions to produce behavioral changes with a slight nudge, compared with the more fragile and modest effect produced by merely supplying information.

HOW MARKETING NEEDS TO MAKE US MORE OBESE ANF HOW TO FIGHT IT

Worldwide people wish to have access to a variety of tasty, convenient, cheap and safe foods that can be consumed in great quantities. By supplying and stimulating this strong biological preference developed by natural selection, food marketing has been often accused of contributing to the global growth of the obesity problem.

According to the definition of the American Marketing Association, marketing is “the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large”.

Those in charge of marketing influence the volume of consumed food by means of four basic mechanisms

that vary in their visibility. (18)

1) *Long and short-term food price*: in the last 50 years there has been a consistent reduction in the price of brand name foods, processed with a large quantity of sugars and fats, prepared and ready to eat away from home. In turn, fresh foods have constantly increased the price following inflation, producing an ever greater rift between increasingly cheaper highly processed foods and more expensive fresh foods. The lower price of processed foods has led to a rise in the total energy intake, even preserving the consumed volume, due to a greater energy density per gram of food.

Randomized clinical trials have demonstrated almost without exception that higher prices reduce consumption. A recent study showed that Austrian consumers think that prices are not related with the quality of food, which is not surprising, because expert estimation from this country shows no correlation between price and quality. Consumers have learnt that low price foods are as enjoyable and satisfactory as those with high price, except for a few categories as wine, where the definition of what is good taste is somewhat ambiguous.

In the short-term effects it has been shown that price promotion not only produces sale changes among the different brands, but that seasonal promotions can lead to a significant increase in consumption. There are studies demonstrating that 12.5% seasonal discounts in healthier foods increases the purchase volume by 11% among low income consumers receiving coupons and that the effect persists after 6 months of having withdrawn the promotion.

2) *Marketing communications*: the influence of marketing can sometimes be visible as price changes, but consumers are not always aware of some of the new forms of marketing communications (e.g. "games to call the attention", package designs, package size and servings, choice architecture or activities in social media) and even when they know the persuasive attempts behind these tools, they are unaware that their consumption decisions are under the influence of the industry.

It has been shown that in 3-year old children who receive different servings of macaroni and cheese in three separate occasions, they consume a similar quantity in each meal, which indicates that very small children instead of responding to food suggestions, as the serving size, are still able to regulate their intake in response to physiological indications as hunger and satiety.

However, already at 5 years of age, children consume more energy if the serving is larger, revealing that internal suggestions are less effective in food consumption than external factors which have greater influence, because it was seen that those who increase their intake when they receive a larger serving probably eat without being hungry.

It is interesting to admit that children eat 25%

less of an abundant first course when they decide how much food they put on their plate, than when a large serving is decided by an adult. This suggests that to help children eat adequate portions, adults should offer them a variety of nutritive foods and allow them to decide how much they will eat, by serving themselves. (18)

The same mechanism works in adults; for example, the package size determines food consumption. It has been shown for a variety of foods that the larger the package the more food is served at the table. But not only the package or serving size determine putting more food on the plate, but also that more is eaten. (19)

When adults (men and women) were served different helpings of macaroni and cheese on different occasions, they consumed 30% more energy (162 kcal more) when they were offered the largest serving (1000 g) than when they were offered a smaller one (500g). However, participants manifested similar appreciation of hunger and satiety at the end of the meals, despite the great difference in consumption.

All the experimental evidence shows that the serving size has a significant short-term effect in adult food intake, suggesting they ignore or discard the signs of hunger and satiety when they are presented with large servings of food, preserving as adults the behavior they learnt when young of eating without hunger. (19)

Supermarket choice architecture refers to the design for the framing and presentation of choice options by omission, making more notorious or visible the food they wish to sell, placing them in the main circuits, with the product at eye level, near the cash register where people wait in the queue. In a controlled study in Massachusetts General Hospital (Boston) cafeteria, changing the choice architecture by relocating food options and beverages allowed the increase of the healthier options. The strongest example of the effectiveness of this measure was the 26% increase in bottled water, changing two refrigerators from a peripheral to a central position, at eye level and in baskets near the cash registers, which produced their choice by omission.

The effects of advertisements and promotions convey the message that eating processed foods is what is seen as normal, can even be funny and socially rewarding.

3) *Price and the package quantity or size*: studies have shown that people accelerate the consumption of products that are perceived being purchased at a lower price. Thus, a marketing strategy is to reduce the relative price of food offering discounts for quantities with larger packages or offerings with packages with several units, becoming triggers of greater calorie consumption in "super" or "big" sizes. A study showed that during the weeks where multiple unit packages or containers were purchased, fruit juice consumption rose 100% and that of cookies 92%, which increases the

industry profit due to greater food sales. It is thought that the greater purchase of a determined food, due to the larger or multiple package discount influences the consumption because it makes food more visible in the pantry or the freezer and not due to the price reduction per se.

Other measures against marketing (the anti-marketing)

When children watch television, besides being seated and with less physical activity, they receive the influence of all snacks and unhealthy food advertisements and turn eating in front of the TV into a social activity, being distracted and hence with slower awareness of satiety. However, these studies do not unravel the effect of the position of watching TV from the effect produced by TV commercials.

The most convincing study from the real world comes from Quebec's ban on television advertising aimed at children in French-speaking television networks. A first study showed that the ban decreased the amount of cereals in the homes of French-speaking children of Quebec, but not for English-speaking children, who continued to be exposed to the same amount of food advertising through US television stations. A second study concluded that the Quebec ban also significantly reduced fast food consumption because French-speaking families with children eat less often in fast-food restaurants than English-speaking families with children or French families without children. (18) The form of the advertisement matters, as people perceive that a food is low fat and has better quality if the label says "75% fat free" than when it says that it contains "25% of fat". Brands also influence the interpretation of the sensory experience when they claim that a food contains a "special ingredient" than when they say that the ingredient is "vinegar", which is confirmed with the neuronal representations in the functional images localized in the brain, where these marketing actions stimulate the encephalic loci of the real pleasure of consuming a certain food.

The labels with selected nutrients and special ingredients could be omitted if the use of traffic lights in the front-of-package labels were regulated.

The composition of foods to increase their "flavor" is a combination of the food taste and chiefly the smell, which induces to consume more calories of liquid than of solid foods with the same energy density, due to the lower effort and shorter sensory exposure that limits the satiety sensation. The same happens with the manipulation of change from high energy density at a low volume to a high volume with low energy density. We will next analyze all these marketing effects when speaking of the State instruments to regulate the composition of processed foods.

Marketing also acts due to the easy access to processed foods; the exceptional or the visibility makes them more conspicuous in restaurant and cafeteria display racks. Anti-marketing is doing that, but with "healthy" food. The exceptional or the visibility also

work with the food we have at home or at work. For example, when a bowl with 30 chocolates was placed on the secretaries' desks, those who had a transparent bowl consumed the chocolates 46% faster than the ones with an opaque bowl. Food intake is greater because its visibility is a constant reminder to the consumption temptation. (18)

Generally, marketing acts on what people want in the short term, that is tasty, cheap, varied, convenient and healthy food, qualities which are more or less appreciated in that order of importance.

As shown, the main factors which induce people to eat more may also turn them to eat less, promoting the consumption of healthier foods and in general, increasing the importance given to health over that of flavor, price and convenience. These mechanisms are seen in small retail shops as well as in supermarkets, restaurants and cafeterias.

RELATIONSHIP BETWEEN CHANGES IN FOOD PRICE AND PURCHASE PATTERNS

The fiscal policy, which includes taxes and subsidies, has been used to influence consumer behavior, operating mainly through the known principle of classical economy called the "law of demand". The law establishes that if all the other factors remain constant, as the price of a good rises (or falls), the demanded quantity of that good will decrease (or increase). This law was the underlying driving force for the increase in the tobacco tax, which produced a considerable fall in the rate of smokers. (21)

The response to price is measured by the "specific price elasticity", which is defined as the percent change in the demanded quantity resulting from a percent change in the price. It has been shown that the "specific price elasticity" is high for many products of unhealthy food. Food prepared away from home (soft drinks, juices and meat) have an estimated elasticity ranging between 0.68 and 0.81; thus, taxing these foods would significantly reduce their purchase. For example, soft drinks with a "specific price elasticity" of 0.79 indicate that a 10% increase in the price would reduce consumption by 7.9%. In general, the elasticity of these foods is higher than that on the cigarette demand, which is estimated at approximately 0.3 to 0.5 in the short term.

However, it should be recalled that the "specific price elasticity" does not take into account the potential changes in the purchase of other products as a result of that price change. These purchasing changes can compensate some of the beneficial effects of decreasing the purchase of products that have increased their price by substitution for another unhealthy product. This substitution as a result of the increased price of a specific product is called "cross price elasticity". (21, 22)

Review of laboratory experimental studies

The review of laboratory experimental studies show

the substitution for healthier food when the prices of less healthy foods are increased and a reduction in the purchase of less healthy foods when the prices of healthier foods are reduced.

However, price manipulation with taxes and subsidies must not be targeted to specific foods that can be easily substituted by a similar one, but aimed to manipulation of prices according to the food characteristics, such as energy density or calories per nutrient, because in these conditions it is impossible to substitute it for another unhealthy food, as any other similar unhealthy food would be increased by the same tax.

It is very different from establishing a fixed tax on a specific type of food, as sweetened beverages, which could be associated with its substitution by other unhealthy beverages or sugar sources. (21-23)

In each case studied, the change in prices resulted in an improvement of the nutritional characteristics of the acquired foods. Perhaps, the most outstanding finding is that if only taxing is used, according to the nutritional characteristics, there would be a reduction of the acquired energy, but if only the subsidy is used, the energy that is bought increases, even of healthy foods such as fruits and vegetables. Thus, if the subsidy is used to raise the purchase of healthy foods, equivalent taxes should be applied to unhealthy foods to avoid the increase in calories and obesity. (21)

Review of cafeteria, restaurant, vending machine and supermarket studies

The studies in the real world have the great advantage of their external validity.

Among the studies performed in cafeterias only one examined the effect of substitution and showed that when a fixed tax was applied to sweetened beverages these were substituted by healthier ones. The study did not show that the addition of health messages improved the purchase beyond the change in price alone.

The manipulation of price changes in "vending machines" at universities, colleges and working places showed a consistent lineal response between price changes and variation in purchase behavior: price reduction of 50%, 25% and 10% led to 93%, 39% and 9% increased purchase of low-fat snacks, respectively. The price effects were greater than announcements or promotions and no interaction with these other measurements have been published. In the four supermarket studies with discount in fruits and vegetables and other healthy foods, price changes were more effective than education in food purchase, although this effect was not observed in customers who did not know or use the discounts.

The larger the categorization system to group prices, the lower the concern that participants will substitute them with similar less healthy products. These nutrient profiles constitute a better basis for food prices than price changes in narrow categories,

as sweetened beverages.

There is shortage of studies evaluating the relationship between price changes with the nutritional characteristics of foods and the changes in body weight. (24)

Although in approximately all cases the effect on prices was greater than the sole information, there are few studies that have evaluated these interactions.

It must be borne in mind that many of the recommended tax proposals consider relatively low rates which, although politically acceptable, have very slight incidence in food purchase.

Neutral profit schemes can be designed, in which the subsidies can cover their cost with the help provided by taxes on the sales of less healthy foods.

In conclusion, the experimental, laboratory and field research, of how prices influence different aspects of public health, is still in its early stages and should be a research priority. Ideally, investigations should be implemented at different levels of analysis, to gain insight on the effectiveness of new forms of applying price interventions.

CHANGING THE ENERGY DENSITY OF FOODS AS A STRATEGY TO CONTROL WEIGHT

As food prepared at home with fresh ingredients requires time and ability people no longer have, there is waste associated to decayed fresh food and, most important, that it is much more expensive for the same amount of calories, (25) as any processed food is less expensive than fruits and vegetables, (26) people will continue to buy processed foods. Therefore, we should improve the nutritional quality and the energy density of the foods most people eat most of the time. (3)

The reformulation of mass market products seems to be the most obvious reason for a Copernican change in the worldwide policy of the food system. The salt reduction program in the food of the United Kingdom has already reduced the national average salt intake by 16% in the first 6 years. (27)

The principle that underlies this strategy is that changing food composition (the offer) is as important, or much more important, than changing people (the demand).

The significance of energy density (higher when there are more calories in the same food volume) in the regulation of food consumption became more clear when controlled laboratory studies showed that during the course of a few days, the weight of consumed food was more constant than the ingested calories. For example, when the food energy density decreased by 30%, the daily energy consumption also decreased by 30%. The study participants were unaware of this considerable reduction in energy density and reported similar levels of hunger and satiety with both diets. (28)

Another example is that with the intake of a low energy density first course of soup or salad there was a reduction in the total calorie consumption compared

with a first course of higher energy density or not taking a first course.

The simple message of doctors when they say to a patient “eat less” is not effective to control weight, because the patient remains with a sensation of hunger and satiety deficiency. In its place, a message to limit the high energy density food servings while encouraging the intake of satisfying low energy density foods may help to control weight because it provides substantial servings with few calories.

There will probably be a small effect on customer satisfaction due to the State’s regulation on the reduction of manufactured food energy density, if the taste is preserved and the cost does not increase. The addition of vegetables rich in water together with a decrease in fat content may reduce the energy density of many popular processed foods, as hamburgers, sandwiches and pizzas. The modification of processed foods with no implication in the consumer’s behavior is a great promise towards a healthy diet. Scientists and the food industry should work together to develop foods with reduced energy density that are acceptable for the consumer and profitable for the retailer.

CONCLUSIONS

It could be concluded that the greatest challenge and opportunity for public health lie in reducing tobacco, alcohol and the harmful consumption of an unhealthy diet to the rising global burden of non-communicable diseases. This shows the impending need we have of improving our understanding of how industrial corporations (Big Tobacco, Big Booze and Big Food) contribute to this disease burden, both directly by promoting products that damage health and indirectly through their influence over public policies. “The concept of an industrial epidemic—an epidemic emerging from the commercialization of potentially health-damaging products—lends itself to this purpose”. (29)

The great tobacco companies (Big Tobacco) do not differ substantially from the great alcohol industries (Big Booze) or the great food industries (Big Food) in their behavior towards public health.

“Indeed, the fiduciary responsibilities of all corporations require them to maximize profits regardless of consequences to health, society, or the environment and thus to oppose policies that could reduce their profits. There are, therefore, significant limits to the compatibility of industry interests with public health. Food companies, for example, have two basic strategic options to enhance shareholder revenue: to persuade consumers to eat more or to increase profit margins. As much higher profits come from processed compared to fresh foods, promoting the latter, advising people to eat less or eat more healthily contradicts the core business models of many food companies. (29)

In the adaptation of the traditional concept of public health, there is a great amount of information which identifies and tries, ineffectively, to change the role of the host (the consumer), the nature of the

agent (food) and the environment, and there is very little research and suggestions to change the crucial vector of disease (the food industry).

The dominant ideology in today’s world is the “ideology of free commerce and individual responsibility”. The assumption that we are isolated individuals and hence with personal responsibility has an important impact in the way the prevention of non-communicable diseases is approached with a healthy diet.

The former British Prime Minister Tony Blair commented in 2006: “Our public health problems are not, strictly speaking, public health questions at all. They are questions of individual lifestyle –obesity, smoking, alcohol abuse, diabetes, sexually transmitted diseases-. These are not epidemics in the epidemiological sense. They are the result of millions of individual decisions, at millions of points in time.”

It is a true premise that at the individual level, the energy balance –physiologically speaking- between the levels of physical activity and the calories in the diet will determine people’s weight. However, if our objective is to improve health by changing the diet, it is important to acknowledge that populations are different and behave differently than individuals. It should be simply admitted that the dieting industry to reduce weight, even applied to self-selected groups of highly-motivated subjects with the wish to change, has discouraging results, as most diets fail for most people, most of the time. Of course, this does not necessarily mean failure in the individual case.

Why does this happen? Because it is slightly probable that personal responsibility and individual motivation work as triggers of massive behavior changes in the absence of an environment, as the current one, that supports and favors the healthiest options. The “problem” is that the individual behavior is in truth the average behavior of the population adapted to and developed in response to the environment that surrounds it. For example, the pressures of time and work, urbanization, long trips to go and return from work, many more women taking part in the workforce, and an industry of ready-made foods that has in part developed in answer to these same factors, means that today’s typical food is very different from what it was fifty years ago. (30)

Why do the food industry and supermarkets continue to invest large sums of money in food advertisements? Because it works. In 2004, Pepsico and Coca-Cola spent worldwide 1700 and 2200 million dollars, respectively, in advertisements, a total exceeding the two-year budget of the World Health Organization.

The receipts on lifestyle are important strategies of change for individuals, and they should be encouraged as part of a wide political response. But it is scarcely probable that they will succeed, unless the State works to change the population’s lifestyle embarking on what influences the unhealthy choices at the anti-marketing, traffic lights level to help choice, providing subsidies to healthy foods and imposing

taxes on unhealthy ones, and persuading or obliging food manufacturing companies to give precedence to healthy foods in their promotions, improving the nutritional quality and lowering the calorie density of their products.

In conclusion, the answer to the title: how to achieve healthy eating? is that it is necessary to focus on policies that can influence the average behavior of the population, but not necessarily in a drastic way (we know that individual drastic changes tend to be unattainable), but subtly, through small, consistent and progressive modifications of many people, creating an environment that supports and encourages healthy choices and that this environmental change assists healthier lifestyles, so that our current behavior of trying to force individuals one by one becomes less necessary.

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